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Abstract–Meteoritical Bulletin 105 contains 2666 meteorites including 12 falls (Aouinet Legraa, Banma, Buritizal, Ejby, Kamargaon, Moshampa, Mount Blanco, Murrili, Osceola, Sariçiçek, Sidi Ali Ou Azza, Stubenberg), with 2244 ordinary chondrites, 142 HED achondrites, 116 carbonaceous chondrites, 37 Lunar meteorites, 20 enstatite chondrites, 20 iron meteorites, 20 ureilites, 19 Martian meteorites, 12 Rumuruti chondrites, 10 primitive achondrites, 9 mesosiderites, 5 angrites, 4 pallasites, 4 ungrouped achondrites, 2 ungrouped chondrites, 1 enstatite achondrite, and 1 relict meteorite, and with 1545 from Antarctica, 686 from Africa, 245 from Asia, 147 from South America, 22 from North America, 14 from Europe, 5 from Oceania, 1 from unknown origin. Note: 5 meteorites from Russia were counted as European. It also includes a list of approved new Dense Collection Areas and a nomenclature of the Aletai (IIIE-an) iron meteorites from Xinjiang, China.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Data S1. A complete copy of entire Meteoritical Society Bulletin can be found in the supplementary information of this article as well as on the Meteoritical Bulletin Archive page at http://meteoriticalsociety.org/?page_id = 57. Information about the approved meteorites can be obtained from the Meteoritical Bulletin Database (MBD) available online at https://www.lpi.usra.edu/meteor/.

1. Alphabetical text entries for non-Antarctic meteorites

Abadla 30°56’13.04’’N, 2°42’56.40’’W
Bechar, Algeria
Find: 2015 Mar 15
Classification: HED achondrite (Eucrite, cumulate)
History: Found by Mr. Abdelrahman about 15 km south of the village of Abadla, Algeria, on March 15, 2015. Purchased by Didi Moulay El Bechir in 2015.
Physical characteristics: Single stone with black fusion crust. A saw cut reveals a mosaic of gray, coarse-grained, interlocking crystals.
Petrography: (C. Agee, *UNM*) This cumulate rock consists of ~80% equilibrated, unzoned pyroxene, with no microscopically visible exsolution lamellae, and ~15% maskelynite. Most maskelynite domains are surrounded by pyroxene with radiating fractures suggesting shrinkage cracks. Accessory chromite, ilmenite, troilite, and iron oxide were observed.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Low-Ca pyroxene $Fs_{39.1\pm1.3}Wo_{2.9\pm1.5}$, Fe/Mn=30±1, n=15; augite $Fs_{22.1\pm5.5}Wo_{32.1\pm10.0}$, Fe/Mn=28±3, n=5; plagioclase $An_{92.6\pm0.4}$, n=10.
Classification: Cumulate eucrite
Specimens: 21.12 g including a probe mount on deposit at *UNM*, Didi Moulay El Bechir holds the main mass.

Abarkouh 001 31°18.26’N, 53°10.30’E
Fars, Iran
Find: 2014 May 18
Classification: Ordinary chondrite (L5)
History: Meteorites were found during a systematic search conducted by the AsemanSang group. A sample was sent to H. Pourkhorsandi in January 2016.
Physical characteristics: Samples are partially covered by a dark-brown crust. Cut surface shows a light-brown interior.
Petrography: Recrystallized chondritic texture. FeNi metal and troilite are well separated. Some weathering veins can be seen. Troilite shows limited weathering. Chromite-plagioclase assemblages are present.
Classification: L5 based on petrography and magnetic susceptibility.
Specimens: Type specimen 27 g and a polished section at *CEREGE*. 17 g and a thin section at New England Meteoritical Services (NEMS).

Al Haggounia 004 27°6’24’’N, 12°1’36’’W
Saguia el Hamra, Western Sahara
Find: 15 Jan 2015
Classification: Carbonaceous chondrite (CK3)
History: Four brownish fragments were found by Mr. Zaid Balli at Ouad Ouinaght and subsequently purchased by Marcin Cimala.
Physical characteristics: The meteorite shows a strongly altered brownish-orange sawn surface.
Petrography: The meteorite is composed of separated and clearly defined chondrules set into abundant olivine-rich matrix. Few chondrules contain compositionally unequilibrated olivine and less abundant low-Ca pyroxene. Throughout the matrix olivine is equilibrated. Cr-bearing

magnetite and intermediate plagioclase are abundant in the matrix; accessories include Ca-pyroxene, pyrrhotite and troilite.
Geochemistry: Equilibrated matrix olivine: $Fa_{29.4\pm0.3}$, n=16; unequilibrated olivine: $Fa_{12.8\pm10.2}$ ($Fa_{2.2\text{-}29.1}$, n=15); low-Ca pyroxene: $Fs_{23.0\pm1.6}Wo_{0.6\pm0.1}$ ($Fs_{21.1\text{-}24.7}Wo_{0.4\text{-}0.8}$, n=6); Ca-pyroxene: $Fs_{18.3}Wo_{49.2}$ (N=2); C_2O_3 in magnetite: 3.8 wt% (N=4)

Alatage Mountain 042 (AM 042) 41°41’19.8"N, 92°57’10.4"E
Xinjiang, China
Find: 1 May 2013
Classification: Ordinary chondrite (L5)
History: An expedition found 42 meteorites between 30 April and 1 May 2013 in a 2.7 × 1.4 km area 80 km east of Alatage Mountain. The expedition included Bingkui Miao, Yangting Lin, Shijie Li, Deqiu Dai, Wenjie Shen, Sen Hu, Lei Kesi, Peng Wang, and Zhipeng Xia.
Physical characteristics: Total mass: 403.8 g (only 1 piece) no fusion crust, gray surface
Petrography: The meteorite shows a homogeneous lithology. The sizes of minerals are mostly <100 μm. Mosaic extinction of olivine is common. More than 50% of metal and sulfide is oxidized.
Geochemistry: Minerals are uniform. Olivine: $Fa_{22.2\pm0.7}$ (n=9); low-Ca pyroxene: $Fs_{19.1\pm2.2}Wo_{4.7\pm1.9}$ (n=9)
Classification: Ordinary chondrite (L5); S5; W2.
Specimens: 100 g sample and one thin section are deposited in *GUT*.

Nomenclature of the Aletai (IIIE-an) iron meteorites from Xinjiang, China

Chemical and petrographic analyses of multiple iron meteorite masses in the northern part of Xinjiang Uyghur Autonomous Region, China, indicate pairing of these masses with the Armanty (IIIE) iron. All of these iron meteorites, as well any paired material that may be discovered in the future, will henceforth carry the official name “**Aletai**,” the name of a local county. The names “Armanty,” “Xinjiang (b),” and “Xinjiang 008” (a provisional name) are now abolished, and become synonyms for Aletai. In a previous action (MetBull 95), the name “Ulasitai” was abolished, and made a synonym for Armanty; “Ulasitai” will now become a synonym for Aletai.

This entry also corrects previously published coordinates for the 28 tonne Armanty mass, announces several new masses, and presents compositional data by J.T. Wasson, *UCLA*, for five of the paired masses. The masses form a NW-SE array, spanning approximately 425 km across China and a sliver of Mongolia (although no masses have been reported from Mongolia).

The new nomenclatural system for these irons is analogous to the grouping, some decades ago, of previously named IIAB irons under the name “North Chile.” When referring generally to the irons, authors should use the names “Aletai” and “North Chile.” When referring to a specific mass, authors should identify it as, for example, the "Armanty mass of Aletai" or the "Filomena mass of North Chile." The list of recommended mass names for Aletai appears in the table below.

The coordinates listed for this entry correspond to the corrected location at which the Armanty mass was discovered.

Discovery of the Wuxilike mass of Aletai:
History: A large iron was found by a local farmer in a valley in a mountainous area of Aletai County. It was surrounded by rocks and half buried. A small specimen was taken for analysis. Heavy machinery was used to move the meteorite from the valley to the discoverer's home. *Physical characteristics*: The kamacite bandwidth is 0.89±0.41 mm. *Petrography*: The major phases of the meteorite are kamacite, taenite, and plessite. Minor phases include schreibersite, daubréelite, troilite, and haxonite.

Discovery of the Akebulake mass of Aletai:
An account of the discovery of this large iron mass in a remote mountainous region was published by Beatty (2011) based on a trip there by Ayisha in June 2011. It has an irregular surface with partial regmaglypts but has been severely affected by terrestrial weathering. The iron is dark-brown; it was partly covered by a granite slab on the side of a mountain. Its exterior was marked by several scrawls of graffiti and cuts. Aletai City officials worried that the meteorite would be further damaged they built a road and moved the Akebulake mass to the Aletai city hall in 2011.

Table 1. Known masses of Aletai.
Analyses by J. T. Wasson, UCLA, See MetBull 104 for an analysis of Xinjiang (b). Aletai is an anomalous IIIE. It has the highest Au concentration in the group, and its Ir concentration is much higher than that inferred through the trend of the other group members.

Mass name	mass	Latitude (N)	Longitude (E)	Co mg/g	Ni mg/g	Cu µg/g	Ga µg/g	As µg/g	W ng/g	Ir µg/g	Au µg/g
Armanty	28 t	45°52.272'	90°30.279'	5.15	97.8	109	16.9	14.4	0.28	0.228	1.810
Akebulake	18 t	48°6.25'	88°16.57'	5.17	98.8	110	16.9	15.1	0.32	0.224	1.814
Wuxilike[1]	5 t	48°3.13'	88°22.32'	5.20	98.0	105	17.0	15.8	0.26	0.234	1.862
Ulasitai[2]	0.43 t	44°57'24"	91°24'09"	5.21	96.9	108	16.7	15.0	0.28	0.235	1.894
Xinjiang (b)[3]	35 kg	47°58.7'	88°13.1'								
(unnamed)	15 kg	(see note 4)		5.22	93.2	95	16.4	15.5	0.31	0.230	1.855

[1] Was given the provisional name Xinjiang 008
[2] Published in MetBull 90 as a distinct meteorite
[3] Published as a distinct IIIAB iron in MetBull 104
[4] Found in the Xiaodonggou region close to the place where Wuxilike and Akebulake were found

Allan Hills 12073 (ALH 12073) 76°42.750'S, 158°46.926'E
Antarctica
Find: 2012 Dec 24
Classification: HED achondrite (Eucrite)
History: A small, meteorite with minor weathering was found in the Allan Hills near the Western Icefield during the XXVIII PNRA Italian expedition, 2012-2013 (in collaboration with KOREAMET)

Physical characteristics: Small, uncrusted stony fragment (6 × 5 × 5 mm)
Petrography: (J. Nava, M. Gemelli, M. D'Orazio, T. Di Rocco, L. Folco, *DST-PI*) holocrystalline rock with subophitic igneous texture. Inequigranular rock with medium to fine-grained crystals. Meteorite dominated by plagioclase (47 vol%) and low-Ca pyroxene (35 vol%), with minor tridymite (7 vol%; identified by Raman spectroscopy), high-Ca pyroxene (4 vol%), sulfides (4 vol%), phosphates (2 vol%), Fe,Ni metal (1 vol%), and spinel (tr.). Poikilitic plagioclase grains, up to 1 mm across, enclose anhedral low-Ca pyroxene and tridymite (<100 μm). Subhedral grains of low-Ca pyroxene (up to 1 mm) often contain inclusions of rounded plagioclase (<100 μm) and exsolution lamellae of high-Ca pyroxene, which also occurs as small isolated interstitial grains (up to 100 μm). Tridymite occurs as large lath-shaped crystals (0.5-1 mm).
Geochemistry: (J. Nava and M. Gemelli, EMP at *CNR* Padua) Plagioclase, $An_{92.4\pm1.7}Ab_{7.5\pm1.6}Or_{0.2\pm0.1}$; low-Ca pyroxene, $En_{63.1\pm0.8}Fs_{33.9\pm0.7}Wo_{3.1\pm0.5}$, Fe/Mn=25±2 (n=52); high-Ca pyroxene, $En_{43.3\pm1.1}Fs_{16.1\pm1.1}Wo_{40.5\pm1.7}$, Fe/Mn=23±3 (n=22); troilite, Fe=63.2, S=36.6 (wt%). Oxygen Isotopes: (A. Pack, *UGött*): $\delta^{18}O = 4.4$ ‰, $\delta^{17}O = 2.04$ ‰, $\Delta^{17}O = -0.266$ ‰.
Classification: Eucrite
Specimens: Main mass (0.1 g), type specimen and one thin section (*MNA-SI*).

Aouinet Legraa 27.120°N, 7.018°W
Tindouf, Algeria
Probable fall: 2013 July
Classification: HED achondrite (Eucrite, unbrecciated)
History: An extremely bright fireball was seen by several persons as it moved in an easterly direction over western Algeria in the vicinity of Tindouf at approximately 11 pm on July 17, 2013. No sonic phenomena were documented. Sightings were also made by residents in the Algerian village of Oum el Assel. A search for meteorites was initiated soon after the event, but it was not until April 2014 that a strewnfield was located at 27.120°N, 7.018°W. Subsequently, many fusion-crusted stones were purchased in May 2014 from the finders by Darryl Pitt.
Physical characteristics: Fresh stones coated by black fusion crust with numerous anastomozing ridges. Interiors are notable for the bright internal reflections within vitreous plagioclase laths and the unusually abundant, accessory, bronze-colored sulfides.
Petrography: (A. Irving and S. Kuehner, *UWS*) Two studied stones have a subophitic diabasic texture, and exhibit no evidence of deformation or terrestrial alteration. Composed of prismatic exsolved pigeonite grains and calcic plagioclase laths with accessory silica polymorph, Ti-rich chromite, Ti-poor chromite, troilite and ilmenite, plus rare zircon and Ni-free metal.
Geochemistry: Low-Ca pyroxene host ($Fs_{57.1-58.0}Wo_{6.2-6.7}$, FeO/MnO = 29-30, N = 3), high-Ca pyroxene exsolution lamellae ($Fs_{28.1-29.3}Wo_{42.0-41.6}$, FeO/MnO = 29-31, N = 3), high-Ca pyroxene host ($Fs_{28.1}Wo_{42.3}$, FeO/MnO = 31), low-Ca pyroxene exsolution lamella ($Fs_{57.6}Wo_{6.4}$, FeO/MnO = 31), plagioclase ($An_{93.2-94.5}Or_{0.7-0.5}$, N = 4). Magnetic susceptibility, log χ (× 10^{-9} m^3/kg) = 2.95.
Classification: Eucrite (diabasic, unbrecciated).
Specimens: 43 g including two polished thin sections at *UWB*; 51.7 kg (including a 35.9 kg mass) with *DPitt* and the remainder with anonymous collectors.

Banma 33°15.18'N, 100°27.9'E
Qinghai, China
Confirmed fall: 2016 Aug 24

Classification: Ordinary chondrite (L5)
History: On 24 August 2016, at about 21:00 local time, several nomads of Banma City, Qinghai province, saw a bright object flying from a southeasterly direction, followed by a loud explosion. The next day, the nomads searched in the direction of the explosion and found a black stone embedded in the ground in a small crater on a hillside.
Physical characteristics: The stone is relatively flat and 32 × 23 cm and 18 cm thick. Fusion crust and regmaglypts are well preserved.
Petrography: Chondrule outlines are obscure. The matrix displays a moderate to high degree of recrystallization. Poorly defined BO chondrules are 0.4-0.6 mm wide. All the feldspar grains are relatively small, less than 50 μm. Numerous FeNi metal and FeS grains are present.
Geochemistry: (W. Hsu, *PMO*) Olivine, $Fa_{24.0\pm0.4}$ (n=14), range $Fa_{23.2\text{-}24.8.}$ Low-Ca pyroxene, $Fa_{20.3\pm0.5}Wo_{1.6\pm0.1}$ (n=10), range $Fs_{19.7\text{-}21.4}Wo_{1.5\text{-}1.8.}$
Classification: Ordinary chondrite, L5, S2, W0
Specimens: 64 g at *PMO*. Main mass at the Banma City Hall.

Bir Moghrein 25°54.790'N, 11°59.431'W
Tiris Zemmour, Mauritania
Find: 2016 Apr 11
Classification: HED achondrite (Diogenite, olivine)
History: (H. Chennaoui Aoudjehane) Found on 11 April 2016 by Mouloud Bachikh and his brother Bdyad during a search for meteorites in the area of Lamlawiya, close to Wad Tismar and Khang Ar Ramla, in the military zone of the Moroccan frontier with Mauritania. A few days after the first find, many hunters came to the site searching for other pieces, but only a few pieces were found after the initial discovery of the large stone.
Physical characteristics: (H. Chennaoui Aoudjehane, *FSAC*) One big piece of ~11 kg and 10 small fragments totaling 150 g were found. The rock is coarse grained, brown-green colored, and its surface is shiny. Green olivine crystals are visible, and brownish pyroxene grains predominate, both millimeter sized. A very few clear plagioclase grains are present. Some regmaglypts were noted on the surface of the rock, which shows a very few relict patches of fusion crust.
Petrography: (C. Agee, *UNM*) This meteorite consists of ~90% orthopyroxene, ~5% olivine, and ~2% plagioclase, and trace amounts of augite. Chromite and troilite are ubiquitous accessory phases. Heavily shocked, plagioclase has been converted to maskelynite.
Geochemistry: (C. Agee, *UNM*) Olivine $Fa_{23.2\pm0.4}$, Fe/Mn=51±3, n=19; low-Ca pyroxene $Fs_{21.0\pm0.7}Wo_{2.4\pm0.5}$, Fe/Mn=28±1, n=10; plagioclase $An_{87.2\pm2.0}$, n=11.
Classification: Diogenite-olivine
Specimens: 18.7 and 1.3 g at *FSAC*, probe mount at *UNM*. Mouloud Bachikh holds the main mass.

Buritizal 20°10'57.28"S, 47°43'0.10"W
Sao Paulo, Brazil
Confirmed fall: 1967 Aug 14
Classification: Ordinary chondrite (LL3.2)
History: On August 14, 1967, at 03:40 AM (local time), many residents of São Simão and Buritizal witnessed a big explosion in the sky and a light so bright that it turned the sky as bright as day. Hearing about it, reporter Saulo Gomes, working at TV Tupi, went to Buritizal to

investigate the fall and write a newspaper report. He confirmed the reports and found three fragments of the meteorite in the stable of a small farm in Buritizal owned by Mr. Almir Canc. The event was well documented at the time. Years later, in 2014, Saulo Gomes donated one of the meteorite fragments to *MNRJ*.

Physical characteristics: Three meteorite fragments with total mass 210 g. The fragment studied is ~4 × 3 × 2 cm and largely covered by dull to shiny, ~2 mm thick, black fusion crust. Interior shows a pronounced chondritic texture, with abundant well-defined chondrules having 0.8 mm average diameter. Chondrules and fragments are embedded in a gray to black, fine-grained matrix. Bulk density 3.3 g/cm^3.

Petrography: Weakly shocked (S3), well-developed chondritic texture with mineralogy and mineral compositions consistent with an unequilibrated ordinary chondrite. All principal types of chondrules are present, including porphyritic olivine, porphyritic pyroxene, radial pyroxene and well-developed barred olivine. Many metal grains are composed of kamacite with inclusions of tetrataenite. Several chondrules are Al-rich; one of them shows a dust-rich rim with glass and Al-rich minerals. The major minerals are forsterite, enstatite and clinoenstatite. The meteorite is a genomict breccia.

Geochemistry: (R.N. Salaverry and M.E. Zucolotto, with collaborators K. Keil, J.C. Mendes, A. Zanardo, J. Gattacceca, A. Tosi and F. Vasques) Microprobe analysis shows ferromagnesian minerals with unequilibrated composition. Olivine ($Fa_{29.8\pm13.6}$; n=48) and low-Ca pyroxene ($Fs_{25.3\pm16.7}Wo_{1.5\pm1.1}$, n=16). Metallic Fe,Ni is composed of kamacite (93 wt% Fe) tetrataenite (47 wt% Fe), taenite (62 wt% Fe) and troillite (61 wt% Fe; 35 wt% S). The rims of dust-laden shells have an average: Al_2O_3=21.1, MgO=6.7, SiO_2=63.7, FeO=4.1, CaO=3.3, Cr_2O_3=4.4, all in wt%. The genomict breccia has in average: Al_2O_3=6.5, MgO=14.6, Na_2O=0.07, CaO=4.6, SiO_2=54.8, FeO=16.4, Cr_2O_3=0.6, all in wt%.

Classification: LL group classification based on: bulk density (3.3 g/cm^3), chondrule mean apparent diameter (0.8 mm), content of metallic Fe,Ni (2 vol%), Co content of kamacite (1.3 wt%), 20.88 total iron (wt%), a low magnetic susceptibility (log χ ($\times 10^{-9}$ m^3/kg) = 4.47) with a low weathering meteorite (W1) and $Fs_{25.3}$, $Fa_{29.8}$ = LL . Petrologic type 3.2 classification based on the texture and highly unequilibrated minerals: mean Cr_2O_3 content of ferroan olivine is ~0.22±0.19 wt%; PMD of Fa content of olivine = 45, PMD of Fs content of pyroxene = 65; absence of albite in mesostasis chondrules type I and II; matrix <20% recrecrystallized; Ni content of troilite (0.09 wt%); Ni heterogeneity of kamacite (16.2%); and, cathodoluminesnce (CL) analysis shows rare yellow CL, common blue CL, present red CL and a low matrix CL.

Specimens: The 122 g specimen is held intact by the reporter Saulo Gomes; 47 g, UNESP University; 40 g, *MNRJ*.

Castelvecchio 43.98483°N, 10.72317°E
Toscana, Italy
Find: 2015
Classification: Iron meteorite (IIAB)

History: On 3 Aug 2015, a lumberjack appointed by meteorite collector Mario Goiorani to explore the area with a metal detector and a GPS, found several bomb slivers and a single small, rounded, metallic sample completely covered by rust and buried in the ground at a depth of about 10 cm.

Physical characteristics: The main mass, 37 g, displays an ablated outer surface. It was cut on one side to get the type specimen. No Widmanstaetten pattern was visible on the etched surface.

Petrography: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*). A 1 cm × 1 cm chip of the sample was analyzed by SEM. No exsolution lamellae were detected in BSE in the exposed area. A SEM X-ray linescan performed across the entire section provided a homogeneous kamacitic composition with no appreciable variations.
Geochemistry: SEM-EDX spot analyses, all in wt.% (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*): kamacite $Fe_{95.1\pm0.5}Ni_{4.5\pm0.5}$ (N=5); Bulk composition (C. Herd and G. Chen, *UAb*): Ni=59.4, Co=4.7 (both mg/g); Cu=141, Ga=55.5, Ge=166, As=4.1, W=1.3, Ir=0.07, Pt=3.2, Pd=2.3, Ru=3.0, Os=5.2, Rh=1.6, Ag=0.6, Sb=0.3 (all μg/g). Obtained by solution ICP-MS using North Chile (Filomena) as an internal standard.
Classification: Iron meteorite (IIAB). Hexahedrite.
Specimens: The remaining of the main mass, weighing 26 g, is owned by Mario Goiorani. An 11 g sample and a polished section is on deposit at MSN-Fi.

Castiglione del Lago 43.129°N, 12.02317°E
Umbria, Italy
Find: 1970
Classification: Iron meteorite (IAB-MG)
History: A single mass, weighing 667 g, was recovered in 1970 near Castiglion del Lago by a peasant while plowing his field. The peasant preserved the sample for many years in his home considering it just a curiosity until he read an interview of Matteo Chinellato, an Italian meteorite collector, in 2007 who invited people to send him potential meteorites for analysis. Chinellato received the main mass, cut a slice and sent it to *MSP* and to MSN-Fi for analysis.
Physical characteristics: The main mass has a severely rusted outer surface and has been cut on one side to get the type specimen. An etching of the cut surface showed a distinct Widmanstaetten pattern.
Petrography: (V. Moggi Cecchi, G. Pratesi, S. Caporali, Uni-Fi). Although silicate inclusions are visible on the cut and etched type specimen, the 1 × 1 cm polished section examined does not contain silicates. Metal is formed by coarse-grained (~4 mm width) equigranular kamacite grains with 120° grain boundaries, inside which Neumann lines are visible. Taenite is rare. Scattered schreibersite laths, up to 100 microns in width and to 1 mm in length, can be observed within some kamacite grains and at grain boundaries, frequently surrounded by iron oxides.
Geochemistry: SEM-EDX spot analyses, all in wt% (V. Moggi Cecchi, G. Pratesi, S. Caporali, Uni-Fi): schreibersite $P_{15.5\pm0.2}Fe_{47.0\pm0.3}Ni_{37.5\pm0.4}$ (N=5); taenite $Fe_{75.4\pm0.5}Ni_{24.6\pm0.2}$ (N=5) ; kamacite $Fe_{93.5\pm0.6}Ni_{6.5\pm0.2}$ (N=7). Bulk composition (C. Herd and G. Chen, *UAb*) Ni=66.4, Co=4.4 (both mg/g); Cu=151, Ga=98.2, Ge=414, W=1.4, Ir=4.2, Pt=8.1, Pd=3.5, Ru=7.0, Re=0.3, Os=1.4, Ag=1.6, Sb=0.5 (all ?g/g). Obtained by ICP-MS using North Chile as a calibration standard.
Classification: Iron meteorite, IAB-MG, coarse octahedrite. Composition is consistent with IAB Complex, Main Group (MG).
Specimens: An end-cut, weighing 27.2 g, is on deposit at *MSP* (inventory number MSP2391). A polished thin section is on deposit at MSN-Fi. Main mass with Matteo Chinellato.

Catalina 001 25°6.000’S, 69°45.500’W
Antofagasta, Chile
Find: Dec 2009
Classification: Ordinary chondrite (L3)

History: E. Christensen and M. Warner found eight similar looking stones within a restricted area on a deflated gravel plain in the Antofagasta region of Chile.
Physical characteristics: The largest stone (842 g) is ~30% fusion crusted and exhibits well-developed regmaglypts. None of the other stones preserve fusion crust. The sawn surfaces of each stone look identical showing a sea of chondrules supported by abundant dark matrix, with only minor patches of iron staining. Magnetic susceptibility varies from log χ ($\times 10^{-9}$ m^3/kg) = 4.78 to 4.82 (n=8).
Petrography: (L. Garvie, *ASU*) Five thin sections from five stones were examined. The sections are all similar and show an abundance of chondrules and chondrules fragments supported by dark matrix. Sharply defined chondrules from 0.1 to 2 mm, with a few to 6 mm. Matrix contains an abundance of sulfide and metal, which is occasionally concentrated at chondrules rims. In ultrathin sections the matrix is green in plane-polarized light and largely isotropic under crossed polars. Glass is common in chondrules ranging from clear (and isotropic) to partly devitrified.
Geochemistry: (L. Garvie, *ASU*) Microprobe analyses show olivine and pyroxene of variable compositions. Olivine, $Fa_{0.92\text{-}40.91.}$ Cr_2O_3 in olivine shows a maximum at 0.05 wt%, with a range of values to 0.4 wt%. Pyroxene $Fs_{2.32\text{-}34.29}Wo_{0.16\text{-}16.6.}$ Oxygen isotopes: (R. Tanaka and D. Rumble, *OkaU*), (mean of two replicates: $\delta^{17}O$=3.655; $\delta^{18}O$=5.151; $\Delta^{17}O$=0.941 per mil).
Classification: The oxygen isotopes are consistent with the L ordinary chondrite group and the probe data with petrologic type 3.4.
Specimens: *ASU* holds 115.97 g (in six pieces) and five thin sections.

Catalina 151 ~25°14'S, ~69°43'W
Antofagasta, Chile
Find: 2014 Oct 25
Classification: Ordinary chondrite (LL3)
Physical characteristics: Crusted stone. Cut surface reveals a brownish interior with closely packed, well-delineated mm-sized chondrules.
Petrography: Closely packed chondrules with apparent diameter 700?510 μm (N=53). Chondrule mesostasis shows quenched texture. Many chondrules are rimmed with opaques (metal and sulfides) or 50 μm wide dust rims. A 7 mm large igneous inclusion is visible.
Geochemistry: Olivine $Fa_{16.3\pm10.3}$ ($Fa_{0.6\text{-}35.0}$, PMD 50%, N=22). Ferroan olivine has 0.11±0.08 wt% Cr_2O_3 (N=20). Orthopyroxene $Fs_{12.4\pm1.4}Wo_{1.4\pm1.9}$ ($Fs_{2.0\text{-}29.3}$, PMD 71%, N=13). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.16.
Classification: LL3 with suggested sub-type of 3.2/3.3 from the Cr_2O_3 content of olivine and the scatter of olivine Fa and orthopyroxene Fs.
Specimens: 51 g and a polished section at *CEREGE*. Main mass at *MMC*.

Christiana 27°54'S, 25°9'E
North West, South Africa
Find: 2004
Classification: Iron meteorite (IVA)
History: Found by a farm laborer out hunting in farm fields around 2004. It was then acquired by a gem and mineral dealer in Capetown, and subsequently sold at the Tucson Rock and Mineral Show circa 2005.

Physical characteristics: The main mass weighs approximately 128 kg and is irregular in shape with a glossy brown to red-brown exterior. Numerous regmaglypts are present, including some that are spherical and several cm across.
Petrography: Optical investigation reveals a well-developed Widmanstatten pattern consistent with a finest octahedrite. Troilite and schreibersite inclusions are common.
Geochemistry: ICP-MS data, using sample of North Chile (Filomena) as standard (C. Herd and G. Chen *UAb*): Ni = 8.2, Co = 0.39 (both wt%); Ir = 2.6, Ga = 2.5, W = 0.65, Re = 0.29, Cu = 170, Ru = 4.2, Pd = 2.8, Pt = 6.1 (all μg/g).
Classification: (C. Herd, *UAb*): IVA iron, finest octahedrite.
Specimens: Type specimen of 139.8 g at *UAb*. Main mass at *JTESM*.

Clarendon (c) 34.983°N, 100.933°W
Texas, United States
Find: 2015 Apr 6
Classification: Ordinary chondrite (L4)
History: Frank and DeeDee Hommel of the Bar H Working Dude Ranch located northwest of Clarendon, Texas, were out riding on their property on April 6, 2015, and report that "their horses went crazy" when they approached a large unusual rock (later determined to weigh 345 kg). They dug up additional fragments weighing about 32 kg near the large mass located at 34.983°N, 100.933°E. They contacted Eric *Twelker*, who arranged for testing of a specimen.
Physical characteristics: The main mass (345 kg) has a reddish-brown exterior and lacks fusion crust. The relatively fresh interior is medium gray with abundant bright metal grains.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules up to 3.3 mm occur within a relatively coarse-grained matrix containing abundant stained kamacite plus accessory sodic plagioclase, merrillite and troilite.
Geochemistry: Olivine ($Fa_{24.1-24.6}$, N = 3), orthopyroxene ($Fs_{20.5-20.6}Wo_{1.2-1.5}$, N = 3), clinopyroxene ($Fs_{7.3-7.6}Wo_{45.2-45.0}$, N = 2). Oxygen isotopes (K. Ziegler, *UNM*): analysis of acid-washed subsamples by laser fluorination gave, respectively, $\delta^{17}O$ = 3.611, 3.702, 3.673; $\delta^{18}O$ = 4.855, 4.950, 4.827; $\Delta^{17}O$ = 1.048, 1.088, 1.124 per mil.
Classification: Ordinary chondrite (L4).
Specimens: 20.6 g plus one polished thin section at *UWB*; remaining material with the finders.

Claromecó 38°48.264’S, 60°07.386’W
Buenos Aires, Argentina
Find: 1963
Classification: Ordinary chondrite (L5/6)
History: Two reddish brown meteoritic stones of 13 kg each were found in 1963 by Mr. F. Massigogge. The stones were leaning against a windmill in his farm at Argentine Pampas, and were reported a few years ago to geologist Rogelio Daniel Acevedo. The farm owner knew the exact location where he had found the stones. No other specimens are known.
Physical characteristics: The meteorites have a rusty appearance that is indicative of having experienced significant terrestrial weathering and the matrix is oxidized. About 90% of the original specimens were covered by a fusion crust. The degree of weathering is variable on the cm-scale of the thin section. The sample is moderately weathered and about half of the metals have been destroyed. Close to the surface most of the metal is gone. Once cut the metal grains

are barely oxidized by terrestrial alteration, but the matrix is significantly colored by iron staining.
Petrography: Rogelio D. Acevedo (*CONICET*), J. M. Trigo-Rodriguez (*CSIC-IEEC*), A. Bischoff and S. Ebert, *(IfP)*, I. Subías, J. Reche and A. Bergara Pinto (*UAdB*). The sample is well equilibrated and recrystallized. Thus, in some area, the meteorite looks like a type 6 chondrite, and in other areas chondrules can be clearly observed indicating a type 5 classification. Thus, a Type 5/6 classification is most appropriate. The olivines show planar fractures in olivine, clearly indicating shock stage S3.
Geochemistry: Mineral compositions: Olivine: $Fa_{24.9\pm0.4}$ (n =10); Pyroxene: $Fs_{20.7\pm0.4}Wo_{1.5\pm0.4}$ (n = 10).
Classification: L5/6 Ordinary chondrite
Specimens: 459.2 g at *CONICET* and 20 g plus two thin sections at Institute of Space Sciences (*CSIC-IEEC*).

Dayet el Aam 26°44’ N, 7°58’ W
Tiris Zemmour, Mauritania
Find: 2012 Sept
Classification: Iron meteorite (IIAB)
History: One mass of 4975 g was found by nomads on Erg El Ahmar, north of Taoudenni, near the border to Algeria in September 2012. The specimen was subsequently purchased by S. Buhl and M. Jost in September 2014.
Physical characteristics: The sand-polished exterior of the compact mass shows shallow regmaglypts, moderate sand-abrasion and a gray-greenish patina.
Petrography: (C. Herd, *UAb*): Optical and SEM investigation a 3 × 4 cm polished and etched slice reveals kamacite crystals with grain boundaries demarcated by laths of schreibersite. Tabular inclusions of schreibersite were also observed.
Geochemistry: Bulk composition: (C. Herd and G. Chen, *UAb*) Ni = 57, Co = 4.6 (both mg/g); Cu = 142, Ga = 74.1, As = 5.4, W = 2.8, Ir = 7.7, Pt = 27.2, Pd = 1.6, Ru = 18.8, Re = 0.53, Au = 0.5 (all μg/g). Obtained by solution ICP-MS using North Chile (Filomena) as an internal standard.
Classification: (C. Herd, *UAb*): IIAB, hexahedrite.
Specimens: Type specimen of 57.7 g from which ~0.8 g of material was removed for analysis, at *UAb*. Main mass split between S. Buhl and M. Jost.

Dhofar 2005 (Dho 2005) 18°51.792’N, 54°51.217’E
Zufar, Oman
Find: 2003 Mar 12
Classification: Carbonaceous chondrite (CO3)
History: Discovered on a desert expedition on March 12, 2003.
Physical characteristics: One dark brown stone of 30 g. Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 3.98.
Petrography: (R. Bartoschewitz, *Bart*) Microprobe examination of a polished thin section shows a variety of chondrules up to 0.6 mm (avg. 0.2 mm) set in a fine-grained matrix. Chondrule/matrix ratio ~1.

Geochemistry: (R. Bartoschewitz, *Bart*, P. Appel and B. Mader, *Kiel*) Olivine: $Fa_{22.8}$ ($Fa_{1.7\text{-}54.2}$), Cr_2O_3=0-0.6 wt.%, Fe/Mn=74 (n=19); low-Ca pyroxene: $Fs_{1.5}Wo_{2.0}$ ($Fs_{0.6\text{-}3.5}Wo_{0.4\text{-}4.4}$, n=9); feldspar $An_{66}Or_{0.2.}$ Kamacite Ni 5.2, Co 1.3 (n=1); taenite Ni 34-40, Co 0.3-0.7 (n=4) wt.%.
Classification: Carbonaceous chondrite (CO3)
Specimens: 6.33 g on deposit at *Kiel*, main mass anonymous

Dhofar 2043 (Dho 2043) 18°28’21.5"N, 54°10’11.6
Zufar, Oman
Find: 2014 Nov 08
Classification: Carbonaceous chondrite (CO3)
Petrography: Chondrules and rare CAIs in a dark brown matrix (~50 vol%). Chondrule mean apparent diameter 210±110 μm (N=33).
Geochemistry: Cr_2O_3 in ferroan olivine 0.08±0.08 wt% (n=5)
Classification: CO3

Dhofar 2046 (Dho 2046) 18°21’24.4"N, 54°11’14.4"E
Zufar, Oman
Find: 2011 Mar 13
Classification: Carbonaceous chondrite (CM2, anomalous)
Physical characteristics: A single black stone. Cut surface reveal homogeneous black interior.
Petrography: Chondrules (mostly olivine-rich), chondrule fragments and olivine fragments (20 vol%) in a fine-grained iron-rich matrix (80 vol%). Average chondrule diameter 240±130 μm (N=25). Chondrules have fine-grained dust mantles. FeNi + FeS grains to 50 μm are found in the matrix and in the chondrules.
Geochemistry: Olivine $Fa_{15.2\pm24.2}$ ($Fa_{0.5\text{-}76.7}$, median $Fa_{1.4}$, PMD=90%, N=9). Oxygen isotopic composition (J. Gattacceca, C. Sonzogni, *CEREGE*) is $\delta^{17}O$=7.78 ‰, $\delta^{18}O$=19.93 ‰ (analysis of one acid-washed 1.5 mg aliquot of a powdered 200 mg bulk sample). Magnetic susceptiblity log χ ($\times 10^{-9}$ m^3/kg) = 4.05.
Classification: CM2-anomalous. The oxygen isotopic composition is anomalous compared to most CM chondrites. The meteorite is possibly paired with Dhofar 225 that has the same oxygen isotopic composition and was found nearby.
Specimens: Type specimen and polished section at *CEREGE*. Main mass with anonymous finder.

Dhofar 2047 (Dho 2047) 19°19.900’N, 54°47.146’N
Zufar, Oman
Find: 2014 Mar 12
Classification: Lunar meteorite (feldspathic breccia)
History: Found by a prospector.
Physical characteristics: Fusion crust is absent.
Petrography: Brecciated. Plagioclase is stained pink from hematite. No petrography in thin section was carried out because of the small stone mass.
Geochemistry: Bulk composition (R. Korotev, *WUSL*) INAA of subsamples gave the following mean abundances (in wt.%) FeO 3.1, Na_2O 0.35; (in ppm) Sc 4.6, La 0.8, Sm 0.33, Eu 0.74, Yb 0.26, Lu 0.040, Th 0.09.

Classification: Lunar (feldspathic breccia). The stone is indistinguishable in lithophile element composition from Dhofar 303, 305, 306, 309, 310, 908, 911, and 1085 and was found 0.7-1.6 km away from these.
Specimens: 1.14 g at *UAb*.

Dhofar 2056 (Dho 2056) 19°25.552'N, 54°42.998'E
Zufar, Oman
Find: 2002 Feb 23
Classification: Ordinary chondrite (L3)
History: Discovered by a desert expedition on Feb. 23, 2002.
Physical characteristics: One dark brown stone of 63.12 g.
Petrography: (R. Bartoschewitz, *Bart*) Microscopic examination of a thin section shows clustered chondrules (PO, BO, RP) up to 2 mm (avg. 0.7 mm) with opaque oxidized rims. Chondrule matrix ratio >10.
Geochemistry: (R. Bartoschewitz, *Bart*, P. Appel and B. Mader, *Kiel*) Olivine: $Fa_{8.3\pm4.2}$ (n=28); pyroxene: $Fs_{8.5\pm7.4}Wo_{1.0\pm0.9}$ (n=20); kamacite, Ni 2.9-3.8, Co 0.5-0.6 wt.% (n=3). O-isotopes (R. Greenwood and Ian Franchi, *OU*): $\delta^{17}O = 4.031$, $\delta^{18}O = 4.74$ (permil). Magnetic susceptibility (R. Bartoschewitz, *Bart*) log χ ($\times 10^{-9}$ m^3/kg) = 4.49.
Classification: Ordinary chondrite (L3)
Specimens: 13.4 g on deposit at *Kiel*, main mass anonymous

Ejby 55°42.02'N, 12°24.33'E
Hovedstaden, Denmark
Confirmed fall: 2016 Feb 6
Classification: Ordinary chondrite (H5/6)
History: (H. Haack, *NHMD*): A bright fireball was observed over eastern Denmark Feb. 6, 2016, 22:07:19 (UTC+1). It was overcast in the area below the fireball, but many people reported having seen a very bright light. Pictures of the fireball were taken from three locations in Germany and one in Austria (at a distance of 890 km) by automatic cameras designed to take pictures of noctilucent clouds. A surveillance camera on the Danish west coast also recorded a video of the fireball. None of the cameras in the Danish fireball network had clear skies during the event. 279 reports with observations of the fireball and/or sound phenomena were received by the Danish fireball network. Loud sonic booms were heard by many people up to 30 km from the place where the meteorites were found. The day after the fireball was observed the first meteorite (60 g fragment) was found on the tiles in front of the main door of a private house in Ejby, which is a suburb in the western part of Copenhagen. The owner of the house had not seen the rock before. Later that day 6.5 kg of shattered fragments were found on the tiled courtyard of a business property. These fragments had not been there when the business closed on Friday – the day before the fall. During the following 19 days a total of 11 individual meteorites were found in an area measuring 5 × 5 km. The biggest piece weighed 6.5 kg. It hit a tiled area and shattered into hundreds of fragments.
Physical characteristics: 11 meteorites have been recovered, with a total mass of 8938 g. Some of the fragments were recovered wet and the weights are therefore decreasing as the samples dry out.
Petrography: (M. Patzek and A. Bischoff, *IfP*). Based on the study of the thin sections, Ejby is unbrecciated. Highly recrystallized areas with large plagioclase grains were observed, and areas

with abundant relict chondrules also exist. Thus, the rock is transitional between type 5 and 6. In places, high metal and sulfide abundances were found. Olivine shows undulatory extinction indicating that the rock is very weakly shocked (S2). As opaque phases metals (kamacite, taenite), troilite, and chromite were observed. Other accessory phases include Cl-apatite and merrillite.
Geochemistry: (M. Patzek and A. Bischoff, *IfP*). The mean composition of olivine is $Fa_{19.3\pm0.1}$ with a compositional range of $Fa_{18.8\text{-}19.5}$ (n=19). The low-Ca pyroxenes have a mean composition of $Fs_{16.9\pm0.2}$ (n= 21), range $Fs_{16.4\text{-}17.2}$. Mean plagioclase is $An_{11.5\pm0.9}Or_{6.0\pm1.6}$ (n= 10; range $An_{9.0\text{-}12.8}$). Kamacite has mean Ni- and Co-concentrations of 6.3 and 0.45 wt%, respectively (n=8). The taenite composition has 48.7±2.8 wt% Ni (mean Co: ~0.05 wt%; n=10).
Specimens: Except for a few small fragments of the 6.5 kg main mass, all recovered fragments are at *NHMD*.

El Keurt 35°22.36'N, 0°4.49'E
Mascara, Algeria
Find: Nov 1999
Classification: Ordinary chondrite (L4)
History: Collected by Romano Serra along the road while travelling towards a desert area for meteorite recovery.
Physical characteristics: Single stone, partial crust. The sawn surface shows a chondritic texture.
Petrography: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) The thin polished section displays a chondritic texture with several chondrules of various types (BO,PO, RP, PP) ranging in size from 200 to 800 μm in diameter within a fine grained silicate matrix. Opaque phases are Fe-Ni alloys and troilite.
Geochemistry: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Olivine ($Fa_{23.0\pm2.5}$, Fe/Mn=48±3, n=10; MD=1.8 PMD=8.8); low-Ca pyroxene ($Fs_{18.1\pm2.3}Wo_{1.6\pm0.1}$; Fe/Mn=25±3, n=8; MD=1.0 PMD=8.4).
Classification: Ordinary Chondrite (L4); S2; W4
Specimens: A total of 21.0 g specimen and one thin section are on deposit at MSN-Fi; *OAM* holds the main mass.

El Médano 297 ~24°51'S, ~70°32'W
Antofagasta, Chile
Find: 2013 Nov 10
Classification: Ordinary chondrite (LL7)
Petrography: Triple junctions. Rare relic chondrules.
Geochemistry: Plagioclase $An_{10.6}Ab_{84.4}Or_{5.0}$
Classification: LL7. Type 7 based on texture and Wo content of orthopyroxene. Probably paired with El Medano 298 and 299.

El Médano 298 ~24°51'S, ~70°32'W
Antofagasta, Chile
Find: 2013 Nov 10
Classification: Ordinary chondrite (LL7)
Petrography: Triple junctions. Rare relict chondrules.

Classification: LL7. Type 7 based on texture and Wo content of orthopyroxene. Probably paired with El Medano 297 and 299.

El Médano 299 ~24°51'S, ~70°32'W
Antofagasta, Chile
Find: 2013 Nov 10
Classification: Ordinary chondrite (LL7)
Petrography: Triple junctions. Rare relic chondrules.
Classification: LL7. Type 7 based on texture and Wo content of orthopyroxene. Probably paired with El Medano 297 and 298.

El Médano 300 ~24°51'S, ~70°32'W
Antofagasta, Chile
Find: 2013 Nov 09
Classification: Iron meteorite (IAB, ungrouped)
History: Found by Matthieu Gounelle during a systematic search for meteorites organized by *CEREGE* in 2013.
Physical characteristics: The meteorite is a full oriented specimen with pyramid shape, regmaglypts and a few weathering pits. Cut surface shows unweathered metallic interior with dark mm-sized inclusions, some organized in flower-like structures.
Petrography: Metal with fine grained (circa 100 μm) homogeneous texture. The meteorite has graphite "flowers" with dimensions up to 5 mm that are quite similar to those in IAB-ungrouped NWA 8154 and NWA 8155. However, the composition of this iron is very different from these two NWA irons. Also present is abundant fine (20 μm) schreibersite, rare troilite globule and schreibersite large crystals (mm size).
Geochemistry: Bulk composition (INAA, J.T. Wasson, *UCLA*): Co = 5.02 mg/g; Ni = 66.0 mg/g, Ga = 57.6 μg/g, Ge = 307 μg/g, As = 12.3 μg/g, Ir = 1.60 μg/g, Au = 1.608 μg/g. The meteorite has high Sb (280 ng/g). Data are the mean of two analyses. The high Au, As and Sb indicate the this iron is a member of the IAB complex. Its composition is, however, unique. The most similar irons are Redfields, Pedernales and Mundrabilla, but none of these are closely related. It also differs in major ways from NWA 8154 and NWA 8155, which also show graphite flowers; for example, the latter have 133 mg/g Ni and 24 μg/g Ir.
Classification: Iron, IAB-ung
Specimens: Main mass and type specimen in *CEREGE*, INAA slab (1.47 g) in *UCLA*, 2.6 g at *MNHN*.

El Médano 301 ~24°51'S, ~70°32'W
Antofagasta, Chile
Find: 2013 Nov 09
Classification: Ungrouped chondrite
History: Two stones were found 1 m apart in the Atacama desert by Pierre Rochette on November 4, 2013.
Physical characteristics: A single brown stone without fusion crust
Petrography: Closely packed, well-defined chondrules with average apparent diameter 490±330 μm (N=60). Main minerals are olivine (forsterite), enstatite, diopside, chlorapatite, chromite,

troilite, kamacite, taenite. Metal and sulfides have been extensively replaced by weathering products.
Geochemistry: Olivine $Fa_{3.9\pm0.4}$ ($Fa_{3.6\text{-}5.0}$, PMD 5.5%, FeO/MnO=8.0±1.3, N=10), Cr_2O_3 0.02±0.03 wt%. Orthopyroxene $Fs_{13.1\pm5.7}$ ($Fs_{6.6\text{-}21.0}$, PMD=40%, N=11). Oxygen isotopic composition (J. Gattacceca, C. Sonzogni, *CEREGE*) is $\delta^{17}O$ = 3.58 ‰, $\delta^{18}O$ = 5.38 ‰, $\Delta^{17}O$ = 0.78‰ (analysis of one 1.5 mg sample of hand-picked separated silicates after acid cleaning). Magnetic susceptiblity log χ ($\times 10^{-9}$ m^3/kg)=4.62.
Classification: Chondrite-ung. With $Fa_{3.6\text{-}5.0}$, this meteorite has affinities with NWA 7135 that has $Fa_{4.8\text{-}6.3}$ and similar oxygen isotope composition, although NWA 7135 is more reduced, with occurrence of schreibersite and oldhamite.
Specimens: Polished section, main mass and type specimen at *CEREGE*

El Médano 322 (EM 322) ~24°51'S, ~70°32'W
Antofagasta, Chile
Find: 2013 Nov 2
Classification: Ordinary chondrite (H5, melt breccia)
Petrography: Chondritic breccia composed of large type 5 clasts in a melt matrix. The type 5 clasts show pervasive shock darkening, with abundant troilite and metal veinlets and droplets. Chondrules are visible, and plagioclase average size is below 50 μm. Most metal and sulfides are in the form of eutectic mixtures with grain size to mm. Plagioclase-chromite assemblages to several hundreds μm are found. The melt part also contains troilite and metal eutectic mixtures, with smaller average grain size compared to the clasts.
Geochemistry: Olivine and orthopyroxene compositions are the same in the molten host and the type 5 clasts
Classification: H5-impact melt breccia.

Elephant Moraine 13002 (EET 13002) 76°17.057'S, 156°27.242'E
Antarctica
Find: 2014 Jan 09
Classification: Carbonaceous chondrite (CK5)
Physical characteristics:
Petrography: This meteorite consists of silicates (olivine and minor pyroxene and plagioclase) and opaque minerals (mainly magnetite). A few chondrules (up to 1.5 mm) are present.
Geochemistry: Olivine is $Fa_{30.3\pm0.2}$; low-Ca pyroxene is $Fs_{28.1\pm2.4}Wo_{0.9\pm0.3}$; plagioclase composition is variable, $An_{21\text{-}54}$.

Galb Inal 21°18'N, 14°58'W
Inchiri, Mauritania
Find: Jan 2011
Classification: Lunar meteorite
History: (H. Chennaoui Aoudjehane, A. Jambon) Found in 2011 by nomads, in a sandy area close to the village of Inal, Mauritania, south of Tichla. The stone was found north of the railway and south of the frontier. The stone was given the provisional name "Northwest Africa 7173" in Jan 2012, prior to documentation of the find location.

Physical characteristics: A 4 kg crust-free and minimally weathered stone, broken in two pieces. The black lustered stone has up to centimeter-sized white lithic clasts. The surface is sand blasted. Magnetic susceptibility (*UPVI*): log χ ($\times 10^{-9}$ m^3/kg)= 3.93.
Petrography: (A. Jambon, O. Boudouma, *UPVI*) Feldspathic breccia with a significant melt matrix containing petrographically diverse areas. Lithic (ferro anorthosite, troctolite, spinel troctolite, norite; hedenbergite-fayalite-silica; rare clasts of silica associated with K-feldspar) and mineral fragments, shocked clasts, impact melt pockets, devitrified glassy clasts and glass beads. Contains ilmenite, ulvöspinel, chromite, ilmenite, rutile, (F-Cl) apatite. Rare small grains of troilite, kamacite and schreibersite.
Geochemistry: (A. Jambon, *UPVI* and R. Korotev, *WUSL*) Orthocumulate olivine Fa_{19} (FeO/MnO = 90), plagioclase An_{94}, subcalcic augite $Fs_{22}Wo_{30}$, Pigeonite $Fs_{27\text{-}33}Wo_{5\text{-}15}$ and $Fs_{35\text{-}4}Wo_{12\text{-}19}$, Ca-pyroxene core, $Fs_{16}Wo_{31}$ and rim, $Fs_{41}Wo_{14}$. Bulk composition: XRF (*UPVI*) INAA (*WUSL*). INAA : Na_2O = 0.45 wt %; Sc = 21 ppm; Cr = 1400 ppm; FeO = 9.5 wt %; Ni = 200 ppm; Sm = 3.5 ppm, Eu = 0.95 and Ba = 250 ppm. XRF wt %: SiO_2 = 45.7; Al_2O_3 = 21.6; Cr_2O_3 = 0.2; TiO_2 = 0.48; FeO = 9.6; MgO = 4.1; CaO = 17.4; K_2O = 0.41. Oxygen isotopes (R. Greenwood, *OU*) : $\delta^{17}O‰$= 3.238, $\delta^{18}O‰$= 6.198, $\Delta^{17}O‰$= 0.015.
Classification: Lunar regolith breccia. Despite a chemical kinship with NWA 2995 the physical aspect and texture do not favor pairing of these two finds.
Specimens: A 21.5 g type specimen is on deposit at *UPVI*. Anonymous finder holds the main mass.

Gandom Beryan 31°52.31’N, 57°03.31’E
Kerman, Iran
Find: 2016 Apr 2
Classification: Ordinary chondrite (L3)
History: The sample was found in the desert by Mr. Kryachko Timur. V. and Mr. Khatami Majid.
Physical characteristics: 5 fragments of meteorite were covered by dark brown fusion crust.
Petrography: Ivanova M. A. (*Vernad*) The meteorite has a chondritic texture and consists of POP, PO, RP, and BO chondrules embedded in a fine-grained matrix. Boundaries between chondrules and the matrix are sharp and clear. The average chondrule diameter is 0.8 mm.
Geochemistry: Mineral compositions and geochemistry: Ivanova M.A. (Verna.) Olivine, $Fa_{20.3\pm6.9}$ (N=27), PMD of Fa, 34.4%. Orthopyroxene, $Fs_{17.9\pm13.3}Wo_{1.8\pm2.2}$ (N=25). Co content in kamacite, 0.96±0.08 wt%.
Classification: L3, suggested sub-type 3.6, W1, S1. Ivanova M. A. (*Vernad*)
Specimens: 654 g, 13.6 g and a thin section are deposited in *Vernad*. The main mass is with Mr. T. V. Kryachko (bredfild@mail.ru) and Mr. V.V. Shulimin, private collection

Grove Mountains 090407 (GRV 090407) 72°46’42.1"S, 75°19’10.9
Antarctica
Find: 23 Jan 2010
Classification: Ordinary chondrite (L4, melt breccia)
Physical characteristics: The specimen is dark black with a surface partially covered by remnant fusion crust.
Petrography: In thin-section, GRV 090407 shows a porphyritic structure. Phenocrysts (~30 vol%) are euhedral to subhedral olivine with an average diameter of 100~200 μm, and remnant

chondrules are present. Olivine shows shock effects such as planar deformation fractures and undulatory extinction. In transmitted light, the matrix (~70 vol%) is opaque, and is mainly composed of glass with traces of granular silicates and metal. The granular silicates in the matrix are <50 μm in size, and include mainly low-calcium pyroxene, olivine and feldspar. The other opaque minerals in the matrix are represented by kamacite, taenite, troilite and chromite. With the exception of oxidized metallic veins developed along fractures, the metal is dispersed in circular droplets (previously molten) between 5 and 30 μm. The GRV 090407 is a breccia with melted matrix.
Geochemistry: The minerals have uniform chemical compositions, with an olivine (phenocrysts and granular matrix) composition of $Fa_{23.52\pm0.19}$, pyroxene of $Fs_{23.52\pm0.19}Wo_{1.49\pm0.11.}$ The compositional characteristics of olivine and low calcium pyroxene are consistent with the L group.

Hassi Bou Talha 28.112°N, 9.890°W
South, Morocco
Find: 2016 Apr 2
Classification: HED achondrite (Eucrite, polymict)
History: Found by a Moroccan prospecting team, 41 km S of Aouinet Lahna, 59 km NWW of Zag and 71 km SW of Assa, Morocco, and subsequently acquired by Fabien Kuntz.
Physical characteristics: A single broken stone (308 g) lacking fusion crust and exhibiting a fine-grained, gray interior.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of sparse lithic clasts (with subophitic to microgabbroic textures) and abundant crystal debris in a finer grained matrix. Minerals are exsolved pigeonite (of several different bulk compositions), calcic plagioclase, silica polymorph, chromite, ilmenite, troilite, rare zircon (as grains up to 30 μm across) and minor secondary calcite.
Geochemistry: Orthopyroxene host A ($Fs_{52.9}Wo_{4.02}$, FeO/MnO = 28), clinopyroxene exsolution lamella A ($Fs_{18.4}Wo_{44.4}$, FeO/MnO = 21), low-Ca pyroxene host B ($Fs_{34.2}Wo_{5.8}$, FeO/MnO = 29), clinopyroxene exsolution lamella B ($Fs_{14.1}Wo_{41.5}$, FeO/MnO = 21).
Classification: Eucrite (polymict breccia).
Specimens: 20.55 g including one polished thin section at *PSF*; remainder with *Kuntz*.

Indio 33º46’20.2"N, 116º08’21.5"W
California, United States
Find: 2013 Jan
Classification: Ordinary chondrite (H5)
History: The specimen was found as three stones that fit together; the large one is 475.5 g and is being retained by the finder.
Physical characteristics: The main mass is oblong and is largely covered by brownish-black fusion crust.
Petrography: The sample has readily delineated chondrules. Plagioclase grains range up to 20 μm across.

Itaka 53°52.65’N, 118°41.45’N
Chitinskaya oblast’, Russia
Find: 2015 Jul

Classification: Iron meteorite (IIIAB)
History: The meteorite was found by Mr. Grikov on the banks of the Itaka river between the mouths of the Sukhaya Itaka river and the Aleksey river, near the the town of Itaka. The meteorite was possibly excavated during gold mining.
Physical characteristics: The 900 g meteorite has an ellipsoidal shape. The oxidized surface shows a relict Widmanstätten structure.
Petrography: (C. Lorenz, S. Teplyakova, *Vernad*) the meteorite consists of kamacite, taenite, plessitic aggregate, minor FeNi phosphides (schreibersite and rhabdites) and accessory troilite. The average kamacite bandwidth is 4.5 mm.
Geochemistry: (N. N. Kononkova, *Vernad*) kamacite: Ni = 5.47, Co = 0.5; taenite: Ni = 30.6 - 50.5 (all in wt%); (ICP-AS, I. A. Gromyak, ICP-MS, E. S. Toropchenova, *Vernad*, bulk sample) Ni 9.16 wt %, Co 0.53, Au 1.15, Ga 26.2, Ir 2.29, Cr 9.82, W 0.47, As 8.18 (all in ppm).
Classification: Iron (IIIAB), coarsest octahedrite (Ogg), moderately weathered.
Specimens: The type specimen of 108 g and one polished section are on deposit at the *Vernad*. Mr. Sergey V. Grikov holds a main mass of the meteorite.

Jiddat al Harasis 955 (JaH 955) 19.989930°N, 56.407860°E
Al Wusta, Oman
Find: 2013 Nov
Classification: Rumuruti chondrite (R6)
Physical characteristics: A dark stone with dull fusion crust. Cut surface reveals dark-gray interior.
Petrography: Recrystallized chondritic texture with only rare remnants of chondrules. Mineralogy: olivine (dominant), Ca-pyroxene, plagioclase (to 100 μm), sulfides (to 600 μm, modal abundance 9 vol% by point counting with N=334), ilmenite, magnetite. No metal visible.
Geochemistry: Olivine $Fa_{39.9\pm0.1}$, FeO/MnO=88.4, NiO 0.29 wt% (N=5). Chromite Cr# = 0.85, TiO_2 4.3 wt% (N=2).
Classification: R6. Moderate weathering.
Specimens: 13.2 g at *CEREGE*, main mass with anonymous finder.

Jiddat al Harasis 959 (JaH 959) 19°38’23"N, 55°45’04"E
Al Wusta, Oman
Find: 2011 Oct 28
Classification: Ordinary chondrite (H4)
Petrography: Unusual texture with only 50% intact chondrules set in a groundmass of mostly mineral fragments. Chondrule mesostasis is devitrified.
Classification: H4. Brecciated

Jiddat al Harasis 971 (JaH 971) 19° 47' 7"N, 56° 30' 0"E
Al Wusta, Oman
Find: 2013
Classification: Ordinary chondrite (H5/6)
Petrography: Contains mm sized higly recrystallized (granulitic) clasts with olivine $Fa_{18.7\pm0.1}$ (N=2), pyroxene $Fs_{17.4\pm0.5}Wo_{4.0\pm0.1}$ (N=2).

Kamargaon 26°37’56.9884"N, 93°46’11.5115"E

Assam, India
Confirmed fall: 13 Nov 2015
Classification: Ordinary chondrite (L6)
History: On November 13, 2015, at 12:00 pm local time, a meteorite fell near the town of Kamargaon in the Golaghat district of Assam, India. The villagers saw the meteorite falling from the clear sky on a bright sunny day followed by 30 to 40 s of sonic booms. A 12.095 kg mass impacted in a freshly plowed field forming a 45 cm diameter by 90 cm deep hole. The superintendent of police for the Golaghat district subsequently procured the meteorite. The fall was reported in the November 14 issue of the local newspaper, Dainik Janambhumi. Details of the fall are described by Goswami et al. (2016). The meteorite was broken into four pieces and three pieces distributed as follows: 2.668 kg to the Department of Applied Geology, *DibrU*, ~ 2kg to the Department of Physics, Assam University, and 2.15 kg to the Jorhat Science Center and Planetarium. Goswami, T.K., Ray, D., Sarmah, R.K., Goswami, U., Bhattacharyya, P., Majumdar, D., Bezbaruah, D. and Borgohain, P. (2016) Komargaon, Assam (India) witnessed a new meteorite fall. Planex, 6 (1), 10-11.
Physical characteristics: (T.K. Goswami, *DibrU*) Single fusion-crusted blocky stone showing a few broad regmaglypts. Sawn surface is light greyish white with even distribution of small metal and sulfide grains and a few recognizable chondrules, one to 8 mm. Stone crisscrossed by a few shock veins. The hammered stone broke along one of the shock veins, which shows a well-developed slickenside surface. Fusion crust to 1 mm thick.
Petrography: (L. Garvie, *ASU*) A polished microprobe section shows dominantly coarse-grained recrystallized minerals, with few recognizable chondrules. Plagioclase, anhedral, abundant to 250 μm. Sparse chromite grains to 350 μm are anhedral with rounded outlines and heavily fractured. Troilite grains to 400 μm, single crystal and lacking shock lamellae. Metal grains to 0.5 mm, range from polycrystalline kamacite, to composite grains composed of polycrystalline kamacite, dark etched plessite and high Ni-metal. Kamacite lacks Neumann bands. Fine-grained melt pockets are present but rare. Scattered Ca-Cl and Ca-Mg-Na phosphates to 0.5 mm found.
Geochemistry: (L. Garvie, *ASU*) Olivine $Fa_{25.1\pm0.4}$, Fe/Mn=48.4±3.2 wt%, n=16. Low Ca pyroxene $Fs_{21.2\pm0.2}Wo_{1.4\pm0.2}$, Fe/Mn=30.0±1.8 wt%, n=8. High Ca pyroxene $Fs_{8.4\pm0.3}Wo_{44.5\pm0.4}$, n=3. Feldspar $An_{9.4\pm0.4}Or_{6.7\pm0.2}$, n=8.
Classification: Ordinary chondrite, L6, S3, W0
Specimens: 23.4 g and one polished mount at *ASU*.

Kerman 029 30°45.149’N, 57°48.516’E
Kerman, Iran
Find: 2016 Feb 11
Classification: Ordinary chondrite (H3)
History: Found during a systematic search for meteorites by "Afshin Group". Samples were sent to H. Pourkhorsandi in April 2016.
Petrography: FeNi metal and troilite are present as round shape assemablages and also separated phases.
Geochemistry: Olivine $Fa_{17.7\pm4.7}$ ($Fa_{5.7\text{-}23.4}$, PMD 17%, N=9), orthopyroxene $Fs_{12.9\pm4.9}Wo_{0.9\pm0.4}$ ($Fs_{7.7\text{-}16.8}$, PMD 32%, N=10). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.70.
Classification: H3

Kerman 046 30°48.366’N, 57°45.254’E

Kerman, Iran
Find: 2016 Feb 12
Classification: Ordinary chondrite (H5)
Classification: Probably paired with Kerman 004.

Kerman 047 30°46.424’N, 57°47.413’E
Kerman, Iran
Find: 2016 Feb 12
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assamblage. Weathering of troilite to pyrite/marcasite. Some troilite rims.
Classification: Probably paired with Kerman 004.

Kerman 048 30°45.806’N, 57°47.342’E
Kerman, Iran
Find: 2016 March
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 20 μm. Weathering of troilite to pyrite/marcasite.
Classification: Probably paired with Kerman 004.

Kerman 049 30°46.471’N, 57°47.135’E
Kerman, Iran
Find: 2016 March
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 15 μm.
Classification: Probably paired with Kerman 004.

Kerman 050 30°45.382’N, 57°48.193’E
Kerman, Iran
Find: 2016 March
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 20 μm. Weathering of troilite to pyrite/marcasite.
Classification: Probably paired with Kerman 004.

Kerman 051 30°45.787’N, 57°48.334’E
Kerman, Iran
Find: 2016 March
Classification: Ordinary chondrite (H5)
Physical characteristics: Fusion crust is preserved.
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 40 μm. Remnants of troilite rims.
Classification: Probably paired with Kerman 004.

Kerman 052 30°45.487’N, 57°47.661’E

Kerman, Iran
Find: 2016 March
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 053 30°45.396'N, 57°48.163'E
Kerman, Iran
Find: 2016 March
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 20 μm.
Classification: Probably paired with Kerman 004.

Kerman 054 30°45.874'N, 57°48.061'E
Kerman, Iran
Find: 2016 March
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 055 30°45.832'N, 57°47.433'E
Kerman, Iran
Find: 2016 March
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 056 30°45.546'N, 57°48.387'E
Kerman, Iran
Find: 2016 March
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 20 μm.
Classification: Probably paired with Kerman 004.

Kerman 057 30°45.933'N, 57°48.292'E
Kerman, Iran
Find: 2016 March
Classification: Ordinary chondrite (H5)
Physical characteristics: Fusion crust is partly preserved.
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 058 30°46.482'N, 57°47.917'E
Kerman, Iran
Find: 2016 March
Classification: Ordinary chondrite (H5)

Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 40 μm. Remnants of troilite rims.
Classification: Probably paired with Kerman 004.

Kerman 059 30°45.525'N, 57°48.562'E
Kerman, Iran
Find: 2016 March
Classification: Ordinary chondrite (H5)
Physical characteristics: Fusion crust is partly preserved.
Classification: Probably paired with Kerman 004.

Kerman 060 30°44.863'N, 57°47.484'E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Classification: Probably paired with Kerman 004.

Kerman 061 30°46.353'N, 57°47.393'E
Kerman, Iran
Find: 2016 Feb 19
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 30 μm.
Classification: Probably paired with Kerman 004.

Kerman 062 30°46.078'N, 57°47.460'E
Kerman, Iran
Find: 2016 Apr 15
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 063 30°45.336'N, 57°48.416'E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Big troilite grains (maximum 2 mm)
Classification: Probably paired with Kerman 004.

Kerman 064 30°45.472'N, 57°47.946'E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 30 μm.
Classification: Probably paired with Kerman 004.

Kerman 065 30°46.277'N, 57°47.352'E

Kerman, Iran
Find: 2016 Apr 15
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 30 μm.
Classification: Probably paired with Kerman 004.

Kerman 066 30°44.860'N, 57°47.852'E
Kerman, Iran
Find: 2016 Mar 04
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 067 30°46.254'N, 57°47.369'E
Kerman, Iran
Find: 2016 Apr 15
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 15 μm.
Classification: Probably paired with Kerman 004.

Kerman 068 30°47.315'N, 57°46.700'E
Kerman, Iran
Find: 2016 Apr 15
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 30 μm.
Classification: Probably paired with Kerman 004.

Kerman 069 30°45.838'N, 57°48.527'E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Classification: Probably paired with Kerman 004.

Kerman 070 30°45.218'N, 57°48.034'E
Kerman, Iran
Find: 2016 Mar 04
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 20 μm.
Classification: Probably paired with Kerman 004.

Kerman 071 30°46.005'N, 57°47.582'E
Kerman, Iran
Find: 2016 Apr 15
Classification: Ordinary chondrite (H6)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 100 μm.

Kerman 072 30°45.755’N, 57°47.480’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 073 30°46.325’N, 57°47.306’E
Kerman, Iran
Find: 2016 Apr 15
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 074 30°45.659’N, 57°48.381’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 20 μm.
Classification: Probably paired with Kerman 004.

Kerman 075 30°45.722’N, 57°48.524’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 60 μm.

Kerman 076 30°45.590’N, 57°48.415’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Pollycrystalline troilite. Plagioclase maximum size 30 μm.
Classification: Probably paired with Kerman 004.

Kerman 077 30°44.702’N, 57°48.253’E
Kerman, Iran
Find: 2016 Apr 16
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 20 μm.
Classification: Probably paired with Kerman 004.

Kerman 078 30°46.038’N, 57°48.533’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 50 μm.

Classification: Probably paired with Kerman 004.

Kerman 079 30°45.737’N, 57°48.253’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: A clast with finer texture. Plagioclase maximum size 20 μm.
Classification: Probably paired with Kerman 004.

Kerman 080 30°45.978’N, 57°47.298’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Classification: Probably paired with Kerman 004.

Kerman 081 30°46.494’N, 57°47.423’E
Kerman, Iran
Find: 2016 Feb 19
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 20 μm.
Classification: Probably paired with Kerman 004.

Kerman 082 30°45.600’N, 57°47.876’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 20 μm. FeNi metal is completely altered.
Classification: Probably paired with Kerman 004.

Kerman 083 30°45.738’N, 57°48.264’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Classification: Probably paired with Kerman 004.

Kerman 084 30°45.824’N, 57°48.438’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Classification: Probably paired with Kerman 004.

Kerman 085 30°45.748’N, 57°48.253’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 20 μm.

Classification: Probably paired with Kerman 004.

Kerman 086 30°47.411’N, 57°46.779’E
Kerman, Iran
Find: 2016 Mar 04
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 087 30°46.084’N, 57°47.444’E
Kerman, Iran
Find: 2016 Apr 15
Classification: Ordinary chondrite (H5)
Physical characteristics: Fusion crust is partly preserved.

Kerman 088 30°44.992’N, 57°48.669’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Physical characteristics: Fusion crust is preserved. Central parts of the broken surface show higher metal abundance.
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 089 30°45.701’N, 57°48.263’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages.
Classification: Probably paired with Kerman 004.

Kerman 090 30°45.742’N, 57°48.270’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 091 30°45.667’N, 57°48.452’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 10 μm. Contains a clast which shows plagioclase maximum size 40 μm. It’s a breccia.
Classification: Probably paired with Kerman 004.

Kerman 092 30°47.411’N, 57°46.779’E
Kerman, Iran
Find: 2016 Mar 22
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 093 30°46.135’N, 57°47.193’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 20 μm.
Classification: Probably paired with Kerman 004.

Kerman 094 30°46.224’N, 57°47.381’E
Kerman, Iran
Find: 2016 Apr 15
Classification: Ordinary chondrite (H5)
Classification: Probably paired with Kerman 004.

Kerman 095 30°46.263’N, 57°47.459’E
Kerman, Iran
Find: 2016 Feb 12
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 40 μm. Polycrystalline troilite.

Kerman 096 30°47.538’N, 57°46.654’E
Kerman, Iran
Find: 2016 Mar 22
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 20 μm.
Classification: Probably paired with Kerman 004.

Kerman 097 30°47.534’N, 57°46.671’E
Kerman, Iran
Find: 2016 Apr 15
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 098 30°46.424’N, 57°47.942’E
Kerman, Iran
Find: 2016 Mar 04
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 20 μm.
Classification: Probably paired with Kerman 004.

Kerman 099 30°46.878’N, 57°46.775’E
Kerman, Iran
Find: 2016 Apr 15
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 40 μm. Shock veins.
Classification: Probably paired with Kerman 004.

Kerman 100 30°45.684’N, 57°48.664’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 60 μm.
Classification: Probably paired with Kerman 004.

Kerman 101 30°44.448’N, 57°48.309’E
Kerman, Iran
Find: 2016 Apr 16
Classification: Ordinary chondrite (H5)
Classification: Probably paired with Kerman 004.

Kerman 102 30°45.711’N, 57°48.228’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 40 μm. Shock veins.
Classification: Probably paired with Kerman 004.

Kerman 103 30°45.281’N, 57°48.029’E
Kerman, Iran
Find: 2016 Mar 04
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages.
Classification: Probably paired with Kerman 004.

Kerman 104 30°45.899’N, 57°48.382’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 105 30°46.107’N, 57°47.423’E
Kerman, Iran
Find: 2016 Apr 15
Classification: Ordinary chondrite (H5)

Petrography: Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 106 30°46.419’N, 57°47.276’E
Kerman, Iran
Find: 2016 Apr 15
Classification: Ordinary chondrite (H5)
Classification: Probably paired with Kerman 004.

Kerman 107 30°45.692’N, 57°48.383’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 20 μm.
Classification: Probably paired with Kerman 004.

Kerman 108 30°46.327’N, 57°47.338’E
Kerman, Iran
Find: 2016 Apr 15
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages.
Classification: Probably paired with Kerman 004.

Kerman 109 30°47.538’N, 57°46.654’E
Kerman, Iran
Find: 2016 Mar 22
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 110 30°44.631’N, 57°47.999’E
Kerman, Iran
Find: 2016 Mar 04
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 50 μm.
Classification: Probably paired with Kerman 004.

Kerman 111 30°46.074’N, 57°47.439’E
Kerman, Iran
Find: 2016 Apr 15
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 50 μm. A partly weathered big troilite grain (2.8 mm).
Classification: Probably paired with Kerman 004.

Kerman 112 30°46.094’N, 57°47.450’E
Kerman, Iran

Find: 2016 Apr 15
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 40 μm. Traces of shock veins.
Classification: Probably paired with Kerman 004.

Kerman 113 30°45.757'N, 57°48.251'E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 30 μm.
Classification: Probably paired with Kerman 004.

Kerman 114 30°44.986'N, 57°47.353'E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 50 μm.
Classification: Probably paired with Kerman 004.

Kerman 115 30°45.948'N, 57°47.515'E
Kerman, Iran
Find: 2016 Apr 15
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 116 30°47.228'N, 57°46.713'E
Kerman, Iran
Find: 2016 Mar 04
Classification: Ordinary chondrite (H5)
Classification: Probably paired with Kerman 004.

Kerman 117 30°45.963'N, 57°47.551'E
Kerman, Iran
Find: 2016 Apr 15
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 15 μm.
Classification: Probably paired with Kerman 004.

Kerman 118 30°45.331'N, 57°48.603'E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages.
Classification: Probably paired with Kerman 004.

Kerman 119 30°45.586’N, 57°48.330’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 120 30°45.268’N, 57°48.081’E
Kerman, Iran
Find: 2016 Mar 04
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 30 μm.
Classification: Probably paired with Kerman 004.

Kerman 121 30°44.686’N, 57°47.978’E
Kerman, Iran
Find: 2016 Mar 04
Classification: Ordinary chondrite (H5)
Physical characteristics: Fusion crust is preserved. Central parts of the broken surface show higher metal abundance.
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 20 μm.
Classification: Probably paired with Kerman 004.

Kerman 122 30°45.751’N, 57°48.262’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Plagioclase maximum size 30 μm.
Classification: Probably paired with Kerman 004.

Kerman 123 30°45.667’N, 57°48.301’E
Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Petrography: Chromite and plagioclase assemblages.
Classification: Probably paired with Kerman 004.

Kerman 124 30°44.288’N, 57°46.239’E
Kerman, Iran
Find: 2016 Apr 16
Classification: Ordinary chondrite (H5)
Petrography: Finely polycrystalline troilite. Plagioclase maximum size 40 μm.
Classification: Probably paired with Kerman 004.

Kerman 125 30°45.281’N, 57°48.668’E

Kerman, Iran
Find: 2016 Feb 26
Classification: Ordinary chondrite (H5)
Physical characteristics: Fusion crust is preserved. Central parts of the broken surface show higher metal abundance.
Petrography: Chromite and plagioclase assemblages. Plagioclase maximum size 50 μm.
Classification: Probably paired with Kerman 004.

Kölked 45.96°N, 18.69°E
Baranya, Hungary
Find: March 2016
Classification: Ordinary chondrite (H5)
History: In early March 2016, an anonymous individual found the stone buried at a depth of approximately 40 cm in wet soil, in a moorland, between the town of Mohács and the village of Kölked. The stone was sent to Zsolt Kereszty who measured its specific gravity (3.16 g/cc), noted strong attraction to a magnet, and observed chondrules in a cut surface.
Physical characteristics: A single stone with no fusion crust, reddish-brown oxidized surface. Saw cut reveals numerous, densely packed, small chondrules set in an orange-brown matrix.
Petrography: (C. Agee, *UNM*) This meteorite has many equilibrated chondrules, a relatively high porosity, and much of the metal has been oxidized. Barite weathering product was detected.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{17.0\pm0.3}$, Fe/Mn=36±2, n=31; low-Ca pyroxene $Fs_{15.1\pm0.2}Wo_{1.4\pm0.2}$, Fe/Mn=21±1, n=13; augite $Fs_{4.6}Wo_{46.2}$, Fe/Mn=13, n=1.
Classification: Ordinary chondrite (H5)
Specimens: 22.1 g on deposit at *BajaAO*, 2.2 g including a probe mount at *UNM*, *ZKereszty* holds the main mass.

La Ciénega (b) 30°12’03.5"N, 111°56’24.97"W
Sonora, Mexico
Find: 2014 Jan 30
Classification: Ordinary chondrite (L6)
History: On the 30 January 2014, Hugo Lino was prospecting for gold near the abandoned mining community of La Ciénega in Sonora, Mexico, and found a 6143 g, fusion crusted meteorite. The stone was subsequently purchased by Michael Farmer.
Physical characteristics: A relatively fresh fusion crusted rounded stone with a few broad regmaglypts. Sawn surface is largely light colored with scattered rust staining around metal grains. Metal evenly distributed with grains to 2 mm. Chondrules difficult to recognize, with one to 4 mm.
Petrography: (L. Garvie, *ASU*) This section shows that the stone is largely recrystallized with difficult-to-recognize chondrules, including BO, PO, and RP. Many olivine grains with planar fractures. Plagioclase abundant and often >100 μm. Chromite irregularly shaped, to 600 μm. Kamacite irregularly shaped with weakly developed Neumann bands; some grains polycrystalline. Metal grains of tetrataenite rims and cores of dark-etching plessite or acicular kamacite common. Troilite largely single crystal and lacking shock features. Sparse metal pockets around troilite and metal. Native Cu is rare to 20 microns. Weathering is low and locally present around some kamacite grains. Many of the metal-troilite grains show complex finely intergrown textures of the two.

Geochemistry: (L. Garvie, *ASU*) Olivine, $Fa_{24.5\pm0.3}$, Fe/Mn=48.2±2.0, n=10; low Ca-pyroxene, $Fs_{20.6\pm0.1}Wo_{1.5\pm0.2}$, Fe/Mn=28.2, n=8; high Ca-pyroxene, $Fs_{8.0}Wo_{44.6}$, Fe/Mn=28.2, n=1; and, feldspar, $Or_{5.9\pm0.7}An_{10.4\pm0.2}$, n=5.
Classification: L6, W1, S3
Specimens: 164 g and one thin section at *ASU*.

La Garita 37°56'N, 106°12'W
Colorado, United States
Find: 2006
Classification: Iron meteorite (ungrouped)
History: A single mass of 1387 g was found on an alluvial fan, 6.7 miles northeast of the town of La Garita, Saguache County, Colorado. In 2006, Mr. Robert Garcia was hunting for projectile points on his relative's property when he noticed what appeared to be a "cannon ball fragment" lying in the dirt. He picked it up and thought it may be a meteorite after researching them on the internet.
Physical characteristics: The specimen is dome-shaped with a subtle rollover lip and measures 13 × 9 cm across and ~3 cm thick. It has a mostly dark brown-black exterior with a few cm-scale regmaglypts, and red-brown staining in spots.
Petrography: Optical investigation reveals a well-developed Widmanstatten pattern consistent with a fine octahedrite. Troilite inclusions are common.
Geochemistry: Bulk composition: ICP-MS data, using sample of North Chile (Filomena) as standard (C. Herd and G. Chen, *UAb*): Ni = 12.1, Co = 0.45 (both wt%); Ir = 0.76, Ga = 30, Ge = 117, W = 1.0, Re = 0.11, Cu = 682, Ru = 5.3, Pd = 5.3, Pt = 6.7 (all μg/g).
Classification: (C. Herd, *UAb*): Ungrouped iron, fine octahedrite. Concentrations of Ni, Ir and Ga appear to be consistent with the IAB group, possibly related to the sLM subgroup of Wasson and Kallemeyn (2002); however, Ge, Pt, Cu and W are anomalously high for the sLM subgroup. Au could not be reliably determined. Classified as ungrouped based on the bulk composition, as well as the lack of silicate inclusions which are typical of IAB iron meteorites.
Specimens: Type specimen of 21.1 g at *UAb*. Main mass with M. Morgan.

La Yesera 005 23°17.7'S, 70°29.2'W
Antofagasta, Chile
Find: 2003 Apr
Classification: Iron meteorite (IVA)
History: Found by Rodrigo Martinezin in 2003, while he was searching for meteorites. Informally known as "Cuenca del Tiburon."
Physical characteristics: A single, roughly parallelepipedic metallic mass.
Petrography: Fine octahedrite with minor fine inclusions of schreibersite and troilite. Bandwidth is 0.3-0.5 mm.
Geochemistry: Bulk composition (INAA, J.T. Wasson, *UCLA*): Co = 3.89 mg/g; Ni = 74.5 mg/g; Ga = 1.99 μg/g; As = 3.26 μg/g; Ir = 2.62 μg/g; Au = 0.844 μg/g; Ge not determined. The meteorite plots in the IVA fields on element-Au diagrams. Its composition is slightly lower in Au and As but the same in Ni as the mean of two Gibeons used to define the low Au, As end of the Gibeon compositional range. Cosmogenic ^{36}Cl content of 24.8 dpm/kg (measured at *CEREGE*) clearly excludes it from being a piece of Gibeon, which has no detectable ^{36}Cl.
Classification: Iron, IVA, fine octahedrite

Specimens: Main mass in *MMC*, type specimen 22 g in *CEREGE*, 1.2 g INAA slab in *UCLA*

La'gad 27°25'32.57''N, 8°44'35.57''W
Saguia el Hamra, Western Sahara
Find: 2015 Mar 27
Classification: Lunar meteorite (feldspathic breccia)
History: Found by Mr. Alla about 25 km east of the village of Al-Mahbas, Western Sahara, on March 27, 2015. Purchased by Didi Moulay El Bechir in 2015.
Physical characteristics: Three identically appearing pieces, 137.56, 13.94, and 186.24 g, found together. Irregular exterior, no fusion crust. A saw cut reveals a polymict breccia with numerous fragmental light and dark clasts.
Petrography: (C. Agee, *UNM*) This feldspathic, polymict breccia has at least two distinct pyroxene populations: 1) ferropigeonite lithology, not in equilibrium with olivine, and 2) a relatively Mg-rich pyroxene lithology showing a Ca-enrichment continuum from low-Ca pyroxene to pigeonite to augite, and in apparent chemical equilibrium with coexisting olivine. Accessory silica, ilmenite, troilite, and iron oxide were observed.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Ferropigeonite $Fs_{54.4\pm4.0}Wo_{15.4\pm4.8}$, Fe/Mn=71±4, n=7; olivine $Fa_{36.6\pm2.5}$, Fe/Mn=100±6, n=22; low-Ca pyroxene/pigeonite $Fs_{29.5\pm4.0}Wo_{12.8\pm5.8}$, Fe/Mn=57±4, n=12; augite $Fs_{27.5\pm6.3}Wo_{29.5\pm5.0}$, Fe/Mn=53±4, n=3; plagioclase $An_{96.1\pm1.6}$, n=6; Shock melt (10 _m defocused electron beam, proxy for bulk meteorite composition): SiO_2=45.8±1.2, TiO_2=0.63±0.37, Al_2O_3=27.3±4.8, Cr_2O_3=0.12±0.10, MgO=5.1±3.0, FeO=6.0±2.9, MnO=0.07±0.04, CaO=15.4±1.7, NiO=0.05±0.05, Na_2O=0.56±0.11, K_2O=0.14±0.05 (all wt%), n=22.
Classification: Lunar (feldspathic, polymict breccia)
Specimens: 20.2 g including a probe mount on deposit at *UNM*, Didi Moulay El Bechir holds the main mass.

Langres 47°51'38''N, 5°18'49''E
Champagne-Ardenne, France
Find: 2004
Classification: Ordinary chondrite (L4)
History: Mr. Jacques Bochaton discovered a broken rusty rock partially surrounded with a fusion crust among old rocks and pieces of stained-glass windows in a heap of rubbles that was found next to a low wall surrounding the field of an old chapel 10 m away, at "Sainte Anne farm," and situated about a kilometer from Langres. Years later, he decided to send pictures of various samples to *MNHNP* and sent a small broken samples to Jean-Claude Lorin de la Grandmaison, who cut it and sent additional pieces to Catherine Caillet Komorowski in order to make sections to be classified.
Physical characteristics: The whole rock initially measuring 79 × 72 × 40 mm is a fragment that weighed 340 g. Fusion crust is present on the sample that appears quite rusty. Millimeter-sized chondrules are visible on the surface.
Petrography: SEM investigations reveal a chondritic structure displaying a wide range of chondrule sizes. It shows numerous densely well-defined chondrules (the smallest is about 150 μm in diameter and the largest is 4.6 mm) juxtaposed in a sparse relatively coarse-grained microcrystalline matrix. Chondules have various textures and contain much more pyroxene than olivine crystals. Some tiny barred olivine chondrules coexist with large porphyritic chondrules

with devitrified and partially recrystallized glass. Metal is very rare compared to sulfide. However, few μm-sized FeNi metal grains are present in olivine crystals or in silicate aggregates associated to the only one large metal-rich area found in the matrix. We found one 1600-μm black pyroxene fine-grained inclusion enclosing metal grains and distinct Ni-rich and Ni-poor sulfides. 300 μm-large chloroapatite associated with opaque mineral phases is also present interstitially in the matrix. Small merillite blebs are poikilitically enclosed within olivine. Large sulfide areas in the matrix exhibit triple-junction grains.
Geochemistry: Mineral compositions: EMPA of olivine and pyroxene crystals indicate small variations in chemical compositions of olivine $Fa_{24.4\pm0.9}$ ($Fa_{22.9\text{-}26.2}$, N=12) and low-Ca pyroxene crystals $Fs_{21.4\pm0.8}$ ($Fs_{20.3\text{-}22.7}$, N=9).
Classification: Ordinary chondrite (L4); Shock features are essentially ubiquitous irregular fractures in silicates whose visibility is enhanced by iron oxide creeping into the fractures. It is weakly shocked S2. Weathering is moderate W2-3.
Specimens: Mr Bochaton who collected the rock holds the main mass: 273.5 g. Two small samples (26.1 g + 10.5 g) totaling 36.6 g, one polished section, and one polished thin section are on deposit at *MNHNP*.

Los Vientos 119 (LoV 119) ~24°41'S, ~69°46'W
Antofagasta, Chile
Find: 2016 March
Classification: Ordinary chondrite (H6)
History: The stone was found lying at the surface in the Atacama desert.
Physical characteristics: A single brownish stone with regmaglypts and few remnants of fusion crust. Cracks due to terrestrial weathering.

Los Vientos 123 (LoV 123) ~24°41'S, ~69°46'W
Antofagasta, Chile
Find: 2015 Jan 27
Classification: Carbonaceous chondrite (CO3.1)
History: Found in January 2015 in the Atacama desert by Rodrigo Martinez while looking for meteorites.
Physical characteristics: A single fully crusted stone. Cut surface reveals a dark interior wirh small chondrules.
Petrography: (J. Gattacceca, *CEREGE*) Abundant chondrules (predominantly of type I) and small CAIs set in a fine-grained Fe-rich matrix (36 vol% by point counting, N=157). Average chondrule apparent size 170±150 μm (N=42). Based on the structural order of the polyaromatic matter assessed by Raman spectroscopy (L. Bonal, *IPAG*), this meteorite appears to be slightly less metamorphosed than Colony (CO3.1) and more metamorphosed than ALHA 77307 (CO3.05). The Raman spectroscopy parameters of interest are FWHM-D (cm-1)=187.1±3.2, ID/IG=0.95±0.02 (see Bonal et al. 2016, figure 6).
Geochemistry: Olivine in the range $Fa_{0.3\text{-}72.4}$ (mean $Fa_{13.6\pm18.7}$, PMD=96%, N=19). Cr_2O_3 in ferroan olivine 0.41±0.20 wt.% (N=9). Low-Ca pyroxene $Fs_{15.3\pm19.6}Wo_{0.9\pm0.4}$ (N=3). Oxygen isotopic composition (J. Gattacceca, C. Sonzogni, *CEREGE*) from analysis of one acid-washed 1.5 mg aliquot of a powdered 200 mg bulk sample is $\delta^{17}O$=-6.77‰, $\delta^{18}O$=-3.33‰, $\Delta^{17}O$=-5.04‰ (linearized, slope 0.5247, analytical uncertainties 0.08‰, 0.12‰, 0.03‰ respectively). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.74.

Classification: CO3.1. Subtype from Raman spectroscopy. Low weathering.
Specimens: 49 g and a polished section at *CEREGE*. Main mass at *MMC*.

Los Vientos 129 (LoV 129) ~24°41'S, ~69°46'W
Antofagasta, Chile
Find: 2014 Nov 13
Classification: Ordinary chondrite (LL7)
History: The meteorite was found by Bertrand Devouard while he was looking for meteorites in the Atacama desert.
Physical characteristics: Full stone almost entirely covered with fusion crust with visible flow lines. Cut surface reveals a light brownish interior with rare metal flakes.
Petrography: Strongly recrystallized chondritic texture with triple junctions. Plagioclase to 200 μm (average 100 μm). A few relict chondrules were observed in the 2 cm2 polished section. Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 3.33.
Geochemistry: Olivine $Fa_{29.3}$ (N=1). Orthopyroxene $Fs_{24.8\pm0.1}Wo_{2.0\pm0.3}$ (N=2).
Classification: LL7 based on texture and Wo content of orthopyroxene
Specimens: Main mass and type specimen at *CEREGE*.

Lut 011 30°55.02'N, 59°46.07'E
Khorasan, Iran
Find: 2015 October 14
Classification: Ordinary chondrite (L4)
History: Two pieces found about 4 m apart during a systematic search for meteorites in the Lut desert. A single piece weighing 24.7 g was sent to H. Pourkhorsandi (*CEREGE*) on 13 Jan 2016.
Physical characteristics: Two brown-colored rock fragments without fusion crust. Cut surface shows distinct chondrules with a maximum chondrule size of 3 mm. An inner, less-weathered core is surrounded by a much more weathered region (porous in some parts).
Petrography: The mesostasis of chondrules is not completely crystallized. Troilite rims occur around some chondrules. In some regions troilite can be seen as inclusions inside rounded metal grains. Troilite is finely polycrystalline. A compound chondrule (porphyritic type hosting a barred type) is present.
Geochemistry: Olivine $Fa_{22.8\pm1.0}$ (N=4), orthopyroxene $Fs_{17.6\pm1.5}Wo_{0.6\pm0.8}$ (N=4). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.64.
Classification: L4

Mahmutlar 36°30.88'N, 32°6.98'E
Antalya, Turkey
Find: 5 Apr 2014
Classification: Ordinary chondrite (H5)
History: The meteorite was found by astronomer Mr. V. V. Bogdanovsky, who systematically searched for meteorites on small, dry, flattened surfaces in Turkey, ~10 km from Alania willage.
Petrography: The meteorite has chondritic texture and contains of well-defined chondrules and chondrule fragments (~70 vol%), and FeNi metal grains (~10 %) surrounded by fine-grained, granular, transparent matrix. The chondrules are 150-450 μm in diameter. The olivine grains have undulatory extinction and planar fractures. Secondary feldspar in the matrix is 5-40 μm in size, with large grains showing undulatory extinction.

Marsa Alam 006 (MA 006) 25°12.90'N, 34°46.34'E
Al Bahr al Ahmar, Egypt
Find: 2013 Nov 25
Classification: Ordinary chondrite (H3-5)
History: The meteorite was found 2 m from Marsa Alam 002 by Mr. T. Kryachko on a small plateau near the wadi Marsa Ijli, Egypt, in November 2013.
Physical characteristics: The stone is a meteorite fragment with the relics of fusion crust; a total mass of the sample is 97 g.
Petrography: A host lithology of the meteorite consists of C, RP, BO, PO, and BOP chondrules, 100-1000 μm in size, with average diameter 440 μm (n=95, 60 vol%), fine-grained cataclastic aggregate of olivine, pyroxene and minor partly devitrified feldspatic glass (40 vol%), accessory troilite (1.8 vol%), FeNi metal (0.6 vol%), and chromite. FeNi hydroxides are abundant in the cataclastic aggregate. Clasts 1.5-3 mm in size (29 vol%) have distinct boundaries with the host and are composed of chondrule fragments (~80 vol%), fragments of olivine, pyroxene, minor feldspar, and recrystallized silicate matrix. Other phases are FeNi-hydroxides (10 vol%) and troilite (1 vol%); FeNi metal is accessory. The glass in chondrules is devitrified.
Geochemistry: (N. N. Kononkova, *Vernad*) host lithology: $Fa_{17.5\pm3.7}$ (N=45; PMD Fa=21.3); $Fs_{15.4\pm3.9}Wo_{1.3\pm1.0}$ (N=37), metal (wt%): Ni=6.43; Co=0.59; troilite Ni=0.02, Cr=0.03, Co=0.05; clasts: $Fa_{18.6\pm0.2}$ (N=10; PMD Fa=1.0); $Fs_{16.2\pm1.3}Wo_{1.2\pm1.2}$ (N=10); metal (wt%): Ni=7.24; Co=0.64; troilite Ni=0.15, Cr=0.10, Co=0.09.
Classification: H3-5 breccia. On the basis of PMD Fa and texture, the host lithology is approximately sub-type H3.7; the clasts are type H5.
Specimens: The type specimen of 23.7 g and thin polished section are on deposit at *Vernad*. Mr. T. V. Kryachko holds a main mass of the meteorite.

Marsa Alam 007 (MA 007) 25°12.79'N, 34°46.29'E
Al Bahr al Ahmar, Egypt
Find: 2013 Nov 27
Classification: H3.6-4
History: The meteorite was found by Mr. T. Kryachko on a small plateau near the wadi Marsa Ijli, Egypt, in November 2013.
Physical characteristics: The 90.5 g stone is a meteorite fragment with remnant fusion crust.
Petrography: A sample is composed of two lithologies with indefinite boundaries: 1) the host lithology consists of chondrules 60-1200 μm in size, with C, RP, BO, PO, BOP types (55 vol%, average diameter 630 μm, n=157) and a fine-grained cataclastic aggregate (45 vol%) of olivine, pyroxene and minor feldspatic glass; the aggregate contains abundant FeNi-hydroxide; accessories are troilite, chromite and rare FeNi metal (<0.02 vol%); 2) minor lithology (7.2 vol%) consists of chondrules, chondrule fragments, fragments of olivine, pyroxene and devitrified feldspatic glass, FeNi-metal (5-10 vol%), FeNi-hydroxides, troilite, and minor crystalline silicate matrix.
Geochemistry: (Borisovsky S. E., *IGEM*) Host lithology: olivine $Fa_{17.6\pm6.6}$ (N=42, PMD Fa=37.5); pyroxene $Fs_{9.4\pm5.4}Wo_{1.0\pm0.9}$ (N=13); metal (wt%): kamacite (Ni 4.67, Co 0.65, Si 0.05, Cr 0.12), taenite (Ni 44.6, Co 0.17, Si 0.05, Cr 0.09); minor lithology (clasts): olivine $Fa_{18.4\pm0.8}$ (N=8; PMD Fa=4.2), pyroxene $Fs_{16.3\pm0.2}Wo_{1.4\pm0.1}$ (N=10); metal (wt%): kamacite (Ni 6.71, Co 0.64, Si 0.01, Cr 0.04), taenite (Ni 31.2, Co 0.25, Si 0.01, Cr 0.03).

Classification: H3.6-H4 breccia. On the basis of the texture, TL sensitivity (0.34±0.02, A. I. Ivliev, N. S. Kujunko, *Vernad*) and PMD Fa, the host lithology is type 3.6 brecciated chondrite; on the basis of PMD Fa, the clasts are H4 chondrite.
Specimens: The type specimen of 18.2 g and thin polished section are on deposit at *Vernad*. Mr. T. V. Kryachko holds a main mass of the meteorite.

Mdaouer 29°54.56'N, 6°55.31'W
Guelmime-Es-Semara, Morocco
Purchased: 2014 May 4
Classification: Carbonaceous chondrite (CO3.0)
History: Found and purchased from the finder in the Foum Zguid region of Morocco, May 4, 2014.
Physical characteristics: Many dark fragments, some with dull fusion crust.
Petrography: Chondrules and chondrule fragments in an abundant fine-grained foliated Fe-rich matrix. Abundances (by point counting, N=236): matrix 62 vol%, chondrules and fragments 38 vol%. Average chondrule apparent size 130±90 μm (N=35). Sulfide/magnetite and sulfide/metal assemblages are found in the matrix and chondrules as 100 μm blebs and as abundant μm-sized grains in the matrix.
Geochemistry: Olivine $Fa_{17.3\pm19.2}$ ($Fa_{0.4\text{-}61.8}$, PMD=112%, N=33). Cr_2O_3 in ferroan olivine is 0.40±0.15 wt% (N=28). Orthopyroxene $Fs_{3.1\pm2.3}Wo_{2.0\pm1.2}$ (N=10). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.32.
Classification: CO3.0, sub-type from Cr_2O_3 content of ferroan olivine and olivine Fa range. Minor weathering.
Specimens: 15.3 g at *CEREGE*. Main mass with P. Thomas.

Meadview 35º55.780'N, 114º06.400'W
Arizona, United States
Find: 15 Sept 2003
Classification: Ordinary chondrite (H6)
Petrography: The rock contains recrystallized chondrules and abundant metallic Fe-Ni; minor phases include chromite and troilite. Also present are small grains of Ca pyroxene ($Fs_{6.5}Wo_{45.2}$). Olivine exhibits undulose extinction but lacks planar fractures.

Mercantour 44.145°N, 7.311°E
Provence-Alpes-Cote d'Azur, France
Find: 2014 Sept 25
Classification: Ordinary chondrite (L4-6)
History: A systematic search of moraines and rocky surfaces by Eric Paillery led to this single discovery in the Southern Alps granitic massif, within Mercantour National Park, near 2900 m elevation.
Physical characteristics: A single angular fragment, covered ~30% by a relatively fresh fusion crust. Gray color with minor rust spots. Inner surface sometimes covered by a carbonate rind. Little patina visible. A few small rounded quartz grains inserted in cracks, with a light-orange soil matrix.
Petrography: Breccia with type 4 to 6 clasts (major class 4 to 5). Distinguishing type 4, 5 and 6 was done based on polished section observation of the morphology and overall texture of

chondrules and metal grains. Mean chondrule diameter 707±39 μm. One fine-grained clast with low metal and troilite content was observed. Weathering at microscopic scale is hardly detectable but macroscopic rust spots indicate W1.
Geochemistry: Type 6 lithology: olivine $Fa_{27.7}$ (n=1), orthopyroxene $Fs_{21.2}Wo_{0.7}$ (n=1). Type 4 lithology: olivine $Fa_{24.7}$ (n=1), orthopyroxene $Fs_{20.2}Wo_{2.1}$ (n=1).
Classification: in the L group is based on magnetic susceptibility and chondrule size. Petrography (SEM and reflected optical microscopy) indicates a L4-6 breccia.
Specimens: 22.6 g at *CEREGE*.

Mesa La Caguama 27°35'N, 113°4'W
Baja California Sur, Mexico
Find: 1971
Classification: Iron meteorite (IAB-MG)
History: An "extremely heavy rock" was found by Francisco Arce Arce in 1971. It was discovered along a burro trail between Rancho San Gregorio and the dirt road that leads to Rancho San Francisco, off the paved road to San Ignacio. Noting the unusual density of the rock, Mr. Arce Arce believed that it might be something special. In 1991, Richard and Alice Gross were revisiting the area after an earlier tour, were shown the object, and, on a later trip in 2003, brought it to the US in the hope of confirming its extraterrestrial nature, and to sell it on behalf of Mr. Arce Arce. The specimen was brought to Michael Blood, who brokered the sale of the iron to the Utas Meteorite Collection.
Physical characteristics: The meteorite weighed 6897 g when found. The flattened, irregular mass is differentially weathered due to its position in the ground: one side of the iron is relatively smooth, while the other exhibits numerous larger, more sharply defined regmaglypts. Several of the promontories show crude saw and hammer marks: evidence of failed attempts to remove samples. Two ~1-2 cm. sulfide inclusions are visible on the surface of the iron.
Petrography: (J.T. Wasson, *UCLA*) Relatively fresh iron. Few inclusions; one phosphide 1.5 × 0.2 mm, a few smaller ones. Kamacite bandwidth is 1.8±0.3 mm, thus Og. A 1-2 mm-thick heat-altered rim is visible along one edge of the cut face.
Geochemistry: Composition: 4.59 mg/g Co, 68.6 mg/g Ni, 94.3 μg/g Ga, 473 μg/g Ge, 10.3 μg/g As, 2.16 μg/g Ir, and 1.431 μg/g Au. Based on the composition and structure, this a member of the IAB main group. It falls near the low-Au end of the group. Its nearest relatives are Allan Hills 76002, Cosby's Creek, Morasko, and New Leipzig, but it is compositionally resolved from all of these.
Classification: Iron, IAB-MG
Specimens: Only one specimen known.

Moshampa 36° 57' 57"N, 47° 41' 28"E
Zanjan, Iran
Confirmed fall: 2015
Classification: Ordinary chondrite (LL5)
History: On Thursday, 2015 July 30, between 20:10 and 20:15 local time (+04:30 GMT), a very bright fireball appeared in the evening sky of N and NW Iran. Thousands of observational reports in the north to north-west of the country spread immediately in the local and international media. Very loud sonic booms were heard in Zanjan province. Ghadir Mohammadi, a farmer from Moshampa village was working in a field near the Moshampa village, close to the Qezel

Ozan river when heard four loud booms (the last one the being much louder) and saw a zig-zag shaped cloud in the sky. He heard the sound of an object falling into the wet soil about 5-10 m away from him. Worried it might be unexploded military ordnance, he went back to the village. He then heard about the fireball reports and realized that the army and police were looking for the object. The day after, he went back to the fall place and found a 1554 g stone buried about 20 cm deep in a hole and informed the media about his finding. Hamed Pourkhorsandi received two pieces of the meteorite at *CEREGE* on 2015 October 7. Ten additional fragments, with a total weight of ~700 g, were found two weeks later by Shahram Mohammadi near the location of the main mass.

Physical characteristics: The meteorite is roughly pyramidal with an approximate size 15 × 10 × 7 cm. It is entirely covered by fusion crust except for a broken area that shows a light-gray interior. Regmaglypts, melt droplets and polygonal cracks can be seen on the surface of the fusion crust. The broken surface shows chondrules up to 2.5 mm. A 5 mm, white colored, fined-grained clast is visible.

Petrography: Optical microscopy shows a fractured texture (breccia) with different types of chondrules set in a clastic matrix. Some shock-darkened clasts can be seen with the unaided eye. Olivine shows undulatory extinction and planar fractures. An elongated, 40 μm copper grain at the interface of troilite and metal was observed. Among the different clasts, a 1 mm type 6 clast with plagioclase grains up to 100 μm is present. The fine-grained white clast visible on the broken surface shows a fine-grained texture and the same mineralogy as the rest of the sample.

Geochemistry: Olivine $Fa_{29.0\pm0.1}$ ($Fa_{28.9\text{-}29.1}$, PMD 0.2%, N=6), low-Ca pyroxene $Fs_{23.8\pm0.3}$ $Wo_{1.8\pm0.0}$ (N=2), plagioclase $An_{10.3}Ab_{84.5}Or_{5.2.}$ Type 6 clast olivine $Fa_{29.8}$ (N=1), orthopyroxene $Fs_{23.8}Wo_{1.9}$ (N=1). Light-gray clast olivine $Fa_{29.2\pm0.01}$ (N=4), plagioclase $An_{11.6}Ab_{83.7}Or_{4.7.}$ Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 3.80 (measured on 23.8 g).

Classification: Ordinary chondrite (LL5, brecciated)

Specimens: Type specimen 22 g and two polished thin and thick sections at *CEREGE*. Main mass with finder.

Mount Blanco 33°45.37644'N, 101°14.9367'W
Texas, USA
Confirmed fall: 18 Feb 2016
Classification: Ordinary chondrite (L5)

History: On the night of February 18, 2016, the American Meteorite Society received numerous reports from Texas, Kansas, Oklahoma, and New Mexico of a fireball. The probable location of this fall was identified by Robert Ward and Dr. Marc Fries using radar data. One stone was discovered in a cotton field by Terry Scott and Sonny Clary on February 22.

Physical characteristics: Single stone of 36.2 g, almost fully fusion-crusted. A cut surface revealed a light-gray interior with abundant metal and a few clearly distinguished chondrules.

Petrography: (R.G. Mayne, *TCU*). The thin section used for classification of this meteorite contains one barred olivine (BO) chondrule with sharp boundaries but the remaining chondrules, although they can be discerned, do not show similar sharp boundaries and in some cases are poorly delineated. The matrix is recrystallized and chondrule glass appears devitrified. Feldspar grains within the section vary in size but are less than 50 μm.

Geochemistry: (C. Agee, *UNM*) Average compositions are as follows, olivine (N=6) $Fa_{24.8\pm0.1}$, pyroxene (N=7) $Fs_{20.8\pm0.2}$ $Wo_{1.4\pm0.3.}$

Classification: Ordinary Chondrite (L5); the sample is a freshly collected fall (W0).

Specimens: 8.4 g *TCU*; main mass of 26.8 g shared by *Clary* and Terry Scott/landowner.

Murrili 29.26089°S, 137.53765°E
South Australia, Australia
Confirmed fall: 2015 Nov 27
Classification: Ordinary chondrite (H5)
History: The Murrili fireball was imaged by observatories of the Desert Fireball Network, and witnessed by local people at William Creek and Maree, as it blazed through the skies of South Australia around 9:15 pm on November 27, 2015. The object encountered the Earth close to its perihelion point, entering the atmosphere at 13.7 km/s. The object stopped ablating at an altitude of 18.32 km over Kati Thanda-Lake Eyre South. Its darkflight and fall position were modelled using a WRF climate model. An initial aerial search (2 weeks after the fall) revealed a small crater-like impact in the surface of the salt lake. The Arabana people are the traditional custodians of this land. Just after Christmas, with their permission and help – two Arabana men assisted with the search – the ground-based search team set out to collect the rock before rain erased evidence of the fall. On New Year's Eve, a second aerial reconnaissance pinpointed the fall site. After some digging, the meteorite was pulled up through the salt-rich clay mud of the lake. It was recovered 218 m from the calculated fall line. The meteorite had punched a cylindrical hole through the mud and came to rest 43 cm below the surface.
Physical characteristics: Murrili fell as a single stone with a mass of 1.68 kg measuring approximately 13 × 7 × 6 cm. The mass was originally heart shaped. It is entirely covered with a matte looking fusion crust, aside from one small broken corner revealing a lighter gray interior. Two smaller wedges were cut from the mass for study. The cut surface shows extensive alteration with rusty staining heterogeneously distributed. The alteration does not affect the entire rock, there are areas that preserve the unaltered nature of the meteorite.
Petrography is based on investigations of a small polished thick section, which samples both the altered and unaltered materials in the sample. The overall texture is typical of ordinary chondrites having some chondrules (barred olivine, the remnants of porphyritic olivine, and possible radiating pyroxene) with distinct outlines, as well as large single mineral crystal clasts. Murrili contains olivine, orthopyroxene, plagioclase, metal and sulfide. Phosphate and chromite also occur in minor abundances. Metal and sulfide are randomly distributed throughout the sample. Some metal grains are altered on the edges, but the majority of metal grains are clean. There are fine-grained intergrowths of chromite-plagioclase.
Geochemistry: Olivine composition ranges from $Fa_{18.5}$ to $Fa_{20.4}$ ($Fa_{18.8\pm0.5}$, n=15). Orthopyroxene ranges from $Fs_{16.1}Wo_{1.8}$ to $Fs_{16.9}W1.1$ ($Fs_{16.4\pm0.3}Wo_{1.1\pm0.3}$, n=8). Chromite compositions range from Cr/Cr+Al = 0.850 to 0.868 (n=7); and Fe/Fe+Mg = 0.843 to 0.860.
Classification: The above compositions are consistent with classification at a type H ordinary chondrite. The texture, along with the Wo composition of OPX (Scott et al. 1986) and the chromite composition, indicates a petrologic type of 5.
Specimens: Main Mass is also type specimen at *SAM*. Two smaller pieces (137.2 g and 86.9 g) plus a cut slab (38.6 g) as well as one polished thick section are held at *CUWA* with the Desert Fireball Network team.

Nagornyj 47°22.95'N, 41°45.03E
Rostovskaya oblast', Russia
Find: Apr 1989

Classification: Ordinary chondrite (H5)
History: A single stone was found by Mr. R. G. Isakov on a plowed field near Nagornyj willage in 1989. In 2015 the stone was purchased by Mr. D. A. Kazakov.
Physical characteristics: Physical characterisics: A single rounded stone of reddish-brown color is completely covered with a fusion crust. The mass of the stone is 2748 g.
Petrography: The meteorite mostly comprises chondrule fragments and a few whole chondrules 400-600 μm in diameter, surrounded by fine-grained crystalline matrix. The grains of FeNi metal (100-200 μm in size) are partly replaced by FeNi hydroxide, that also forms numerous thin veinlets in the meteorite. Olivine has weak undulatory extinction and irregular fractures; feldspar grains are up to 60 μm and have undulatory extinction. The minor phases are troilite and chromite.

Navoi 40°2.75700'N, 65°20.24580'E
Navoi, Uzbekistan
Find: 2016 Feb 27
Classification: Ordinary chondrite (H6)
History: The stone was found on a small plateau, 5 km south of the city of Navoi.
Physical characteristics: The single stone is angular and has a black fusion crust. The fusion crust is observed on a relatively flat surface on the top of the stone. The surface of the meteorite without fusion crust is weathered and has a dull-tan color. The fresh cut surface has a dark color with apparent fresh metal. The stone was broken off into two pieces of 2632.7 g and 114.7 g when lifted from the ground.
Petrography: (A. Munro, *UWO*) This meteorite is composed of olivine ~50%, pyroxene ~33%, metal ~15%, plagioclase ~2%, and accessory troilite and apatite. Weathering products can be found as as iron oxides locally and within veins throughout the sample. The veins are typically 10-100 μm in width and lead to the exterior surface of the stone. Unoxidized iron-nickel metal is found disseminated in circular ~100 μm grains. The largest apatite grain observed is 50 μm across. The matrix supporting a few distinguishable chondrules is composed of broken up or relict chondrules. The chondrule compositions vary with both olivine and pyroxene-bearing chondrules. Types IA and IB chondrules were identified based on the amount of metal and olivine.
Geochemistry: Mineral compositions were obtained using WDS EMPA (in mol%): Olivine $Fa_{18.9\pm0.2}$ (n=12), Pyroxene $Fs_{16.6\pm0.0}Wo_{1.4\pm0.4}$, Fe/Mn = 22.3±0.6 (n=5), and feldspar plagioclase $An_{12.8\pm0.2}$ (n=9).
Classification: Ordinary chondrite H6
Specimens: 30.4 g at *UWO* including a polished thin section and probe mount. Remaining mass with owner.

Northwest Africa 090 (NWA 090)
(Northwest Africa)
Purchased: 2000
Classification: Primitive achondrite (Acapulcoite)
History: A 30 g meteorite was purchased by Michael Farmer from a Moroccan meteorite dealer in Erfoud, Morocco, in 2000.
Physical characteristics: A rounded stone covered by a well-developed fusion crust. Interior is fine grained with even distribution of small metal and troilite grains.

Petrography: (C. Ostrander, Z. Torrano, *ASU*) Proto-granular texture dominated by pyroxene, olivine, Fe-Ni metal, and troilite. Uniform grain size near 200 μm. Section shows several rounded mineral aggregates (~400 μm). The rounded aggregates are dominated by pyroxene, one with a radial texture. Holly-leaf-shaped Fe-Ni metal grains, some peppered with sub-μm inclusions. Fe-Ni metal distribution is not homogeneous. Troilite dominantly single crystal, showing uneven distribution with metal. Crystals typically and lacking 120º junctions. Shock is low.
Geochemistry: Olivine $Fa_{6.1\pm0.3}$, FeO/MnO = 10.7-15.4, Cr_2O_3 = 0.01-0.07 wt.%, n=4; low Ca pyroxene $Fs_{7.3\pm0.3}Wo_{1.2\pm0.3}$, FeO/MnO = 7.9-14.0, n=4; high Ca pyroxene $Fs_{3.4\pm0.2}Wo_{45.9\pm0.2}$, n=5; and, plagioclase $An_{12.7\pm0.2}Or_{5.4\pm0.1}$, n=5. Accessory chromite, Cr/[Cr+Al] = 0.89-0.91.
Classification: Acapulcoite, medium weathering, low shock
Specimens: 12.6 g, one polished thin section and a polished thick section are on deposit at *ASU*.

Northwest Africa 657 (NWA 657)
(Northwest Africa)
Purchased: 2000 Nov
Classification: Ordinary chondrite (L5)
History: Purchased by Michael Cottingham in November 2000 from a dealer in Erfoud, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules occur in a recrystallized matrix containing stained metal.
Geochemistry: Olivine ($Fa_{25.0\text{-}25.9}$, N = 3), orthopyroxene ($Fs_{21.1\text{-}21.4}Wo_{1.8\text{-}1.6}$, N = 3), clinopyroxene ($Fs_{7.2\text{-}8.1}Wo_{45.7\text{-}43.9}$, N = 2).
Classification: Ordinary chondrite (L6).
Specimens: 21.7 g including one polished thin section at *PSF*; remainder is held by *Cott*.

Northwest Africa 791 (NWA 791)
(Northwest Africa)
Purchased: 2001 Mar
Classification: Ordinary chondrite (L5)
History: Purchased by Michael Farmer in March 2001 from a dealer in Casablanca, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules occur in a recrystallized matrix containing stained metal.
Geochemistry: Olivine ($Fa_{25.5\text{-}25.8}$, N = 3), orthopyroxene ($Fs_{20.5\text{-}20.7}Wo_{1.4\text{-}1.6}$, N = 3), clinopyroxene ($Fs_{7.4\text{-}8.3}Wo_{44.9\text{-}44.3}$, N = 2).
Classification: Ordinary chondrite (L6).
Specimens: 146.7 g including one polished thin section at *PSF*; 226 g at *UCLA*; remainder is held by *MFarmer*.

Northwest Africa 1618 (NWA 1618)
(Northwest Africa)
Purchased: 2002
Classification: Carbonaceous chondrite (CO3)
History: Purchased by Nelson Oakes in 2002 from a dealer in Agadir, Morocco.

Petrography: (A. Irving and S. Kuehner, *UWS*) Small, well-formed chondrules (apparent diameter 200±150 μm), AOA, CAI and zoned mineral fragments are set in a fine grained, black matrix (~40 vol.%) containing minor secondary calcite.
Geochemistry: Olivine ($Fa_{1.2\text{-}70.3}$, Cr_2O_3 in ferroan examples 0.20-0.60 wt.%, mean 0.41±0.14 wt.%, N = 8), orthopyroxene ($Fs_{1.1\text{-}1.2}Wo_{0.9\text{-}1.1}$, N = 2), clinopyroxene ($Fs_{1.2}Wo_{35.5}$; $Fs_{0.7}Wo_{46.9}$; N = 2).
Classification: Carbonaceous chondrite (CO3).
Specimens: 4.1 g including one polished thin section at *PSF*; 8.6 g at *UCLA*; remainder with *Oakes*.

Northwest Africa 2421 (NWA 2421)
(Northwest Africa)
Purchased: Feb 2014
Classification: HED achondrite (Eucrite, brecciated)
Physical characteristics: One rough-surfaced, fusion crusted individual stone.
Petrography: This highly shocked breccia consists dominantly of pyroxene, plagioclase (and maskelynite) and glassy shock-melt. Surviving crystal fragments are up to 2.5 mm (pyroxene) but most of the material has been granulated to <<1 mm. Accessory phases include ilmenite and silica.
Geochemistry: Low-Ca pyroxene clusters near $Fs_{55}Wo_3$, but shows a 5 mol% spread in Mg/(Mg+Fe), along with commensurate-composition, e.g. $Fs_{32}Wo_{33}$, augite. Pyroxene FeO/MnO averages (26 analyses) 30.6. Plagioclase (26 analyses) is $An_{79\text{-}93}$, average $An_{88.5\pm2.5.}$
Classification: Eucrite, breccia.

Northwest Africa 2422 (NWA 2422)
(Northwest Africa)
Purchased: Feb 2014
Classification: HED achondrite (Eucrite, monomict)
Physical characteristics: One smooth-surfaced, completely fusion-crusted individual stone.
Petrography: Although mildly brecciated, this monomict eucrite clearly shows its original subophitic igneous texture, with plagioclase laths up to 3 mm long. Both major phases, pyroxene and plagioclase, are "cloudy" with abundant microinclusions. Pyroxene shows typical eucrite fine-scale exsolution. Accessory phases include ilmenite and silica.
Geochemistry: Low-Ca pyroxene clusters near $Fs_{60}Wo_2$, with a very narrow (difficult to detect, "equilibrated") spread in Mg/(Mg+Fe), along with commensurate-composition $Fs_{27}Wo_{42}$ (mostly exsolved) augite. Pyroxene FeO/MnO averages (29 analyses) 31.2. Plagioclase (11 analyses) is $An_{86\text{-}91}$, average $An_{88.5\pm1.4.}$
Classification: Eucrite, monomict breccia.

Northwest Africa 3260 (NWA 3260)
(Northwest Africa)
Purchased: 2007
Classification: Ordinary chondrite (LL3)
History: Purchased in Rissani in 2007.
Physical characteristics: (R. Bartoschewitz, *Bart*) One brown stone of 8.2 g; saw cut shows closely packed chondrules.

Petrography: (R. Bartoschewitz, *Bart*) Microscopic examination of a thin section shows dark fine groundmass with mineral fragments, chondrules (PO, BO, RP, dominated by type I) up to 1.7 mm (avg. 1 mm), and CAIs. Chondrule/matrix ratio ~10.
Geochemistry: (R. Bartoschewitz, *Bart*, P. Appel and B. Mader, *Kiel*) Olivine, $Fa_{13.7\pm8.3}$ (n=18); pyroxene, $Fs_{9.9\pm5.7}Wo_{1.6\pm1.3}$ (n=20); Ca-pyroxene, $En_{86\pm8}Fs_{7.5\pm6}Wo_{6.5\pm0.3}$ (n=2, Fe/Mn=27); kamacite, Ni=2.5-3.9, Co=0.5 wt.%. O-isotopes (R. Greenwood and Ian Franchi, *OU*): $\delta^{17}O$ = 3.569, $\delta^{18}O$ = 5.65 (permil). Magnetic susceptibility (R. Bartoschewitz, *Bart*) log χ ($\times 10^{-9}$ m^3/kg) = 3.75.
Classification: Ordinary chondrite (LL3)
Specimens: 1.6 g on deposit at *Kiel*, main mass Bilet (As, Norway), and *Bart* 1.0 g.

Northwest Africa 3320 (NWA 3320)
(Northwest Africa)
Find: 2006
Classification: Ordinary chondrite (LL6, melt breccia)
History: The stone was discovered in 2006 and was purchased from a Moroccan dealer at a German mineral fair in the same year.
Physical characteristics: One yellow-brown stone of 1800 g. Saw cut shows lighter interior with few small vugs.
Petrography: (R. Bartoschewitz, *Bart*) Microscopic examination of a thin section shows two distinct lithologies. One of micro-crystalline matrix with olivine grains up to 0.8 mm (avg. 0.1 mm), and small metallic globes (0.02 mm) and oxidized veins. The other of recrystallized matrix with mineral fragments and poorly developed chondrules (PO, BO, RP) up to 1 mm.
Geochemistry: (R. Bartoschewitz, *Bart*, P. Appel and B. Mader, *Kiel*) Olivine, $Fa_{25.7\pm0.8}$ (n=14); Ca-rich pyroxene, $En_{44.9\text{-}46.4}Fs_{7.7\text{-}8.5}Wo_{46.4\text{-}44.0}$ (n=2); feldspar, $An_{9.7}Or_{5.3.}$ O-isotopes (R. Greenwood and I. Franchi, *OU*): $\delta^{17}O$ = 3.94, $\delta^{18}O$ = 5.35 (permit). Magnetic susceptibility (R. Bartoschewitz, *Bart*) log χ ($\times 10^{-9}$ m^3/kg) = 3.13.
Classification: Ordinary chondrite (LL melt breccia)
Specimens: 20.0 g on deposit at *Kiel*, main mass *Haiderer*, and *Bart* 9.6 g.

Northwest Africa 4679 (NWA 4679)
(Northwest Africa)
Purchased: 2006 May
Classification: Carbonaceous chondrite (CK4)
Petrography: (K. Metzler, *IfP*) Chondrules and CAIs (up to 6 mm) are embedded in a fine-grained brownish matrix. Mean apparent chondrule size 1.4±0.5 mm (0.2-2.9 mm; n=63). The sample is interspersed with magnetite nodules.
Geochemistry: Random olivine measurements revealed$Fa_{32.2\pm0.6}$ ($Fa_{31.3\text{-}33.0}$; n=14). One BO chondrule with igneous rim shows a relict unequilibrated core with $Fa_{7.9.}$ The compositional range of feldspar is $An_{17.3\text{-}35.1}$ (n=4). Magnetite is the most abundant opaque phase and shows significant concentrations of elements other than Fe (n=3): MgO 1.9-2.0 wt%; Al_2O_3 3.4-4.0 wt%; TiO_2 0.8-0.9 wt%; Cr_2O_3 2.9-3.6 wt%; NiO 0.3-0.5 wt%.
Classification: CK chondrite based on mineral chemistry. Petrologic type 4 based on the chemical variation of olivine and pyroxene.

Northwest Africa 4964 (NWA 4964)

(Northwest Africa)
Purchased: 2007
Classification: Carbonaceous chondrite (CK3)
Petrography: (K. Metzler, *IfP*) Chondrules and CAIs are embedded into a fine-grained brownish matrix. The matrix consists mostly of equilibrated Fe-rich olivine grains, interspersed with magnetite nodules. The mean apparent chondrule diameter is 1.13±0.69 mm (0.47-3.83 mm; n=31). Chondrules with igneous rims occur and CAIs up to 1.3 cm are observed.
Geochemistry: The composition of matrix olivine is $Fa_{33.8\pm0.6}$ (Fa_{32-35}; n=16), while olivine in chondrule cores retained its original Mg-rich composition. Random olivine measurements revealed $Fa_{30.7\pm5.9}$ (Fa_{13-35}; n=22). Low-Ca pyroxene ($En_{95-98}Fs_{1-4}Wo_1$; n=5) mainly occurs in chondrules. Most pyroxene grains outside of chondrules are Ca-rich ($En_{36-42}Fs_{7-14}Wo_{49-51}$; n=7). The compositional range of feldspar (n=4) is $An_{21-31.}$ Magnetite is the most abundant opaque phase and shows significant concentrations of elements other than Fe (n=3): MgO 0.8-0.9 wt%; Al_2O_3 3.2-3.6 wt%; TiO_2 0.8-0.9 wt%; Cr_2O_3 2.6-3.7 wt%; NiO 0.3-0.4 wt%.
Classification: CK chondrite based on mineral chemistry. Petrologic type 3 based on the chemical variation of olivine and pyroxene.

Northwest Africa 4993 (NWA 4993)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (H3)
History: The meteorite was found by an anonymous finder in northwest Africa and bought by the main mass holder in Morocco.
Physical characteristics: One brownish fragment without fusion crust weighing 300 g was found.
Petrography: The sample is an unbrecciated chondrite with unequilibrated olivine and pyroxene in chondrules and matrix, and Fe,Ni-metal. The on average about 0.4 mm sized chondrules are well discernable and of large variation in the textural types.

Northwest Africa 4995 (NWA 4995)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (H3)
History: The meteorite was found by an anonymous finder in northwest Africa and bought by the main mass holder in Morocco.
Physical characteristics: One dark brown fragment of 190 g lacking any fusion crust was found.
Petrography: The meteorite is an unbrecciated chondrite with abundant clearly defined chondrules (about 0.3 mm in diamter) of various textural types. Olivine and pyroxene in chondrules and matrix are unequilibrated; FeNi metal is mostly oxidized.

Northwest Africa 4997 (NWA 4997)
(Northwest Africa)
Purchased: 2006
Classification: Carbonaceous chondrite (CV3)
History: The meteorite was found by an anonymous person in northwest Africa and bought by the main mass holder in Morocco.

Physical characteristics: One dark gray fragment without fusion crust weighing 50 g was found.
Petrography: The meteorite displays a dark-grayish interior and is composed of mm-sized chondrules, whitish CAIs, and olivine amoeboids set into a fine-grained, almost opaque matrix. Several chondrules show reddish staining due to terrestrial weathering; no type II chondrules were encountered.

Northwest Africa 5005 (NWA 5005)
(Northwest Africa)
Purchased: 2006
Classification: Ordinary chondrite (L3)
History: The meteorite was found by an anonymous finder in northwest Africa and bought by the main mass holder in Morocco.
Physical characteristics: One brownish-gray fragment of 40 g was found.
Petrography: The meteorite is composed of sharply defined chondrules of various petrological types about 0.6 in diameter set into a fine-grained matrix of chondrule and mineral fragments and FeNi metal.

Northwest Africa 5006 (NWA 5006)
(Northwest Africa)
Purchased: 2006
Classification: Ordinary chondrite (L3-6)
History: The meteorite was found by an anonymous finder in northwest Africa and bought by the main mass holder in Morocco.
Physical characteristics: One fragment of 50 g partly covered with fusion crust was found.
Petrography: The meteorite is a chondritic breccia composed of L3 to L6 clasts set into a fine-grained clastic matrix. Plagioclase grain size in L5 clasts is about 30 μm and in L6 clasts about 70 μm. Olivine and pyroxene in L3 clasts are highly unequilibrated with $Fa_{22.9\pm8.8}$ (7.8-44.2, n=53) and $Fs_{15.2\pm6.3}Wo_{1.0\pm1.0}$ ($Fs_{1.6\text{-}24.4}Wo_{0.2\text{-}4.5}$, n=34). In L5 and L6 clasts olivine and pyroxene are equilibrated at $Fa_{23.5\pm0.2}$, n=15 and $Fs_{19.8\pm0.5}Wo_{1.0\pm0.7}$, n=11.

Northwest Africa 5007 (NWA 5007)
(Northwest Africa)
Purchased: 2006
Classification: Enstatite chondrite (EL6)
History: The meteorite was found by an anonymous finder in northwest Africa and bought by the main mass holder in Morocco.
Physical characteristics: One small, dark brown fragment without fusion crust weighing 21 g was found.
Petrography: The meteorite consists dominantly of almost pure enstatite and displays a completely recrystallized texture. Minor phases include troilite, alabandite and daubreelite. Metal is strongly altered to iron oxides.
Geochemistry: Metal contains about 1.1 wt% Si

Northwest Africa 5009 (NWA 5009)
(Northwest Africa)
Purchased: 2006

Classification: Enstatite chondrite (EL6)
History: The meteorite was found by an anonymous finder in northwest Africa and bought by the main mass holder in Morocco.
Physical characteristics: Three fragments partly covered with fusion crust totaling 85 g were found.
Petrography: The meteorite shows a recrystallized texture of large sized enstatite grains and contains minor albitic feldspar, troilite, schreibersite and daubreelite. Felspar grain size is about 50 μm. No relict chondrules were observed.
Geochemistry: Albitic feldspar: $An_{15}Or_{3.9}Ab_{81.1}$, n=6; metal contains about 1.0 wt% Si.

Northwest Africa 5012 (NWA 5012)
(Northwest Africa)
Purchased: 2007
Classification: Ordinary chondrite (L3-6)
History: The meteorite was found by an anonymous finder in northwest Africa and bought by the main mass holder in Morocco.
Physical characteristics: One brownish fragment without fusion crust weighing 700 g was found.
Petrography: The sample is a brecciated meteorite consisting of light-gray and more brownish angular clasts of different petrologic types. Plagioclase grain size in L5 clasts is about 25 μm and in L6 clasts about 60 μm. In the type 3 fragments chondrules are well recognizable.
Geochemistry: In type 3 lithology, olivine and pyroxene are unequilibrated with $Fa_{14.5\pm8.1}$ (3.0-36.9, n=22) and $Fs_{12.9\pm6.9}Wo_{0.7\pm0.6}$ ($Fs_{3.4\text{-}23.9}Wo_{0.1\text{-}2.2}$, n=26). Type 6 fragments are completely recrystallized and the silicates show homogeneous chemical composition at $Fa_{25.0\pm0.2}$, n=33 and $Fs_{19.8\pm0.5}Wo_{1.9\pm0.2}$, n=34.

Northwest Africa 5018 (NWA 5018)
(Northwest Africa)
Purchased: 2007
Classification: HED achondrite (Eucrite)
History: The meteorite was found by an anonymous finder in northwest Africa and bought by the main mass holder in Morocco.
Physical characteristics: One fragment partly covered with fusion crust weighing 254 g was found.
Petrography: The meteorite is an unbrecciated basalt consisting dominantly of coarse-grained exsolved pyroxene and calcic plagioclase. Minor phases include ilmenite, chromite and silica. Few regions appear more fine-grained and plagioclase poor than the major part of the meteorite.
Geochemistry: Low-Ca pyroxene: $Fs_{62.5\pm0.9}Wo_{2.2\pm0.5}$ ($Fs_{60.8\text{-}64.1}Wo_{1.2\text{-}3.1}$, n=21, FeO/MnO=30-34); Ca-pyroxene: $Fs_{28.0\pm1.1}Wo_{43.0\pm1.3}$ ($Fs_{26.9\text{-}31.1}Wo_{39.6\text{-}44.5}$, n=20, FeO/MnO=28-36); calcic plagioclase: $An_{87.7\pm4.4}$ ($An_{78.5\text{-}91.1}$, n=12)

Northwest Africa 5030 (NWA 5030)
(Northwest Africa)
Purchased: 06/2007
Classification: HED achondrite (Eucrite, brecciated)

History: The meteorite was bought from a Moroccan dealer at the meteorite fair in Ensisheim, France.
Petrography: The meteorite is a eucritic breccia composed of basaltic and dark impact melt clasts. Basaltic lithologies are composed of up to 0.5 mm sized exsolved pyroxene and up to 1.5 mm sized calcic plagioclase grains. Minor phases include chromite and silica polymorphs.
Geochemistry: Low-Ca pyroxene: $Fs_{58.7\pm1.6}Wo_{3.4\pm2.1}$ ($Fs_{54.4\text{-}61.0}Wo_{1.2\text{-}8.7}$, n=22, FeO/MnO=26-31); Ca-pyroxene: $Fs_{26.5\pm1.2}Wo_{42.8\pm1.4}$ ($Fs_{24.3\text{-}29.6}Wo_{39.5\text{-}44.9}$, n=25, FeO/MnO=24-33); calcic plagioclase: $An_{89.3\pm0.9}$ ($An_{87.9\text{-}90.7}$, n=19)

Northwest Africa 5391 (NWA 5391)
(Northwest Africa)
Purchased: 2008
Classification: Ureilite
History: The meteorite was bought in 2008 on a mineral fair in Bruegg, Switzerland.
Petrography: The meteorite has a cumulate texture with blocky, up to 2 mm sized olivine and pigeonite crystals. Olivine displays reduced rims. The meteorite contains flaky graphite.
Geochemistry: Reduced rims in olivine: $Fa_{5.8\text{-}13.8}$; Cr_2O_3 in olivine: ~0.7 wt%.

Northwest Africa 5555 (NWA 5555)
(Northwest Africa)
Purchased: 2008
Classification: Ureilite
History: The meteorite was bought in 2008 from a Moroccan meteorite dealer on a meteorite fair in Ensisheim, France.
Petrography: The meteorite displays a recrystallized texture composed of up to 2 mm sized olivine ($Fa_{9.0\pm0.1}$, n=16) and pigeonite ($Fs_{8.2\pm0.1}Wo_{9.0\pm0.1}$, n=16) grains. Olivine shows characteristic reduced rims. Additionally, it contains rare orthopyroxene with $Fs_{8.0}Wo_{5.0}$, N=4.
Geochemistry: reduced rims in olivine: $Fa_{3.3\text{-}6.8}$; Cr_2O_3 in ol: ~0.6 wt%

Northwest Africa 5556 (NWA 5556)
(Northwest Africa)
Purchased: 2008
Classification: HED achondrite (Eucrite, polymict)
History: The meteorite was bought in 2008 from a Moroccan meteorite dealer on a mineral fair in St. Marie aux Mines, France.
Petrography: The meteorite is a polymict breccia of lithic and mineral clasts in a fine-grained clastic matrix. Lithic clasts include basaltic and impact melt clasts. Dominant minerals in clasts and matrix are exsolved pyroxenes and calcic plagioclase. Diogenitic orthopyroxene makes up about 4 vol.%. Minor phases are chromite and silica.
Geochemistry: Pyroxene host to augite lamellae: $Fs_{50.2\pm0.6}Wo_{1.9\pm0.3}$ ($Fs_{49.5\text{-}51.3}Wo_{1.6\text{-}2.6}$, n=14, FeO/MnO=29-35); Ca-pyroxene: $Fs_{22.5\pm1.7}Wo_{42.4\pm2.5}$ ($Fs_{19.6\text{-}27.6}Wo_{35.7\text{-}46.4}$, n=21, FeO/MnO=26-30); diogenitic pyroxene: $Fs_{32.5\pm3.6}Wo_{2.9\pm0.3}$ ($Fs_{26.8\text{-}40.3}Wo_{2.5\text{-}3.4}$, n=9, FeO/MnO=34-43); calcic plagioclase: $An_{88.6\pm4.7}$ ($An_{78.1\text{-}92.9}$, n=12)

Northwest Africa 5558 (NWA 5558)
(Northwest Africa)

Purchased: 2008
Classification: HED achondrite (Eucrite)
History: The meteorite was bought in 2008 on a mineral fair in Ensisheim, France.
Petrography: The meteorite shows a basaltic texture of up to 0.5 mm sized often lath-shaped plagioclase grains and more fine-grained exsolved pyroxene. Minor phases include chromite, pyrrhotite and silica.
Geochemistry: low-Ca pyroxene: $Fs_{57.9\pm0.2}Wo_{6.2\pm0.1}$ n=16 ($Fs_{57.5\text{-}58.1}Wo_{6.1\text{-}6.5}$, n=15, FeO/MnO=31-34); Ca-pyroxene: $Fs_{29.3\pm0.4}Wo_{41.3\pm0.4}$ ($Fs_{28.7\text{-}30}Wo_{40.6\text{-}42}$, n=16, FeO/MnO=34-38); calcic plagioclase: $An_{90.1\pm1.3}$ ($An_{87.2\text{-}91.8}$, n=18)

Northwest Africa 5673 (NWA 5673)
(Northwest Africa)
Purchased: 2008
Classification: Carbonaceous chondrite (CK3)
History: The meteorite was bought in 2008 on a mineral fair in Ensisheim, France.
Petrography: The meteorite is composed of well-defined chondrules (0.3-1.5 mm in diameter) and rare CAIs set into abundant fine-grained greenish matrix. Feldspar in matrix is albitic and magnetite contains about 3 wt% Cr_2O_3; metal is virtually absent.

Northwest Africa 5675 (NWA 5675)
(Northwest Africa)
Purchased: 2008
Classification: HED achondrite (Eucrite)
History: The meteorite was bought in 2008 from a local meteorite dealer in Erfoud, Morocco.
Petrography: The meteorite is a brecciated eucrite with up to 3 cm sized basaltic and gabbroic clasts, black appearing recrystallized melt clasts and mineral fragments set into a finer grained matrix. Dominant mineral phases are calcic plagioclase and exsolved pyroxene; minor phases include chromite, troilite, and silica.
Geochemistry: low-Ca pyroxene: $Fs_{56.3\pm1.5}Wo_{5.9\pm1.8}$ ($Fs_{54.2\text{-}58.1}Wo_{3.8\text{-}8.1}$, n=7, FeO/MnO=29-32); Ca-pyroxene: $Fs_{38.2\pm5.5}Wo_{28.0\pm6.7}$ ($Fs_{25.9\text{-}44.7}Wo_{20.7\text{-}42.5}$, n=16, FeO/MnO=29-32); calcic plagioclase: $An_{89.4\pm1.2}$ ($An_{87.9\text{-}92.2}$, n=16)

Northwest Africa 5676 (NWA 5676)
(Northwest Africa)
Purchased: 2008
Classification: HED achondrite (Eucrite, brecciated)
History: The meteorite was bought in 2008 from a Moroccan meteorite dealer on a mineral fair in Bruegg, Switzerland.
Petrography: The meteorite is a brecciated eucrite composed of lithic and mineral clasts set into a clastic matrix. Dominant minerals in matrix and basaltic clasts are exsolved pyroxene and calcic plagioclase. Minor phases include chromite and silica. The meteorite contains abundant almost black melt clasts. Some regions show brownish staining due to terrestrial alteration.
Geochemistry: low-Ca pyroxene: $Fs_{60.5\pm0.9}Wo_{3.5\pm0.7}$ ($Fs_{58.6\text{-}61.7}Wo_{2.6\text{-}5.0}$, n=16, FeO/MnO=30-32); Ca-pyroxene: $Fs_{26.4\pm3.5}Wo_{41.5\pm2.5}$ ($Fs_{22.8\text{-}35.4}Wo_{34.7\text{-}44.3}$, n=18, FeO/MnO=27-32); calcic plagioclase: $An_{86.3\pm4.7}$ ($An_{79.0\text{-}92.9}$, n=12)

Northwest Africa 5690 (NWA 5690)
(Northwest Africa)
Purchased: 2007
Classification: Ordinary chondrite (L5, melt breccia)
History: The meteorite was bought from a Moroccan meteorite dealer at the mineral fair in Munich, Germany.
Petrography: The meteorite is composed of regions displaying chondritic textures with well recognizable chondrules and shock melted melt regions containing FeNi metal and sulfide globules. Chondritic regions are of L5 type; plagioclase grains size within type 5 regions is about 20 µm.

Northwest Africa 5695 (NWA 5695)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (LL3-6)
Petrography: The meteorite is a chondritic breccia composed of LL3 to LL6 clasts set into a fine-grained clastic matrix. LL3 and LL4 clasts show perfect chondritic textures with clearly defined chondrules about 1 mm in diameter. Plagioclase grain size in LL5 clasts is about 30 µm and in LL6 clasts about 80 µm.
Geochemistry: Olivine and pyroxene in LL3 clasts are highly unequilibrated with $Fa_{23.8\pm9.3}$ (1.0-32.4, n=25) and $Fs_{15.4\pm6.4}Wo_{1.0\pm0.7}$ ($Fs_{1.8\text{-}25.1}Wo_{0.2\text{-}2.8}$, n=28). In LL5 and LL6 clasts olivine and pyroxene are equilibrated at $Fa_{29.8\pm0.4}$, n=15 and $Fs_{24.4\pm0.4}Wo_{0.7\pm0.4}$, n=27.

Northwest Africa 5747 (NWA 5747)
(Northwest Africa)
Purchased: 2008 Dec 12
Classification: Carbonaceous chondrite (CV3)
History: Purchased from a moroccan dealer at the mineral fair (CCH) in Hamburg, Germany.
Petrography: (K. Metzler, *IfP*) Abundant chondrules with apparent sizes up to 4 mm set into a dark gray, fine-grained matrix. Many chondrules show yellow to orange colors due to terrestrial staining. Several whitish CAIs with irregular and spherical shapes occur, with apparent sizes up to 2.5 mm. Small, partly oxidized Fe,Ni grains are visible.

Northwest Africa 5749 (NWA 5749)
(Northwest Africa)
Purchased: 2008 Dec 12
Classification: Ordinary chondrite (LL4-6)
History: Purchased from a Moroccan dealer at the mineral fair (CCH) in Hamburg, Germany.
Petrography: (K. Metzler, *IfP*) Genomict breccia, consisting of LL4 clasts and LL6 clasts, embedded in related fine-grained clastic material. Contains melt rock clasts.
Geochemistry: Olivine compositions from type 4 and type 6 clasts are indistinguishable. Low-Ca pyroxene in type 6 clasts: 26.0±0.8, n=9; Low-Ca pyroxene in type 4 clasts: $Fs_{22.8\pm2.1}$, n=8

Northwest Africa 5750 (NWA 5750)
(Northwest Africa)
Purchased: 2008 Dec 12

Classification: Mesosiderite (group C)
History: Purchased from a Moroccan dealer at the mineral fair (CCH) in Hamburg, Germany.
Petrography: (K. Metzler, *IfP*) Coarse-grained breccia, mainly consisting of orthopyroxenite clasts (up to 2.5 cm) and some plagioclase fragments, embedded in a metal-rich matrix of related debris. Overall metal abundance about 20 vol%; orthopyroxenite clasts contain <5 vol% metal. Plagioclase abundance <10 vol%.
Geochemistry: Plagioclase composition: $An_{94.3\pm1.6}$ (92.3-97.4; n=16)
Classification: Mesosiderite based on texture, metal abundance and mineral chemistry. Type C mesosiderite based on low abundance of plagioclase (<10 vol%) and high abundance of low-Ca pyroxene.

Northwest Africa 5754 (NWA 5754)
(Northwest Africa)
Purchased: 2008 Oct 30
Classification: Rumuruti chondrite (R3-5)
History: Purchased from a Moroccan dealer at the mineral fair (Messe München) in Munich, Germany.
Petrography: (K. Metzler, *IfP*) Genomict breccia, consisting of unequilibrated (R3) and equilibrated clasts (R5), embedded in finer-grained material. Mean apparent chondrule size in unequilibrated areas: 0.38 mm (0.1-1.3 mm; n=42). No metal is observed. Most sulfides are terrestrially oxidized.

Northwest Africa 5758 (NWA 5758)
(Northwest Africa)
Purchased: 2008 Jun 25
Classification: HED achondrite (Howardite)
History: Purchased from a Moroccan dealer at the meteorite fair in Sainte-Marie-aux-Mines, France.
Physical characteristics: Individual stone with brownish fusion crust
Petrography: (K. Metzler, *IfP*) Polymict breccia, consisting of small eucrite clasts (ophitic to subophitic) and diogenitic pyroxene fragments (~15 vol%), embedded in related fine-grained clastic material.
Geochemistry: Low-Ca pyroxene in eucrite clasts: $Fs_{47.7\text{-}54.9}$ (n=39). Diogenitic low-Ca pyroxene: $Fs_{24.8\text{-}30.3.}$ Plagioclase composition: $An_{86.7\pm6.4}$ ($An_{70.9\text{-}94.2}$; n=20)
Classification: Howardite based on abundance of diogenitic low-Ca pyroxene (>10 vol%)

Northwest Africa 5903 (NWA 5903)
(Northwest Africa)
Purchased: 2008
Classification: HED achondrite (Eucrite, brecciated)
History: The meteorite was bought in 2008 from a Moroccan meteorite dealer on a mineral fair in Bruegg, Switzerland.
Petrography: The meteorite is a breccia consisting of fine- and more coarse-grained basaltic clasts set into a clastic groundmass of dominantly calcic plagioclase and exsolved pyroxene. Plagioclase grains are up to 1.5 mm in size. Minor phases are ilmenite, chromite and silica.

Geochemistry: low-Ca pyroxene: $Fs_{61.9\pm0.8}Wo_{2.1\pm0.9}$ ($Fs_{60.3\text{-}62.9}Wo_{1.5\text{-}4.0}$, n=11, FeO/MnO=29-33); Ca-pyroxene: $Fs_{30.4\pm2.0}Wo_{40.4\pm2.3}$ ($Fs_{27.4\text{-}33.4}Wo_{36.3\text{-}44.6}$, n=22, FeO/MnO=28-35); calcic plagioclase: $An_{90.1\pm0.8}$ ($An_{89.0\text{-}91.8}$, n=23)

Northwest Africa 5904 (NWA 5904)
(Northwest Africa)
Purchased: 2008
Classification: Ureilite
History: The meteorite was bought in 2008 from a meteorite dealer in Erfoud, Morocco.
Petrography: The meteorite shows a characteristic cumulate texture of 0.5 to 2 mm sized olivine, pigeonite and rare orthopyroxene crystals. Olivine shows pronounced reduced rims and the meteorite contains flaky graphite attesting to low degree of shock.
Geochemistry: orthopyroxene: $Fs_{17.9\pm0.2}Wo_{4.6\pm0.1}$ ($Fs_{8.4\text{-}16.5}Wo_{4.6\text{-}4.7}$, n=5); pigeonite: $Fs_{12.5\pm2}Wo_{10.2\pm1.8}$ ($Fs_{28.7\text{-}30}Wo_{8\text{-}13.9}$, n=14); reduced rims in olivine: $Fa_{2.4\text{-}13.7}$; Cr_2O_3 in ol: ~0.5 wt%

Northwest Africa 5907 (NWA 5907)
(Northwest Africa)
Purchased: 2008
Classification: Carbonaceous chondrite (CK6)
History: The meteorite was bought in 2008 on a mineral fair in Bruegg, Switzerland.
Petrography: The meteorite displays a dark greyish to slightly greenish interior and is dominatly composed of recrystallized matrix; relict chondrules are rare. Olivine is the most abundant mineral phase; more minor components are feldspar, Ca-pyroxene and Cr-bearing magnetite.
Geochemistry: Cr_2O_3 in magnetite: about 5 wt%

Northwest Africa 5996 (NWA 5996)
Morocco
Find: 2009
Classification: Ureilite
History: Provided by a dealer for classification in November 2009.
Physical characteristics: One single stone. No crust, significantly weathered. log χ ($\times 10^{-9}$ m^3/kg) = 3.51.
Petrography: Aggregate of coarse olivine grains with reduced margins and minor pyroxenes, with recrystallized texture. Dominant olivine (>90%). Millimeter-sized graphite laths. Rare small interstitial pyroxene (mostly low Ca).
Geochemistry: (EMPA) Olivine: core and rim $Fa_{18\pm3}$ (N=16), core $Fa_{13\pm0.4}$ (N=3) with more magnesian rims and high Cr_2O_3 (0.6±0.2; N=16), FeO/MnO = 40. Low Ca pyroxene with $Fs_{12\pm1}Wo_{7\pm5}$(N=3)and FeO/MnO = 20.
Classification: Ureilite
Specimens: Both pieces at *UPVI*

Northwest Africa 6000 (NWA 6000)
(Northwest Africa)
Purchased: 2009 Aug
Classification: HED achondrite (Howardite)

History: Purchased from a mineral dealer in Erfoud, Morocco
Petrography: (K. Metzler, *IfP*) Fine-grained breccia, consisting of mm-sized clasts of equilibrated and unequilibrated basalt (subophitic and ophitic texture) and diogenitic pyroxene, set in a fine-grained matrix of related debris. The diogenite component is unevenly distributed (mean concentration about 15 vol%). Main accessories are ilmenite, chromite, and (mostly oxidized) metal.
Geochemistry: Eucritic lithologies: low-Ca pyroxene $Fs_{44.7\pm13.0}$ (34-62; n=6); augite exsolution lamellae $Fs_{27.1}$ ($Fs_{26\text{-}28}$; n=2). Diogenitic pyroxene $Fs_{25.9\pm3.0}$ ($Fs_{22\text{-}31}$; n=7). Plagioclase variation $An_{90.2\pm3.3}$ ($An_{82.5\text{-}94.7}$; n=13)

Northwest Africa 6001 (NWA 6001)
(Northwest Africa)
Purchased: 2009 Aug
Classification: Carbonaceous chondrite (CV3)
History: Purchased from a mineral dealer in Erfoud, Morocco
Petrography: (K. Metzler, *IfP*) Abundant chondrules set into a dark gray, fine-grained matrix. Many chondrules show orange to brown colors due to terrestrial staining. Mean apparent chondrule size 1.1±0.6 mm (0.3-4.3 mm; n=48). Several CAIs with irregular and spherical shapes occur, with apparent sizes up to 2.8 mm.

Northwest Africa 6002 (NWA 6002)
(Northwest Africa)
Purchased: 2009 Aug
Classification: Rumuruti chondrite (R5)
History: Purchased from a mineral dealer in Erfoud, Morocco.
Petrography: Fine-grained breccia composed of few chondrules and chondrule fragments, embedded in a fine-grained yellow-brown matrix.
Geochemistry: No low-Ca pyroxene was found. Plagioclase variation: $An_{9.4\text{-}11.0}$ (n=3)

Northwest Africa 6057 (NWA 6057)
(Northwest Africa)
Purchased: 2009
Classification: Mesosiderite
History: The meteorite was bought in 2009 from a Moroccan meteorite dealer on a mineral fair in Berne, Switzerland.
Petrography: The meteorite is composed of a metal (about 40 vol%) and silicate (about 60 vol%) portion. The silicate portion dominantly consists of up to 2 mm sized igneous orthopyroxene, clinopyroxene and calcic plagioclase; minor phases include troilite and silica. Virtually all FeNi metal has been altered to Fe-oxides.
Geochemistry: low-Ca pyroxene: $Fs_{26.9\pm3.4}Wo_{1.9\pm0.9}$ ($Fs_{18.0\text{-}34.1}Wo_{1.1\text{-}3.7}$, n=40, FeO/MnO=25-34); pigeonite: $Fs_{36.4\pm5.5}Wo_{8.4\pm2.9}$ ($Fs_{28.4\text{-}46.9}Wo_{5.2\text{-}17.5}$, n=15, FeO/MnO=24-27); calcic plagioclase: $An_{94.3\pm2.0}$ ($An_{91.1\text{-}96.8}$, n=20)

Northwest Africa 6058 (NWA 6058)
(Northwest Africa)
Purchased: 2009

Classification: Ordinary chondrite (LL melt breccia)
Petrography: The meteorite is a melt breccia composed of fragments with largely melted and recrystallized regions as well as some relict chondrules. Recrystallized olivine in melted regions shows a variety of morphologies including dendrites, swallowtail and euhedral shapes and displays compositional zoning from $Fa_{23.7\text{-}34.0}$, n=7. Olivine and pyroxene in chondrules are equilibrated.

Northwest Africa 6067 (NWA 6067)
(Northwest Africa)
Purchased: 2009
Classification: HED achondrite (Eucrite, polymict)
History: The meteorite was bought in 2009 from a local meteorite dealer in Morocco.
Petrography: The meteorite is a fresh polymict breccia composed of eucrite clasts, melt clast with different quenching textures and mineral fragments embedded in fine grained matrix. Mineral phases are exsolved pyroxene, calcic plagioclase and sparse grains of diogenitic orthopyroxene. Accessories include silica polymorph, ilmenite, chromite, and troilite.
Geochemistry: Pyroxene host to augite lamellae: $Fs_{54.0\pm3.1}Wo_{2.8\pm0.9}$ ($Fs_{50.9\text{-}57.8}Wo_{1.8\text{-}4.0}$, n=10, FeO/MnO=35-41); Ca-pyroxene: $Fs_{24.9\pm2.2}Wo_{41.6\pm1.1}$ ($Fs_{22.3\text{-}27.6}Wo_{39.3\text{-}43.7}$, n=15, FeO/MnO=26-33); diogenitic pyroxene: $Fs_{28.8\pm3.1}Wo_{3.5\pm0.6}$ ($Fs_{25.3\text{-}34.1}Wo_{2.7\text{-}4.7}$, n=13, FeO/MnO=32-45); calcic plagioclase: $An_{89.0\pm3.3}$ ($An_{81.4\text{-}92.4}$, n=12)

Northwest Africa 6254 (NWA 6254)
(Northwest Africa)
Purchased: 2009
Classification: Carbonaceous chondrite (CK3)
Petrography: (K. Metzler, *IfP*) Chondrules and CAIs are embedded into a fine-grained brownish matrix. The matrix consists mostly of equilibrated Fe-rich olivine grains, interspersed with magnetite nodules. The mean apparent chondrule diameter is 1.08±0.44 mm (0.46-2.23 mm; n=54). CAIs up to 0.9 cm are observed. A ~4 cm long vein (confined by the sample size), filled by dark fine-grained material, transects the sample slice.
Geochemistry: The composition of matrix olivine is $Fa_{33.9\pm0.8}$ ($Fa_{32\text{-}35}$; n=17), while olivine in chondrule cores retained its original Mg-rich composition. Random olivine measurements revealed $Fa_{30.7\pm8.3}$ ($Fa_{0\text{-}35}$; n=21). Low-Ca pyroxene ($En_{89\text{-}97}$ $Fs_{2\text{-}10}$ $Wo_{1\text{-}4}$; n=4) mainly occurs in chondrules. Most pyroxene grains outside of chondrules are Ca-rich ($En_{35\text{-}38}Fs_{10\text{-}14}Wo_{49\text{-}52}$; n=5). The compositional range of feldspar (n=4) is $An_{15\text{-}24}$. Magnetite is the most abundant opaque phase and shows significant concentrations of elements other than Fe (n=3): MgO 0.5-0.7 wt%; Al_2O_3 2.8-3.3 wt%; TiO_2 0.9-1.1 wt%; Cr_2O_3 4.1-4.5 wt%; NiO 0.2-0.5 wt%.
Classification: CK chondrite based on mineral chemistry. Petrologic type 3 based on the chemical variation of olivine and pyroxene.

Northwest Africa 6743 (NWA 6743)
Morocco
Purchased: 2008 Apr
Classification: Carbonaceous chondrite (CV3)
History: The stone was purchased in Agadir in April 2008.

Physical characteristics: One dark brown stone of 60.4 g. Saw cut shows brown matrix, chondrules and red-brown weathering areas.
Petrography: (R. Bartoschewitz, *Bart*) Microscopic examination of a thin section shows dark fine groundmass with mineral fragments, chondrules (PO, RP; PP; GO) up to 1 mm (avg. 0.6 mm), and CAIs. Chondrule/matrix ratio ~0.9.
Geochemistry: (R. Bartoschewitz, *Bart*, P. Appel and B. Mader, *Kiel*) Olivine, $Fa_{25.2\pm20.9}$ (n=13); pyroxene, $Fs_{1.4\pm0.7}Wo_{1.0\pm0.2}$ (n=7); feldspar, $An_{76}Or_{0.9}$ (n=1). O-isotopes (R. Greenwood and I. Franchi, *OU*): $\delta^{17}O$ = -3.86, $\delta^{18}O$ = -0.14 (permil). Magnetic susceptibility (R. Bartoschewitz, *Bart*) log χ ($\times 10^{-9}$ m^3/kg) = 4.27.
Classification: Carbonaceous chondrite (CV3)
Specimens: 12.1 g on deposit at *Kiel*, main mass AKnöfel, and *Bart* 6.9 g.

Northwest Africa 6744 (NWA 6744)
(Northwest Africa)
Purchased: 2007 Jan
Classification: Ordinary chondrite (L3)
History: Purchased on ebay in Jan. 2007
Physical characteristics: One brown stone of 150 g. Polished face shows closely packed chondrules.
Petrography: (R. Bartoschewitz, *Bart*) Microscopic examination of a thin section shows wide variety of chondrules, dominated by type II, up to 2 mm (avg. 0.6 mm) and some mineral fragments. Chondrule matrix ratio ~10.
Geochemistry: (R. Bartoschewitz, *Bart*, P. Appel and B. Mader, *Kiel*) Olivine $Fa_{20.0\pm6.7}$ ($Fa_{0.6\text{-}28.1}$, n=9, Fe/Mn=44); pyroxene, $Fs_{13.1\pm5.6}Wo_{0.7\pm0.4}$ ($Fs_{4.1\text{-}23.7}Wo_{0.2\text{-}2.1}$, n=11); kamacite Ni=5.9, Co=1.0 wt.%. O-isotopes (R. Greenwood and Ian Franchi, *OU*): $\delta^{17}O$ = 3.43, $\delta^{18}O$ = 5.05 (?). Magnetic susceptibility (R. Bartoschewitz, *Bart*) log χ ($\times 10^{-9}$ m^3/kg) = 4.24.
Classification: Ordinary chondrite (type L3)
Specimens: 21.6 g on deposit at *Kiel*, main mass *Bart*.

Northwest Africa 6745 (NWA 6745)
Morocco
Purchased: 2008 Mar
Classification: Ordinary chondrite (L3)
History: Purchased in S-Morocca in March 2008
Physical characteristics: One dark brown stone of 135 g. Saw-cut shows matrix and close packed chondrules.
Petrography: (R. Bartoschewitz, *Bart*) Microscopic examination of a thin section shows wide variety of clustered chondrules up to 2 mm (av. 0.6 mm) with opaque oxidized rim. Chondrule matrix ratio ~10.
Geochemistry: (R. Bartoschewitz, *Bart*, P. Appel and B. Mader, *Kiel*) Olivine, $Fa_{18.7\pm5.5}$ ($Fa_{3.7\text{-}25.4}$, n=29, Fe/Mn=45); pyroxene, $Fs_{5.3\pm1.7}Wo_{0.5\pm0.1}$ ($Fs_{2.6\text{-}9.3}Wo_{0.3\text{-}0.8}$, n=8); kamacite, Ni=4.5-7.2, Co=0.9-1.1 (wt.%). O-isotopes (R. Greenwood and Ian Franchi, *OU*): $\delta^{17}O$ = 3.54 , $\delta^{18}O$ = 5.26 (permil). Magnetic susceptibility (R. Bartoschewitz, *Bart*) log χ ($\times 10^{-9}$ m^3/kg) = 4.33.
Classification: Ordinary chondrite (type L3)
Specimens: 20.0 g on deposit at *Kiel*, main mass anonymous, *Bart* 9.6 g.

Northwest Africa 6746 (NWA 6746)
(Northwest Africa)
Purchased: 2008
Classification: Carbonaceous chondrite (CV3)
History: The stone was purchased in Morocco in 2008.
Physical characteristics: One dark brown stone of 2000 g. Saw cut shows very dark matrix, chondrules and CAIs.
Petrography: (R. Bartoschewitz, *Bart*) fine-grained dark matrix with chondrules (PO, GO) up to 2 mm (average 0.7 mm), chondrule fragments, CAIs (average 3 mm) and isolated mineral grains. Opaque minerals are awaruite and pentlandite.
Geochemistry: (R. Bartoschewitz, *Bart*, P. Appel and B. Mader, *Kiel*) Olivine, $Fa_{3.6\pm2.1}$ (n=15); pyroxene, $Fs_{1.6\pm0.9}Wo_{1.7\pm1.0}$ (n=9). O-isotopes (R. Greenwood and I. Franchi, *OU*): $\delta^{17}O$ = -3.90 (permil); $\delta^{18}O$ = 0.84 (?). Magnetic susceptibility (R. Bartoschewitz, *Bart*) log χ ($\times 10^{-9}$ m^3/kg) = 4.60.
Classification: Carbonaceous chondrite (CV3)
Specimens: 20.0 g on deposit at *Kiel*, main mass anonymous, *Bart* 8.8 g.

Northwest Africa 6965 (NWA 6965)
(Northwest Africa)
Purchased: 2011
Classification: Rumuruti chondrite (R5)
History: The meteorite was bought in 2011 from a local meteorite dealer in Erfoud, Morocco.
Physical characteristics: The meteorite displays a light brownish to orange interior and appears unbrecciated in the thin section studied.
Petrography: The meteorite is composed of typically 0.4 mm sized chondrules and mineral fragments set in a fine-grained groundmass. Ferroan olivine is the dominant mineral phase in all lithologies. Minor phases include albitic feldspar, orthopyroxene, augite, chromite, pentlandite and pyrrhotite. FeNi metal is virtually absent. Olivine and pyroxene are compositionally equilibrated

Northwest Africa 6966 (NWA 6966)
(Northwest Africa)
Purchased: 2011
Classification: HED achondrite (Eucrite, brecciated)
History: The meteorite was bought in 2011 from a local meteorite dealer in Erfoud, Morocco.
Physical characteristics: The stone lacks any fusion crust and displays a greyish interior.
Petrography: The meteorite is a breccia composed of differently textured basaltic clasts up to 2 cm in size. Dominant minerals are exsolved pyroxene and calcic plagioclase up to 0.8 mm in size. Minor phases are silica, FeS, chromite and zircon. No metal was detected.
Geochemistry: low-Ca pyroxene: $Fs_{64.0\pm0.5}Wo_{3.5\pm0.6}$ ($Fs_{63.1\text{-}65.0}Wo_{2.9\text{-}4.7}$, n=15, FeO/MnO=31-35); Ca-pyroxene: $Fs_{37.7\pm7.1}Wo_{32.7\pm9.2}$ ($Fs_{29.1\text{-}46.9}Wo_{21.5\text{-}43.1}$, n=19, FeO/MnO=28-35); calcic plagioclase: $An_{81.0\pm3.0}$ ($An_{77.6\text{-}87.7}$, n=20)

Northwest Africa 6967 (NWA 6967)
(Northwest Africa)
Purchased: 2011

Classification: HED achondrite (Eucrite, monomict)
History: The meteorite was bought in 2011 from a local meteorite dealer in Erfoud, Morocco.
Physical characteristics: The stone is partly covered by fusion crust and displays a gray-white-speckled interior.
Petrography: The meteorite has a basaltic texture with up to 1 mm sized exsolved pyroxene and calcic plagioclase, with sometimes lath-shaped morphology. Minor phases are chromite, FeS, silica and FeNi metal. Contains several shock melt veins.
Geochemistry: low-Ca pyroxene: $Fs_{53.8\pm0.5}Wo_{5.3\pm0.6}$ ($Fs_{52.9\text{-}54.5}Wo_{4.3\text{-}6.5}$, n=10, FeO/MnO=29-31); Ca-pyroxene: $Fs_{32.0\pm1.7}Wo_{32.5\pm2.1}$ ($Fs_{29.4\text{-}35.7}Wo_{28.4\text{-}35.5}$, n=11, FeO/MnO=27-31); calcic plagioclase: $An_{89.0\pm0.9}$ ($An_{86.7\text{-}90.4}$, n=15)

Northwest Africa 6968 (NWA 6968)
(Northwest Africa)
Purchased: 2011
Classification: HED achondrite (Eucrite, brecciated)
History: The meteorite was bought in 2011 from a local meteorite dealer in Erfoud, Morocco.
Physical characteristics: The meteorite displays a light-grayish interior and is partly covered by fusion crust.
Petrography: The meteorite is a fine-grained breccia composed of lithic and mineral clasts up to 0.5 mm in size set into a clastic groundmass. Lithic clasts are basaltic and impact melt fragments. Dominant minerals are exsolved pyroxenes and calcic plagioclase. Minor phases include silica, chromite, zircon and pyrrhotite.
Geochemistry: low-Ca pyroxene: $Fs_{59.2\pm1.6}Wo_{4.1\pm2.1}$ ($Fs_{56.3\text{-}60.9}Wo_{1.8\text{-}8.2}$, n=7, FeO/MnO=28-30); Ca-pyroxene: $Fs_{29.9\pm2.3}Wo_{40.0\pm2.2}$ ($Fs_{26.5\text{-}37.3}Wo_{32.7\text{-}43.1}$, n=24, FeO/MnO=26-33); calcic plagioclase: $An_{87.6\pm2.1}$ ($An_{82.2\text{-}89.7}$, n=20)

Northwest Africa 6969 (NWA 6969)
(Northwest Africa)
Purchased: 2011
Classification: HED achondrite (Eucrite, monomict)
History: The meteorite was bought in 2011 from a local meteorite dealer in Erfoud, Morocco.
Physical characteristics: The small meteorite shows a light-grayish interior and is crosscut by numerous black shock veins. It is partly covered by fusion crust.
Petrography: The meteorite is a basaltic breccia dominantly composed of up to 200 µm sized exsolved pyroxenes and lath-shaped calcic plagioclase. Minor phases are chromite, ilmenite and silica.
Geochemistry: low-Ca pyroxene: $Fs_{59.7\pm1.0}Wo_{2.5\pm0.9}$ ($Fs_{75.4\text{-}61.0}Wo_{2.0\text{-}4.7}$, n=13, FeO/MnO=28-33); Ca-pyroxene: $Fs_{26.6\pm1.3}Wo_{43.0\pm1.5}$ ($Fs_{25.1\text{-}31.5}Wo_{37.6\text{-}44.9}$, n=23, FeO/MnO=27-35); calcic plagioclase: $An_{88.9\pm0.4}$ ($An_{88.0\text{-}89.5}$, n=15)

Northwest Africa 6981 (NWA 6981)
(Northwest Africa)
Purchased: 2011
Classification: Ordinary chondrite (LL5-6)
History: The meteorite was bought in 2011 from a local meteorite dealer in Morocco.
Physical characteristics: The grayish individual is partly covered by a pale fusion crust.

Petrography: The meteorite is a breccia composed of L5 and L6 fragments set into a fine-grained clastic groundmass. Plagioclase grain size in type 5 fragements is about 30 μm; plagioclase grain size in type 6 fragements is about 60 μm.

Northwest Africa 6983 (NWA 6983)
(Northwest Africa)
Purchased: 2011
Classification: HED achondrite (Eucrite, brecciated)
History: The meteorite was bought in 2011 from a local meteorite dealer in Morocco.
Physical characteristics: The two grayish individuals are partly covered by fusion crust.
Petrography: The meteorite is a lithic breccia composed of basaltic, gabbroic, melt and mineral clasts up to 5 mm in size embedded in a fine-grained clastic matrix. Basaltic clasts show coarse- and fine-grained textures and melt clasts are almost opaque. Dominant minerals in clasts and groundmass are calcic plagioclase and exsolved pyroxene. Minor phases include pyrrhotite, troilite, silica, zircon and chromite.
Geochemistry: low-Ca pyroxene: $Fs_{43.5\pm0.6}Wo_{2.5\pm0.9}$ ($Fs_{42.5\text{-}44.3}Wo_{1.3\text{-}4.1}$, n=17, FeO/MnO=27-32); Ca-pyroxene: $Fs_{23.6\pm7.0}Wo_{34.6\pm10.9}$ ($Fs_{15.3\text{-}32.0}Wo_{21.2\text{-}50.6}$, n=13, FeO/MnO=24-28); calcic plagioclase: $An_{87.3\pm4.4}$ ($An_{79.9\text{-}92.6}$, n=14)

Northwest Africa 6984 (NWA 6984)
(Northwest Africa)
Purchased: 2010
Classification: HED achondrite (Eucrite, monomict)
History: The meteorite was bought in 2010 from a local meteorite dealer in Morocco.
Physical characteristics: The meteorite displays a sand-coloured interior and is partly covered by fusion crust.
Petrography: The meteorite is a monomict breccia displaying a basaltic texture of up to 1 mm sized exsolved pyroxenes and 1.5 mm sized calcic pagioclase. Minor phases include chromite, silica, pyrrhotite and ilmenite. Shock melt veins are abundant.
Geochemistry: low-Ca pyroxene: $Fs_{57.7\pm1.4}Wo_{3.2\pm1.7}$ ($Fs_{55.5\text{-}59.1}Wo_{1.6\text{-}5.9}$, n=7, FeO/MnO=29-32); Ca-pyroxene: $Fs_{23.7\pm1.0}Wo_{43.7\pm1.0}$ ($Fs_{24.3\text{-}27.3}Wo_{40.9\text{-}44.3}$, n=14, FeO/MnO=28-31); calcic plagioclase: $An_{88.3\pm3.0}$ ($An_{81.3\text{-}91.1}$, n=15)

Northwest Africa 7160 (NWA 7160)
(Northwest Africa)
Purchased: 2011
Classification: Ordinary chondrite (H3)
History: Purchased by Marcin Cimala in 2011 from a dealer in Erfoud, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*; T. Bunch, *NAU*) Well-formed, fairly closely-packed chondrules are set in a finer matrix.
Geochemistry: Olivine ($Fa_{0.5\text{-}33.2}$, Cr_2O_3 in ferroan olivine 0.06-0.15 wt.%, mean 0.08 wt.%, sd 0.02 wt.%, N = 8), orthopyroxene ($Fs_{2.8\text{-}39.7}Wo_{0.5\text{-}2.0}$, N = 3), clinopyroxene ($Fs_{10.2\text{-}10.3}Wo_{31.3\text{-}31.8}$, N = 2). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg)=4.97.
Classification: Ordinary chondrite (H3). H group classification based on magnetic susceptibility.
Specimens: 21.6 g including one polished thin section at *PSF*; main mass with Mr. M. Cimala.

Northwest Africa 7431 (NWA 7431)
(Northwest Africa)
Purchased: 2006 Feb
Classification: Ordinary chondrite (H4)
History: Purchased by Dr. David Gregory in February 2008 from a Moroccan dealer at the Tucson Gem and Mineral Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively small chondrules in a relatively coarse grained matrix containing altered metal.
Geochemistry: Olivine ($Fa_{18.5-18.6}$, N = 3), orthopyroxene ($Fs_{16.1-16.4}Wo_{1.9-1.0}$, N = 3), clinopyroxene ($Fs_{7.1}Wo_{35.9}$; $Fs_{5.8}Wo_{46.1}$; N = 2).
Classification: Ordinary chondrite (H4).
Specimens: 21 g plus one polished thin section at *ROM*; remainder with *Gregory*.

Northwest Africa 7795 (NWA 7795)
Northwest Africa
Purchased: 2012
Classification: Iron meteorite (IAB, ungrouped)
History: Jason Utas purchased the iron from Gary Fujihara on ebay in late January 2012.
Petrography: As described for NWA 8154, NWA 8155, and NWA 8539, the metal consists of grains 0.20 × 0.15 mm with no evidence of an octahedral pattern. The structures is anomalous. The absence of a pattern suggest fast cooling. The small graphite ellipsoids (sometimes arranged like the petals of a flower) may reflect the locations of the last, C-rich melt to crystallize.
Geochemistry: Composition: Co, 4.72 mg/g; Ni, 136.0 mg/g; Ga, 50.2 µg/g; Ge,~320 µg/g.; As, 16.0 µg/g; Ir 22.0 µg/g; Au, 1.545 µg/g. The meteorite is compositionally a member of the IAB complex.
Classification: The meteorite is classified IAB-ungr. On most element-Au diagrams it plots close to IAB-sLM but there are large deviations in some elements (a factor of 2 for W) and IAB-ungr is the best choice.
Specimens: This meteorite is closely similar to NWA 8154, NWA 8155 and NWA 8539 and appears to be paired with them.

Northwest Africa 8353 (NWA 8353)
(Northwest Africa)
Purchased: 2014 Nov
Classification: Ungrouped achondrite
History: Purchased by Scott Perekslis in November 2014 from a dealer in Erfoud, Morocco.
Physical characteristics: A green and gray, relatively coarse grained stone (82.37 g) with partial green fusion crust. Plagioclase has a macroscopic "frosty" luster.
Petrography: (A. Irving and S. Kuehner, *UWS*) Gabbro composed mainly of diopside and calcic plagioclase with subordinate forsteritic olivine and accessory iron sulfide and kamacite (mostly as blebs within plagioclase). Plagioclase consists of numerous microdomains.
Geochemistry: Olivine $Fa_{3.0-3.2}$,FeO/MnO 35-42 (N = 3), diopside $Fs_{1.2-1.4}Wo_{45.6-45.4}$, FeO/MnO 9-10 (N = 3), plagioclase $An_{90.1-90.4}Or_{0}$ (N = 2).
Classification: Achondrite (ungrouped). Paired with NWA 7325, NWA 8014, NWA 8409 and other stones from the Bir Abbas site.
Specimens: 16.5 g including one polished endcut at *UWB*; remainder with Mr. S. Perekslis.

Northwest Africa 8405 (NWA 8405)
(Northwest Africa)
Purchased: 2014 Nov
Classification: Angrite
History: Purchased by Scott Perekslis in November 2014 from a dealer in Erfoud, Morocco.
Physical characteristics: A dark, dense rock (501 g) lacking fusion crust. The fresh interior is mostly khaki-colored with visible black and white grains.
Petrography: (A. Irving and S. Kuehner, *UWS*) Protogranular texture, mean grainsize 0.6 mm with some oxide grains (pleonaste spinel) up to 5 mm. Composed of olivine, Al-Ti-augite (pink in thin section), anorthite, pleonaste spinel (purple-brown in thin section), Mg-merrillite and troilite (partially altered to iron hydroxides).
Geochemistry: Olivine ($Fa_{45.0-45.8}$, FeO/MnO = 65-75, CaO = 1.5-1.6 wt.%, N = 4), Al-Ti-augite ($Fs_{11.4-11.7}Wo_{55.4-56.1}$, FeO/MnO = 58-67, Al_2O_3 = 9.7-10.3 wt.%, TiO_2 = 2.0-2.2 wt.%, N = 3), anorthite ($An_{99.2-99.3}Or_{0.1}$, N = 2).
Classification: Angrite. Paired with NWA 4801.
Specimens: 20.1 g including one polished thin section at *UWB*; remainder with Mr. S. Perekslis.

Northwest Africa 8409 (NWA 8409)
(Northwest Africa)
Purchased: 2013 Jun
Classification: Ungrouped achondrite
History: Purchased by Marc Jost in June 2013 from several Moroccan dealers at the Ensisheim Show.
Physical characteristics: A group of essentially identical dark green, uncrusted stones ranging in size from 99 g to <1 g. Distinctive green clinopyroxene and gray, frosty plagioclase are evident.
Petrography: (A. Irving and S. Kuehner, *UWS*) Cumulate igneous texture. Composed mainly of calcic plagioclase, diopside and forsterite with accessory Cr-bearing troilite and kamacite. Lobate forsterite grains are commonly associated with elongate pores.
Geochemistry: Olivine ($Fa_{4.5-4.6}$, FeO/MnO = 36-41, N = 3), clinopyroxene ($Fs_{1.8-2.2}Wo_{44.3-43.8}$, FeO/MnO = 12-15, N = 3).
Classification: Achondrite (ungrouped). Paired with NWA 7325, NWA 8014 and other stones from the Bir Abbas site.
Specimens: 20.4 g including one polished piece at *UWB*; remainder held by *SJS*.

Northwest Africa 8454 (NWA 8454)
(Northwest Africa)
Purchased: 2014 Jan
Classification: HED achondrite (Eucrite, monomict)
History: Purchased by Pierre-Marie Pele in January 2014 from a dealer in Tata, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Fresh fragmental monomict breccia composed of fairly closely-packed angular to rounded basaltic eucrite clasts in a sparse matrix of related crystalline debris. Minerals are exsolved pigeonite, calcic plagioclase, silica polymorph, ilmenite, fayalite and troilite.

Geochemistry: Olivine ($Fa_{76.8-77.6}$; FeO/MnO = 44, N=3), host orthopyroxene ($Fs_{59.6-60.1}Wo_{4.3-2.3}$; FeO/MnO = 31, N=3), clinopyroxene exsolution lamellae ($Fs_{29.2-30.4}Wo_{40.3-40.4}$; FeO/MnO = 30-33, N=3).
Classification: Eucrite (basaltic, monomict breccia).
Specimens: Type specimen plus one polished thin section are at *PSF*; main mass with Mr. P. Pele.

Northwest Africa 8539 (NWA 8539)
(Northwest Africa)
Purchased: 2012
Classification: Iron meteorite (IAB, ungrouped)
Petrography: As previously described for NWA 8154 and NWA 8155, the metal consists of tiny grains 0.15 mm, with no evidence of an octahedral pattern. The structures are anomalous. The absence of a pattern suggest fast cooling. The small graphite ellipsoids (sometimes arranged like the petals of a flower) may reflect the locations of the last, C-rich melt to crystallize.
Geochemistry: *UCLA* INAA data: Co, 4.70 mg/g; Ni, 134.5 mg/g; Ga, 51.0 µg/g; Ge,~294 µg/g.; Sb 650 ng/g; As, 16.5 µg/g; Ir 27.0 µg/g; Au, 1.602 µg/g.
Classification: Based on their high contents of Au, As and Sb this meteorite (NWA 8539) and its three siblings (NWA 8154, 8155 and 7795) are classified ungrouped members of the IAB complex. However, non-IAB ungrouped irons have lower contents of these elements (and especially of Sb). It is ungrouped because it does not consistently plot in the Ni-Au, As-Au, Co-Au and Ga-Au fields of the IAB main group or of the five IAB subgroups.

Northwest Africa 8665 (NWA 8665)
(Northwest Africa)
Purchased: 2009 Jan
Classification: Ordinary chondrite (H3)
History: Purchased by Dr. David Gregory in January 2009 from a Moroccan dealer at the Tucson Gem and Mineral Show.
Physical characteristics: Cut surface shows that the specimen consists of about equal parts rounded chondrule-bearing clasts and very fine matrix rich in ragged metal.
Petrography: (A. Irving and S. Kuehner, *UWS*) Composed of clasts irregularly distributed within a much finer-grained, dark, fragmental matrix. The matrix shows no evidence of melting. The clasts contain relatively small (mean apparent diameter 500±300 µm), round to ellipsoidal, fairly closely packed chondrules and relatively abundant metal.
Geochemistry: Olivine ($Fa_{1.7-43.7}$; Cr_2O_3 in ferroan olivine 0.07-0.14 wt.%, mean 0.13±0.08 wt.%, N = 10), orthopyroxene ($Fs_{1.3-15.6}Wo_{0.3-0.1}$, N = 3), augite ($Fs_{5.5-7.1}Wo_{45.2-45.5}$, N = 2). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) =5.45.
Classification: Ordinary chondrite (H3, breccia). H group designation based on magnetic susceptibility.
Specimens: 635 g plus five polished thin sections at *ROM*; one polished thin section at *UWB*. The remainder is held by *Gregory*.

Northwest Africa 8738 (NWA 8738)
(Northwest Africa)
Purchased: 2009

Classification: Ordinary chondrite (LL3-6)
History: Purchased by Blaine *Reed* in Tucson, 2009.
Physical characteristics: Four fragments. Saw cuts show brecciated texture, dark and light clasts set in a light-gray groundmass, scattered metal/sulfide grains.
Petrography: (C. Agee) Microprobe examination of a polished mount reveals a polymict breccia with at least three distinct lithologies corresponding to LL3, LL6, and L6. Type 6 is ~75%, type 3 is ~25%. The type 3 lithology has some PO chondrules with igneous zoning, also PP chondrules with enstatitic pyroxenes, BO chondrules, all with mesostasis or glass, whereas the type 6 lithologies have a few relict chondrules, and appear to be mostly recrystallized, with equilibrated olivines and pyroxenes, and plagioclase >100 μm. Ubiquitous troilite, kamacite, chromite, and Cl-rich apatite.
Geochemistry: (C. Agee, *UNM*) L6 component: olivine 25.5±0.2, Fe/Mn=50±3, n=4; low-Ca pyroxene $Fs_{22.7\pm0.4}Wo_{1.2\pm0.4}$, Fe/Mn=33±1, n=4. LL6 component: olivine 29.4±0.9, Fe/Mn=60±3, n=17; low-Ca pyroxene $Fs_{25.2\pm0.0}Wo_{1.2\pm0.1}$, Fe/Mn=38±0, n=3. LL3 component: porphyritic pyroxene chondrule $Fs_{4.4\pm0.4}Wo_{0.2\pm0.1}$, Fe/Mn=12±1, n=4. Random olivines range $Fa_{16.5\text{-}29.9}$, $Fa_{25.8\pm5.2}$, Fe/Mn=55±9, n=10.
Classification: Ordinary chondrite (LL3-6), breccia of LL3, LL6, and L6 components, weathering grade W1, shock stage S4.
Specimens: 23.6 g including a probe mount on deposit at *UNM*, *Reed* holds the main mass.

Northwest Africa 8772 (NWA 8772)
(Northwest Africa)
Purchased: 2014 Apr
Classification: Rumuruti chondrite (R3)
History: Purchased by Darryl Pitt in April 2014 from a dealer in Mauritania.
Petrography: (A. Irving and S. Kuehner, *UWS*) Separated chondrules (1.0±0.5 mm) occur within a red-brown matrix. Metal or altered metal is absent; accessory phases include ilmenite, Ti-chromite and Ni-bearing troilite.
Geochemistry: Olivine, $Fa_{1.9\text{-}44.8}$; Cr_2O_3 in ferroan olivine = 0.05-0.08 wt.%, mean 0.07±0.01 wt.%, N = 8; orthopyroxene, $Fs_{6.8\text{-}28.0}Wo_{0.3\text{-}4.9}$, N = 3; augite, $Fs_{10.1\text{-}10.2}Wo_{45.4\text{-}45.5}$, N = 2. Oxygen isotopic composition (J. Gattacceca, C. Sonzogni, *CEREGE*) from analysis of one acid-washed 1.5 mg aliquot of a powdered 40 mg bulk sample is $\delta^{17}O$=6.40‰, $\delta^{18}O$=7.91‰ , $\Delta^{17}O$=2.24‰ (linearized, slope 0.5247, analytical uncertainties 0.08‰, 0.12‰, 0.03‰ respectively). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 3.21.
Classification: Rumuruti chondrite (R3)
Specimens: 16.4 g including one polished thin section at *UWB*. The remainder is held by *DPitt*.

Northwest Africa 8785 (NWA 8785)
(Northwest Africa)
Purchased: 2014 Jan
Classification: Enstatite chondrite (EL3)
History: Purchased by Fabien Kuntz in January 2014 from a dealer in Rissani, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, spherical chondrules are set in a dark, deep red-brown matrix (~40 vol.%). Minerals are orthopyroxene, forsterite, silica polymorph (with enstatite in chondrules), kamacite, troilite (some Cr-bearing), Al-Ti-bearing

diopside, schreibersite and minor calcite and gypsum (probably representing altered oldhamite). No CAI were found.
Geochemistry: Olivine ($Fa_{0.2-1.0}$, Cr_2O_3 = 0.01-0.28 wt.%, mean 0.15±0.09 wt.%, N = 18), orthopyroxene ($Fs_{0.1-14.9}Wo_{0.1-2.6}$, N = 17), diopside ($Fs_{0.4-0.5}Wo_{42.9-42.1}$, Al_2O_3 6.9-7.5 wt.%, TiO_2 1.2-1.0 wt.%, N = 2), metal (Si 0.7 wt.%, Ni 7.1 wt.%, Co 0.5 wt.%, N = 2). Oxygen isotopes (K. Ziegler, *UNM*): analyses of four acid-washed subsamples by laser fluorination gave, respectively, $\delta^{17}O$ 3.180, 2.880, 2.996, 2.922; $\delta^{18}O$ 6.042, 5.707, 5.820, 5.849; $\Delta^{17}O$ -0.010, -0.133, -0.077, -0.166 (all per mil).
Classification: Enstatite chondrite (EL3). Matrix is unusually abundant for an enstatite chondrite.
Specimens: 12.86 g including one polished thin section at *PSF*; main mass with *Kuntz*.

Northwest Africa 8787 (NWA 8787)
(Northwest Africa)
Purchased: 2014 Jul
Classification: Carbonaceous chondrite (CO3)
History: Purchased by Fabien Kuntz in July 2014 from a dealer in Foum El Hisn, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, small chondrules and fine grained CAI (up to 1.2 mm) in a finer-grained matrix containing some stained metal.
Geochemistry: Olivine ($Fa_{0.4-40.9}$; Cr_2O_3 in ferroan examples 0.08-0.15 wt.%, mean 0.11±0.03 wt.%, N = 8), orthopyroxene ($Fs_{1.0-7.9}Wo_{0.9-1.6}$, N = 3), augite ($Fs_{4.7}Wo_{39.7}$), diopside ($Fs_{0.9}Wo_{50.0}$).
Classification: Carbonaceous chondrite (CO3).
Specimens: 4.86 g including one polished thin section at *PSF*; main mass with *Kuntz*.

Northwest Africa 8789 (NWA 8789)
(Northwest Africa)
Purchased: 2014 Jan
Classification: Enstatite chondrite (EH3)
History: Purchased by Fabien Kuntz in January 2014 from a dealer in Rissani, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Small, well-formed chondrules are set in a red-brown matrix (~30 vol.%). Minerals are orthopyroxene, silica polymorph (with enstatite in chondrules), albite, intermediate plagioclase, altered kamacite, suessite, schreibersite, troilite, gypsum (as "mothy" grains, probably after primary oldhamite) and rare forsterite. No CAI were found.
Geochemistry: Olivine ($Fa_{0.2}$, N =1), orthopyroxene ($Fs_{0.2-15.2}Wo_{0.0-1.5}$, N = 18), metal (Si 3.1 wt.%, Ni 2.7 wt.%, Co 0.5 wt.%, N = 2), suessite (Ni 80.7 wt.%, Si 14.8 wt.%, Fe 4.1 wt.%, Co <0.1 wt.%).
Classification: Enstatite chondrite (EH3). The relatively high proportion of matrix and presence of accessory suessite are anomalous features.
Specimens: 17.52 g including one polished thin section at *PSF*; main mass with *Kuntz*.

Northwest Africa 8792 (NWA 8792)
(Northwest Africa)
Purchased: 2012 Aug
Classification: Carbonaceous chondrite (CV3)

History: Purchased by Fabien Kuntz in August 2012 from a dealer in Zagora, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, large granular chondrules (some with concentric dust rims) and irregularly-shaped CAI occur within an orange matrix.
Geochemistry: Olivine ($Fa_{1.9-43.8}$, N = 3), orthopyroxene ($Fs_{0.8-1.2}Wo_{1.0-0.7}$, N = 3), subcalcic augite ($Fs_{0.7}Wo_{36.0}$), augite ($Fs_{2.3}Wo_{43.1}$).
Classification: Carbonaceous chondrite (CV3).
Specimens: 20.1 g plus one polished thin section at *PSF*; 21.89 g at *MGC*; main mass with *Kuntz*.

Northwest Africa 8793 (NWA 8793)
(Northwest Africa)
Purchased: 2011 Jun
Classification: Ordinary chondrite (H(L)3)
History: Purchased by Fabien Kuntz in June 2011 from a Moroccan dealer at the Ensisheim Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules (average apparent diameter 700 μm) are set in a finer-grained matrix containing abundant altered metal.
Geochemistry: Olivine ($Fa_{11.3-30.6}$; Cr_2O_3 in ferroan examples 0.02-0.13 wt.%, mean 0.08±0.04 wt.%, N = 8), orthopyroxene ($Fs_{4.5-15.2}Wo_{0.3-1.1}$, N = 3), subcalcic augite ($Fs_{9.1}Wo_{29.5}$), augite ($Fs_{6.1}Wo_{44.7}$). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.68.
Classification: Ordinary chondrite, L(H)3.
Specimens: 26.2 g plus one polished thin section at *PSF*; 26.05 g at *MGC*; main mass with *Kuntz*.

Northwest Africa 10079 (NWA 10079)
(Northwest Africa)
Purchased: 2014 Oct
Classification: HED achondrite (Diogenite, polymict)
History: Purchased by Fabien Kuntz in October 2014 from a Moroccan dealer at the Munich Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Fresh fragmental breccia composed of angular clasts of mostly orthopyroxene (of several different compositions) with accessory anorthite, Al-poor chromite, silica polymorph, olivine, kamacite, Al-rich chromite, ilmenite and troilite, plus several percent of lithic clasts of basaltic and cumulate eucrite.
Geochemistry: Olivine ($Fa_{33.0-39.5}$, FeO/MnO = 53-55, N = 2), orthopyroxene ($Fs_{20.9}Wo_{0.5}$; $Fs_{26.0}Wo_{1.8}$; FeO/MnO = 29-36; N = 2), clinopyroxene host ($Fs_{29.2-30.1}Wo_{41.2-40.5}$, FeO/MnO = 32-36, N = 2), low-Ca pyroxene exsolution lamella ($Fs_{34.3}Wo_{4.2}$, FeO/MnO = 28)..
Classification: Diogenite (polymict breccia). The range in Fs content (>5 mol. %) for analyzed orthopyroxenes in this breccia is much greater than in any intact diogenite or monomict diogenite breccia, and the presence of eucritic clasts establishes that it is polymict.
Specimens: 21.78 g including one polished thin section at *PSF*; main mass with. *Kuntz*.

Northwest Africa 10126 (NWA 10126)
(Northwest Africa)
Purchased: 2013 Dec
Classification: Carbonaceous chondrite (CM2)

History: Purchased by Gary Fujihara in December 2013 from a Moroccan dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Very small, well-formed chondrules together with angular mineral fragments and amoeboid, very fine grained CAI are set in a finer grained matrix (deep reddish brown in thin section) containing pyrrhotite and cronstedtite-tochilinite.
Geochemistry: Olivine ($Fa_{0.4\text{-}40.6}$, Cr_2O_3 in ferroan examples 0.08-0.43 wt.%, N = 7), orthopyroxene ($Fs_{1.6\text{-}7.5}Wo_{0.9\text{-}2.2}$, N =2), subcalcic augite ($Fs_{39.2}Wo_{31.3}$), diopside ($Fs_{1.0}Wo_{42.1}$). Oxygen isotopic composition (J. Gattacceca, C. Sonzogni, *CEREGE*) from analysis of one 1.5 mg aliquot of a powdered 20 mg bulk sample is $\delta^{17}O$=1.73‰, $\delta^{18}O$=7.78‰ , $\Delta^{17}O$=-2.33‰ (linearized, slope 0.5247, analytical uncertainties 0.08‰, 0.12‰, 0.03‰ respectively).
Classification: Carbonaceous chondrite (CM2).
Specimens: 3.52 g including one polished thin section at *UWB*. The remainder is held by Mr. G. Fujihara.

Northwest Africa 10154 (NWA 10154)
(Northwest Africa)
Purchased: 2015 February
Classification: HED achondrite (Diogenite, anomalous)
History: Discovered in January 2015 at the border of Western Sahara and the southeastern corner of the Al Hamada region. Purchased from a dealer in Mauritania.
Physical characteristics: One piece with no fusion crust present. A saw-cut surface shows pale green pyroxene crystals up to 1-cm in size. Numerous dark-gray patches of maskelynite are observed throughout.
Petrography: (C. Agee, *UNM*) Orthopyroxene makes up approminately 70% of this meteorite, followed by ~20% plagioclase and 5-10% clinopyroxene. The pyroxene is heavily fractured with many cleavage partings, The plagioclase composition domains appear smooth and unfractured in BSE images, consistent with maskelynite. Accessory troilite, Low-Ni metal, iron oxide, and chromite were observed. Thin calcite weathering veins are present.
Geochemistry: (C. Agee and N. Muttik, *UNM*) orthopyroxene $Fs_{32.6\pm0.3}Wo_{3.4\pm0.5}$, Fe/Mn=30±1, n=14; clinopyroxene $Fs_{14.2\pm0.0}Wo_{43.5\pm0.5}$, Fe/Mn=25±1, n=3; plagioclase (maskelynite) $An_{93.7\pm0.4}Ab_{5.8\pm0.4}Or_{0.4\pm0.1}$, n=10. Oxygen isotopes (K. Ziegler, *UNM*) laser fluorination of acid-washed bulk subsamples gave (average) respectively, $\delta^{17}O$ = 1.332, $\delta^{18}O$ = 3.086, $\Delta^{17}O$ = -0.305 ‰ (linearized).
Classification: This is an equilibrated, unbrecciated, gabbronoritic diogenite with anomalously low ?17O and ?18O, and an anomalously high percentage of plagioclase or maskelynite.
Specimens: 22.5 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10176 (NWA 10176)
(Northwest Africa)
Purchased: 2012 Sep
Classification: Carbonaceous chondrite (CM2)
History: Purchased by John Curchin in September 2012 from a Moroccan dealer at the Denver Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Small chondrules, mineral fragments and sparse CAI are set in a reddish-brown matrix containing relatively coarse-grained, platy cronstedtite, kamacite spheres, taenite and minor barite.

Geochemistry: Olivine ($Fa_{2.3-57.9}$, N = 3), orthopyroxene ($Fs_{0.9-1.7}Wo_{1.1-0.5}$, N = 3), subcalcic augite ($Fs_{1.1-1.5}Wo_{32.1-38.3}$, N = 2). Oxygen isotopic composition (J. Gattacceca, C. Sonzogni, *CEREGE*) from analysis of one 1.5 mg aliquot of a powdered 20 mg bulk sample is $\delta^{17}O$=1.51‰, $\delta^{18}O$=9.27‰ , $\Delta^{17}O$=-3.33‰ (linearized, slope 0.5247, analytical uncertainties 0.08‰, 0.12‰, 0.03‰ respectively)
Classification: Carbonaceous chondrite (CM2).
Specimens: 3.6 g including one polished thin section at *UWB*. The remainder is held by Mr. J. Curchin.

Northwest Africa 10240 (NWA 10240)
(Northwest Africa)
Purchased: 2010 June
Classification: Ordinary chondrite (LL7)
History: Purchased in June 2010 at Saint-Marie-aux-Mines
Physical characteristics: A single crusted stone. Cut surface reveals angular dark clasts up to 5 mm in a lighter matrix.
Petrography: Highly recrystallized chondrite with triple junctions and typical grain size ~100 μm. Rare relict barred olivine chondrules to 1 mm in diameter. Main minerals are olivine, pyroxenes, plagioclase (mean size 100 μm, to 200 μm), chromite (to 100 μm), Ca-phosphate (to 500 μm), FeNi metal. The rock is brecciated and contains dark clasts up to 5 mm.
Geochemistry: Olivine $Fa_{32.0\pm0.3}$ (N=5), orthopyroxene $Fs_{26.3\pm0.1}Wo_{2.8\pm0.2}$ (N=3), augite $Fs_{11.1}Wo_{43.7}$ (N=1), plagioclase $An_{10.5}Ab_{84.8}Or_{4.7}$ (N=2), chromite Cr#=0.87±0.01 (N=3).
Classification: LL7 based on Wo content of orthopyroxene and plagioclase grain size. Brecciated.
Specimens: 23 g in *CEREGE*, main mass with *Labenne*

Northwest Africa 10261 (NWA 10261)
Morocco
Purchased: 2014
Classification: Carbonaceous chondrite (CV3)
History: The meteorite was purchased in Guelmim town, Morocco, from a nomad seller, including around a large piece and two polished end-cut specimens, altogether 127 g.
Physical characteristics: A 27 g specimen is an unfractured unit with homogeneous appearance, without fusion crust, but rounded and rough surfaces
Petrography: Around a dozen of AOAs could be observed at each cm^2 of the thin section with size up to 2 mm, and a few CAI grains were also present. Chondrules 36 vol%; AOAs 25 vol% with size 0.2-2.6 mm; matrix is 38 vol% of sample. The average chondrule size is 0.8 mm (range: 0.2-2.6 mm). The minerals are fractured and mechanical twins are present in pyroxenes; olivines show mosaicism. Main minerals: olivine, pyroxene, opaques (troilite, magnetite, pentlandite), few feldspars. About 70-90% of troilite and metal in opaque chondrules is oxidized, opaque veins are tranformed to iron oxides.
Geochemistry: Mineral composition and geochemistry: olivine $Fa_{26.3\pm27.7}$ ($Fa_{20.6-78.8}$, N=58), cpx: $Fs_{12.2\pm8.9}Wo_{24.5\pm14.5}$ ($Fs_{0-30.8}Wo_{5.5-45.3}$ N=21); and opx: $Fs_{7.7\pm5.7}Wo_{1.9\pm1.9}$, ($Fs_{0-20.6}Wo_{0.0-4.7}$, N=14) (measurements with EPMA).
Classification: CV3, S3
Specimens: 2 specimens, total 127 g. 27 g *CSFK*; main mass, Zs. Kereszty, private collection

Northwest Africa 10264 (NWA 10264)
(Northwest Africa)
Purchased: 2015 Feb
Classification: Ordinary chondrite (LL(L)3)
History: Purchased by Gary Fujihara in February 2015 from a Moroccan dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Closely packed, well-formed chondrules (apparent diameter up to 2.7 mm) are set in a sparse, finer grained matrix containing altered metal. Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.38.
Geochemistry: Olivine ($Fa_{0.8\text{-}67.0}$; Cr_2O_3 in ferroan examples = 0.15-0.28 wt.%, mean 0.22±0.05 wt.%, N = 6), orthopyroxene ($Fs_{1.7\text{-}6.5}Wo_{0.5\text{-}0.6}$, N = 3), subcalcic augite ($Fs_{6.6}Wo_{24.0}$), augite ($Fs_{1.2}Wo_{38.3}$).
Classification: Ordinary chondrite LL(L)3. The range in Fa content in olivine and the Cr_2O_3 contents in ferroan olivine are consistent with a relatively low subtype (estimated to be 3.3 to 3.4).
Specimens: 20.4 g including one polished thin section at *UWB*; main mass with Mr. G. Fujihara.

Northwest Africa 10268 (NWA 10268)
(Northwest Africa)
Purchased: 2015 Feb
Classification: HED achondrite (Diogenite)
History: Three identical crusted stones were purchased by Gary Fujihara from a Moroccan dealer in February 2015.
Petrography: (A. Irving and S. Kuehner, *UWS*) Fresh, coarse grained specimen consisting predominantly of interlocking grains of orthopyroxene (up to 8 mm, finely exsolved) with ~10 vol.% calcic plagioclase plus accessory chromite and minor troilite. Both pyroxene and plagioclase exhibit marked undulose extinction. Sparse thin shock veinlets crosscut the specimen.
Geochemistry: Orthopyroxene ($Fs_{34.9\text{-}36.9}Wo_{2.6\text{-}2.5}$, FeO/MnO = 29-31, N = 3), clinopyroxene exsolution lamellae ($Fs_{13.7\text{-}15.1}Wo_{43.4\text{-}43.1}$, FeO/MnO = 25, N = 2), plagioclase ($An_{83.5\text{-}85.2}Or_{0.5\text{-}0.9}$, N = 3).
Classification: Diogenite (noritic). Although the Fs content of low-Ca pyroxene is in the range for cumulate eucrites, a diogenite classification is supported by the low plagioclase abundance and the presence of orthopyroxene rather than pigeonite. Other diogenites have similar pyroxene composition (NWA 6928, NWA 8000, NWA 8367, NWA 8744).
Specimens: 18.2 g including one polished thin section at *UWB*; main masses with Mr. G. Fujihara.

Northwest Africa 10326 (NWA 10326)
(Northwest Africa)
Find: 2007
Classification: Ordinary chondrite (H6)
History: Found in Morocco, 2007.
Physical characteristics: Single, complete stone, angular with weathered fusion crust covered exterior; a saw cut shows faint chondrules set in a dark-gray matrix.

Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows scattered, texturally equilibrated chondrules; the plagioclase grain size is up to 150 μm. Abundant kamacite and troilite throughout; ubuiquitous troilite, chromite, phosphate, and clinopyroxene.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Olivine $Fa_{19.3\pm0.5}$, Fe/Mn=39±1, n=6; low-Ca pyroxene $Fs_{16.8\pm0.2}Wo_{1.4\pm0.1}$, n=4.
Classification: Ordinary chondrite (H6)
Specimens: 24 g including a probe mount on deposit at *UNM*, Brain Caress holds the main mass.

Northwest Africa 10327 (NWA 10327)
(Northwest Africa)
Find: 2015
Classification: HED achondrite (Eucrite, melt breccia)
History: Reportedly found in Morocco, 2015 and purchased by Dave Gheesling fom Rachid Chaoui in early 2015.
Physical characteristics: Single stone with weathered fusion-crusted exterior. A saw cut shows a breccia of light-gray and white clasts set in a matrix of dark impact melt, some of it vesicular. A few small caliche-filled cracks and veins are present in the outer rind of the stone, however they do not penetrate throughout the mass.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows many fragmental plagioclase and pyroxene grains, and a few microgabbro clasts, bounded by melt veins and pools. Some melt zones transition into a cataclastic groundmass of very fine-grained plagioclase and pyroxene. Most pyroxenes possess exsolution lamellae. Accessory troilite, chromite, ilmenite and silica. Calcite and barite weathering products detected.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Low-Ca pyroxene $Fs_{61.7\pm0.6}Wo_{2.5\pm0.7}$, n=8; high-Ca pyroxene $Fs_{27.4\pm0.6}Wo_{43.1\pm1.1}$, n=6; plagioclase $An_{89.3\pm2.3}$, n=4.
Classification: Achondrite (Eucrite, melt breccia) fragmental, equilibrated basaltic eucrite grains set in a eucritic melt rock.
Specimens: 23.6 g including a probe mount on deposit at *UNM*, Dave Gheesling holds the main mass.

Northwest Africa 10328 (NWA 10328)
(Northwest Africa)
Find: 2015
Classification: Ordinary chondrite (L5, melt breccia)
History: Reportedly found in Morocco, 2015 and purchased by Dave Gheesling fom Rachid Chaoui in early 2015.
Physical characteristics: Single stone with weathered fusion-crusted exterior. A saw cut shows a breccia of ordinary chondrite clasts set in a matrix of dark, fine-grained material.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows many fragmental L5 clasts, bounded by fine cataclastic to recrystallized grains, and pervasive quenched melt throughout this brecciated sample. L5 clasts contain numerous distinct chondrules with plagioclase up to 20 μm. Metal and sulfide are concentrated as domains up to 2 mm, but also ubiquitous as finely disseminated grains ~1-5 μm.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Olivine $Fa_{25.5\pm0.5}$, Fe/Mn=51±3, n=6; low-Ca pyroxene $Fs_{21.7\pm0.2}Wo_{1.0\pm0.2}$, n=5; high-Ca pyroxene $Fs_{11.8}Wo_{32.6}$, n=1.

Classification: Ordinary chondrite (L5, melt breccia) fragmental, L5 chondrite clasts set in a recrystallized melt matrix.
Specimens: 23.2 g including a probe mount on deposit at *UNM*, Dave Gheesling holds the main mass.

Northwest Africa 10436 (NWA 10436)
(Northwest Africa)
Purchased: Dec 2014
Classification: Ordinary chondrite (LL7)
History: Purchased in northwest Africa by Brahim Tahiri and sent to his partner, Sean Tutorow, for analysis in December 2014.
Physical characteristics: Four fragments that fit together, with weathered exterior, glossy brown patina, some caliche, and small grayish areas protruding through the patina.
Petrography: (C. Agee, *UNM*) This meteorite consists of ~50% olivine, ~30% pigeonite, and ~10% sodic plagioclase. Fe-metal, troilite, and Ti-chromite observed. Chondrules are absent.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Olivine $Fa_{31.1\pm0.3}$, Fe/Mn=60±2, n=14; pigeonite $Fs_{25.1\pm1.0}Wo_{6.5\pm2.2}$, Fe/Mn=34±3, n=14; plagioclase $An_{11.8\pm1.2}Ab_{84.1\pm0.9}Or_{4.1\pm0.5}$, n=7.
Specimens: 21.2 g including a probe mount on deposit at *UNM*, Sean Tutorow holds the main mass.

Northwest Africa 10445 (NWA 10445)
(Northwest Africa)
Purchased: 2015 May
Classification: Carbonaceous chondrite (CO3)
History: Purchased by Fabien Kuntz in May 2015 from a dealer in Erfoud, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Small chondrules (mean apparent diameter 450±300 μm), angular mineral fragments and small CAI are set in a red-brown matrix (~40 vol.%).
Geochemistry: Olivine ($Fa_{0.3\text{-}63.8}$, Cr_2O_3 in ferroan examples 0.10-0.52 wt.%, N = 7), orthopyroxene ($Fs_{3.7\text{-}5.4}Wo_{1.1\text{-}2.3}$, N = 3), subcalcic augite ($Fs_{4.7}Wo_{32.5}$), augite ($Fs_{3.3}Wo_{37.6}$).
Classification: Carbonaceous chondrite (CO3).
Specimens: 20.21 g including one polished thin section at *PSF*; remainder with *Kuntz*.

Northwest Africa 10459 (NWA 10459)
Mauritania
Find: 2012 Sep 22
Classification: HED achondrite (Howardite)
History: Three stones with a combined weight of 47.4 g were found in Mauritania in 2012. Larry Taylor acquired the samples from a meteorite prospector in Morocco the same year.
Physical characteristics: The stones are tabular shaped and covered in a desert patina. The brecciated nature is clear in the thin sections of the stones, with white anorthite-rich basaltic clasts and orthopyroxene phenocrysts, set within a matrix of comminuted diogenitic and eucritic mineral fragments.
Petrography: The samples show eucritic and diogenitic clasts in a matix of crushed pyroxene, plagioclase, and glass. Eucritic clasts have diameters as large as 1.5 cm. Troilite and FeNi metal are present in the matrix, and in the eucritic clasts.

Geochemistry: No olivine present. Eucritic clasts: Low-Ca pyx = $Fs_{60.4\pm2.3}Wo_{3.5\pm2.7}$, N=19; High-Ca pyx = $Fs_{28.0\pm1.8}Wo_{42.1\pm2.1}$, N=12. The Fe/Mn value for pyroxenes in the eucritic clasts is 32.5±1.0; plagioclase in the eucritic clasts is $An_{89.0\pm2.7.}$ Diogenetic clasts: Low-Ca pyx = $Fs_{28.5\pm6.8}Wo_{3.6\pm2.0}$, N=35; High-Ca pyx = $Fs_{28.6\pm4.2}Wo_{42.0\pm3.2}$, N=32.
Classification: Howardite
Specimens: 9.6 g on deposit at *SI*, the rest of the mass is on deposit at *UTenn*.

Northwest Africa 10461 (NWA 10461)
(Northwest Africa)
Purchased: 2015 Aug
Classification: Lunar meteorite (feldspathic breccia)
History: Purchased by Jean Redelsperger from Aziz Habibi in Agadir, Morocco, August 2015. Reportedly found near the border with Mauritania.
Physical characteristics: Two identical appearing pieces 233.8 g and 51.95 g, with irregular exterior, no fusion crust. A saw cut reveals a polymict breccia with numerous fragmental light and dark clasts.
Petrography: (C. Agee, *UNM*) This breccia has numerous fragmental olivine, pyroxene, and plagioclase grains. There are also microgabbro clasts scattered throughout, as well as shock melt veins and pockets.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{26.8\pm8.5}$, Fe/Mn=93±9, n=23; low-Ca pyroxene $Fs_{31.9\pm9.5}Wo_{4.6\pm2.8}$, Fe/Mn=58±6, n=16; augite $Fs_{23.4\pm10.5}Wo_{34.6\pm9.8}$, Fe/Mn=53±10, n=10; plagioclase $An_{96.1\pm0.5}$, n=19; Shock melt (20 μm defocused electron beam, proxy for bulk meteorite composition): SiO_2=43.3±0.4, TiO_2=0.19±0.05, Al_2O_3=28.9±2.5, Cr_2O_3=0.10±0.03, MgO=6.5±2.5, FeO=4.3±1.3, MnO=0.06±0.02, CaO=16.1±1.4, NiO=0.01±0.01, Na_2O=0.35±0.02, K_2O=0.04±0.01 (all wt%), n=10.
Classification: Lunar (feldspathic breccia)
Specimens: 20.11 g including a probe mount on deposit at *UNM*, Jean Redelsperger holds the main mass.

Northwest Africa 10462 (NWA 10462)
(Northwest Africa)
Purchased: Dec 2014
Classification: Ordinary chondrite (LL6, anomalous)
History: Four identical appearing specimens were purchased by Zohir Fettouh in December 2014 in Guelmim from a local meteorite hunter who found them near Bir Anzarane, Morocco. Type specimen was provided by Steve Arnold.
Physical characteristics: Four stones with weathered exterior; saw cuts shows a gray fine-grained interior with some mild brecciation.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows some distinct chondrules, plagioclase up to 100 μm. No kamacite, but FeNiS phase + taenite, and chromite, iron sulfide and iron-nickel sulfide were observed.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Olivine $Fa_{33.8\pm0.4}$, Fe/Mn=70±2, n=6; low-Ca pyroxene $Fs_{27.0\pm0.3}Wo_{1.8\pm0.2}$, Fe/Mn=41±2, n=6.
Classification: Ordinary chondrite (LL6-an). Anomalous based on olivine Fa-content outside the range for LL-chondrites (Fa>33), similar to NWA 6588 (LL6-an with $Fa_{33.3}$).

Specimens: 21 g including a probe mount on deposit at *UNM*, Zohir Fettouh holds the main mass.

Northwest Africa 10463 (NWA 10463)
(Northwest Africa)
Purchased: 2015 Aug 4
Classification: Angrite
History: Purchased on August 4, 2015, from Aziz Habibi in Erfoud, Morocco.
Physical characteristics: Single mass, coated in desert soil, no fusion crust. Broken surfaces show a fresh polycrystalline aggregate of mm-size green, yellow, and black minerals. Friable.
Petrography: (C. Agee, *UNM*) This meteorite has a granular texture of fassaite (~50%) and olivine (~30%) up to ~1 mm in diameter, with stubby plagioclase laths (~15%) up to 300 μm in length. Some olivines have exsolved kirschsteinite. Accessory titanium-iron oxides and troilite were observed.
Geochemistry: (C. Agee, N. Muttik, A. Santos, *UNM*) Fassaite $Fs_{21.6\pm7.9}Wo_{53.5\pm1.2}$, range: $Fs_{16.2\text{-}32.7}$, Fe/Mn=104±17, Al_2O_3 (wt%)=8.1±1.6, n=12; olivine $Fa_{59.7\pm14.8}Lrn_{3.9\pm2.1}$, range $Fa_{32.6\text{-}79.6}$, Fe/Mn=88±9, n=16; kirschsteinite $Fa_{47.7\pm1.7}Lrn_{43.5\pm1.2}$, Fe/Mn=69±2, n=4; plagioclase $An_{99.4\pm0.1}$, n=3.
Classification: Based on the strong igneous zoning of olivine and fassaite this is likely an angrite. It lacks a fine-grained groundmass found in more quickly cooled angrites, and shows kirschsteinite exsolution in olivine. Although there are some textural similarities with NWA 4590, and broadly similar fassaite compositions to LEW 87051, this meteorite is likely unpaired, thus representing a new angrite type.
Specimens: 20.6 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10464 (NWA 10464)
(Northwest Africa)
Purchased: 2015 May 5
Classification: HED achondrite (Eucrite, monomict)
History: Purchased from Aziz Habibi in Erfoud in May 2015
Physical characteristics: One piece with partial fusion crust. A sawn surface shows prominent lithic clasts with variable textures, some more than 1 cm, set in a very fine-grained groundmass.
Petrography: (C. Agee, *UNM*) Pyroxene (~50%) and plagioclase (~45%) are the major minerals in this meteorite. Some domains consist of fragmental to cataclastic mineral grains, while others show an intergranular texture. Accessory silica, ilmenite, and chromite were observed.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Low-Ca pyroxene $Fs_{55.9\pm1.8}Wo_{6.4\pm0.9}$, Fe/Mn=32±1, n=9; high-Ca pyroxene $Fs_{31.6\pm7.2}Wo_{35.6\pm7.2}$, Fe/Mn=32±1, n=5; plagioclase $An_{84.4\pm8.9}$, n=2.
Classification: Monomict eucrite
Specimens: 20.6 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10465 (NWA 10465)
(Northwest Africa)
Purchased: 2015 Jul
Classification: HED achondrite (Eucrite, polymict)
History: Found in far-western Algeria in early June 2015.

Physical characteristics: One piece with weathered exterior. A sawn surface shows a fragmental breccia with gabbroic, pyroxene-rich, and feldspar-rich clasts set in a very fine-grained, light gray groundmass.
Petrography: (C. Agee, *UNM*) This meteorite consist of at least two distinct eucrite lithologies; the dominant lithology is a basaltic eucrite, and a minor lithology is a cumulate eucrite. Many domains consist of fragmental to cataclastic mineral grains. Accessory silica, ilmenite, and troilite were observed.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Pigeonite $Fs_{55.1\pm3.8}Wo_{8.3\pm3.2}$, Fe/Mn=32±1, n=11; high-Ca pyroxene $Fs_{36.0\pm7.6}Wo_{36.0\pm7.6}$, Fe/Mn=32±2, n=2; Cumulate eucrite low-Ca pyroxene $Fs_{37.3}Wo_{2.4}$, Fe/Mn=36, n=1; plagioclase $An_{89.7\pm0.9}$, n=2.
Classification: Polymict eucrite
Specimens: 24.9 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10466 (NWA 10466)
(Northwest Africa)
Purchased: 2015 Jul
Classification: HED achondrite (Eucrite, unbrecciated)
History: Found in far-western Algeria in early June 2015.
Physical characteristics: Single stone with fusion crust. A sawn surface shows a fine-grained mixture of plagioclase and pyroxene, with light gray color.
Petrography: (C. Agee, *UNM*) Pyroxene (~60%) and plagioclase (~35%) are the major minerals in this meteorite. Accessory silica, ilmenite, and troilite were observed.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Low-Ca pyroxene $Fs_{63.5\pm0.3}Wo_{2.0\pm0.2}$, Fe/Mn=33±1, n=6; high-Ca pyroxene $Fs_{28.3\pm1.4}Wo_{43.2\pm1.8}$, Fe/Mn=32±2, n=6; plagioclase $An_{86.3\pm5.2}$, n=2.
Classification: Unbrecciated, equilibrated, basaltic eucrite
Specimens: 21.6 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10467 (NWA 10467)
(Northwest Africa)
Purchased: 2015 Jul
Classification: Ordinary chondrite (L, melt rock)
History: Found at the border of Algeria and Mauritania in June 2015
Physical characteristics: Single stone with an irregular exterior of weathered fusion crust. A sawn surface shows scattered oxidized iron blebs up to 3 mm set in a very fine-grained, dark green groundmass.
Petrography: (C. Agee, *UNM*) This meteorite consists of fine-grained olivine and pyroxene with ubiquitous interstitial feldspathic domains. Iron, iron oxide, and iron sulfide are segregated into large weathered spherules that are commonly surrounded by metal-rich networks. Relict chondrules are present.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Olivine $Fa_{25.1\pm0.9}$, Fe/Mn=49±1, n=4; low-Ca pyroxene $Fs_{19.3\pm0.8}Wo_{2.5\pm0.8}$, Fe/Mn=31±2, n=4.
Classification: L-melt rock.
Specimens: 20.6 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10468 (NWA 10468)

(Northwest Africa)
Purchased: 2015 Jul
Classification: HED achondrite (Eucrite, unbrecciated)
History: Found in far-western Algeria in early June 2015.
Physical characteristics: Single stone with fusion crust. A sawn surface shows a fine-grained mixture of plagioclase and pyroxene, with light-gray color, some iron staining present.
Petrography: (C. Agee, *UNM*) Pyroxene (~60%) and plagioclase (~35%) are the major minerals in this meteorite. Accessory chromite, ilmenite, silica, iron metal, and troilite were observed.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Low-Ca pyroxene $Fs_{61.9\pm0.9}Wo_{1.9\pm0.8}$, Fe/Mn=34±1, n=8; high-Ca pyroxene $Fs_{35.8\pm9.9}Wo_{33.1\pm10.9}$, Fe/Mn=33±0, n=4; plagioclase $An_{82.4\pm4.8}$, n=3.
Classification: Unbrecciated basaltic eucrite.
Specimens: 20.4 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10469 (NWA 10469)
(Northwest Africa)
Purchased: 2015 Jul
Classification: HED achondrite (Eucrite, monomict)
History: Found at the border of Algeria and Mauritania in June 2015
Physical characteristics: One piece with fusion crust. A sawn surface shows prominent lithic clasts up to 3 cm set in a fine-grained groundmass.
Petrography: (C. Agee, *UNM*) Pyroxene (~65%) and plagioclase (~30%) are the major minerals in this meteorite. Some domains consist of fragmental to cataclastic mineral grains, while others show an intergranular texture. Accessory silica, ilmenite, chromite, and zircon were observed.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Low-Ca pyroxene $Fs_{59.4\pm1.2}Wo_{1.6\pm0.8}$, Fe/Mn=35±0, n=8; high-Ca pyroxene $Fs_{38.8\pm6.3}Wo_{25.5\pm7.9}$, Fe/Mn=34±1, n=5; plagioclase $An_{85.2\pm4.6}$, n=3.
Classification: Monomict eucrite
Specimens: 20.2 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10470 (NWA 10470)
(Northwest Africa)
Purchased: 2015 Jul
Classification: HED achondrite (Eucrite, monomict)
History: Found at the border of Algeria and Mauritania in June 2015
Physical characteristics: One piece with fusion crust. A sawn surface shows prominent lithic clasts up to 3 cm set in a fine-grained groundmass.
Petrography: (C. Agee, *UNM*) Pyroxene (~65%) and plagioclase (~30%) are the major minerals in this meteorite. Some domains consist of fragmental to cataclastic mineral grains, while others show an intergranular texture. Accessory silica, ilmenite, troilite, and phosphate were observed.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Low-Ca pyroxene $Fs_{60.0\pm0.4}Wo_{1.7\pm0.4}$, Fe/Mn=34±1, n=7; high-Ca pyroxene $Fs_{30.9\pm7.8}Wo_{36.5\pm8.8}$, Fe/Mn=34±1, n=5; plagioclase $An_{84.2\pm2.8}$, n=2.
Classification: Monomict eucrite
Specimens: 12.1 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10471 (NWA 10471)
(Northwest Africa)
Purchased: 2015 Jul
Classification: HED achondrite (Eucrite, monomict)
History: Found at the border of Algeria and Mauritania in June 2015
Physical characteristics: One piece with fusion crust. A sawn surface shows weak brecciation with variable groundmass grain-size.
Petrography: (C. Agee, *UNM*) Pyroxene (~65%) and plagioclase (~30%) are the major minerals in this meteorite. Most domains consist of fragmental mineral grains. Accessory silica, ilmenite, and chromite were observed.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Low-Ca pyroxene $Fs_{59.8\pm2.0}Wo_{4.7\pm1.0}$, Fe/Mn=33±0, n=5; high-Ca pyroxene $Fs_{41.2\pm11.3}Wo_{26.6\pm14.0}$, Fe/Mn=33±1, n=9; plagioclase $An_{89.2\pm0.8}$, n=4.
Classification: Monomict eucrite
Specimens: 20.3 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10472 (NWA 10472)
(Northwest Africa)
Purchased: 2015 Jul
Classification: HED achondrite (Howardite)
History: Found in far-western Algeria in early June 2015.
Physical characteristics: Single stone with fusion crust. A sawn surface shows finely brecciated texture with white, gray, and black clasts.
Petrography: (C. Agee, *UNM*) This meteorite contains at least six different lithologies: diogenite ~40%, cumulate eucrite ~10%, basaltic eucrite ~50%, carbonaceous chondrite CM2 ~1%, stony-iron (pallasite-like) <1%, and stony-iron (mesosiderite-like) <1%. The CM2 and stony-iron clasts are approximately 500 μm in size. The CM2 clasts are rounded or oval in shape and consist primarily of magnesian-rich chondrules set in a groundmass of phyllosilicates. The pallasite-like clast observed has a typical pallasite texture of rounded olivines suspended in Fe-Ni metal, although the olivine grain size (~100 μm) is much smaller than typical PMG. The mesosiderite-like clast is unbrecciated and consists of equilibrated pyroxenes, plagioclase, silica, and Fe-Ni metal; it most resembles a type A3 mesosiderite. Most HED domains consist of fragmental mineral grains, although there are also a few intersertal basaltic clasts Accessory silica, ilmenite, and chromite were observed.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Diogenite: low-Ca pyroxene $Fs_{26.3\pm4.9}Wo_{3.1\pm2.2}$, Fe/Mn=30±2, n=8. Cumulate eucrite: low-Ca pyroxene $Fs_{42.8\pm5.0}Wo_{3.1\pm1.2}$, Fe/Mn=30±1, n=5; high-Ca pyroxene $Fs_{19.2\pm0.4}Wo_{44.1\pm1.0}$, Fe/Mn=26±0, n=2. Basaltic eucrite: low-Ca pyroxene $Fs_{62.9\pm0.3}Wo_{2.3\pm1.0}$, Fe/Mn=32±1, n=6; high-Ca pyroxene $Fs_{30.6\pm3.1}Wo_{40.9\pm2.8}$, Fe/Mn=32±1, n=3, plagioclase $An_{91.7\pm3.3}$, n=5. CM2: forsterite $Fa_{1.5\pm1.0}$, Cr_2O_3 (wt%)=0.46±0.20, n=9; enstatite $Fs_{1.6\pm0.5}Wo_{1.3\pm0.7}$, n=6. Pallasite-like clast: olivine $Fa_{9.7\pm0.2}$, Fe/Mn=47±3, n=6. Mesosiderite-like clast: pigeonite $Fs_{55.7\pm1.6}Wo_{11.7\pm1.6}$, Fe/Mn=34±1, n=5; high-Ca pyroxene $Fs_{28.9\pm3.4}Wo_{38.0\pm4.7}$, Fe/Mn=27±2, n=6; plagioclase $An_{89.6\pm4.6}$, n=2.
Classification: Howardite (xenolith-bearing). Howardite classification based on the presence of diogenite, cumulate eucrite, and basaltic eucrite lithologies. There are also three xenolithic lithologies present: 1) CM2 lithology, 2) main group pallasite-like lithology, 3) A3 mesosiderite-like lithology.

Specimens: 9.6 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10474 (NWA 10474)
(Northwest Africa)
Purchased: 2015
Classification: Carbonaceous chondrite (CV3)
History: The meteorite was purchased from the Moroccan meteorite dealer Hamza Lharbi.
Petrography: The meteorite displays a dark-grayish interior and is composed of up to several mm-sized chondrules, abundant whitish CAIs, and olivine amoeboids set into a fine-grained, almost opaque matrix. No type II chondrules were encountered.

Northwest Africa 10475 (NWA 10475)
(Northwest Africa)
Purchased: 2015
Classification: HED achondrite (Eucrite, brecciated)
History: The meteorite was purchased from the Moroccan meteorite dealer Abdelfattah.
Physical characteristics: A small individual partly covered with fusion crust was recovered from the north-African Sahara.
Petrography: The meteorite is a breccia composed of lithic and mineral clasts set into a fine-grained clastic matrix. Lithic clasts are dominantly basaltic and impact melt, mineral clasts include exsolved pyroxene and feldspar grains. Accessories are chromite, pyrrhotite, and silica. Some calcite weathering veins are present.
Geochemistry: low-Ca pyroxene: $Fs_{45.1\pm16.7}$ ($Fs_{25.8\text{-}63.5}WoWo_{2.7\pm0.8}$, n=20, FeO/MnO=28-32); Ca-pyroxene: $Fs_{27.2\pm5.5}Wo_{40.1\pm4.6}$ ($Fs_{19.2\text{-}39.6}Wo_{26.6\text{-}44.3}$, n=16, FeO/MnO=25-36); calcic plagioclase: $An_{88.4\pm3.1}$ ($An_{71.7\text{-}92.9}$, n=42)

Northwest Africa 10476 (NWA 10476)
(Northwest Africa)
Purchased: 2015
Classification: HED achondrite (Eucrite, cumulate)
History: The meteorite was purchased from the Moroccan meteorite dealer Med Lamine Ahmed.
Physical characteristics: Two small individuals partly covered with fusion crust were recovered from the north-African Sahara.
Petrography: The meteorite displays a light-grayish interior and is dominantly composed of large blocky low-Ca pyroxene and plagioclase. The mm-sized pyroxene grains often contain blobby augite. Minor phases include chromite and SiO_2 polymorphs. The meteorite is highly shocked, i.e., plagioclase is partly converted to maskelynite.
Geochemistry: low-Ca pyroxene: $Fs_{35.2\pm0.2}Wo_{2.6\pm0.1}$ ($Fs_{35.2\text{-}35.9}Wo_{2.4\text{-}2.7}$, n=16, FeO/MnO=28-30), Ca-pyroxene: $Fs_{15.2\pm0.1}Wo_{43.1\pm0.3}$ ($Fs_{15\text{-}15.4}Wo_{42.6\text{-}43.6}$, n=15, FeO/MnO=30-31); calcic plagioclase: $An_{84.9\pm0.8}$ ($An_{83.6\text{-}86.2}$, n=25)

Northwest Africa 10477 (NWA 10477)
(Northwest Africa)
Purchased: 2015
Classification: Enstatite chondrite (EL6)
History: The meteorite was purchased from the Moroccan meteorite dealer Hamza Lharbi.

Petrography: The meteorite dominantly consists of large, about 100 µm sized enstatite grains, less abundant albitic feldspar, troilite, alabandite and daubreelite. No relict chondrules were observed; metal is completely altered to iron oxides.
Classification: Although the metal is completely altered and the Si-content cannot be determined, the presence of alabandite strongly argues for EL (see e.g., Lin Y. and El Goresy A., 2002).

Northwest Africa 10478 (NWA 10478)
(Northwest Africa)
Purchased: 2015
Classification: Ordinary chondrite (LL4)
History: The meteorite was purchased from the Moroccan meteorite dealer Adam Ait-hiba at the mineral fair in Munich, Germany.
Petrography: The meteorite displays a well defined chondritic texture of chondrules belonging to various petrological types about 0.9 mm in diameter set into a fine-grained matrix of chondrule and mineral fragments and FeNi metal. Olivine is compositionally equilibrated, pyroxene still unequilibrated.

Northwest Africa 10479 (NWA 10479)
(Northwest Africa)
Purchased: 2015
Classification: HED achondrite (Eucrite, brecciated)
History: The meteorite was purchased from the Moroccan meteorite dealer Smara Addi.
Physical characteristics: One small individual partly covered with fusion crust was recovered from the north-African Sahara.
Petrography: The meteorite is a breccia composed of lithic clasts set into a fine-grained matrix. Lithic lasts are dominantly coarse-grained basaltic. Most abundant minerals are exsolved pyroxenes and plagioclase, less abundant are chromite, pyrrhotite and SiO_2 polymorphs. Some shock melt veins are present.
Geochemistry: low-Ca pyroxene: $Fs_{31.8\pm3.3}Wo_{6.9\pm1.6}$ ($Fs_{28.4\text{-}40.2}Wo_{5.2\text{-}10.2}$, n=27, FeO/MnO=26-31); Ca-pyroxene: $Fs_{53.6\pm9.6}Wo_{22.5\pm2.7}$ ($Fs_{39.5\text{-}74.1}Wo_{18.2\text{-}27.9}$, n=34, FeO/MnO=27-38); calcic plagioclase: $An_{85.2\pm2.9}$ ($An_{79.5\text{-}92.3}$, n=25)

Northwest Africa 10480 (NWA 10480)
(Northwest Africa)
Purchased: 2015
Classification: Lunar meteorite
History: The meteorite was purchased from the Moroccan meteorite dealer Ismaili at the mineral fair in Munich, Germany.
Physical characteristics: One small individual covered with a black shiny crust was recovered from the north-African Sahara.
Petrography: The meteorite is a polymict breccia composed of lithic and mineral clasts set in a fine-grained clastic matrix. Lithic clasts are dominantly gabbroic, basaltic and impact melt up to 5 mm in size; mineral clasts include olivine, fayalite, pyroxene with very fine exsolution lamellae, and feldspar grains. Accessories are pigeonite ($Fs_{55.3}Wo_{13.7}$), Ti-chromite, ilmenite, and silica. Some melt veins and pockets are present.

Geochemistry: olivine: $Fa_{34.1\pm2.2}$ ($Fa_{31.7\text{-}40.3}$, n=24) FeO/MnO mean= 100±9; fayalite: $Fa_{92.3\pm3.9}$ ($Fa_{83.7\text{-}97}$, n=26) FeO/MnO mean= 97±5; Ca-pyroxene: $Fs_{39.1\pm9.5}Wo_{32.4\pm9.6}$ ($Fs_{29.7\text{-}55.8}Wo_{20.3\text{-}43.3}$, n=33, FeO/MnO mean= 79±11.9); calcic plagioclase: $An_{93.4\pm1.6}$ ($An_{90.2\text{-}94.6}$, n=16)

Northwest Africa 10481 (NWA 10481)
(Northwest Africa)
Purchased: 2015
Classification: Ordinary chondrite (L3)
History: The meteorite was purchased from a Moroccan meteorite dealer at the mineral fair in Munich, Germany.
Petrography: The meteorite is a chondritic breccia composed of lithic clasts separated from each other by abundant melt veins. The clasts consist of sharply defined chondrules (about 0.7 mm in diameter) set into a greyish matrix of chondrule fragments, individual mineral grains and FeNi metal.

Northwest Africa 10482 (NWA 10482)
(Northwest Africa)
Purchased: 2015
Classification: Ordinary chondrite (H3)
History: The meteorite was purchased from a Moroccan meteorite dealer at the mineral fair in Munich, Germany.
Petrography: The meteorite displays a strong chondritic texture of well-defined chondrules of various petrological types about 0.3 mm in diameter set into a fine-grained matrix of chondrule and mineral fragments and FeNi metal. The meteorite is brecciated.

Northwest Africa 10484 (NWA 10484)
(Northwest Africa)
Purchased: 2015
Classification: HED achondrite (Eucrite, brecciated)
History: The meteorite was purchased from a Moroccan meteorite dealer at the mineral fair in Munich, Germany.
Physical characteristics: Three small individuals partly covered with fusion crust were recovered from the north-African Sahara.
Petrography: The meteorite is a fine-grained breccia with basaltic, impact melt and mineral clasts set into a clastic matrix. Exsolved pyroxene and plagioclase are the most abundant minerals. Minor phases include chromite, pyrrhotite and SiO_2 polymorphs.
Geochemistry: low-Ca pyroxene: $Fs_{61.2\pm1.7}Wo_{2.1\pm0.5}$ ($Fs_{58.8\text{-}64.5}Wo_{1.7\text{-}3.7}$, n=19), FeO/MnO=30-35; Ca-pyroxene: $Fs_{28.6\pm2.3}Wo_{41.8\pm2.6}$ ($Fs_{25.2\text{-}35.9}Wo_{37.9\text{-}46.2}$, n=20), FeO/MnO=31-35; calcic plagioclase: $An_{88.9\pm4.1}$ ($An_{75.1\text{-}93.1}$, n=20)

Northwest Africa 10485 (NWA 10485)
(Northwest Africa)
Purchased: 2015
Classification: Ordinary chondrite (L3)
History: The meteorite was purchased from a Moroccan meteorite dealer at the mineral fair in Munich, Germany.

Petrography: The meteorite is composed of sharply defined chondrules of various petrological types about 0.6 mm in diameter set into a fine-grained matrix of chondrule and mineral fragments and FeNi metal.

Northwest Africa 10486 (NWA 10486)
(Northwest Africa)
Purchased: 2010
Classification: Ordinary chondrite (H3-5)
History: One stone weighing 42.5 g was found in Morocco in 2010. David Holden acquired the sample from a meteorite prospector in Erfoud 2010.
Physical characteristics: The stone is dark brown and has a rounded-irregular shape. The stone is covered by a weathered patina. The cut face of the interior of the stone is orange in color and displays small chondrules, chondrule fragments, and unweathered flakes of metal.
Petrography: Description and classification (A. Love, *App*): Sample is a breccia composed of recrystallized and shock-darkened clasts set within a host of well-defined chondrules and fragments included in a fragmental matrix of clastic debris. Host chondrules are well-defined, have turbid mesostasis and have an average diameter of 420 μm. The recrystallized clast is composed of indistinct chondrules and chondrule fragments set within a yellow-stained, recrystallized matrix. The shocked clast contains rounded and flattened chondrules and is crosscut by a series of subparallel fractures.
Geochemistry: (A. Love, *App*) Host: Olivine $Fa_{14.2\pm9.1}$ ($Fa_{0.7\text{-}27.7}$) N=17; Low Ca pyroxene $Fs_{12.1\pm5.2}Wo_{1.3\pm0.6}$ ($Fs_{4.2\text{-}17.7}Wo_{0.3\text{-}2.5}$), N=13, Equilibrated clasts: Olivine $Fa_{17.9\pm0.5}$, N=2; low-Ca Pyroxene $Fs_{16.5\pm0.1}Wo_{1.7\pm0.1}$, N=2.
Classification: Based on textures and mineral compositions, sample is an H3-5, S3, W2. Based on compositions of Type I chondrules and CL signature of chondrule mesostasis (Huss et al., 2006), unequilibrated host falls between petrologic type 3.5-3.7.
Specimens: An endcut and two slices weighing 8.54 g, and a polished thin section are currently on deposit at *App*.

Northwest Africa 10487 (NWA 10487)
(Northwest Africa)
Purchased: 2010
Classification: Ordinary chondrite (H5)
History: 1 stone weighing 88.8 g was found in Morocco in 2010. David Holden acquired the sample from a meteorite prospector in Erfoud, 2010.
Physical characteristics: The stone is dark brown and has a rounded-irregular shape and is covered by a weathered patina. The stone is friable and the cut face of the interior of the stone is orange in color and displays small chondrules, chondrule fragments, and both fresh and weathered flakes of metal.
Petrography: Description and classification (A. Love, *App*): Sample is composed of distinct chondrules and fragments set in a recrystallized matrix. Chondrules have an average diameter of 480 μm. Taken in concert with irregular fractures and sharp optical extinction, the occurrence of plagioclase-chromite assemblages and strongly polycrystalline troilite suggest sample has been annealed during a subsequent an impact event with a maximum prior shock level of S3.
Geochemistry: (A.Love, *App*) Olivine $Fa_{18.6\pm0.4}$, N=8; low-Ca pyroxene $Fs_{17.1\pm0.2}Wo_{1.8\pm0.1}$, N=6

Classification: Based on mineral textures and compositions, this is an ordinary chondrite H5, S3, W2.
Specimens: An endcut and two slices weighing 18.8 g, a polished mount and a polished thin section are currently on deposit at *App*.

Northwest Africa 10488 (NWA 10488)
(Northwest Africa)
Purchased: 2014
Classification: Ordinary chondrite (L6)
History: 1 stone weighing 54.6 g was found in Morocco in 2014. David Holden acquired the sample from a meteorite prospector in Erfoud, 2014.
Physical characteristics: The stone is black and angular in shape displaying a few small, shallow regmaglypts. Weathered brown fusion crust covering approximately 100% of the exterior. A rollover lip surrounds one face that also shows a few small bubbles. The cut face of the interior of the stone is dark brown and displays small, closely packed chondrules and fresh and weathered flakes of metal.
Petrography: Description and classification (A. Love, *App*): Sample displays recrystallized chondritic texture crosscut by a few glassy shock veins. Few chondrules are defined. Porphyritic chondrules have recrystallized mesostasis. A single barred olivine chondrule is 3.4 mm in diameter.
Geochemistry: (A.Love, *App*) Olivine $Fa_{26.2\pm0.3}$, N=6; Low-Ca pyroxene $Fs_{21.7\pm0.3}Wo_{1.9\pm0.3}$, N=6.
Classification: Based on mineral compositions and textures, sample is an L6 S5 W3 ordinary chondrite.
Specimens: An endcut and one slice weighing 11.2 g, and a polished thin section are currently on deposit at *App*.

Northwest Africa 10489 (NWA 10489)
(Northwest Africa)
Purchased: 2009
Classification: Ordinary chondrite (LL6)
History: 1 stone weighing 37.5 g was found in Morocco in 2009. David Holden acquired the sample from a meteorite prospector in Erfoud, 2009.
Physical characteristics: The stone is dark brown and has a rounded-irregular shape. The stone is covered by a weathered patina. The cut face of the interior of the stone is orange in color and has a brecciated textured composed of fine-grained clasts and small flakes of metal.
Petrography: Description and classification (A. Love, *App*): Sample is a breccia composed of rounded to irregular-shaped clasts of poikoblastic, recrystallized chondritic rock with few relict chondrules and mineral fragments set within comminuted matrix of similar material. The sample is transected by thin opaque shock veins, which highlight boundaries between clasts.
Geochemistry: (A. Love, *App*) Olivine $Fa_{31.8\pm0.4}$, N=6; low-Ca pyroxene $Fs_{25.3\pm0.1}Wo_{2.4\pm0.2}$, N=6.
Classification: Based on mineral compositions and textures, sample is an LL6, S4, W3 ordinary chondrite breccia.
Specimens: An endcut and one slice weighing 7.5 g, and a polished thin section are currently on deposit at *App*.

Northwest Africa 10490 (NWA 10490)

(Northwest Africa)
Purchased: 2015 Sep
Classification: Ordinary chondrite (LL6)
History: Purchased by John Higgins in September 2015 from a dealer in Laayoune, Morocco.
Petrography: (A. Irving, *UWS*) Mostly recrystallized with rare partial chondrule remnants.
Geochemistry: (P. Carpenter, *WUSL*) Olivine ($Fa_{30.2-30.4}$, N = 3), orthopyroxene ($Fs_{25.5-25.8}Wo_{2.4-2.3}$, N = 3), plagioclase ($An_{9.9}Or_{2.8}$). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg)=3.43.
Classification: Ordinary chondrite (LL6).
Specimens: 21 g including one polished thin section at *UWB*; main mass with Mr. J. Higgins.

Northwest Africa 10491 (NWA 10491)
(Northwest Africa)
Purchased: 2015 Aug
Classification: HED achondrite (Diogenite)
History: Purchased by Aras Jonikas in August 2015 from a Moroccan dealer.
Physical characteristics: A single broken crusted fragment (30 g).
Petrography: (A. Irving, *UWS*) Matrix-poor breccia consisting of some larger lithic clasts plus closely-packed interstitial, related mineral debris. Orthopyroxene is the predominant phase accompanied by calcic plagioclase (~5 vol.%), chromite and minor stained metal.
Geochemistry: (P. Carpenter, *WUSL*) Orthopyroxene ($Fs_{23.6-24.6}Wo_{4.3-3.0}$, FeO/MnO = 28, N = 2), plagioclase ($An_{85.2-85.5}Or_{0.3-0.4}$, N = 2)
Classification: Diogenite (breccia, plagioclase-bearing).
Specimens: 6.28 g including one polished thin section at *PSF*; main mass with Mr. A. Jonikas.

Northwest Africa 10492 (NWA 10492)
(Northwest Africa)
Purchased: 2015 Mar
Classification: Ordinary chondrite (H4)
History: Found in November 2014 by Mr. M. Smara in the Boujdour region of southern Morocco, and subsequently purchased by John Higgins in March 2015 from a dealer in Laayoune, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, equilibrated chondrules are set in a finer matrix.
Geochemistry: Olivine ($Fa_{18.7-19.1}$, N = 3), orthopyroxene ($Fs_{15.6-15.9}Wo_{1.4-0.9}$, N = 3), clinopyroxene ($Fs_{5.5-7.9}Wo_{46.0-44.6}$, N = 2). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg)=4.56.
Classification: Ordinary chondrite (H4).
Specimens: 29.5 g including one polished thin section at *UWB*; main mass with Mr. J. Higgins.

Northwest Africa 10493 (NWA 10493)
(Northwest Africa)
Purchased: 2013 Mar
Classification: Carbonaceous chondrite (CO3.0)
History: Purchased in Spain by Darryl Pitt in March 2013 from a Mauritanian dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Small, well-formed chondrules (apparent diameter 0.45 ± 0.3 mm; one 1.8 mm), mineral fragments and sparse, irregularly-shaped CAI are

set in a deep brown matrix (~40 vol.%). Accessory phases include Al-free chromite, kamacite and pentlandite.
Geochemistry: Olivine ($Fa_{0.5-87.4}$, Cr_2O_3 in ferroan olivine 0.29-0.67 wt.%, mean 0.40 wt.%, sd 0.10 wt.%, N = 20), orthopyroxene ($Fs_{1.2-1.4}Wo_{0.8-0.7}$, N = 2), clinopyroxene ($Fs_{1.9}Wo_{42.9}$; $Fs_{1.0}Wo_{49.3}$, N = 2).
Classification: Carbonaceous chondrite (CO3.0). The mean and range of Cr_2O_3 contents of ferroan olivine occurring as rims and as matrix grains is essentially the same as for Colony, which was designated as a CO3.0 by Grossman and Brearley (2005, Figure 5).
Specimens: 10.05 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 10494 (NWA 10494)
(Northwest Africa)
Purchased: 2015 Sep
Classification: Ordinary chondrite (LL3)
History: Purchased by John Higgins in September 2015 from a dealer in Laayoune, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, fairly closely-packed chondrules plus sparse mineral fragments are set in a finer matrix.
Geochemistry: Olivine ($Fa_{0.7-58.0}$, Cr_2O_3 in ferroan olivine 0.07-0.11 wt.%, mean 0.09±0.02 wt.%, N = 8), orthopyroxene ($Fs_{3.0-14.3}Wo_{0.2-0.3}$, N = 3), clinopyroxene ($Fs_{2.4}Wo_{40.3}$; $Fs_{22.0}Wo_{37.7}$, N = 2). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg)=3.63.
Classification: Ordinary chondrite (LL3).
Specimens: 23 g including one polished thin section at *UWB*; main mass with Mr. J. Higgins.

Northwest Africa 10495 (NWA 10495)
Morocco
Find: 2015
Classification: Lunar meteorite (feldspathic breccia)
History: A group of similar stones were found together at an undisclosed location in southern Morocco during 2015.
Physical characteristics: Several grayish brown stones (total weight 15.6 kg) lacking fusion crust, but with a polished external appearance. All exhibit the same overall fine grained texture, with some visible larger whitish clasts within a dark gray matrix.
Petrography: (A. Irving and S. Kuehner, *UWS*) Relatively fine grained fragmental breccia composed of mineral clasts of anorthite, pigeonite, olivine, augite, Ti-chromite and troilite set in a matrix containing minor secondary barite.
Geochemistry: Olivine ($Fa_{34.8-42.3}$, FeO/MnO = 86-95, N = 4), pigeonite ($Fs_{29.8-32.4}Wo_{8.8-12.9}$, FeO/MnO = 47-52, N = 3), augite ($Fs_{20.6}Wo_{35.4}$, FeO/MnO = 49), plagioclase ($An_{96.4-97.1}Or_{0.1}$, N = 2). Bulk composition (R. Korotev, *WUSL*) INAA of subsamples gave the following mean abundances: (in wt.%) FeO 7.0, Na_2O 0.30; (in ppm) Sc 17.0, La 1.9, Sm 1.0, Eu 0.67, Yb 1.0, Lu 0.15, Hf 0.6, Th 0.15.
Classification: Lunar (feldspathic breccia).
Specimens: 24.3 g including one stone polished on one side at *UWB*; the remaining material is held by the anonymous finders.

Northwest Africa 10496 (NWA 10496)
(Northwest Africa)

Purchased: 2015 Sep
Classification: Ordinary chondrite (LL3)
History: Purchased by John Higgins in September 2015 from a dealer in Zagora, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, fairly closely-packed chondrules are set in a finer matrix.
Geochemistry: Olivine ($Fa_{0.6-40.9}$, Cr_2O_3 in ferroan olivine 0.05-0.14 wt.%, mean 0.08 wt.%, sd 0.03 wt.%, N = 8), orthopyroxene ($Fs_{0.8-14.4}Wo_{0.5-1.0}$, N = 3), clinopyroxene ($Fs_{13.6-14.3}Wo_{36.3-33.7}$, N = 2). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg)=3.71.
Classification: Ordinary chondrite (LL3).
Specimens: 27 g including one polished thin section at *UWB*; main mass with Mr. J. Higgins.

Northwest Africa 10497 (NWA 10497)
(Northwest Africa)
Purchased: 2011 Dec
Classification: Primitive achondrite (Brachinite)
History: Purchased in December 2011 by Scott Feek from Gary Fujihara who had acquired it from a Moroccan dealer.
Petrography: (A. Irving, *UWS*) Protogranular aggregate of olivine (~80 vol.%) with subordinate orthopyroxene and clinopyroxene, plus accessory chromite, chlorapatite and taenite.
Geochemistry: (P. Carpenter, *WUSL*) Olivine ($Fa_{29.9-30.4}$, FeO/MnO = 60-61, N = 3), orthopyroxene ($Fs_{24.4-24.6}Wo_{2.3-2.2}$, FeO/MnO = 36-37, N = 2), clinopyroxene ($Fs_{9.8-9.9}Wo_{44.0-44.3}$, FeO/MnO = 26-28, N = 2). Oxygen isotopic composition (J. Gattacceca, C. Sonzogni, *CEREGE*) from analysis of one acid-washed 1.5 mg aliquot of a powdered 50 mg bulk sample is $\delta^{17}O$=2.22‰, $\delta^{18}O$=4.67‰ , $\Delta^{17}O$=-0.22‰ (linearized, slope 0.5247, analytical uncertainties 0.08‰, 0.12‰, 0.03‰ respectively).
Classification: Primitive achondrite (brachinite). Although the mineralogy and mineral compositions are similar to those in NWA 5400 and paired stones, the oxygen isotopic composition is quite different (but similar to that for NWA 6152)
Specimens: 3.25 g plus one polished thin section at *UWB*; remainder with Mr. S. Feek.

Northwest Africa 10498 (NWA 10498)
(Northwest Africa)
Purchased: 2013 Mar
Classification: Carbonaceous chondrite (CO3.0)
History: Purchased in Spain by Darryl Pitt in March 2013 from a Mauritanian dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Small, well-formed chondrules (apparent diameter 0.35 ± 0.2 mm), mineral fragments and sparse, irregularly-shaped CAI are set in a deep brown matrix (~40 vol.%).
Geochemistry: Olivine ($Fa_{0.6-65.6}$, Cr_2O_3 in ferroan olivine 0.19-0.60 wt.%, mean 0.32 wt.%, sd 0.12 wt.%, N = 20), orthopyroxene ($Fs_{1.0-1.3}Wo_{1.1}$; $Fs_{38.4}Wo_{1.1}$, N = 3), clinopyroxene ($Fs_{0.9}Wo_{32.0}$).
Classification: Carbonaceous chondrite (CO3.0). The mean and range in Cr_2O_3 contents of ferroan olivine occurring as rims and as matrix grains is essentially the same as for Colony, which was designated as a CO3.0 by Grossman and Brearley (2005, Figure 5).
Specimens: 1.13 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 10499 (NWA 10499)
(Northwest Africa)
Purchased: 2015 Sep
Classification: Ordinary chondrite (LL3)
History: Purchased by John Higgins in September 2015 from a dealer in Zagora, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, fairly closely-packed chondrules are set in a finer matrix.
Geochemistry: Olivine ($Fa_{0.3\text{-}53.6}$, Cr_2O_3 in ferroan olivine 0.06-0.21 wt.%, mean 0.14 wt.%, sd 0.05 wt.%, N = 9), orthopyroxene ($Fs_{0.7\text{-}25.0}Wo_{3.5\text{-}4.9}$, N = 3), clinopyroxene ($Fs_{1.9\text{-}4.8}Wo_{42.1\text{-}45.7}$, N = 2). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg)=4.08.
Classification: Ordinary chondrite (LL3).
Specimens: 32 g including one polished thin section at *UWB*; main mass with Mr. J. Higgins.

Northwest Africa 10500 (NWA 10500)
(Northwest Africa)
Purchased: 2015 May
Classification: Ordinary chondrite (LL4-5)
History: Purchased by Pierre-Marie Pelé in May 2015 from a dealer in Erfoud, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Matrix-poor breccia composed of equilibrated type 4 and type 5 clasts. Some well-formed chondrules have apparent diameter up to 1.9 mm.
Geochemistry: Olivine ($Fa_{30.3\text{-}30.5}$, N = 3), orthopyroxene ($Fs_{22.3\text{-}22.6}Wo_{2.6\text{-}2.4}$, N = 3), clinopyroxene ($Fs_{10.1\text{-}10.4}Wo_{43.7\text{-}43.4}$, N = 2). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 3.55.
Classification: Ordinary chondrite (LL4-5 breccia).
Specimens: 26.43 g including one polished thin section at *PSF*; remainder with Mr. P. Pelé.

Northwest Africa 10501 (NWA 10501)
(Northwest Africa)
Purchased: 2015 Sep
Classification: HED achondrite (Eucrite)
History: Purchased by Aras Jonikas in September 2015 from a Moroccan dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of diabasic eucrite clasts and related crystalline debris. Exsolved pyroxene is orange in thin section and calcic plagioclase is polycrystalline. Accessory minerals include silica polymorph, ilmenite, Ti-chromite and troilite, plus minor secondary calcite and barite.
Geochemistry: Orthopyroxene host ($Fs_{59.9\text{-}61.3}Wo_{4.5\text{-}2.7}$, FeO/MnO = 30-34, N = 3), clinopyroxene exsolution lamellae ($Fs_{28.1\text{-}28.8}Wo_{42.3\text{-}41.7}$, FeO/MnO = 28-29, N = 3).
Classification: Eucrite (diabasic breccia, shocked).
Specimens: 17.8 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

Northwest Africa 10502 (NWA 10502)
(Northwest Africa)
Purchased: 2015 May
Classification: Ordinary chondrite (LL3)
History: Purchased by Pierre-Marie Pelé in May 2015 from a dealer in Erfoud, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, fairly closely packed chondrules (apparent diameter 1.3±0.8 mm) are set in a finer matrix.

Geochemistry: Olivine ($Fa_{2.1-38.3}$, Cr_2O_3 in ferroan olivine 0.05-0.07 wt.%, mean 0.06±0.01 wt.%, N = 8), orthopyroxene ($Fs_{3.2-24.3}Wo_{0.4-2.1}$, N = 3), clinopyroxene ($Fs_{16.5-16.7}Wo_{30.4-33.8}$, N = 2). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.02.
Classification: Ordinary chondrite (LL3).
Specimens: 26.28 g including one polished thin section at *PSF*; remainder with Mr. P. Pelé.

Northwest Africa 10503 (NWA 10503)
(Northwest Africa)
Purchased: 2015 May
Classification: Ungrouped achondrite
History: Purchased by Fabien Kuntz in May 2015 from a dealer in Zagora, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Triple-grain-junction texture, grain size 0.1-0.7 mm. Very fresh assemblage of predominantly olivine with subordinate clinopyroxene (~20 vol.%), intermediate plagioclase (~10 vol.%), and accessory pyrrhotite, chromite, taenite and pentlandite.
Geochemistry: Olivine ($Fa_{31.8-32.0}$, FeO/MnO = 79-96, N = 3), clinopyroxene ($Fs_{11.4-11.6}Wo_{42.5-42.6}$, FeO/MnO = 43-44, N = 2), plagioclase ($An_{32.3-33.9}Or_{3.2-3.0}$). Oxygen isotopes (K. Ziegler, *UNM*): analyses of nine acid-washed subsamples by laser fluorination gave, respectively, $\delta^{17}O$ -3.757, -3.884, -3.950, -3.557, -3.569, -3.779, -3.674, -3.818, -3.968; $\delta^{18}O$ -0.848, -1.162, -1.212, -0.555, -0.624, -0.873, -0.792, -0.893, -1.206; $\Delta^{17}O$ -3.309, -3.270, -3.310, -3.264, -3.240, -3.318, -3.256, -3.346, -3.331 per mil.
Classification: Achondrite (ungrouped). Despite similarities in texture this meteorite has an oxygen isotopic composition far removed from those of any brachinites, winonaites, and acapulcoites.
Specimens: 26.3 g including one polished thin section at *PSF*; main mass with *Kuntz*.

Northwest Africa 10504 (NWA 10504)
(Northwest Africa)
Purchased: 2015 May
Classification: Ordinary chondrite (L4)
History: Purchased by Pierre-Marie Pelé in May 2015 from a dealer in Erfoud, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, fairly closely packed chondrules (apparent diameter 1.1 ± 0.7 mm) are set in a finer, stained matrix containing altered metal.
Geochemistry: Olivine ($Fa_{25.8-25.9}$, N = 3), orthopyroxene ($Fs_{20.7-21.2}Wo_{4.2-0.9}$, N = 3), clinopyroxene ($Fs_{8.1-10.5}Wo_{45.6-41.3}$, N = 2). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.15.
Classification: Ordinary chondrite (L4).
Specimens: 26.08 g including one polished thin section at *PSF*; remainder with Mr. P. Pelé.

Northwest Africa 10505 (NWA 10505)
(Northwest Africa)
Purchased: 2015 Sep
Classification: HED achondrite (Diogenite)
History: Purchased by Marcin Cimala in September 2015 from a dealer in Ouarzazate, Morocco.
Petrography: (A. Irving, *UWS*) Protogranular aggregate of predominantly orthopyroxene with ~5 vol.% olivine, accessory chromite, kamacite and troilite, plus rare calcic plagioclase.

Cataclastic textures are absent. Secondary calcite occurs in small patches and along grain boundaries.
Geochemistry: (P. Carpenter, *WUSL*) Orthopyroxene ($Fs_{24.7-24.8}Wo_{3.7-3.8}$, FeO/MnO = 29-30, N = 3), olivine ($Fa_{29.7-29.9}$, FeO/MnO = 48-50, N = 2).
Classification: Diogenite (protogranular, olivine-bearing).
Specimens: 26 g including one polished thin section and one polished thick section at *PSF*; remainder with Mr. M. Cimala.

Northwest Africa 10506 (NWA 10506)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (L4/5)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Somewhat recrystallized but with some well-formed, spherical chondrules (apparent diameter 0.9±0.5 mm).
Geochemistry: Olivine ($Fa_{25.0-25.3}$, N = 3), orthopyroxene ($Fs_{20.5-20.6}Wo_{1.6-1.7}$, N = 2), clinopyroxene ($Fs_{7.5-9.6}Wo_{45.8-43.9}$, N = 2).
Classification: Ordinary chondrite (L4/5).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10507 (NWA 10507)
(Northwest Africa)
Purchased: 2015 Oct
Classification: Carbonaceous chondrite (CO3.0)
History: Purchased by Aras Jonikas in October 2015 from a Moroccan dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Small, well-formed chondrules (apparent diameter 0.55±0.3 mm), mineral fragments and sparse, irregularly shaped CAI are set in a deep brown matrix (~50 vol.%).
Geochemistry: Olivine ($Fa_{1.0-89.4}$, Cr_2O_3 in ferroan olivine 0.20-0.84 wt.%, mean 0.38±0.15 wt.%, N = 20), orthopyroxene ($Fs_{1.3-4.7}Wo_{1.1-3.4}$, N = 3), clinopyroxene ($Fs_{1.6}Wo_{47.7}$; $Fs_{18.6}Wo_{47.5}$, N = 2).
Classification: Carbonaceous chondrite (CO3.0). The mean and range of Cr_2O_3 contents of ferroan olivine occurring as rims and as matrix grains is essentially the same as for Colony, which was designated as a CO3.0 by Grossman and Brearley (2005).
Specimens: 22.5 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

Northwest Africa 10508 (NWA 10508)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (L3)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to the *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed spherical chondrules (apparent diameter 1.0±0.7 mm; one 2.7 mm) are set in a finer matrix. Olivine is mostly equilibrated but magnesian cores are present in some grains.

Geochemistry: Olivine (cores $Fa_{8.8}$; predominantly $Fa_{25.3\text{-}25.8}$, N = 4; Cr_2O_3 in ferroan olivine 0.02-0.07 wt.%), orthopyroxene ($Fs_{3.1\text{-}10.2}Wo_{0.5\text{-}1.0}$, N = 3), clinopyroxene ($Fs_{12.7}Wo_{35.5}$; $Fs_{15.7}Wo_{28.0}$, N = 2).
Classification: Ordinary chondrite (L3).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10509 (NWA 10509)
Morocco
Find: 2014 Aug
Classification: Lunar meteorite (anorth)
History: Purchased by Ke Zuokai in Dec. 2015 from a Moroccan dealer.
Physical characteristics: A single, irregularly shaped stone lacking fusion crust. Small white clasts are visible in a pale, finer-grained matrix.
Petrography: Fragments of plagioclase (100 μm to sub-mm) set in recrystallized matrix of fine-grained (~ 20 μm) olivine, pigeonite, and plagioclase. Olivine fragments are less abundant.
Geochemistry: Plagioclase ($An_{86.5\text{-}98.0}Ab_{3\text{-}13}Or_{0\text{-}1}$, average: $An_{94\pm4}Ab_{5\pm4}$) (n=8), olivine ($Fa_{22\text{-}41}$, FeO/MnO = 83-98), pigeonite ($Fs_{17\text{-}59}Wo_{3\text{-}22}$, FeO/MnO = 45-61).
Classification: Lunar, anorthositic breccia

Northwest Africa 10510 (NWA 10510)
Morocco
Purchased: 2015 Dec
Classification: HED achondrite (Eucrite)
History: Purchased by Ke Zuokai in Dec. 2015 from a Moroccan dealer.
Physical characteristics: One piece of stone with a cm-sized shock-induced melt vein. No fusion crust.
Petrography: The brecciated meteorite displays an overall basaltic texture of dominantly lath-shaped calcic plagioclase and exsolved pyroxene. Accessory minerals include chromite, and SiO_2 polymorphs.
Geochemistry: Low Ca pyroxene ($Fs_{35.8\text{-}59.7}Wo_{2.4\text{-}4.8}$, Fe/Mn=31.9±1.0, 28.5-32.9) (n=5); augite ($Fs_{15.1\text{-}24.6}Wo_{25.5\text{-}43.7}$, Fe/Mn 28.5-32.3 (n=2); plagioclase $An_{88.7\pm0.8}Ab_{11\pm1}$ ($An_{87.7\text{-}89.3}$, n=8).

Northwest Africa 10511 (NWA 10511)
Morocco
Purchased: 2015 Dec
Classification: HED achondrite (Eucrite)
History: Purchased by Ke Zuokai in Dec. 2015 from a Moroccan dealer.
Physical characteristics: One stone with an irregular shape. No fusion crust.
Petrography: The meteorite displays an overall basaltic texture of dominantly lath-shaped calcic plagioclase and exsolved pyroxene.
Geochemistry: Pigeonite $Fs_{59\text{-}61}Wo_{5.8\text{-}7.8}$, Fe/Mn=26.5±0.6 (25.5-27.6) (n=10); augite $Fs_{30.5\text{-}31.1}Wo_{41.1\text{-}41.6}$, Fe/Mn=27.5±1.2 (25.6-28.6) (n=7); plagioclase $An_{90.6\pm0.7}Ab_{9.1\pm0.6}Or_{0.35\pm0.14}$ (n=13).

Northwest Africa 10512 (NWA 10512)
Morocco
Purchased: Dec. 2015

Classification: Carbonaceous chondrite (CK4)
History: Purchased by Ke Zuokai in Dec. 2015 from a Moroccan dealer.
Physical characteristics: One single stone. No fusion crust. Minimal weathering.
Petrography: A few chondrules set into abundant fine-grained matrix. Fe-rich olivine is the dominant mineral phase. Pyroxene usually is Ca-rich, and plagioclase is Na-rich. Accessory phases include Cr-bearing magnetite and sulfide. This sample does not have metallic FeNi, but contains a few Ni-bearing magnetite. No large CAIs were observed in this sample.
Geochemistry: Olivine ($Fa_{31.5\text{-}35.0}$, Fe/Mn 90-125), Augite ($Fs_{9.1\text{-}16.8}Wo_{44.4\text{-}49.9}$), pigeonite ($Fs_{25.8}Wo_{4.6}$), Plagioclase ($Ab_{60.1\text{-}70.5}Or_{1.4\text{-}3}$)
Classification: CK4. This sample is classified as type 4 because the compositional range of olivine is slightly more heterogeneous (PMD of Fa content of olivine is about 5.8%) than those in type 5.

Northwest Africa 10513 (NWA 10513)
Morocco
Purchased: 2015 Dec
Classification: Ordinary chondrite (L5, melt breccia)
History: Purchased by Ke Zuokai in Dec. 2015 from a Moroccan dealer.
Physical characteristics: One single stone. No fusion crust.
Petrography: A few chondrules (size of 0.6-1.7 mm) are present. Most are porphyritic olivine and pyroxene chondrules. Part of the host is completely melted due to shock impact.
Geochemistry: Olivine ($Fa_{23.2\text{-}25.7}$), low-Ca pyroxene ($Fs_{20.2\text{-}21.1}Wo_{1.0\text{-}1.7}$).

Northwest Africa 10514 (NWA 10514)
Morocco
Purchased: 2015 April
Classification: HED achondrite (Eucrite, monomict)
History: Purchased by team eegooblago (Brahim Tahiri, Dustin Dickens and Sean Tutorow) from a dealer in Morocco in April 2015.
Physical characteristics: The stone is dark, brownish to redish in colour with impact melt visible around the clasts. Amorphous areas (~1 mm) are present in patches.
Petrography: (S. Hutchinson, *UWO*) The rock is dominated by calcic plagioclase and low-Ca pyroxene with some silica polymorphs and oxides. Minerals are anhedral. Most pyroxenes show fine exsolution.
Geochemistry: Mineral compositions and geochemistry (EMPA, *UWO*): pyroxene: $Fs_{57.3\pm6.8}Wo_{8.3\pm5.9}$ ($Fs_{50.5\text{-}62.8}Wo_{4.0\text{-}16.0}$, n=17, Fe/Mn=27.5-32.1); calcic plagioclase: $An_{89.1\pm2.4}$ ($An_{87.4\text{-}91.3}$, n=20).
Classification: Eucrite, monomict breccia
Specimens: 68.2 g including a thin section and polished mount at *UWO*. Sean Tutorow holds the main mass.

Northwest Africa 10515 (NWA 10515)
Morocco
Purchased: 2015 April
Classification: HED achondrite (Eucrite, unbrecciated)

History: Purchased by team eegooblago (Brahim Tahiri, Dustin Dickens and Sean Tutorow) from a dealer in Morocco in April 2015.
Physical characteristics: Beige in color. Medium-grained white plagioclase and brown pyroxene in the matrix, with areas with smaller mineral grain sizes.
Petrography: (S. Hutchinson, *UWO*) Plagioclase and pyroxene are the main mineral phases of the matrix. Chromite was also identified. Areas of 3-4 mm consist of finer-grained materials (~0.1 mm) relative to the rest of the sample (0.5-2 mm). These areas are also more silica-rich, composed primarily of plagioclase, pyroxene and silica polymorphs. The meteorite is unbrecciated.
Geochemistry: Mineral compositions and geochemistry: low-Ca pyroxene: $Fs_{57.1\pm2.4}Wo_{7.2\pm2.7}$ ($Fs_{53.2\text{-}59.3}Wo_{5.3\text{-}11.9}$, n=20, Fe/Mn=28.6-32.0); Ca-pyroxene: $Fs_{29.8\pm0.4}Wo_{40.7\pm0.3}$ ($Fs_{29.5\text{-}30.2}Wo_{40.4\text{-}41.0}$, n=20, Fe/Mn=28.8-31.8); calcic plagioclase: $An_{89.3\pm1}$,4 ($An_{86.8\text{-}90.1}$, n=20).
Classification: Eucrite, unbrecciated
Specimens: 25.4 g including a thin section and polished mount at *UWO*. Sean Tutorow holds the main mass.

Northwest Africa 10516 (NWA 10516)
(Northwest Africa)
Purchased: 2002 Feb
Classification: Ordinary chondrite (L3-6)
History: Donated to *Cascadia* by Edwin Thompson, who obtained the meteorite in February 2002 at the Tucson Gem and Mineral Show from a Moroccan trader.
Physical characteristics: Stone with brown-red weathering patina covering both broken and curved surfaces; the latter contains remnant fusion crust. Polished cut face shows apparent breccia texture with small patches of dark, apparent shock melt and one truncated shock vein.
Petrography: (A. Ruzicka and K. Farley, *Cascadia*) In thin section, a breccia composed of an intimate mixture of mineral and chondrule fragments with diverse (type 3-6) characteristics and some larger clasts; areas between chondrules are mainly composed of smaller chondrule and mineral fragments, although rare fine-grained matrix is present in places. BSE imaging shows that most of the rock ("host") is composed of type 4-6 lithologies, with equilibrated olivine, and coarse plagioclase (30-150 μm long, one grain up to 460 μm long), intermixed with well-defined chondrules and fragments, some glass-bearing. Contains a 4 mm long granoblastic-textured (type 6) chondritic lithic clast.
Geochemistry: (K. Farley and A. Ruzicka, *Cascadia*) Host dominated by equilibrated olivine (median $Fa_{24.2}$, N=55) and low-Ca pyroxene (median $Fs_{20.7}$, N=52) but also contains more varied olivine ($Fa_{5.8\text{-}32.5}$) and low-Ca pyroxene compositions ($Fs_{2.9\text{-}38.7}$). Overall average of mixture including both equilibrated and more varied compositions is olivine ($Fa_{23.4\pm4.9}$, N=55), low-Ca pyroxene ($Fs_{18.0\pm6.4}Wo_{1.1\pm1.0}En_{80.9\pm6.8}$, N=52), Ca-rich pyroxene ($Fs_{7.2\pm2.6}Wo_{42.1\pm4.4}En_{50.7\pm7.0}$, N=4), plagioclase ($Ab_{82.0\pm1.2}Or_{9.0\pm4.3}An_{10.9\pm1.6}$, N=7), alkali feldspar ($Ab_{83.1\pm1.2}Or_{42.9\pm2.0}An_{9.6\pm0.9}$, N=3).
Classification: L3-6 finely intermixed genomict breccia. Type 5-6 lithology implied by abundant equilibrated olivine and pyroxene and common coarse feldspar grain sizes; type 3 lithology implied by presence of magnesian olivine and glass in chondrules and clasts.
Specimens: *Cascadia* holds the entire sample, consisting of 7.0 g in two pieces, a polished thin section, and a potted butt.

Northwest Africa 10517 (NWA 10517)

(Northwest Africa)
Purchased: 2004 Feb
Classification: Ordinary chondrite (L3-6)
History: Purchased by Richard Pugh in February 2004 from a Moroccan trader at the Tucson Gem and Mineral Show.
Physical characteristics: Partly fusion crusted individual with brownish weathering patina on broken surfaces.
Petrography: (A. Ruzicka and K. Farley, *Cascadia*) Breccia with ~7% metal overall, composed of an intimate mixture of mineral and chondrule fragments with diverse (type 3-6) characteristics and some larger clasts; areas between chondrules and clasts largely composed of smaller clasts. BSE imaging of thin section shows that most of the rock is composed of type 4-6 lithologies, with equilibrated olivine, and coarse plagioclase (commonly 20-70 μm and up to 120 μm long), interspersed with sharply-defined glass-bearing chondrules and chondrule fragments. One area prominently shock-blackened.
Geochemistry: (K. Farley and A. Ruzicka) Dominated by equilibrated olivine (median $Fa_{24.4}$, N=68) and low-Ca pyroxene (median $Fs_{21.0}$, N=67) but also containing more varied olivine ($Fa_{4.1\text{-}38.8}$) and low-Ca pyroxene compositions ($Fs_{2.9\text{-}26.1}$). Average of mixture including both equilibrated and more varied compositions is olivine ($Fa_{24.4\pm6.1}$, N=68), low-Ca pyroxene ($Fs_{18.6\pm5.6}Wo_{1.5\pm1.1}En_{80.0\pm6.3}$, N=67), high-Ca pyroxene ($Fs_{9.9\pm1.7}Wo_{42.9\pm2.8}En_{47.2\pm2.9}$, N=19), plagioclase ($Ab_{81.3\pm2.7}Or_{7.2\pm1.4}An_{11.4\pm2.1}$, N=19), alkali feldspar ($Ab_{59.3\pm2.0}Or_{30.7\pm0.0}An_{10.0\pm2.1}$, N=2).
Classification: L3-6 finely intermixed genomict breccia. Type 5-6 implied by common equilibrated olivine and coarse feldspar; type 3 implied by presence of magnesian olivine and glass in chondrules and fragments.
Specimens: *Cascadia* holds the entire sample, which consists of 85.3 g in two pieces, one polished thin section, and a potted butt.

Northwest Africa 10518 (NWA 10518)
(Northwest Africa)
Purchased: 2004 Feb
Classification: Ordinary chondrite (L3-7)
History: A single stone was obtained by Edwin Thompson from a Moroccan trader in Tucson, Arizona at the February 2004 Tucson Gem and Mineral Show. A portion (24 g) was donated and Patrick *Thompson* sold the main mass (85.6 g) to *Cascadia*.
Physical characteristics: Fusion crust, weathered patina, and dust partly cover exterior. Cut faces reveal light colored, partly reddish stained clasts and chondritic texture (chondrules, fragments, metal) with a grey matrix. One prominent large clast is ~2 × 1 cm across; a grey inclusion is also visible.
Petrography: (A. Ruzicka and K. Farley, *Cascadia*) In thin section, a breccia composed of an intimate mixture of mineral and chondrule fragments with diverse (type 3-6) characteristics and some larger clasts; areas between chondrules and clasts composed largely of smaller clasts. BSE imaging shows that most of the rock ("host") is composed of type 4-6 lithologies, with equilibrated olivine, and plagioclase commonly ~35-100 μm across, intermixed with well-defined chondrules and clasts with magnesian silicates. Prominent large clast contains granoblastic silicates, metal, relict chondrules, and feldspar which is especially coarse (length 75-326 μm, average 143±59 μm, N=35). Gray inclusion is ~8 mm long in thin section and composed chiefly of fine-grained zoned olivine set in glass.

Geochemistry: (K. Farley and A. Ruzicka) Host dominated by equilibrated olivine (median $Fa_{24.8}$, N=72) and low-Ca pyroxene (median $Fs_{21.0}$, N=53) but containing more varied olivine ($Fa_{0\text{-}39.5}$) and low-Ca pyroxene compositions ($Fs_{1.8\text{-}26.5}$). Overall average host including mixture of equilibrated and more varied compositions is olivine ($Fa_{21.3\pm7.8}$, Fe/Mn = 42.9±18.6 at., N = 72), low-Ca pyroxene ($Fs_{18.6\pm5.3}Wo_{1.6\pm1.4}En_{79.8\pm5.9}$, Fe/Mn = 23.5±9.3 at., N = 53), high-Ca pyroxene ($Fs_{9.6\pm2.4}Wo_{43.5\pm2.5}En_{46.9\pm1.6}$, Fe/Mn = 11.1±7.3 at., N= 29), feldspar ($Ab_{82.8\pm3.4}An_{11.7\pm2.5}Or_{5.4\pm2.1}$, N = 34). Prominent large clast has olivine ($Fa_{25.7\pm0.7}$, Fe/Mn = 53.9±20.5 at., N = 10), low-Ca pyroxene ($Fs_{22.0\pm0.9}Wo_{1.9\pm0.5}En_{76.0\pm1.0}$, Fe/Mn = 23.4±10.0 at., N = 7), high-Ca pyroxene ($Fs_{9.5\pm2.2}Wo_{43.8\pm2.3}En_{46.7\pm1.5}$ at., N = 8), feldspar ($Ab_{82.2\pm1.3}An_{11.2\pm1.0}Or_{6.6\pm1.0}$ at., N = 10).
Classification: L3-7 finely intermixed genomict breccia. Type 5-6 lithology implied by abundant equilibrated olivine and pyroxene and common coarse feldspar grain sizes; type 3 lithology implied by presence of magnesian olivine in chondrules and clasts; large prominent clast with unusually coarse feldspar can be described as type 7. Gray inclusion resembles shock melt observed in other ordinary chondrites.
Specimens: *Cascadia* holds the entire sample, which consists of 104.0 g in two pieces (85.6 and 18.4 g), additional small fragments (0.8 g), a polished thin section, and a potted butt.

Northwest Africa 10519 (NWA 10519)
Mauritania
Purchased: 2015 Sept
Classification: Enstatite achondrite (ungrouped)
History: Purchased by Michael Farmer from a meteorite dealer at the Denver Gem and Mineral Show, September 2015. The stone was reportedly found in Mauritania.
Physical characteristics: Single, deeply regmaglypted stone weighing 18.197 kg, with remnant fusion crust. Fusion crust on some edges of the stone is worn away, exposing metal. A 21 × 14 cm slab displays a brecciated texture dominated by sub-angular to rounded dark-green to tan metal-silicate clasts, separated by an anastomosing network of metal veins. Recognizable clasts up to 10 cm. Clasts range from blocky, dark-greenish and metal poor (<2 area %) to sub-rounded with ~20 area % metal. The dark blocky clasts commonly have a lighter colored greenish rim (to 1 mm thick). Overall the weathering grade is low, W1, although a few areas near the edge of the sample show W2. Shock stage is low, troilite is single crystal and metal lacks Neumann bands.
Petrography: (D. Schrader and L. Garvie, *ASU*) Electron microprobe analysis shows the silicates are enstatite, diopside, and albitic plagioclase, with minor silica. No olivine was observed. Metal is commonly associated with troilite, alabandite, daubrelite, and minor graphite and schreibersite. Areas of metal, to 2 cm across, show well-developed Widmanstätten pattern, with variable band-width with an average of 0.5 mm. Individual kamacite lamellae typically short, stubby and swollen, with rounded ends, and locally forms 120° triple grain boundaries with adjacent lamellae. Metal shows well-developed dark etching and comb plessite. Metal grain boundaries are decorated with submicron precipitates. Alabandite is present as grains up to 1 mm wide around large metal segregations and grains within troilite. Daubrelite is present as lamellae within troilite. Metal in clasts typically shows grains with holly-leaf to amoeboid outlines.
Geochemistry: (D. Schrader, *ASU*) Enstatite $Fs_{0.6\pm0.3}Wo_{1.2\pm0.4}$, Fe/Mn=5±2, n=13; diopside $Fs_{0.7\pm0.2}Wo_{46.6\pm1.0}$, Fe/Mn=6±5, n=7; plagioclase $An_{21.6\pm0.2}Ab_{76.4\pm0.3}Or_{1.9\pm0.1}$, n=3; and silica. Opaque minerals observed include kamacite (wt.%; Fe 92.6±0.4, Ni 6.6±0.2, Co 0.4±0.0, Si <0.01, P 0.1±0.0; n = 16), taenite (wt.%; Fe 71.2±7.0, Ni 27.7±6.4, Co 0.1±0.0, Si <0.01), P

<0.02; n = 2), troilite (wt.%; Fe 62.7±0.1, S 36.6±0.2, Ti 0.17±0.03, Cr 0.37±0.07; n = 4), alabandite, daubréelite, and schreibersite.
Classification: Ungrouped enstatite achondrite. The meteorite is texturally and chemically similar to the EL6 chondrite Blithfield, compared to data in Rubin (1984). However, this meteorite is distinguished from enstatite meteorites by the lack of Si in metal (below 0.01 wt.%) and the low Ti content of troilite (0.17±0.03 wt.%).
Specimens: A sample of 562 g and a polished mount is at *ASU*. Main mass of 5.5 kg with *Boudreaux*. Remainder with *MFarmer*.

Northwest Africa 10540 (NWA 10540)
(Northwest Africa)
Purchased: 2015 Oct
Classification: HED achondrite (Eucrite, monomict)
History: Purchased by John Higgins in October 2015 from a dealer in Laayoune, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Fragmental breccia composed of larger mineral grains (up to 2.2 mm across) within a finer matrix of the same minerals. The main components are finely exsolved pigeonite and calcic plagioclase with accessory silica polymorph, ilmenite, Ti-free chromite and troilite. Some composite grains with pyroxene and plagioclase in contact are present.
Geochemistry: Host orthopyroxene ($Fs_{46.8-48.3}Wo_{3.4-1.5}$, FeO/MnO = 31-32, N = 3), clinopyroxene exsolution lamellae ($Fs_{17.3-19.1}Wo_{45.3-44.6}$, FeO/MnO = 28, N = 3).
Classification: Eucrite (monomict gabbroic breccia).
Specimens: 26 g including one polished thin section at *UWB*; remaining material with Mr. J. Higgins.

Northwest Africa 10541 (NWA 10541)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (H6)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Recrystallized with rare chondrule remnants.
Geochemistry: Olivine ($Fa_{19.7-19.8}$, N = 3), orthopyroxene ($Fs_{16.6-16.9}Wo_{1.6-1.5}$, N = 3), clinopyroxene ($Fs_{6.2-6.3}Wo_{45.5-45.2}$, N = 2).
Classification: Ordinary chondrite (H6).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10542 (NWA 10542)
(Northwest Africa)
Purchased: 2013
Classification: HED achondrite (Eucrite, brecciated)
History: Purchased by John Curchin in 2013 from a Moroccan dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of gabbroic clasts and related mineral debris in a partly vesicular matrix. The predominant minerals are exsolved pigeonite (pale orange in thin section with some red-brown patches) and calcic plagioclase

(polycrystalline) with accessory silica polymorph, ilmenite and Ti-chromite, plus secondary calcite and barite.
Geochemistry: Host orthopyroxene ($Fs_{62.2-62.6}Wo_{3.3-4.9}$, FeO/MnO = 30-32, N = 3), clinopyroxene exsolution lamellae ($Fs_{28.2-29.5}Wo_{43.5-42.8}$, FeO/MnO = 32-35, N = 2), pigeonite in matrix ($Fs_{45.9}Wo_{20.1}$, FeO/MnO = 30).
Classification: Eucrite (gabbroic breccia, shocked). Paired with NWA 7989, NWA 8036, NWA 8056 and others.
Specimens: 24.1 g including one polished thin section at *UWB*; main mass with Mr. J. Curchin.

Northwest Africa 10543 (NWA 10543)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (H5)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules.
Geochemistry: Olivine ($Fa_{19.2-19.4}$, N = 3), orthopyroxene ($Fs_{16.3-16.6}Wo_{1.0-1.2}$, N = 3), clinopyroxene ($Fs_{6.4-6.5}Wo_{43.9-45.7}$, N = 2).
Classification: Ordinary chondrite (H5).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10544 (NWA 10544)
(Northwest Africa)
Purchased: 2015 Oct
Classification: Primitive achondrite (Lodranite)
History: Purportedly found in Mauritania and purchased by Darryl Pitt in October 2015 from a dealer in Guelmim, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Protogranular aggregate (grainsize up to 2.6 mm) of orthopyroxene, olivine and clinopyroxene with accessory oligoclase, kamacite, troilite, chromite, chlorapatite and minor secondary barite. Kamacite has been extensively altered to orange goethite, which also occurs along grain boundaries.
Geochemistry: Olivine ($Fa_{15.0-15.2}$, FeO/MnO = 27, N = 3), orthopyroxene ($Fs_{13.1-13.4}Wo_{2.3-2.6}$, FeO/MnO = 16, N = 3), clinopyroxene ($Fs_{5.2-5.8}Wo_{44.7-42.4}$, FeO/MnO = 11-12, N = 2), plagioclase ($An_{17.0-19.5}Or_{5.2-3.8}$, N = 2).
Classification: Lodranite.
Specimens: 16.9 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 10545 (NWA 10545)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (L6)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Recrystallized with rare chondrule remnants.
Geochemistry: Olivine ($Fa_{25.3-25.4}$, N = 3), orthopyroxene ($Fs_{20.6-20.9}Wo_{1.8-1.9}$, N = 3), clinopyroxene ($Fs_{8.6-9.9}Wo_{43.8-44.2}$ N = 2).

Classification: Ordinary chondrite (L6).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10546 (NWA 10546)
(Northwest Africa)
Purchased: 2015 Nov
Classification: Lunar meteorite (feldspathic breccia)
History: Purportedly found near the border between Mauritania and Mali. Purchased by Pierre-Marie Pelé in November 2015 from a dealer in Ouarzazate, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Fragmental breccia composed of mineral clasts of anorthite, olivine, pigeonite, augite, subcalcic augite, silica polymorph, ilmenite (with inclusions of baddeleyite), Ti-Al-chromite and rare zircon. Microbubbles are present in parts of the finer grained matrix along with minor secondary barite.
Geochemistry: Olivine ($Fa_{23.1-39.3}$; $Fa_{86.9}$; FeO/MnO = 83-95; N = 4), pigeonite ($Fs_{21.7}Wo_{13.9}$; $Fs_{54.2}Wo_{21.9}$; FeO/MnO = 52-65; N = 2), augite ($Fs_{13.0}Wo_{37.8}$, FeO/MnO = 39), subcalcic augite ($Fs_{32.8}Wo_{31.9}$, FeO/MnO = 49), ferroan augite ($Fs_{51.5}Wo_{40.5}$, FeO/MnO = 72), plagioclase ($An_{90.3-93.3}Or_{0.4-0.1}$, N = 2).
Classification: Lunar (feldspathic breccia).
Specimens: A 9.72 g polished endcut piece is at *PSF*; remainder with Mr. P. Pelé.

Northwest Africa 10547 (NWA 10547)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (H5)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules.
Geochemistry: Olivine ($Fa_{18.9-19.3}$, N = 3), orthopyroxene ($Fs_{15.6-15.9}Wo_{1.1-1.2}$, N = 3), clinopyroxene ($Fs_{5.5-6.4}Wo_{44.4-46.1}$, N = 2).
Classification: Ordinary chondrite (H5).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10548 (NWA 10548)
(Northwest Africa)
Purchased: 2009
Classification: HED achondrite (Eucrite, unbrecciated)
History: Purchased by Philip Mani in 2009 from a dealer in Zagora, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Very fresh specimen with intersertal gabbroic texture (mean grainsize ~1mm). Composed mainly of exsolved pigeonite and calcic plagioclase (bytownite) with accessory silica polymorph, ilmenite, Ti-rich chromite, Ti-Al chromite and troilite.
Geochemistry: Low-Ca pyroxene host ($Fs_{56.6-57.5}Wo_{7.2-6.7}$, FeO/MnO = 30-31, N = 3), high-Ca pyroxene exsolution lamellae ($Fs_{29.7-29.8}Wo_{39.5-40.0}$, FeO/MnO = 31-32, N = 3), plagioclase ($An_{89.5-89.8}Or_{0.3-0.4}$, N = 2).
Classification: Eucrite (unbrecciated, microgabbroic).
Specimens: 20.28 g including one polished thin section at *UWB*; main mass with Mr. P. Mani.

Northwest Africa 10549 (NWA 10549)
(Northwest Africa)
Purchased: 2013 Feb
Classification: Ordinary chondrite (LL(L)3)
History: Purchased by Darryl Pitt in February 2013 from a dealer in Erfoud, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, fairly closely-packed chondrules (apparent diameter 1.3 ± 0.8 mm) are set in a finer matrix.
Geochemistry: Olivine ($Fa_{9.8\text{-}39.9}$, Cr_2O_3 in ferroan olivine 0.05-0.15 wt.%, mean 0.08±0.03 wt.%, N = 8), orthopyroxene ($Fs_{2.3\text{-}27.9}Wo_{0.6\text{-}2.3}$, N = 3), clinopyroxene ($Fs_{2.5}Wo_{38.7}$; $Fs_{18.9}Wo_{33.0}$, N = 2). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.35.
Classification: Ordinary chondrite (LL(L)3).
Specimens: 16.56 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 10550 (NWA 10550)
Layoune, Morocco
Purchased: 2015 May
Classification: Ordinary chondrite (L5)
History: Found by Wald Maatalla in the Layoune region, Morocco. Bought by Jean Redelsperger in Tan Tan in May 2015.
Physical characteristics: A single crusted stone. Cut surface reveals a light-gray interior with metal grains.
Petrography: Some metallic copper grains at the interface between troilite and FeNi grains.
Specimens: 21 g at *CEREGE*. Main mass with Jean Redelsperger.

Northwest Africa 10551 (NWA 10551)
Morocco
Purchased: 2015 Feb
Classification: Carbonaceous chondrite (CK6)
History: Bought by Jean Redelsperger from Abdellag Afiniss in Agadir in February 2015.
Physical characteristics: A single fragment of a fully crusted stone. Cut surface reveals a dark-gray interior with visible chondrules.
Petrography: Mm-sized chondrules set in a recrystallized matrix. Main mineral is olivine. Plagioclase in the matrix is up to 150 μm. Abundant magnetite (to 400 μm), and weathered troilite.
Geochemistry: Olivine $Fa_{33.0\pm0.2}$, NiO 0.41±0.05 wt% (N=6). Magnetite contains 5.6±0.1 wt% Cr_2O_3, 1.94±0.18 wt% Al_2O_3, 0.19±0.05 wt% NiO (N=4). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.52.
Classification: Carbonaceous chondrite (CK6)
Specimens: 20 g at *CEREGE*. Main mass with Jean Redelsperger.

Northwest Africa 10552 (NWA 10552)
(Northwest Africa)
Find: 2000
Classification: Ordinary chondrite (H3-5)

History: 1 stone weighing 314 g was found near Morocco-Algeria border in 2000. Thomas *Webb* acquired the sample from a meteorite prospector in 2001.
Physical characteristics: The stone is dark brown and has a rounded-irregular shape. The stone is covered by a weathered patina. The cut face of the interior of the stone is dark in color and displays small chondrules, chondrule fragments, and unweathered flakes of metal.
Petrography: Recrystallized and shock-darkened clasts which are set within a host of well-defined, poorly equilibrated chondrules, fragments and clastic debris. Boundaries between clasts and host are obscured by shock-darkened regions within the meteorite. Host chondrules are distinct, have turbid mesostasis, and have an average diameter of 439 μm (n=130). The recrystallized clast is composed of indistinct chondrules and chondrule fragments set within a yellow-stained, recrystallized matrix.
Geochemistry: (A. Love, *App*) Host: Olivine $Fa_{18.2\pm8.6}$ ($Fa_{0.9\text{-}31.6}$) N=18; Low Ca pyroxene $Fs_{16.0\pm8.0}Wo_{1.3\pm0.6}$ ($Fs_{3.5\text{-}31.5}Wo_{0.3\text{-}2.5}$), N=12, Equilibrated clasts: Olivine $Fa_{20.5\pm0.3}$, N=4; low-Ca Pyroxene $Fs_{18.2\pm0.1}Wo_{1.9\pm0.1}$, N=3.
Classification: Based on textural relationships using optical, CL and SEM microscope images and mineral compositions, this is an H3-5 S3 W3 ordinary chondrite breccia.
Specimens: 2 slices weighing 20.9 g and a polished thin section are on deposit at *App*.

Northwest Africa 10553 (NWA 10553)
(Northwest Africa)
Find: 2010
Classification: HED achondrite (Eucrite, brecciated)
History: purchased in August 2015 by M. Morgan in Morocco
Physical characteristics: Physical: One piece with thin black fusion crust
Petrography: (Y. Liu, JPL) Dark-gray stone of brecciated pyroxene with exolution lamellae and large plagioclase (maskelynite) grains. Round inclusions up to 1 mm in the largest dimension consist of Fe-rich augite in silica glass. Accessory phases include silica phase, troilite, ilmenite and olivine.
Geochemistry: Olivine ($Fa_{65.3}$, FeO/MnO=44), Low-Ca pyroxene ($Fs_{51\text{-}55}Wo_{2}$, FeO/MnO=32-34) contains low-Ca augite lamellae ($Fs_{41.0}Wo_{18.7}$, FeO/MnO=32); Plagioclase($An_{92.3\pm1.2}$, n =15).
Classification: Eucrite-br
Specimens: 20.3 g at *UCLA*. The remainder is held by *MtMorgan*.

Northwest Africa 10554 (NWA 10554)
(Northwest Africa)
Find: 2010
Classification: HED achondrite (Eucrite)
History: purchased in 2010 by M. Morgan in Morocco
Physical characteristics: Physical: One piece covered by thin black fusion crust with signs of weathering
Petrography: (Y. Liu, JPL) Light-gray stone consists of subophitic assembly of fine-grained plagioclase and pyroxene. Large anhedral pyroxene and plagioclase grains are also present, forming locally porphyritic texture. Accessory phases include silica phase, troilite, ilmenite and chromite.
Geochemistry: Low-Ca pyroxene ($Fs_{60\text{-}59}Wo_{2\text{-}4}$, FeO/MnO=30-34) contains pigeonite lamellae ($Fs_{25\text{-}29}Wo_{45\text{-}40}$, FeO/MnO=31-34) or vise versa; Plagioclase ($An_{90.7\pm1.2}$, n=20).

Classification: Eucrite
Specimens: 20.9 g at *UCLA*. The remainder is held by by *MtMorgan*.

Northwest Africa 10555 (NWA 10555)
(Northwest Africa)
Purchased: 2010
Classification: Ordinary chondrite (H5)
History: One stone weighing 121.1 g was found in Morocco in 2010. David Holden acquired the sample from a meteorite prospector in Erfoud, 2010.
Physical characteristics: The oriented stone is dark brown and dome-shaped with a flattened side displaying a well-defined rollover lip. The stone is 75% covered by a weathered fusion crust that displays shallow regmaglypts. The cut face of the interior of the stone is mottled dark brown and orange in color and displays small chondrules, chondrule fragments, dark clasts and abundant fresh flakes of metal.
Petrography: Description and classification (A. Love, *App*): Sample displays recrystallized chondritic texture. Many chondrules are defined and have an average diameter of 458 μm. Porphyritic chondrules have turbid to recrystallized mesostasis.
Geochemistry: (A. Love, *App*) Olivine $Fa_{19.7\pm0.2}$, N=6; Low Ca pyroxene $Fs_{16.9\pm0.3}Wo_{1.6\pm0.1}$, N=6.
Classification: Based on textural relationships and mineral compositions, this is an H5, S3, W1 ordinary chondrite.
Specimens: An endcut, one slice and several fragments weighing 20.2 g, and a polished thin section are currently on deposit at *App*.

Northwest Africa 10556 (NWA 10556)
(Northwest Africa)
Purchased: 2009
Classification: Ordinary chondrite (H5)
History: One stone weighing 67.1 g was found in Morocco in 2009. David Holden acquired the sample from a meteorite prospector in Erfoud, 2009.
Physical characteristics: The stone is dark brown in color and is oriented. The fusion-crusted face is roughly triangular in profile and the trailing edge, which contains a well-defined rollover lip, is flat. The stone is 75% covered by a weathered fusion crust that displays shallow regmaglypts and a well-defined rollover lip. The cut face of the interior of the stone is mottled dark brown and orange in color and displays small chondrules, chondrule fragments, dark clasts and abundant fresh flakes of metal.
Petrography: Description and classification (A. Love, *App*): Sample displays recrystallized chondritic texture crosscut by glassy, shock veins. Chondrules are defined and have an average diameter of 415 μm. Porphyritic chondrules have turbid to devitrified mesostasis
Geochemistry: (A. Love, *App*) Olivine $Fa_{19.7\pm0.1}$, N=6; Low Ca pyroxene $Fs_{17.8\pm0.2}Wo_{1.6\pm0.4}$, N=6.
Classification: Based on textural relationships and mineral compositions, this is an H5, S3, W1 ordinary chondrite.
Specimens: An endcut and several slices weighing 15.0 g, and a polished thin section are currently on deposit at *App*.

Northwest Africa 10557 (NWA 10557)
(Northwest Africa)

Purchased: 2005
Classification: Ordinary chondrite (LL6)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to the *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular clasts (mostly recrystallized with rare remnant chondrules) in a finer matrix.
Geochemistry: Olivine ($Fa_{29.4-31.9}$, N = 3), orthopyroxene ($Fs_{9.7}Wo_{4.7}$; $Fs_{22.7-22.9}Wo_{1.5-1.4}$, N = 3), clinopyroxene ($Fs_{10.2-10.9}Wo_{43.7-43.2}$, N = 2).
Classification: Ordinary chondrite (LL6 breccia).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10558 (NWA 10558)
(Northwest Africa)
Purchased: 2015 Jun
Classification: Martian meteorite (Shergottite)
History: Purchased by Stefan Ralew in June 2015 from a Moroccan dealer at the Ensisheim Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Diabasic texture with some preferred orientation of inequidimensional pyroxene and maskelynite grains. Composed of prismatic grains of zoned clinopyroxene (up to 4 × 0.6 mm in size) plus subordinate, smaller laths of maskelynite together with accessory ilmenite, ulvöspinel, merrillite (some with chlorapatite rims) and pyrrhotite. Rare inclusions of silica polymorph are present in pyroxene.
Geochemistry: Low-Ca pyroxene ($Fs_{30.9-41.6}Wo_{11.5-8.8}$, FeO/MnO = 28-35, N = 4), high-Ca pyroxene ($Fs_{22.2-36.4}Wo_{33.8-35.7}$, FeO/MnO = 28-32, N = 4), maskelynite ($An_{52.1-52.4}Or_{1.3-1.2}$, N = 2). The compositional ranges for pyroxene are more limited than in most other shergottites. Hf and Nd isotopes (M. Righter and T. Lapen, *UHou*): analysis of clean whole rock cutting dust gave $\varepsilon^{176}Hf = -19.49$ and $\varepsilon^{143}Nd = -9.04$, indicating that this specimen has affinities to enriched shergottites (like Shergotty).
Classification: Martian (diabasic shergottite, enriched).
Specimens: 2.86 g including one polished thin section at *UWB*; main mass with *Ralew*.

Northwest Africa 10559 (NWA 10559)
(Northwest Africa)
Purchased: 2015 Dec
Classification: Carbonaceous chondrite (CK3)
History: Purchased by in Temara, Morocco, by Adam Aaronson in December 2015.
Petrography: (A. Irving and S. Kuehner, *UWS*) Separated, well-formed granular chondrules (apparent diameter 1.2±0.6 mm; one 3.8 mm) containing Cr-magnetite plus sparse irregularly shaped, very fine grained, whitish mineral aggregates (up to 4.5 mm in longest dimension) are set in a finer matrix containing Cr-magnetite, intermediate plagioclase and Ni-bearing pyrrhotite. Relict forsterite cores are present in olivine. The fine grained aggregates consist of intermediate plagioclase, orthopyroxene, diopside, olivine, pleonaste spinel and minor ilmenite.
Geochemistry: Olivine (relict cores $Fa_{0.3-0.6}$; predominantly $Fa_{33.9-34.4}$, FeO/MnO = 108-109, N = 4), clinopyroxene ($Fs_{0.8}Wo_{38.6}$; $Fs_{9.2}Wo_{49.3}$, N = 2).
Classification: Carbonaceous chondrite (CK3).
Specimens: 20.1 g including one polished thin section at *UWB*; main mass with *Aaronson*.

Northwest Africa 10560 (NWA 10560)
(Northwest Africa)
Purchased: 2015 Nov
Classification: HED achondrite (Diogenite)
History: Purchased by Darryl Pitt in November 2015 from a dealer in Guelmim, Morocco
Petrography: (A. Irving and S. Kuehner, *UWS*) Matrix-poor breccia composed of angular diogenite clasts and orthopyroxene grains of varying size. Predominantly orthopyroxene (some with undulose extinction) plus accessory chromite, stained Ni-free metal and troilite.
Geochemistry: Orthopyroxene ($Fs_{27.6\text{-}27.7}Wo_{3.2\text{-}3.5}$, FeO/MnO = 25-26, N = 3).
Classification: Diogenite (monomict breccia).
Specimens: 23.65 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 10561 (NWA 10561)
(Northwest Africa)
Purchased: 2015 Dec
Classification: Carbonaceous chondrite (CO3.0)
History: Purchased by Darryl Pitt in December 2015 from a dealer in Mauritania.
Petrography: (A. Irving and S. Kuehner, *UWS*) Small chondrules, mineral fragments and sparse fine grained CAI are set in a fresh black, opaque matrix (~50 vol.%).
Geochemistry: Olivine ($Fa_{0.5\text{-}84.8}$; Cr_2O_3 in ferroan examples 0.23-0.64 wt.%, mean 0.42±0.11 wt.%, N = 18), orthopyroxene ($Fs_{0.9\text{-}2.0}Wo_{1.1\text{-}0.6}$, N = 3), subcalcic augite ($Fs_{1.0}Wo_{34.6}$), diopside ($Fs_{0.6\text{-}2.1}Wo_{41.5\text{-}37.8}$, N = 2).
Classification: Carbonaceous chondrite (CO3.0). The mean and range of Cr_2O_3 contents of ferroan olivine occurring as rims on more magnesian olivine is essentially the same as for ALHA 77307, which was designated as a CO3.0 by Grossman and Brearley (2005, Figure 5).
Specimens: 20.0 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 10562 (NWA 10562)
(Northwest Africa)
Purchased: 2015 Nov
Classification: HED achondrite (Howardite)
History: Purchased by Bob Falls in November 2015 from a dealer in Zagora, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Fragmental breccia consisting mainly of eucritic mineral debris plus some ophitic-textured eucrite clasts, plus some very fine grained granulitic clasts and ~15 vol.% of large grains (up to 3 mm across) of diogenitic orthopyroxene (with undulose extinction). Other minerals are exsolved pigeonite, calcic plagioclase, silica polymorph, olivine, ilmenite, Ti-free chromite, troilite and Ni-poor kamacite.
Geochemistry: Diogenitic orthopyroxene ($Fs_{25.1\text{-}25.2}Wo_{1.6\text{-}3.2}$, FeO/MnO = 26-31, N = 3), olivine ($Fa_{37.8\text{-}55.2}$, FeO/MnO = 48-50, N = 2), orthopyroxene host ($Fs_{57.9\text{-}59.9}Wo_{4.3\text{-}3.8}$, FeO/MnO = 27-30, N = 3), clinopyroxene exsolution lamellae ($Fs_{26.6\text{-}30.3}Wo_{42.4\text{-}39.9}$, FeO/MnO = 31-33, N = 3).
Classification: Howardite.
Specimens: 29.1 g including one polished thin section at *UWB*; remainder with Mr. R. Falls.

Northwest Africa 10563 (NWA 10563)
(Northwest Africa)

Purchased: 2015 Nov
Classification: Carbonaceous chondrite (CK4)
History: Purchased by Bob Falls in November 2015 from a dealer in Zagora, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Separated, well-formed granular chondrules (apparent diameter 1.3±1.0 mm; some with concentric dust rims) containing Cr-magnetite are set in a finer matrix containing Cr-magnetite and intermediate plagioclase. The studied thin section contains an inclusion (7 mm across) composed mainly of aluminous orthopyroxene and calcic bytownite (zoned to oligoclase rim) plus accessory olivine, K-feldspar and composite grains of magnetite (Ti- and Cr-free) with ilmenite.
Geochemistry: Olivine ($Fa_{29.4\text{-}29.7}$, FeO/MnO = 95-105, N = 3), orthopyroxene ($Fs_{25.1\text{-}25.2}Wo_{2.6\text{-}0.6}$, N = 3), clinopyroxene ($Fs_{10.8\text{-}14.7}Wo_{46.1\text{-}47.0}$, N = 2). Orthopyroxene in inclusion ($Fs_{26.8}Wo_{0.5}$, Al_2O_3 = 5.1 wt.%), plagioclase in inclusion (core $An_{89.8}Or_{0.1}$, rim $An_{25.9}Or_{9.1}$).
Classification: Carbonaceous chondrite (CK4).
Specimens: 26.4 g including one polished thin section at *UWB*; remainder with Mr. R. Falls.

Northwest Africa 10564 (NWA 10564)
(Northwest Africa)
Purchased: 2015 Dec
Classification: HED achondrite (Eucrite, monomict)
History: Purchased by Darryl Pitt in December 2015 from a dealer in Mauritania.
Petrography: (A. Irving and S. Kuehner, *UWS*) Matrix-poor breccia consisting mainly of closely packed, relatively fine-grained subophitic eucrite clasts. Minerals are exsolved pigeonite, calcic plagioclase, silica polymorph, Ti-chromite, ilmenite and troilite. Minor secondary calcite is present.
Geochemistry: Orthopyroxene host ($Fs_{62.6\text{-}63.6}Wo_{2.6\text{-}2.5}$, FeO/MnO = 31, N = 3), clinopyroxene exsolution lamellae ($Fs_{26.8\text{-}27.8}Wo_{43.9\text{-}43.1}$, FeO/MnO = 30-33, N = 3), fayalite ($Fa_{80.2}$, FeO/MnO = 43).
Classification: Eucrite (monomict breccia).
Specimens: 21.2 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 10565 (NWA 10565)
(Northwest Africa)
Purchased: 2015 Dec
Classification: Ordinary chondrite (LL6)
History: Purchased by Aras Jonikas in December 2015 from a Moroccan dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular clasts (mostly recrystallized with rare remnant, relatively large chondrules) in a finer matrix.
Geochemistry: Olivine ($Fa_{29.0\text{-}32.6}$, N = 3), orthopyroxene ($Fs_{23.4\text{-}23.5}Wo_{1.6\text{-}1.5}$, N = 3), clinopyroxene ($Fs_{9.5\text{-}9.9}Wo_{43.8\text{-}43.3}$, N = 2).
Classification: Ordinary chondrite (LL6 breccia).
Specimens: 29 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

Northwest Africa 10566 (NWA 10566)
(Northwest Africa)
Purchased: 2015 Jan
Classification: Lunar meteorite (feldspathic breccia)

History: Purchased by Dr. David Gregory in January 2015 from a Moroccan dealer at the Tucson Gem and Mineral Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Fragmental breccia composed of angular mineral clasts of anorthite, pigeonite, ferropigeonite, orthopyroxene, augite, fayalitic olivine, silica polymorph, ilmenite, Cr-Ti-Fe spinel, troilite and kamacite, plus sparse rounded to angular glass fragments, set in a finer matrix. Some pigeonite grains are exsolved.
Geochemistry: Low-Ca pyroxene ($Fs_{29.8}Wo_{5.2}$, FeO/MnO = 50), pigeonite ($Fs_{23.7}Wo_{10.0}$, FeO/MnO = 44), ferropigeonite ($Fs_{55.2}Wo_{16.2}$, FeO/MnO = 66), augite ($Fs_{44.5}Wo_{38.9}$, FeO/MnO = 66), fayalite ($Fa_{71.2}$; $Fa_{96.2}$; FeO/MnO = 82-108; N = 2), plagioclase ($An_{94.6\text{-}97.0}Or_{0.2\text{-}0.0}$, N = 2). Bulk composition (R. Korotev, *WUSL*): INAA of subsamples gave (in wt.%) Na_2O 0.41, FeO 13.86; (in ppm) Sc 30.2, Cr 1920, Co 42.3, Ni 190, La 6.76, Sm 3.20, Eu 0.888, Yb 2.30, Lu 0.324, Hf 2.2, Th 0.93.
Classification: Lunar (feldspathic breccia). Paired with NWA 7611 and NWA 8277 based on matching bulk elemental compositions.
Specimens: 20 g including one polished thin section at *ROM*; remainder with *Gregory*.

Northwest Africa 10567 (NWA 10567)
(Northwest Africa)
Purchased: 2014
Classification: Martian meteorite (Shergottite)
History: Purchased by Aziz Habibi in Morocco, 2014.
Physical characteristics: Two identical appearing stones (276 and 47 g) with weathered fusion crust, some light-colored desert sediment coating. A broken surface reveals fine-grained, light gray-green basaltic texture.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished epoxy mount shows ~10% olivine, ~60% pyroxene, ~25% maskelynite, ubiquitous Cr-Ti-Fe oxides and troilite. Pyroxenes and olivines show igneous zonation in BSE images. Heavily shocked, with grain size from ~50-500 μm.
Geochemistry: (C. Agee and N. Muttik, *UNM*) EMPA. Olivine $Fa_{49.9\pm4.9}$, Fe/Mn=55±1, n=24; pigeonite $Fs_{31.8\pm4.6}Wo_{10.1\pm2.2}$, Fe/Mn=31±2, n=36; augite $Fs_{24.0\pm2.6}Wo_{29.4\pm5.0}$, Fe/Mn=29±2, n=7; maskelynite $Or_{3.1\pm0.5}Ab_{48.5\pm3.0}An_{48.3\pm3.4}$, n=12.
Classification: Achondrite (Martian basalt), olivine-phyric shergottite, zoned olivines and pigeonites show significant iron-enrichment trend.
Specimens: 20.4 g including microprobe mount on deposit *UNM*, Aziz Habibi holds 190 g, Jean Redelsperger holds 56 g, Jay Piatek holds 47 g.

Northwest Africa 10568 (NWA 10568)
(Northwest Africa)
Purchased: 2015
Classification: HED achondrite (Eucrite, brecciated)
History: The meteorite was bought in 2015 from the Moroccan meteorite dealers Med Lamine Ahmed and Cheikh El Fakraoui.
Petrography: The meteorite is a breccia composed of basaltic clasts set into a more fine-grained clastic matrix. Clasts and matrix are dominantly composed of exsolved pyroxene and plagioclase grains of variable grain size ranging from 0.1 to 1 mm. Accessories include chromite, pyrrhotite, and silica.

Geochemistry: Low-Ca pyroxene: $Fs_{59\pm1.2}Wo_{3.3\pm1.1}$ ($Fs_{57.3\text{-}61.1}Wo_{1.9\text{-}5.1}$, n=15, FeO/MnO=28-34); Ca-pyroxene: $Fs_{27.1\pm0.9}Wo_{42.6\pm0.9}$ ($Fs_{25.8\text{-}28.9}Wo_{41\text{-}44.3}$, n=14, FeO/MnO=29-34); calcic plagioclase: $An_{88.9\pm0.5}$ ($An_{88.1\text{-}90}$, n=14)

Northwest Africa 10569 (NWA 10569)
(Northwest Africa)
Purchased: 2015
Classification: HED achondrite (Eucrite, brecciated)
History: The meteorite was bought in 2015 from the Moroccan meteorite dealers Med Lamine Ahmed and Cheikh El Fakraoui.
Petrography: The meteorite is a eucritic breccia composed of coarse basaltic clasts set into a fine-grained and commonly shock-melted matrix. Dominant minerals in both lithologies are exsolved pyroxene and up to 1 mm sized calcic plagioclase grains. Minor phases include chromite and silica polymorphs.
Geochemistry: Low-Ca pyroxene: $Fs_{60.7\pm0.7}Wo_{2.2\pm0.7}$ ($Fs_{58.9\text{-}61.6}Wo_{1.7\text{-}4}$, n=15, FeO/MnO=30-35); Ca-pyroxene: $Fs_{26.5\pm0.9}Wo_{43.9\pm1}$ ($Fs_{26\text{-}29.8}Wo_{40.2\text{-}44.6}$, n=16, FeO/MnO=29-40); calcic plagioclase: $An_{90\pm1.9}$ ($An_{85.2\text{-}92.4}$, n=15).

Northwest Africa 10571 (NWA 10571)
(Northwest Africa)
Purchased: 2016
Classification: Carbonaceous chondrite (CV3)
History: The meteorite was bought in 2016 from the Moroccan meteorite dealer Hamza Lharbi in Guelmim, Morocco.
Petrography: The meteorite shows an almost black interior and is composed of about 0.1-0.3 mm sized chondrules, rare chondrule pseudomorphs, mineral fragments and few CAIs often surrounded by fine-grained accretionary rims set into an abundant fine-grained matrix. No type II chondrules were observed. Main matrix phases identified by high-resolution electron microbe analyses are phyllosilicates, carbonates, and pyrrhotite. The matrix is Fe-rich. FeNi metal is rare.

Northwest Africa 10573 (NWA 10573)
(Northwest Africa)
Purchased: 2016
Classification: Carbonaceous chondrite (CV3)
History: The meteorite was bought in 2016 from the Moroccan meteorite dealer Hamza Lharbi in Guelmim, Morocco.
Petrography: The meteorite displays a dark grayish interior and is composed of up to several-mm sized chondrules, abundant whitish CAIs, and olivine amoeboids set into a fine-grained, almost opaque matrix. Some chondrules show brownish staining due to terrestrial alteration. No type II chondrules were observed.

Northwest Africa 10574 (NWA 10574)
(Northwest Africa)
Purchased: 2016
Classification: Carbonaceous chondrite (CM2)

History: Many small meteorite fragments were bought in 2016 from the Moroccan meteorite dealer Hamza Lharbi in Guelmim, Morocco.
Petrography: The meteorite shows an almost black interior and is composed of about 0.1-0.3 mm chondrules, chondrule pseudomorphs, mineral fragments and rare CAIs often surrounded by fine-grained accretionary rims set into an abundant fine-grained matrix. Main matrix phases are phyllosilicates, carbonates, and pyrrhotite.

Northwest Africa 10577 (NWA 10577)
(Northwest Africa)
Purchased: 2015
Classification: HED achondrite (Eucrite)
History: The meteorite was bought in 2015 from a local meteorite dealer in Morocco.
Petrography: The unbrecciated meteorite displays a relatively coarse-grained basaltic texture of exsolved pyroxene and lath-shaped calcic plagioclase with grain sizes of up to 1 mm. Minor phases include chromite, ilmenite and SiO_2 polymorphs.
Geochemistry: low-Ca pyroxene: $Fs_{60.5\pm0.9}Wo_{2.4\pm0.7}$ ($Fs_{58.6\text{-}62.7}Wo_{1.9\text{-}4.6}$, n=15, FeO/MnO=32-37); Ca-pyroxene: $Fs_{26.5\pm0.4}Wo_{43.8\pm0.4}$ ($Fs_{25.8\text{-}27.1}Wo_{43.4\text{-}44.7}$, n=15, FeO/MnO=30-33); calcic plagioclase: $An_{88.3\pm2}$ ($An_{81.9\text{-}90.4}$, n=15)

Northwest Africa 10580 (NWA 10580)
(Northwest Africa)
Purchased: October 2015
Classification: Carbonaceous chondrite (CO3)
History: Purchased from a Moroccan dealer, October 2015.
Physical characteristics: Many identical appearing stones. Shiny, black to dark brown, smooth weathered exterior with very small chondrule pits; saw cuts reveals numerous small chondrules and a few small CAIs set in a dark-brown matrix.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous chondrules, many fragmental or irregular, most in the size range 50-200 μm, a few up to 600 μm. Scattered metal/sulfide blebs, fine-grained matrix makes up about 50% of this meteorite. Most chondrules appear to be Type I with forsteritic olivine, enstatitic pyroxene or aluminous diopside. Very few Type II chondrules were observed.
Geochemistry: (C. Agee and M. Spilde, *UNM*) All chondrule olivine $Fa_{9.5\pm17.5}$, Cr_2O_3=0.33±0.16, n=20; Type I chondrule olivines $Fa_{0.7\pm0.2}$, Cr_2O_3=0.27±0.16, n=11; ferroan chondrule olivines ranged from $Fa_{2\text{-}59}$ with an average of $Fa_{21.9\pm23.0}$, Fe/Mn=78±58, Cr_2O_3=0.41±0.14, n=9; Type I chondrule low-Ca pyroxene $Fs_{1.3\pm0.4}Wo_{1.5\pm1.7}$, n=5; Type II chondrule low-Ca pyroxene $Fs_{20.6\pm18.8}Wo_{1.6\pm1.8}$, Fe/Mn=69±20, n=2; aluminous diopside $Fs_{3.2\pm0.8}Wo_{39.7\pm16.5}$, n=2.
Classification: Carbonaceous chondrite (CO3), likely type 3.0 based on mean value and sigma of Cr_2O_3 in ferroan olivine (Grossman and Brearley, 2005), however there were too few Type II chondrules present (n=9) in the probe section to obtain good statistics.
Specimens: 21.73 g including a probe mount on deposit at *UNM*, Gary Fujihara holds the main mass.

Northwest Africa 10582 (NWA 10582)
Morocco, (Northwest Africa)

Purchased: 2015 Feb
Classification: Ordinary chondrite (H4, melt breccia)
Physical characteristics: Single stone, dark brown crust. The sawn surface shows a black matrix with several metal spots and no evident chondrules.
Petrography: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*); The thin polished section displays a texture composed of clasts containing rare remnant chondrules within a dark, very fine-grained black matrix. The matrix contains scattered grains of metal and rounded troilite blebs. Shock stages are S2 for clasts and S5 for matrix.
Geochemistry: (V. Moggi Cecchi, G. Pratesi, S. Caporali, M.Zoppi, *UniFi*) Olivine ($Fa_{19.3\pm1.0}$, N=7), orthopyroxene ($Fs_{16.7\pm0.8}Wo_{1.2\pm0.2}$, N = 8). Analyses were done for both clasts and matrix.
Classification: Ordinary Chondrite (H5-melt breccia); S5; W3
Specimens: A total of 21.2 g specimen and one thin section is on deposit at MSN-Fi. Tomelleri holds the main mass.

Northwest Africa 10583 (NWA 10583)
Morocco
Purchased: 2015
Classification: Ordinary chondrite (LL3)
Petrography: Chondrules range up to 8 mm in diameter with an average size of -600 μm. The rock has very little metallic Fe: <0.1 wt.% unaltered metal, but it does contain -3 vol.% limonite. Troilite is also present. The range $Fa_{2.4\text{-}24.3}$ of the olivine and range $Fs_{1.8\text{-}18.5}$ for pyroxene are consistent with a petrologic type of <3.5.

Northwest Africa 10585 (NWA 10585)
Morocco
Purchased: 2015
Classification: Carbonaceous chondrite (CV3)
Petrography: Chondrules range in size with 700-1000 μm; many have igneous rims. Many chondrules have abundant metal-sulfide blebs in their interiors. Also present is limonite, formed by terrestrial weathering of metal. The apparent lack of magnetite suggests that the rock is a reduced CV3 chondrite. The meteorite contains ~35 vol.% matrix. Also present is a Fluffy Type A CAI that is 2.8 mm across. One AOA was observed; it is 480 μm long.
Classification: CV3-reduced.

Northwest Africa 10586 (NWA 10586)
Morocco
Purchased: 2015
Classification: Rumuruti chondrite (R3-4)
Petrography: Chondrules have an average size of ~400 μm. The chondrules are well defined. The rock is highly weathered. R3 clasts constitute about 5 vol.% of the rock; the clasts are up to 1 cm in size. The meteorite contains ~40 vol.% matrix that is stained red-orange from terrestrial weathering. The opaque phases include only pyrrhotite and limonite; no metallic Fe-Ni is discernable.
Geochemistry: Olivine $Fa_{36.5\pm4.4}$, n=14, low-Ca pyroxene $Fs_{26.3\pm4.0}Wo_{1.4\pm1.0}$, n=6.

Northwest Africa 10588 (NWA 10588)

Morocco
Purchased: 2015
Classification: Carbonaceous chondrite (CK3)
Petrography: The rock has a strong petrofabric; chondrules are significantly fractured. Many chondrules have igneous rims; the average chondrule diameter is ~900 μm. Broken amoeboid olivine inclusions are present. Also present is a CAI composed of olivine, diopside and anorthite that may be a melted AOI. Unlike typical CK chondrites, the matrix of the meteorite is opaque (as in CV3 chondrites); unlike most CV chondrites, the mean olivine Fa content is very high. The matrix constitutes 35-40 vol.% of the rock. Low-Ca pyroxene exhibits polysynthetic twinning. Olivine grains exhibit weak mosaic extinction. Limonite patches and veins are present. There are also small sulfide grains and a few magnetite grains 10-20 μm in size.
Geochemistry: This rock seems to be intermediate between normal CV3 chondrites and typical CK4 chondrites. CK3 is the best classification.

Northwest Africa 10589 (NWA 10589)
Morocco
Purchased: 2015
Classification: Carbonaceous chondrite (CV3)
Petrography: Chondrules range from 300-1700 μm in diameter and have an average diameter of ~850 μm; many chondrules have igneous rims. Also present are a few mm-sized amoeboid olivine inclusions and a few small CAIs, 300-700 μm in size. The rock contains ~40 vol.% matrix. Opaque phases include sulfide, magnetite and only rare grains of metallic Fe-Ni. This suggests that the rock is an oxidized CV3 chondrite.
Classification: CV3-oxidized

Northwest Africa 10591 (NWA 10591)
Morocco
Purchased: 2015
Classification: Carbonaceous chondrite (CR2)
Petrography: The average chondrule size is ~900 μm; some chondrules have igneous rims. Some chondrules are rimmed by small metal blebs and limonite formed by terrestrial weathering of the metal. Some chondrules contain abundant devitrified glass. There are also metal spherules in the matrix up to 600 μm in size. Some chondrules contain internal metal spherules ranging in size from 50-250 μm. The meteorite contains ~45 vol.% matrix. Sulfide is very rare, <1 vol.%.
Geochemistry: Olivine $Fa_{1.7\pm1.0}$, n=23; low-Ca pyroxene $Fs_{2.2\pm1.1}Wo_{1.1\pm0.8}$, n=16.

Northwest Africa 10593 (NWA 10593)
Morocco
Purchased: 2014 Sept
Classification: Martian meteorite (Shergottite)
History: Purchased by D. *Gregory* at the Denver mineral show in September 2014 from a Moroccan dealer
Physical characteristics: (I. Nicklin, *ROM*) Two pieces with an aggregate weight of 279.0 g, the largest piece weighs 219.0 g. Notably regmaglypted surface with significant (~50%) remnant fusion crust, although some of what appears to be fusion crust is actually melt glass showing through from the interior of the specimen. A small amount of caliche is present on one surface.

Where the fusion crust is absent, the interior contains small, randomly oriented, gray-green pyroxene grains surrounding transparent grains of plagioclase.
Petrography: Petrograph: (I. Nicklin, *ROM*) In thin section, the rock is composed of medium-grained prismatic pyroxenes up to 2.5 mm in length intermixed with more equant pyroxene grains in the 1 mm range. The prismatic pyroxenes show twinning. The pyroxenes generally surround stubby to lath-shaped grains of isotropic plagioclase-composition glass based on EMP analysis. In crossed polars, this glass shows crystallites of sub-radiating, gray-white anisotropic needles arranged in margins where the glass is in contact with pyroxene grains. Another notable feature is the presence of large areas (~25% of the cut surface area) of dark-colored, interconnecting melt-glass pockets with vesicles up to or exceeding 1 mm in greatest dimension. In addition to the melt-glass pockets, vesicles and plagioclase-composition glass there are pervasive planar fractures especially noticeable in the prismatic pyroxenes and mosaicism plainly apparent in all the pyroxene grains. No olivine has been observed.
Geochemistry: Mineral compositions and geochemistry: (V. Di Cecco, *ROM*) Pyroxenes: chaotically zoned augite cores ($Fs_{27.6\pm7.8}Wo_{30.6\pm1.8}$ (n=11); FeO/MnO = 30.8±3.6 (n=11)) ferropigeonite rims ($Fs_{61.4\pm7.4}Wo_{17.1\pm2.8}$ (n=7) ; FeO/MnO = 38.4±1.2 (n=7)) and pigeonite mantles ($Fs_{39.2\pm8.0}Wo_{13.6\pm1.9}$ (n=11); FeO/MnO = 32.2. The average composition of the plagioclase is $An_{48.3\pm4.7}Or_{2.85\pm1.7}$ (n=19). Oxygen isotopes (K. Ziegler, *UNM*): analyses of four acid-washed subsamples by laser fluorination gave, respectively, $\delta^{17}O$ = 2.576, 2.736, 2.710, 2.582; $\delta^{18}O$ 4.373, 4.714, 4.691, 4.484; $\Delta^{17}O$ = 0.267, 0.247, 0.233, 0.214 (all values in per mil).
Classification: Martian (shergottite)
Specimens: 20.5 g plus one polished thin section are on hand at the *ROM* and constitute type material. The remainder is held by *Gregory*.

Northwest Africa 10595 (NWA 10595)
(Northwest Africa)
Purchased: 2014 Dec
Classification: Ordinary chondrite (L3-4)
Petrography: The rock is a breccia. The studied thin section of about 2 cm^2 consists of two different lithologies: an equilibrated type 4 and an unequilibrated type 3 lithology. Both lithologies cover a roughly similar area in thin section
Geochemistry: Mineral compositions and geochemistry: Mineral compositions in both lithologies have been analyzed separately. Olivine within the equilibrated part is $Fa_{23.8\pm0.3}$ (n=12) and low-Ca pyroxene is $Fs_{20.0\pm2.0}Wo_{1.2\pm1.2}$ (n=9). Olivine within the unequilibrated part is $Fa_{18.8\pm8.6}$ ($Fa_{2\text{-}29}$, n=24) and low-Ca pyroxene is $Fs_{16.0\pm9.2}Wo_{1.5\pm2.2}$ ($Fs_{2.3\text{-}39.1}Wo_{0.2\text{-}7.4}$, n= 17); both parts have a well-preserved chondritic texture and chondrules of similar size.

Northwest Africa 10596 (NWA 10596)
Morocco
Purchased: 2014
Classification: HED achondrite (Eucrite, brecciated)
History: A sample of 58.6 g was purchased in 2014 in Dakhla, Morocco, from a meteorite dealer.
Petrography: (A. Bischoff, *IfP*) Different basaltic and granulitic eucrite clasts and mineral fragments are embedded within a brownish groundmass. The matrix represents a crystallized

melt mainly consisting of small pyroxene and plagioclase crystals. This texture is typical for melt rocks formed by impact processes.
Geochemistry: Mineral compositions and geochemistry: (M. Patzek, A. Bischoff, *IfP*): Pyroxenes and plagioclase of the lithic clasts were analyzed. Low-Ca pyroxene: $Fs_{57}Wo_{8}$ ($Fs_{53-61}Wo_{3-14}$). Ca-pyroxene: $Fs_{29}Wo_{41}$ (range $Fs_{27-33}Wo_{39-42}$). Plagioclase: $An_{92.3\pm1.5}$ (An_{88-94}; n=13). Fe/Mn of all pyroxene: 33±3. All are typical values for eucritic samples.
Classification: Brecciated eucrite (clast-rich melt rock)

Northwest Africa 10597 (NWA 10597)
Morocco
Purchased: 2016 Feb
Classification: Lunar meteorite (basalt)
History: Purchased by Ke Zuokai in Feb. 2016 at Tucson mineral show from an anonymous Moroccan dealer.
Physical characteristics: A single stone with a complete fresh fusion crust.
Petrography: The meteorite is a medium-grained unbrecciated basalt composed of elongate, zoned pyroxene (up to 1 mm) grains and plagioclase (up to 1.2 mm) laths. Olivine phenocrysts are up to 350 μm, and commonly have inclusions of hercynite, Ti-Al-rich chromite, pigeonite or rarely augite with intergrowth of Na-rich glass. Most pyroxene grains are pigeonite with a minor amount of augite. A few pigeonite grains have augite rims. Plagioclase is partly converted to maskelynite. Late-stage mesostasis is composed of silica, Fe-rich olivine, Fe-rich pyroxene, K-rich glass, ilmenite, pyrrhotite, baddeleyite, and elongate, skeletal apatite and merrillite. Other opaque phases include chromite, Ti-rich chromite, troilite, ulvöspinel, tranquillityite, zirconolite and a few FeNi metal. Shock veins and impact melt pockets are present. Mineral modes (vol%): olivine = 6, pyroxene =52, plagioclase = 32, silica=3, ilmenite = 4, mesostasis + impact melt = 3.
Geochemistry: Plagioclase, $An_{85.1\pm2.3}Or_{0.4\pm0.3}$ ($An_{78.5-87.8}Or_{0.2-0.8}$, n=20); olivine zoned from $Fo_{58.2-49.9}$ (cores) to $Fo_{36.6-40.7}$ (rims) ($Fa_{46.5-93.1}$, n=13; FeO/MnO = 81.9-106.8, average: 91±7); zoned pigeonite, core $En_{57.7-51.6}Wo_{8.9-16.8}$, rim $En_{7.2-22}Wo_{20.2-31.5}$ ($Fs_{28.5-79.6}Wo_{10.1-25.5}$, n=23), and augite, $Fs_{21.3-52.5}Wo_{28.4-39.3}$ ($Wo_{32.9-36.2}$ $En_{11.9-38.8}$, n=9), with pyroxene FeO/MnO = 30.8-81.9, average: 60±10; mesostasis olivine and pyroxene, $Fo_{2.3-13.5}$ and $En_{1-3}Wo_{14-17}$. Chemical compositions (wt.%) of fusion crust: MgO 7.0, FeO 23.5, Al_2O_3 7.9, SiO_2 47.4, CaO 10.6, TiO_2 3.5.

Northwest Africa 10598 (NWA 10598)
(Northwest Africa)
Purchased: 2016
Classification: Ordinary chondrite (LL3.15)
History: Purchased by Morten Bilet, January 2016 from a Moroccan meteorite dealer.
Physical characteristics: Single stone with weathered exterior. Saw cuts shows many densely packed chondrules set in a brown matrix, some chondrules up to 5 mm in diameter.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous porphyritic chondrules, most with mesostasis or glass. Abundant opaque matrix. Apparent mean chondrule diameter 650±450 μm, n=22.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Chondrule olivine $Fa_{17.0\pm9.4}$, Cr_2O_3=0.22±0.08 (wt%), n=29; chondrule low-Ca pyroxene $Fs_{10.4\pm9.0}Wo_{2.5\pm3.1}$, n=7.

Classification: Ordinary chondrite (LL3.15), subtype 3.15 based on mean values of Fa and Fs and 1-sigma standard deviation, and on the ferroan olivine mean value of Cr_2O_3 and 1-sigma standard deviation (Grossman and Brearley, 2005).
Specimens: 22.5 g including a probe mount on deposit at *UNM*, Morten Bilet holds the main mass.

Northwest Africa 10599 (NWA 10599)
(Northwest Africa)
Purchased: 2015
Classification: Lunar meteorite (feldspathic breccia)
History: Purchased from Youssef Ait El Caid, Morocco, 2015.
Physical characteristics: One piece, no fusion crust, irregular weathered exterior, saw cut reveals prominent white feldspathic clasts set in a dark-gray groundmass.
Petrography: (C. Agee, *UNM*) Microprobe examination shows a polymict breccia with fragmental plagioclase, pyroxene, and olivine grains, lithic fragments, shock melt domains, and small vesicles. Pyroxenes are subcalcic augite and pigeonite with iron enrichment trends. Most olivine is approximately Fa_{37} however there were also a few fayalitic olivines (Fa_{62}) observed. Likewise, anorthite is the predominate plagioclase composition, but there were also a few bytownite (An_{85}) grains observed.
Geochemistry: (C. Agee and M. Spilde, *UNM*). Olivine $Fa_{37.1\pm2.4}$, Fe/Mn=95±8, n=7; pigeonite $Fs_{46.3\pm9.2}Wo_{6.4\pm1.7}$, Fe/Mn=65±1, n=3; augite $Fs_{36.5\pm12.2}Wo_{24.6\pm2.7}$, Fe/Mn=59±4, n=3; plagioclase $An_{95.6\pm1.1}$, n=4; Shock melt (20 μm defocused electron beam, proxy for bulk meteorite composition): SiO_2=44.03±0.87, TiO_2=0.50±0.21, Al_2O_3=26.95±2.82, Cr_2O_3=0.14±0.04, MgO=5.51±1.57, FeO=6.75±1.84, MnO=0.09±0.03, CaO=15.36±1.12, NiO=0.03±0.02, Na_2O=0.54±0.08, K_2O=0.09±0.02 (all wt%), FeO/MnO=80±16, n=10.
Classification: Achondrite (lunar feldspathic breccia)
Specimens: A total of 16 g including a probe mount on deposit at *UNM*. Frank Carroll holds the main mass.

Northwest Africa 10600 (NWA 10600)
Morocco
Purchased: 2016 Feb
Classification: Ordinary chondrite (H4)
History: Five stones, weighing 267, 348, 380, 413, and 476 g were found together. They were purchased by Ke Zuokai in February 2016 from a Moroccan dealer (Said Haddany).
Petrography: Well-defined BO and PP chondrules in sizes of 0.40-1.20 mm. FeNi metal, FeS, and chromite are present. Minimal weathering.
Geochemistry: Olivine ($Fa_{17.0\text{-}19.0}$), low-Ca pyroxene ($Fs_{9.2\text{-}19.9}Wo_{0.0\text{-}4.2}$), and high-Ca pyroxene ($Fs_{5.3\text{-}9.0}Wo_{32.2\text{-}44.8}$).

Northwest Africa 10601 (NWA 10601)
Morocco
Purchased: 2016 Feb
Classification: Ordinary chondrite (L4)
History: Purchased by Ke Zuokai in Feb. 2016 from a Moroccan dealer (Said Haddany).

Petrography: Well-defined porphyritic chondrules in sizes of 0.25-1.0 mm. FeNi metal, FeS, and chromite are present. Minimal weathering.
Geochemistry: Olivine ($Fa_{21.9-24.1}$), low-Ca pyroxene ($Fs_{18.5-19.7}Wo_{1.4-2.9}$), and high-Ca pyroxene ($Fs_{7.4-10.3}Wo_{31.7-43.0}$).

Northwest Africa 10602 (NWA 10602)
Mauritania
Purchased: April 2015
Classification: HED achondrite (Eucrite, melt breccia)
History: The sample was purchased by the main mass holder in Morocco, but is believed to originate in Mauritania.
Petrography: (R. Greenwood, *OU*) The meteorite is composed of angular, fine-grained, basaltic fragments up to 1 cm in diameter, enclosed in aphanitic, brown-stained, impact melt material. In a number of areas, oval vesicles up to 3 mm in long dimension are present in the impact melt material. The basaltic fragments have a generally uniform texture composed of acicular feldspar grains, generally less than 200 μm long, intergrown with dark, anhedral pyroxene grains. In places, a spherulitic texture is developed in the basaltic fragments, with elongate feldspars radiating outwards from a common point. Coarser-grained fragments with feldspar grains up to 0.5 mm long are also present. Feldspar in generally fresh, showing distinct undulose extinction in XPL. Pyroxene shows well-developed mosaicism.
Geochemistry: Mineral compositions and geochemistry: Pyroxene consists of a low-Ca pyroxene host, $Fs_{60.3\pm1.1}Wo_{3.7\pm1.3}En_{36.0\pm0.8}$ ($\pm1\sigma$, n=5), with well-developed exsolution lamellae of augite, $Fs_{27.3\pm1.1}Wo_{43.0\pm1.0}En_{29.7\pm0.5}$ ($\pm1\sigma$, n=4)). Plagioclase compositions are in the range $An_{85.9-91.4}$ (n=5). Oxygen isotopes: (Laser-assisted fluorination) $\delta^{17}O = 2.349‰$; $\delta^{18}O = 4.952‰$; $\Delta^{17}O = -0.246‰$ ($\Delta^{17}O$ calculated using method of Miller (2002), GCA 66, 1881-1889).
Classification: This meteorite is a brecciated eucrite with a significant impact melt component. It shows low to moderate weathering. May be paired with NWA 10603. However, the texture observed in polished section is fairly distinct from that of NWA 10603.
Specimens: A type specimen mass of 20.95 g is held at the *OU*. The main mass is held by Mohammed *Hmani*.

Northwest Africa 10603 (NWA 10603)
Mauritania
Purchased: April 2015
Classification: HED achondrite (Eucrite, melt breccia)
History: The sample was purchased by the main mass holder in Morocco but is believed to originate from Mauritania.
Petrography: (R. Greenwood, *OU*) The meteorite has a clastic texture, comprising angular, fine to medium-grained basaltic fragments, up to about 4 mm diameter, enclosed in a dark, flow-banded matrix. Plagioclase grains, are up to 1 mm long, show complex deformation twinning and are often cloudy and partially altered. Pyroxene grains show mosaicism. Numerous, distinct, sub-mm sized oval vesicles are present in the matrix.
Geochemistry: Mineral compositions and geochemistry: Pyroxene consists of a low-Ca pyroxene host, $Fs_{59.4\pm1.0}Wo_{5.4\pm1.1}En_{35.2\pm0.1}$($\pm1\sigma$, n=2), with well-developed exsolution lamellae of augite, $Fs_{29.3\pm2.6}Wo_{41.5\pm2.5}En_{29.2\pm0.2}$ ($\pm1\sigma$, n=3)). Plagioclase compositions are in the range $An_{88.3-91.5}$ (n=6). Accessory minerals include silica, chromite, zircon and ilmenite. Oxygen isotopes:

(Laser-assisted fluorination) $\delta^{17}O = 1.865‰$; $\delta^{18}O = 4.030‰$; $\Delta^{17}O = -0.247‰$ ($\Delta^{17}O$ calculated using method of Miller (2002), GCA 66, 1881-1889.
Classification: This meteorite is a brecciated eucrite with a significant impact melt component. It shows moderate weathering May be paired with NWA 10602. However, the texture observed in polished section is fairly distinct from that of NWA 10602.
Specimens: A type specimen mass of 21.86 g is held at *OU*. The main mass is held by Mohammed *Hmani*.

Northwest Africa 10604 (NWA 10604)
(Northwest Africa)
Purchased: 2014
Classification: Ordinary chondrite (L5)
History: 1 stone weighing 95.6 g was found in Morocco in 2014. David Holden acquired the sample from a meteorite prospector in Erfoud, 2014.
Physical characteristics: The stone is dark brown and has a rounded, irregular shape. The stone is covered by a weathered fusion crust that displays shallow regmaglypts. The cut face of the interior of the stone is orange in color and displays weathered flakes of FeS.
Petrography: Description and classification (A. Love, *App*): Sample displays heavily recrystallized chondritic texture crosscut by glassy, shock veins. Few chondrules are defined and have an average diameter of 1204 μm. Relict porphyritic chondrules have crystalline mesostasis.
Geochemistry: (A. Love, *App*) Olivine $Fa_{26.1\pm0.2}$, N=6; Low Ca pyroxene $Fs_{21.6\pm0.2}Wo_{1.9\pm0.2}$, N=6.
Classification: Based on textural relationships and mineral compositions, this is an L5, S3, W3 ordinary chondrite.
Specimens: An endcut and 1 slice weighing 19.15 g and a polished thin section are on deposit at *App*. David Holden holds the main mass.

Northwest Africa 10605 (NWA 10605)
(Northwest Africa)
Purchased: 2009
Classification: Ordinary chondrite (H5)
History: 1 stone weighing 136.2 g was found in Morocco in 2009. David Holden acquired the sample from a meteorite prospector in Erfoud, 2009.
Physical characteristics: The oriented stone is black and has a rounded, flattened shape. The stone is 90% covered by a weathered fusion crust that displays a well-defined rollover lip and distinctive bubbling on the trailing face. The cut face of the interior of the stone is mottled dark brown in color and displays small chondrules, chondrule fragments, dark clasts and abundant fresh flakes of metal.
Petrography: Description and classification (A. Love, *App*): Sample displays recrystallized chondritic texture. Chondrules are distinct and have an average diameter of 593 μm. Porphyritic chondrules have crystalline mesostasis.
Geochemistry: (A. Love, *App*) Olivine $Fa_{9.7\pm0.3}$, N=6; Low Ca pyroxene $Fs_{17.0\pm0.2}Wo_{2.1\pm0.2}$, N=6.
Classification: Based on textural relationships and mineral compositions, this is an H5, S4, W3 ordinary chondrite.
Specimens: An endcut and one slice weighing 20.2 g, and a polished thin section are currently on deposit at *App*. David Holden holds the main mass.

Northwest Africa 10606 (NWA 10606)
(Northwest Africa)
Purchased: 2009
Classification: Ordinary chondrite (H4)
History: 1 stone weighing 86.7 g was found in Morocco in 2009. David Holden acquired the sample from a meteorite prospector in Erfoud, 2009.
Physical characteristics: The stone is dark brown, rounded and is 90% covered by a weathered fusion crust. The interior of the stone is dark brown and shows chondrules, fragments and fresh and weathered flakes of metal and FeS grains.
Petrography: Description and classification (A. Love, *App*): Sample is transected by numerous FeOH-filled, bifurcating fractures and displays recrystallized chondritic texture. Chondrules are indistinct and have an average diameter of 547 μm. Porphyritic chondrules have crystalline mesostasis.
Geochemistry: (A. Love, *App*) Olivine $Fa_{18.4\pm0.6}$, N=9; Low Ca pyroxene $Fs_{11.5\pm4.3}Wo_{1.2\pm0.9}$ ($Fs_{6.5\text{-}19.1}$), N=8.
Classification: Based on textural relationships and equilibrated olivine compositions and unequilibrated pyroxene compositions, this is an H4, S3, W3 ordinary chondrite.
Specimens: An endcut and three slices weighing 17.9 g, and a polished thin section are currently on deposit at *App*. David Holden holds the Main mass.

Northwest Africa 10607 (NWA 10607)
(Northwest Africa)
Purchased: 2016
Classification: Ordinary chondrite (H4)
History: Purchased by Matt Morgan from a Moroccan meteorite dealer 2016.
Physical characteristics: Single stone, weathered exterior, a saw cut reveals numerous chondrules and opaques set in a brown groundmass.
Petrography: (C. Agee, *UNM*) This meteorite is has numerous close-packed chondrules, many porphyritic; fine grained plagioclase present. Fe-Ni metal is partially oxidized.
Geochemistry: (C. Agee and M. Splide, *UNM*) olivine $Fa_{18.4\pm1.3}$, Fe/Mn=37?6, n=32; low-Ca pyroxene $Fs_{13.3\pm2.8}Wo_{0.9\pm0.6}$, Fe/Mn=20±7, n=7.
Classification: Ordinary chondrite (H4)
Specimens: 22.25 g including a probe mount on deposit at *UNM*, *MtMorgan* holds the main mass.

Northwest Africa 10608 (NWA 10608)
(Northwest Africa)
Purchased: 2016
Classification: Lunar meteorite (feldspathic breccia)
History: Purchased by Jay Piatek in Morocco, 2016.
Physical characteristics: Single stone, weathered exterior without fusion crust; broken surface reveals numerous white feldspathic clasts set in a dark-gray groundmass.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows a fragmental breccia with numerous olivine, pigeonite, and augite grains set in a dominant feldspathic matrix.

Lithic and melt clasts also observed. Pigeonite, augite, and olivine show igneous crystallization, iron-enrichment trends.
Geochemistry: (C. Agee and S. Spilde, *UNM*) Olivine $Fa_{22.2\pm15.5}$, Fe/Mn=91±7, n=15; pigeonite $Fs_{32.3\pm10.6}Wo_{5.7\pm3.4}$, Fe/Mn=58±4, n=7; augite $Fs_{21.2\pm13.4}Wo_{39.1\pm5.3}$, Fe/Mn=50±14, n=3; plagioclase $An_{95.3\pm2.4}$, n=2.
Classification: Lunar feldspathic breccia
Specimens: 20.8 g including a probe mount on deposit at *UNM*, Jay Piatek holds the main mass.

Northwest Africa 10609 (NWA 10609)
(Northwest Africa)
Purchased: 2016
Classification: Lunar meteorite (feldspathic breccia)
History: Purchased by Gary Fujihara from Morocco, 2016.
Physical characteristics: Single stone, weathered exterior without fusion crust. Cut and polished surface reveals numerous white feldspathic clasts set in a dark-gray groundmass. Some of the feldspathic clasts have a reddish tint.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows a fragmental breccia with numerous olivine, pigeonite, and augite grains set in a dominant feldspathic matrix. Lithic and melt clasts with vesicles were also observed.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{38.9\pm14.5}$, Fe/Mn=94±8, n=11; pigeonite $Fs_{39.4\pm7.5}Wo_{9.2\pm6.1}$, Fe/Mn=61±4, n=8; augite $Fs_{21.1\pm4.7}Wo_{38.3\pm3.4}$, Fe/Mn=50±4, n=3; plagioclase $An_{95.7\pm0.7}$, n=6.
Classification: Lunar feldspathic breccia
Specimens: 8.66 g including a probe mount on deposit at *UNM*, Gary Fujihara holds the main mass.

Northwest Africa 10610 (NWA 10610)
(Northwest Africa)
Purchased: 2015
Classification: Carbonaceous chondrite (CK5)
History: Purchased by Gary in from Morocco, 2015.
Physical characteristics: Single stone with fusion crust. Saw cut surfaces reveal scattered, clearly defined, millimeter-sized, dark-colored chondrules, and a few faint CAIs, set in dark green-brown matrix.
Petrography: (C. Agee, *UNM*) This meteorite has distinct, equilibrated, olivine-rich chondrules. The recrystallized matrix consists mainly of olivine and lesser amounts of augite; trace low-Ca pyroxene. The mean diameter of plagioclase grains (~25 μm) indicates type 5. Olivine is nickel-rich and magnetite is present throughout.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{33.2\pm0.3}$, Fe/Mn=127±11, NiO=0.53 wt%, n=11; augite $Fs_{10.8\pm2.2}Wo_{47.0\pm1.1}$, Fe/Mn=84±29, n=9; low-Ca pyroxene $Fs_{27.2\pm0.0}Wo_{2.3\pm2.0}$, Fe/Mn=73±1, n=2.
Classification: Carbonaceous chondrite (CK5)
Specimens: 7.03 g including a probe mount on deposit at *UNM*, Gary Fujihara holds the main mass.

Northwest Africa 10611 (NWA 10611)

Morocco
Purchased: 2016 Feb
Classification: HED achondrite (Eucrite)
History: Purchased by Ke Zuokai in Feb. 2016 from a Moroccan dealer.
Physical characteristics: An irregular stone without fusion crust.
Petrography: The breccia contains fragments of coarse-grained gabbroic and subophitic basaltic clasts ranging in size of 0.2 to 7 mm. The rock fragments and some mineral clasts set in a medium- to fine-grained matrix (10~ 100 μm) composed of elongate calcic plagioclase and subhedral or anhedral pyroxene. Accessories include chromite, ilmenite and SiO_2 polymorphs.
Geochemistry: Plagioclase, $An_{86.4\pm2}Or_{0.4\pm0.2}$ ($An_{82.5\text{-}89.6}Or_{0.1\text{-}1}$, n=31); pigeonite, $Fs_{51.5\pm7.1}Wo_{13\pm5}$ ($Fs_{31.7\text{-}61.4}Wo_{5.3\text{-}23.8}$, n=32); augite, $Fs_{28.1\pm1.9}Wo_{43\pm0.3}$ ($Fs_{27.1\text{-}30.3}Wo_{42.7\text{-}43.3}$, n=3); orthopyroxene, $Fs_{58.9\pm1}Wo_{3.8\pm1.4}$ ($Fs_{58.2\text{-}59.6}Wo_{2.8\text{-}4.8}$, n=2); all pyroxenes, FeO/MnO = 29±2.

Northwest Africa 10612 (NWA 10612)
Morocco
Purchased: 2016 Feb
Classification: HED achondrite (Eucrite)
History: Purchased by Ke Zuokai in Feb. 2016 from a Moroccan dealer.
Physical characteristics: An irregular stone without fusion crust.
Petrography: The brecciated meteorite displays an overall basaltic texture of exsolved pyroxene and plagioclase ranging from 0.1-1.5 mm. Accessory minerals include ilmenite, chromite and SiO_2 polymorphs. Melt veins and melt pockets are common, consisting of crystallite and angular minerals.
Geochemistry: Plagioclase, $An_{88.1\pm2.9}Or_{0.4\pm0.2}$ ($An_{85.9\text{-}96.6}Or_{0.2\text{-}0.8}$, n=15); orthopyroxene, $Fs_{60.6\pm1}Wo_{2.5\pm0.7}$ ($Fs_{59\text{-}62.2}Wo_{1.7\text{-}3.4}$, n=10); pigeonite, $Fs_{55.9\pm1.5}Wo_{7.6\pm2.3}$ ($Fs_{54.4\text{-}57.3}Wo_{5.2\text{-}9.6}$, n=4); augite, $Fs_{26.2\pm1.8}Wo_{43.4\pm0.7}$ ($Fs_{25.2\text{-}27.3}Wo_{42.4\text{-}44.3}$, n=8); all pyroxenes, FeO/MnO = 29±1.

Northwest Africa 10613 (NWA 10613)
Morocco
Purchased: 2013 Sept
Classification: HED achondrite (Eucrite)
History: Purchased by Ke Zuokai in Sept. 2013 from a Moroccan dealer who wants to be anonymous.
Physical characteristics: An irregular stone without fusion crust.
Petrography: The brecciated meteorite displays an overall basaltic texture of dominantly calcic plagioclase and exsolved pyroxene. Accessory minerals include spinel, chromite, ilmenite, and SiO_2 polymorphs.
Geochemistry: Low Ca pyroxene, $Fs_{60.8\pm1.1}Wo_{2.7\pm1.1}$ ($Fs_{58.8\text{-}62.1}Wo_{1.6\text{-}4.1}$, Fe/Mn=32.9±0.8, n=14); augite, $Fs_{55.8\pm4.2}Wo_{6.8\pm2.3}$ ($Fs_{26.1\text{-}28.4}Wo_{39.7\text{-}43.3}$, Fe/Mn=31.8±1.1, n=9); minor pigeonite, $Fs_{24.7\pm1.1}Wo_{42.2\pm1.2}$ ($Fs_{52.8\text{-}58.8}Wo_{5.2\text{-}8.4}$, Fe/Mn=32.8±0.9, n=2); plagioclase, $An_{86.8\pm1.1}Or_{0.4\pm0.1}$ (n=8).

Northwest Africa 10617 (NWA 10617)
(Northwest Africa)
Purchased: 2014
Classification: Rumuruti chondrite (R3)

History: Matthew Martin purchased a 294 g meteorite from a Moroccan dealer at the 2014 Tucson Gem and Mineral Show.
Physical characteristics: Exterior of the stone is shiny and wind polished. Sawn surfaces show a breccia of orange-tan clasts to 1 cm and rarer black clasts in an orange-tan matrix. Chondrules prominent to 2.5 mm, though majority <0.9 mm.
Petrography: A polished microprobe section chosen from the dominant orange-tan area. Abundant chondrules and fragments set in an orange-tan matrix. Chondrules to 1 mm. Dominant minerals are olivine, sub-calcic augite, and augite with minor low-Ca pyroxene, chromite, and FeNi-sulfide. One small (40 μm) Ni-rich Fe grain found. Sulfides heavily oxidized.
Geochemistry: (L. Garvie, *ASU*) Olivine, $Fa_{36.6\pm10.5}$ ($Fa_{16.9\text{-}59.9}$, n=15, Fe/Mn=94.8±22.9, NiO to 0.9 wt%, Cr_2O_3 to 0.4 wt%, and P_2O_5 to 0.5 wt%). High-Ca pyroxene, $Fs_{11.5\pm2.8}Wo_{42.1\pm5.4}$ (n=5). Low-Ca pyroxene, $Fs_{8.4}Wo_{0.5}$ (n=1).
Classification: Rumuruti chondrite (R3), weathering high.
Specimens: 24.5 g and one polished mount at *ASU*.

Northwest Africa 10618 (NWA 10618)
(Northwest Africa)
Purchased: 2015 Oct
Classification: Martian meteorite (Shergottite)
History: Purchased in Erfoud, Morocco by Aziz Habibi in October 2015.
Physical characteristics: The specimen (93.8 g) has an overall dark-gray interior with irregularly distributed, larger orangeish grains (oikocrysts).
Petrography: (A. Irving and S. Kuehner, *UWS*) Large, twinned prismatic grains (up to 1.1 cm long) of low-Ca pyroxene (pale orange in thin section) enclose small olivine chadacrysts. The dominant portion is a microgabbroic aggregate of olivine, pigeonite, subcalcic augite and maskelynite, with accessory Ti-rich chromite, Cr-bearing ilmenite, merrillite, chlorapatite, pyrrhotite and minor baddeleyite. All olivine is variably tan to deep brown in thin section (indicative of high shock).
Geochemistry: (S. Kuehner, *UWS*; P. Carpenter, *WUSL*) Olivine chadacrysts ($Fa_{39.9\text{-}40.1}$, FeO/MnO = 47, N = 3), low-Ca pyroxene oikocryst (core $Fs_{25.8}Wo_{5.3}$; rim $Fs_{30.0}Wo_{8.8}$, FeO/MnO = 28-29, N = 2), pigeonite ($Fs_{29.2\text{-}30.1}Wo_{10.3\text{-}11.3}$, FeO/MnO = 27-29, N = 4), sucalcic augite ($Fs_{19.2\text{-}20.5}Wo_{31.1\text{-}31.8}$, FeO/MnO = 23-24, N = 3), maskelynite ($An_{52.7\text{-}54.6}Or_{2.4\text{-}2.3}$, N = 2).
Classification: Martian (shergottite, poikilitic).
Specimens: 21.4 g including one polished thin section and one polished mount at *UWB*; remainder with Mr. A. Habibi.

Northwest Africa 10619 (NWA 10619)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (L4/5)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Sparse well-formed chondrules occur in a stained, coarsely-recrystallized matrix.
Geochemistry: Olivine ($Fa_{24.8\text{-}24.9}$, N = 3), orthopyroxene ($Fs_{2.1\text{-}20.6}Wo_{0.5\text{-}1.4}$, N = 3), clinopyroxene ($Fs_{8.2\text{-}8.8}Wo_{44.2\text{-}42.3}$, N = 2).

Classification: Ordinary chondrite (L4/5).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10620 (NWA 10620)
(Northwest Africa)
Purchased: 2016 Jan
Classification: Rumuruti chondrite (R4)
History: Purchased by Aras Jonikas in January 2016 from a Moroccan dealer.
Physical characteristics: A group of five identical stones with black fusion crusts and gray interiors (total weight 254.15 g).
Petrography: Very fresh specimen consisting of separated, well-formed chondrules (mostly with apparent diameter 0.2-1 mm, but one 2 mm; some with pentlandite-rich rims) in a finer matrix containing relatively abundant pentlandite. Other minerals are olivine, orthopyroxene, clinopyroxene, sodic plagioclase, Ti-bearing chromite and troilite.
Geochemistry: Olivine ($Fa_{39.4-39.6}$, N = 3), orthopyroxene ($Fs_{29.9-30.7}Wo_{2.4-3.0}$, N = 3), clinopyroxene ($Fs_{11.0-11.1}Wo_{45.0-45.1}$, N = 2), plagioclase ($An_{9.0-13.7}Or_{4.1-3.4}$, N = 2).
Classification: R4 chondrite.
Specimens: 21.44 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

Northwest Africa 10621 (NWA 10621)
(Northwest Africa)
Purchased: 2015 Feb
Classification: Lunar meteorite (feldspathic breccia)
History: Purchased by Matthew Martin in February 2015 from a Moroccan dealer at the Tucson Gem and Mineral Show.
Physical characteristics: The interiors of both stones (total weight 22 g) have a mottled dark and light-gray appearance, with some whitish clasts also present.
Petrography: (A. Irving and S. Kuehner, *UWS*) Very fine grained and relatively olivine-rich fragmental breccia consisting of mineral clasts of anorthite, olivine, pigeonite, subcalcic augite, augite, ilmenite, armalcolite and kamacite in a matrix containing minor barite.
Geochemistry: Olivine ($Fa_{26.5-26.9}$, FeO/MnO = 87-90, N = 2), pigeonite ($Fs_{23.1-23.3}Wo_{6.7-7.8}$, FeO/MnO = 50-58, N = 2), subcalcic augite ($Fs_{13.9}Wo_{34.0}$, FeO/MnO = 47), augite ($Fs_{12.5}Wo_{37.6}$, FeO/MnO = 43), plagioclase ($An_{91.1-91.3}Or_{1.1-1.3}$, N = 2). Bulk composition (R. Korotev, *WUSL*) INAA of subsamples gave (in wt.%) FeO 6.7, Na_2O 0.50; (in ppm) Sc 9.9, Cr 860, Co 40, La 15.7, Sm 7.2, Eu 1.49, Yb 4.7, Lu 0.65, Hf 5.8, Th 2.4.
Classification: Lunar (feldspathic breccia). Paired with NWA 8455 based on textural and bulk compositional similarities.
Specimens: A 4.36 g polished endcut piece is at *UWB*; remainder with Mr. M. Martin.

Northwest Africa 10622 (NWA 10622)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (H5)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to *PSF*.

Petrography: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules; relatively abundant altered metal.
Geochemistry: Olivine ($Fa_{18.6-18.7}$, N = 3), orthopyroxene ($Fs_{16.4-16.6}Wo_{1.1-3.3}$, N = 3), clinopyroxene ($Fs_{7.0-8.3}Wo_{44.7-44.9}$, N = 2).
Classification: Ordinary chondrite (H5).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10623 (NWA 10623)
(Northwest Africa)
Purchased: 2015 Dec
Classification: Carbonaceous chondrite (CV3)
History: Purchased by Darryl Pitt in December 2015 from a dealer in Mauritania.
Petrography: (A. Irving and S. Kuehner, *UWS*) Relatively large, granular chondrules (apparent diameter 0.2-3.0 mm, mean 1.3 mm) and irregularly shaped, very fine grained CAI (up to 2.8 mm long) are set in a very fine-grained orange matrix.
Geochemistry: Olivine ($Fa_{0.3-48.8}$, N = 3), orthopyroxene ($Fs_{1.3-1.4}Wo_{2.7-3.4}$, N = 3), clinopyroxene ($Fs_{0.6-2.6}Wo_{37.7-39.2}$, N = 2).
Classification: Carbonaceous chondrite (CV3).
Specimens: 22.8 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 10624 (NWA 10624)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (L5)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Somewhat recrystallized with sparse chondrules.
Geochemistry: Olivine ($Fa_{25.3-25.5}$, N = 3), orthopyroxene ($Fs_{21.2-21.3}Wo_{1.6-1.5}$, N = 3), clinopyroxene ($Fs_{6.4-7.0}Wo_{45.8-45.2}$, N = 2).
Classification: Ordinary chondrite (L5).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10625 (NWA 10625)
(Northwest Africa)
Purchased: 2014 Apr
Classification: Ureilite
History: Purchased by Scott Feek in April 2014 from a dealer in West Jordan, Utah, who had acquired the stone from a Moroccan source.
Petrography: (A. Irving and S. Kuehner, *UWS*) Aggregate of olivine (grainsize 0.9±0.4 mm) and twinned pigeonite (some as oikocrysts up to 8 mm long) with accessory graphite. Olivine has highly magnesian reduced rims containing tiny inclusions of Fe metal.
Geochemistry: Olivine (cores $Fa_{15.9-16.4}$; rim $Fa_{2.5}$; N = 3), pigeonite ($Fs_{13.6-13.7}Wo_{7.4-7.3}$, N = 2).
Classification: Ureilite.
Specimens: 22.65 g plus one polished thin section at *UWB*; remainder with Mr. S. Feek.

Northwest Africa 10626 (NWA 10626)
(Northwest Africa)
Purchased: 2015 Nov
Classification: Lunar meteorite (feldspathic breccia)
History: Puchased by Darryl Pitt in October 2015 from a dealer in Erfoud, Morocco.
Physical characteristics: The broken, very fresh specimen (1849 g) lacks fusion crust and consists mainly of small, angular light-colored clasts in a dark gray matrix, but there also are some larger, light gray, basaltic-textured clasts (up to 3.5 cm across).
Petrography: (A. Irving and S. Kuehner, *UWS*) The predominant portion is a fragmental breccia consisting of mineral clasts of anorthite, pigeonite, exsolved pigeonite, sparse olivine, ilmenite and chromite plus clasts of glass with quenched crystals. One olivine-free basaltic clast has subophitic texture with domains of variable grain size, and is composed of pigeonite, anorthite, subcalcic augite, ilmenite, Ti-Al-chromite, pyrrhotite and minor Ni-free metal; mesostasis regions contain sparse vesicles.
Geochemistry: Olivine ($Fa_{19.9}$; $Fa_{54.4}$; FeO/MnO = 91-98, N = 2), pigeonite ($Fs_{39.5}Wo_{8.2}$; $Fs_{36.1}Wo_{21.4}$; FeO/MnO = 50-58, N = 2), plagioclase ($An_{91.0\text{-}97.2}Or_{0.6\text{-}0.1}$, N = 2), pigeonite in basalt clast ($Fs_{44.3}Wo_{8.1}$; $Fs_{38.6}Wo_{25.0}$; FeO/MnO = 50-60, N = 2). Bulk composition (R. Korotev, *WUSL*) INAA of subsamples gave (in wt.%) FeO 5.7, Na_2O 0.34; (in ppm) Sc 12.8, Cr 990, Co 15, La 2.0, Sm 1.0, Eu 0.77, Yb 0.89, Lu 0.13, Hf 0.73, Th 0.30.
Classification: Lunar (feldspathic, basalt-bearing breccia).
Specimens: 29.47 g polished slice at *UWB*; remainder with *DPitt*.

Northwest Africa 10627 (NWA 10627)
(Northwest Africa)
Purchased: 2010
Classification: Ordinary chondrite (LL3)
History: One stone weighing 85.9 g was found in Morocco in 2010. David Holden acquired the sample from a meteorite prospector in Erfoud 2010.
Physical characteristics: The oriented stone is dark brown and has a flattened, irregular shape. The stone is 80% covered by an oxidized fusion crust that displays shallow regmaglypts and distinct rollover lipping with minor bubbling on the trailing edge. The cut face of the interior of the stone is dark in color and displays small chondrules, many of which have FeS rims and a minor amount of interstitial fresh metal.
Petrography: Description and classification (A. Love, *App*): Sample is dark-colored and displays numerous close-packed unequilibrated chondrules (avg. dia. 678 μm, 153-1943 μm, n=52) and mineral fragments set within a fine-grained opaque matrix. Porphyritic chondrules show zoned phenocrysts and turbid mesostasis. The mesostasis of some porphyritic chondrules contains isotropic glass. Many chondrules display fine-grained rims composed of clastic silicates and metals and sulfides. Clinoenstatite is the dominant form of low-Ca pyroxene. Sample contains melt pockets and polycrystalline troilite.
Geochemistry: (A. Love, *App*) Olivine $Fa_{16.9\pm5.7}$ ($Fa_{6.5\text{-}24.6}$), N=14; Low Ca pyroxene $Fs_{12.3\pm6.1}Wo_{1.6\pm0.1}$ ($Fs_{6.1\text{-}24.4}$, N=10).
Classification: Based on textural relationships using optical, CL and SEM microscope images and mineral compositions, this is an LL3, S4, W2 ordinary chondrite.
Specimens: 3 slices and several small fragments weighing 19.6 g and a polished thin section are on deposit at *App*.

Northwest Africa 10628 (NWA 10628)
Tindouf, Algeria
Find: 2014
Classification: Martian meteorite (Shergottite)
History: Four fragments were purchased from an anonymous Moroccan dealer in 2015 totaling 24.1 g.
Physical characteristics: The meteorites have a light-brownish appearance with minor patches of fusion crust on the surface.
Petrography: (A. Bischoff, *IfP*). The rock is coarse-grained and consists of mm-sized grains of pyroxene (intergrowth of low-Ca- and Ca-pyroxene; approximately 70 vol%) and interstitial plagioclase/maskelynite grains (~30 vol%, 0.3-1.0 mm). Plagioclase is mostly transformed to maskelynite, but many grains are still crystalline at least at their edges (in contact to pyroxene). Pyroxene is strongly fractured and has shock-induced mosaic extinction. Some glassy melt pockets are also presented. As accessory phases sulfide, Ti-magnetite, ilmenite, and chromite were observed.
Geochemistry: Mineral compositions and geochemistry: (M. Patzek, S. Ebert, *IfP*). Zoned low-Ca pyroxene is $Fs_{32\text{-}68}En_{17\text{-}56}Wo_{11\text{-}23}$ (average: $Fs_{56.8\pm7.7}En_{26.8\pm9.2}Wo_{16.4\pm3.3}$; n= 15; FeO/MnO = 39.5±3). Ca-pyroxene is $Fs_{21.7\pm1.0}En_{44.8\pm0.8}Wo_{33.6\pm1.4}$, on average (n=14). Plagioclase is $An_{48.9\pm4.3}Ab_{46.9\pm3.4}Or_{4.2\pm1.3}$ on average and ranges $An_{42\text{-}59}Ab_{39\text{-}53}Or_{2.1\text{-}5.2}$ (n=14).
Specimens: 4.8 g at *IfP*. Remaining mass with S. Decker, Meteorite-Museum, 55430 Oberwesel, Germany.

Northwest Africa 10633 (NWA 10633)
Morocco
Purchased: Sep 2015
Classification: Ordinary chondrite (LL5, melt breccia)
History: Purchased by Hichame Mimaghador at the Erfoud Market in September 2015.
Physical characteristics: Single stone, dark brown crust. The sawn surface shows a gray matrix with gray-black portions and no evident chondrules.
Petrography: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) The thin section displays a texture consisting of clasts with rare indistinct chondrules within a dark, very fine-grained black matrix. The matrix contains rounded troilite blebs and scattered grains of metal.
Geochemistry: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Olivine ($Fa_{30.9\pm0.6}$, N=7), orthopyroxene ($Fs_{25.4\pm0.6}Wo_{2.1\pm0.2}$, N = 7). Analyses were done for both clasts and matrix.
Classification: Ordinary Chondrite (LL5-melt breccia); S5; W2
Specimens: A total of 8.6 g specimen and one thin section is on deposit at *MSN-FI*. Mimaghador holds the main mass.

Northwest Africa 10635 (NWA 10635)
(Northwest Africa)
Purchased: 2011
Classification: Ordinary chondrite (H5)
History: 1 stone weighing 30.3 g was found in Morocco in 2011. David Holden acquired the sample from a meteorite prospector in Erfoud 2011.

Physical characteristics: The stone is dark brown, rectangular in shape and lacks fusion crust. The interior of the stone is light orangish-gray and shows chondrules, fragments and abundant (~8 vol%) fresh flakes of metal and FeS grains.
Petrography: Description and classification (A. Love, *App*): Sample displays recrystallized chondritic texture composed of distinct droplet chondrules and indistinct porphyritic chondrules which have an average diameter of 403 μm. Porphyritic chondrules have turbid to crystalline mesostasis.
Geochemistry: (A. Love, *App*) Olivine $Fa_{20.1\pm0.2}$, N=6; low Ca pyroxene $Fs_{18.6\pm0.2}Wo_{2.2\pm0.3}$, N=6.
Classification: Ordinary chondrite (H5, S2, W1)
Specimens: An endcut and one slice weighing 6.5 g, and a polished thin section are currently on deposit at Appy. David Holden has the remaining mass.

Northwest Africa 10636 (NWA 10636)
Morocco
Purchased: February 2014
Classification: HED achondrite (Howardite)
History: Purchased from Moroccan meteorite dealer in 2014.
Physical characteristics: Physical Characteristics: Single stone covered with thin caliche layer. Saw cut shows finely brecciated texture with white, gray, and black clasts.
Petrography: (K. Domanik and F. Stephan, *UAz*) Microprobe examination of a polished mount shows a brecciated texture with widely varying clast sizes consisting of approx. 55% basaltic eucrite, 30% cumulate eucrite, and 15% diogenite components. A few large (2 mm) ophitic textured cumulate eucrite fragments are present. Two populations of basaltic pigeonite are observed; the first with extremely fine-scale exsolution lamellae; the second with Fe-enriched rims, no exsolution lamellae, and cross-cutting Fe-rich olivine veins. Accessory silica, chromite, ilmenite, Fe-Ni metal, and minor interstitial melt areas are also present.
Geochemistry: Mineral compositions and geochemistry: (K. Domanik and F. Stephan, *UAz*) Diogenite minerals: low-Ca pyroxene $Fs_{25.3\pm3.1}Wo_{2.6\pm0.9}$, Fe/Mn=29±3, n=24; olivine $Fa_{33.9}$, Fe/Mn=50, n=1. Basaltic eucrite minerals: low-Ca pyroxene $Fs_{58.3\pm3.6}Wo_{2.8\pm0.6}$, Fe/Mn=31±1, n=15; pigeonite $Fs_{59.4\pm6.0}Wo_{7.6\pm1.5}$, Fe/Mn=29±3, n=4; zoned pigeonite cores $Fs_{34.5\pm0.3}Wo_{6.6\pm1.1}$, Fe/Mn=29±2, n=17; augite $Fs_{31.9\pm0.1}Wo_{40.0\pm3.0}$, Fe/Mn=33±2, n=2; plagioclase $An_{86.2\pm1.7}Ab_{13.1\pm1.6}Or_{0.6\pm0.2}$, n=5; olivine veins $Fa_{71.3\pm5.9}$ Fe/Mn=43±2, n=3. Cumulate eucrite minerals: low-Ca pyroxene $Fs_{49.1\pm4.2}Wo_{2.7\pm0.6}$, Fe/Mn=30±1, n=16; pigeonite $Fs_{44.9\pm0.3}Wo_{5.7\pm0.2}$, Fe/Mn=27, n=2; augite $Fs_{21.6\pm2.5}Wo_{42\pm1.1}$, Fe/Mn=28±2, n=8; plagioclase $An_{92.5\pm1.7}Ab_{7.2\pm1.7}Or_{0.3\pm0.1}$, n=6.
Classification: Achondrite (howardite)
Specimens: 42 g including probe mount on deposit at *UAz*, Fredric Stephan holds the main mass.

Northwest Africa 10637 (NWA 10637)
Morocco
Purchased: Feb 2016
Classification: Primitive achondrite (Brachinite)
History: Purchased from Moroccan meteorite dealer in 2016.
Physical characteristics: Physical Characteristics: Single stone, rough, oxidized, brown dark exterior. Saw cut reveals a mosaic of shiny, fine-grained crystals.

Petrography: (K. Domanik and F. Stephan, *UAz*) Microprobe examination of a polished mount shows approximately 87% olivine, 10% low-Ca pyroxene, 3% high-Ca pyroxene texturally equilibrated with triple junctions, silicate grain size 200 – 1200 μm. Oxidized Fe-Ni metal veinlets are present along most grain boundaries. Accessory chromite, Fe-sulfide, oxidized Fe-Ni metal, no plagioclase detected.
Geochemistry: Mineral compositions and geochemistry: (K. Domanik and F. Stephan, *UAz*) Olivine $Fa_{26.8\pm0.3}$, Fe/Mn=52.1±3.3, n=20; low-Ca pyroxene $Fs_{22.3\pm0.1}Wo_{2.1\pm0.1}$, Fe/Mn=32.1±2.2, n=19; augite $Fs_{9.3\pm0.2}Wo_{43.5\pm0.3}$, Fe/Mn=24.1±3.6, n=8. Oxygen isotopes: (K. Zeigler *UNM*) Oxygen isotope values of 3 acid-washed aliquots of bulk sample 1.2, 1.1, 1.8 mg gave $\delta^{17}O$ = 2.402, 2.526, 2.405; $\delta^{18}O$ = 5.048, 5.273, 4.794; $\Delta^{17}O$ = -0.263, -0.258, -0.126 (linearized, all per mil).
Classification: Primitive achondrite (brachinite)
Specimens: 28.3 g including probe mount on deposit at *UAz*, Blaine *Reed* holds the main mass.

Northwest Africa 10638 (NWA 10638)
Morocco
Purchased: Feb 2016
Classification: Ordinary chondrite (L6)
History: Purchased from Moroccan meteorite dealer in 2016.
Physical characteristics: Physical Characteristics: Single stone; rough, brown, dark exterior. Saw cut reveals a few small chondrules set in a dark-gray matrix.
Petrography: (K. Domanik and F. Stephan, *UAz*) Microprobe examination of a polished mount shows a few remaining indistinct equilibrated chondrules and ubiquitous patches of plagioclase 50-300 μm in size. Metal mostly oxidized with numerous oxidized veinlets throughout the meteorite.
Geochemistry: Mineral compositions and geochemistry: (K. Domanik and F. Stephan, *UAz*) Olivine $Fa_{24.8\pm0.3}$, Fe/Mn=48.0±3.1, n=15; low-Ca pyroxene $Fs_{21.1\pm0.2}Wo_{1.5\pm0.3}$, Fe/Mn=27.9±2.5 n=11.
Classification: Oridinary Chonrite (L6)
Specimens: 29.4 g including probe mount on deposit at *UAz*, *Reed* holds the main mass.

Northwest Africa 10639 (NWA 10639)
Western Sahara
Purchased: 2015 Sept
Classification: HED achondrite (Eucrite, monomict)
History: A single stone of 232 g was found by an anonymous finder in Western Sahara and purchased 2015 in Erfoud by Hichame Mimaghador
Physical characteristics: The main mass is partially covered by a black fusion crust.
Petrography: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*): A thin section displays a monomict brecciated texture consisting of basaltic eucrite clasts and related crystalline debris occuring in a finer-grained matrix. Eucritic clasts are mainly characterized by clinopyroxene, with minor anorthitic plagioclase and orthopyroxene displaying very fine (1-2 μm width) exsolution lamellae. Minor phases include ilmenite, troilite, chromite, and FeNi metal.
Geochemistry: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Eucritic clasts: Calcic plagioclase $An_{90.1\pm1.2}Or_{0.9\pm0.1}$, n=6; low-Ca pyroxene ($Fs_{55.2\pm1.4}En_{42.4\pm1.2}Wo_{2.4\pm0.3}$; n=6; Fe/Mn=37.6±0.3); augite ($Fs_{29.7\pm1.2}En_{30.6\pm1.5}Wo_{39.7\pm1.3}$; n=7; Fe/Mn=32.8±0.1); pigeonite

exsolution lamellae in orthopyroxene ($Fs_{57.7\pm1.5}$,$En_{33.8\pm1.4}Wo_{8.5\pm0.9}$; n=8; Fe/Mn = 33.7±0.2). Matrix: low-Ca pyroxene ($Fs_{59.2\pm1.2}En_{37.6\pm1.3}Wo_{3.2\pm0.3}$; n=7; Fe/Mn=36.7±0.2); Calcic plagioclase $An_{88.7\pm1.1}Or_{0.5\pm0.1}$, n=6; Oxygen isotopes: (I. Franchi, R. Greenwood, *OU*) $\delta^{17}O$ = 1.87‰, $\delta^{18}O$ = 4.01‰, $\Delta^{17}O$ = -0.21‰
Classification: Eucrite, monomict with high degree of shock and medium degree of weathering.
Specimens: A total of 36.2 g specimen and one thin section is on deposit at *MSN-FI*. Mimaghador owns the main mass.

Northwest Africa 10640 (NWA 10640)
Morocco
Purchased: 2015 Sept
Classification: HED achondrite (Eucrite, monomict)
History: A single stone of 41.9 g was found by an anonymous finder in Western Sahara and purchased 2015 in Erfoud by Hichame Mimaghador
Physical characteristics: The main mass is covered by a black fusion crust. A sawn surface reveals a brecciated texture.
Petrography: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*): A thin section shows a monomict breccia composed of basaltic eucrite clasts in a matrix of related debris. Eucritic clasts are characterized by clinopyroxene, minor anorthitic plagioclase and orthopyroxene with fine (2-3 μm) pigeonite exsolution lamellae. Minor phases are ilmenite, troilite and chromite.
Geochemistry: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*); Eucritic clasts: Calcic plagioclase $An_{88.0\pm1.2}Or_{0.9\pm0.1}$, n=7; low-Ca pyroxene ($Fs_{56.1\pm1.3}En_{43.6\pm1.3}Wo_{2.3\pm0.2}$; n=7; Fe/Mn=36.5±0.3); augite ($Fs_{39.2\pm8.5}En_{28.0\pm2.1}Wo_{32.9\pm6.5}$; n=7; Fe/Mn=35.4±0.1); pigeonite exsolution lamellae in orthopyroxene ($Fs_{59.4\pm1.4}En_{29.9\pm1.5}Wo_{10.7\pm1.5}$; n=8; Fe/Mn = 34.2±0.3). matrix: low-Ca pyroxene ($Fs_{64.1\pm1.3}En_{32.4\pm1.4}Wo_{3.5\pm0.4}$; n=8; Fe/Mn=34.0±0.3); Oxygen isotopes: (I. Franchi, R. Greenwood, *OU*) $\delta^{17}O$ = 1.82‰, $\delta^{18}O$ = 3.89‰, $\Delta^{17}O$ = -0.21‰.
Classification: Eucrite, monomict with moderate degree of shock and medium degree of weathering.
Specimens: A total of 8.5 g specimen and one thin section is on deposit at the *MSN-FI*. Mimaghador owns the main mass.

Northwest Africa 10641 (NWA 10641)
Morocco
Purchased: 2015 Sept
Classification: HED achondrite (Eucrite)
History: A single stone of 110.3 g was found by an anonymous finder in Western Sahara and purchased 2015 in Erfoud by Hichame Mimaghador.
Physical characteristics: The main mass is partially covered by a black fusion crust.
Petrography: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*): The thin section analyzed displays a basaltic texture. The major phase is orthopyroxene, with crystals 80-130 μm in width, minor clinopyroxene and anorthitic plagioclase. Exsolved low-Ca pyroxene crystals displaying fine, 4-6 μm pigeonite exsolution lamellae, are visible. Minor phases are ilmenite, troilite, chromite, and FeNi metal
Geochemistry: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Calcic plagioclase $An_{90.0\pm1.2}Or_{0.5\pm0.1}$, n=7; low-Ca pyroxene ($Fs_{61.9\pm1.1}En_{36.1\pm1.2}Wo_{2.0\pm0.2}$; n=6; Fe/Mn=34.4±0.2); augite ($Fs_{27.1\pm1.1}En_{29.5\pm1.3}Wo_{43.4\pm0.2}$; n=7; Fe/Mn=35.6±0.1); exsolved low-Ca pyroxene

($Fs_{62.8\pm1.2}En_{35.4\pm1.1}Wo_{1.8\pm0.1}$; n=7; Fe/Mn=34.4±0.2); pigeonite exsolution lamellae in orthopyroxene ($Fs_{55.3\pm1.3}$,$En_{34.4\pm1.2}Wo_{10.3\pm0.3}$; n=7; Fe/Mn = 33.2±0.1).
Classification: Basaltic eucrite with moderate degree of shock and medium degree of weathering.
Specimens: A total of 21.2 g specimen and one thin section is on deposit at *MSN-FI*. Mimaghador owns the main mass.

Northwest Africa 10642 (NWA 10642)
Morocco, (Northwest Africa)
Purchased: 2015 Sept
Classification: HED achondrite (Eucrite, cumulate)
History: Four small fragments totaling 51.0 g were found in Western Sahara and purchased 2015 in Erfoud by Hichame Mimaghador.
Physical characteristics: None of the fragments displays fusion crust.
Petrography: (V. Moggi Cecchi, G. Pratesi, and S. Caporali, *UniFi*): A thin section shows a cumulative medium-grained texture. Orthopyroxene, with crystals 90-150 μm in width, is the dominant phase, with minor clinopyroxene and anorthitic plagioclase. Rare low-Ca pyroxene crystals with fine, 5-7 μm, pigeonitic exsolution lamellae, are visible. Minor phases are ilmenite, troilite and rare chromite.
Geochemistry: (V. Moggi Cecchi, G. Pratesi, and S. Caporali, *UniFi*) Calcic plagioclase $An_{89.5\pm1.2}Or_{0.3\pm0.1}$, n=7; low-Ca pyroxene in matrix ($Fs_{48.3\pm1.1}En_{48.9\pm1.1}Wo_{2.8\pm0.1}$; n=6; Fe/Mn=34.5±0.2); augite ($Fs_{22.8\pm1.1}En_{35.7\pm1.3}Wo_{41.5\pm0.2}$; n=7; Fe/Mn=31.0±0.1); pigeonite exsolution lamellae in orthopyroxene ($Fs_{53.1\pm1.2}En_{40.3\pm1.1}Wo_{6.7\pm0.2}$; n=7; Fe/Mn = 33.0±0.1).
Classification: Eucrite-cm with moderate degree of shock and medium degree of weathering.
Specimens: A total of 16.5 g and one thin section is on deposit at *MSN-FI*. Mimaghador owns the main mass.

Northwest Africa 10642 (NWA 10642)
Morocco, (Northwest Africa)
Purchased: 2015 Sept
Classification: HED achondrite (Eucrite, cumulate)
History: Four small fragments totaling 51.0 g were found in Western Sahara and purchased 2015 in Erfoud by Hichame Mimaghador.
Physical characteristics: None of the fragments displays fusion crust.
Petrography: (V. Moggi Cecchi, G. Pratesi, and S. Caporali, *UniFi*): A thin section shows a cumulative medium-grained texture. Orthopyroxene, with crystals 90-150 μm in width, is the dominant phase, with minor clinopyroxene and anorthitic plagioclase. Rare low-Ca pyroxene crystals with fine, 5-7 μm, pigeonitic exsolution lamellae, are visible. Minor phases are ilmenite, troilite and rare chromite.
Geochemistry: (V. Moggi Cecchi, G. Pratesi, and S. Caporali, *UniFi*) Calcic plagioclase $An_{89.5\pm1.2}Or_{0.3\pm0.1}$, n=7; low-Ca pyroxene in matrix ($Fs_{48.3\pm1.1}En_{48.9\pm1.1}Wo_{2.8\pm0.1}$; n=6; Fe/Mn=34.5±0.2); augite ($Fs_{22.8\pm1.1}En_{35.7\pm1.3}Wo_{41.5\pm0.2}$; n=7; Fe/Mn=31.0±0.1); pigeonite exsolution lamellae in orthopyroxene ($Fs_{53.1\pm1.2}En_{40.3\pm1.1}Wo_{6.7\pm0.2}$; n=7; Fe/Mn = 33.0±0.1).
Classification: Eucrite-cm with moderate degree of shock and medium degree of weathering.
Specimens: A total of 16.5 g and one thin section is on deposit at *MSN-FI*. Mimaghador owns the main mass.

Northwest Africa 10643 (NWA 10643)
(Northwest Africa)
Purchased: 2016
Classification: Lunar meteorite (feldspathic breccia)
History: Purchased from Jaouad Chaoui in Marrakesh, Morocco, December 2015; reportedly found in Mauritania.
Physical characteristics: Single stone, irregular exterior, no fusion crust. A saw cut reveals feldspathic clasts (up to 1 cm) set in a dark-gray groundmass.
Petrography: (C. Agee, *UNM*) This is a highly feldspathic breccia with primarily magnesian olivine (Fa_{20}) and pyroxene fragments scattered throughout. Minor amounts of more iron-rich olivine (Fa_{41}) and pigeonite ($Fs_{66}Wo_{23}$) were detected. Vesicular shock melt veins and pockets are also present.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{20.0\pm2.0}$, Fe/Mn=84±6, n=12; pigeonite $Fs_{33.5\pm8.9}Wo_{9.4\pm8.6}$, Fe/Mn=63±11, n=10; augite $Fs_{22.9\pm2.3}Wo_{40.1\pm0.8}$, Fe/Mn=58±5, n=2; plagioclase $An_{97.0\pm0.5}$, n=5; Shock melt (20 μm defocused electron beam, proxy for bulk meteorite composition): SiO_2=44.5±0.7, TiO_2=0.15±0.07, Al_2O_3=30.7±2.7, Cr_2O_3=0.06±0.04, MgO=5.2±1.9, FeO=2.9±1.1, MnO=0.04±0.00, CaO=17.0±1.0, NiO=0.01±0.01, Na_2O=0.37±0.02, K_2O=0.03±0.01 (all wt%), n=3.
Classification: Lunar (feldspathic breccia)
Specimens: 8.8 g including a probe mount on deposit at *UNM*; Jean Redelsperger holds the main mass.

Northwest Africa 10644 (NWA 10644)
(Northwest Africa)
Purchased: 2016
Classification: Lunar meteorite (feldspathic breccia)
History: Purchased by Dustin Dickens, February 2016, from a Moroccan dealer and sold to Mendy Ouzillou.
Physical characteristics: Single stone, irregular exterior, no fusion crust. A saw cut reveals light-gray feldspathic clasts (up to 1 cm) and some smaller, fragmental, white plagioclase grains set in a dark-gray groundmass.
Petrography: (C. Agee, *UNM*) This is a feldspathic breccia showing several different textural domains: 1) poikilitic plagioclase with olivine and pyroxene inclusions, 2) zones of fragmental plagioclase, olivine, and pyroxene, 3) cataclastic zones of fine-grained (~20 μm) silicates, 4) vesicular shock melt veins and pockets. Pigeonite and augite show significant igneous, iron-enrichment trends.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{37.9\pm1.6}$, Fe/Mn=98±6, n=13; pigeonite $Fs_{39.3\pm13.9}Wo_{17.0\pm4.1}$, Fe/Mn=66±9, n=11; augite $Fs_{32.0\pm22.7}Wo_{37.4\pm1.1}$, Fe/Mn=60±20, n=2; plagioclase $An_{97.6\pm0.5}$, n=5; Shock melt (20 μm defocused electron beam, proxy for bulk meteorite composition): SiO_2=44.7±0.1, TiO_2=0.5±0.1, Al_2O_3=29.2±2.5, Cr_2O_3=0.09±0.05, MgO=4.0±1.4, FeO=5.3±1.7, MnO=0.06±0.02, CaO=16.4±1.0, NiO=0.03±0.02, Na_2O=0.48±0.01, K_2O=0.10±0.01 (all wt%), n=5.
Classification: Lunar (feldspathic breccia)
Specimens: 20.73 g including a probe mount on deposit at *UNM*; Mendy Ouzillou holds the main mass.

Northwest Africa 10645 (NWA 10645)
(Northwest Africa)
Purchased: 2016
Classification: Martian meteorite (Nakhlite)
History: Purchased by Dustin Dickens, February 2016, from a Moroccan dealer.
Physical characteristics: The exterior is partially covered by black fusion crust. Freshly broken surfaces reveal a mixture of mm-sized dark-green pyroxene grains and interstitial cream-colored feldspar.
Petrography: (C. Agee, *UNM*) This meteorite has an ophitic texture consisting of 75% augite, 15% feldspar, and 5% olivine. Some augite crystals are prismatic and up to 2 mm in length. There are two feldspars present, oligoclase and alkali feldspar, no maskelynite was observed; feldspar commonly occupies interstices between augite grains. Augites show igneous zoning with Fs-rich rims, olivines are fayalitic and fairly uniform in composition. Apatite, ilmenite, and titanomagnetite were observed.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{88.1\pm0.8}$, Fe/Mn=41±1, n=5; augite $Fs_{31.9\pm10.2}Wo_{38.9\pm2.1}$, range $Fs_{24.1\text{-}48.9}Wo_{33.3\text{-}40.5}$, Fe/Mn=35±2, n=10; plagioclase $An_{22.9\pm2.7}Ab_{73.0\pm3.0}Or_{4.1\pm0.6}$, n=4; alkali feldspar $An_{3.3}Ab_{40.4}Or_{56.2}$, n=1.
Classification: Martian (nakhlite). This is a martian meteorite based Fe/Mn of augite and olivine, and on the composition of the plagioclase. It is a nakhlite based on the high percentage of augite present. Paired with NWA 10153.
Specimens: 2.5 g including a probe mount on deposit at *UNM*; Dustin Dickens holds the main mass.

Northwest Africa 10646 (NWA 10646)
(Northwest Africa)
Purchased: 2016
Classification: Angrite
History: Purchased by Dustin Dickens, February 2016, from a Moroccan dealer.
Physical characteristics: Single piece, some fine desert soil on surface, partial fresh fusion crust. Broken surfaces show a fresh polycrystalline aggregate of mm-sized green, yellow, and black minerals. Friable.
Petrography: (C. Agee, *UNM*) This meteorite has a granular texture of fassaite (~50%) and olivine (~30%) up to ~1 mm, with stubby plagioclase laths (~15%) up to 300 μm. Some olivines have exsolved kirschsteinite. Accessory titanium-iron oxides and troilite were observed.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Fassaite $Fs_{17.0\pm7.1}Wo_{52.7\pm1.3}$, range: $Fs_{12.0\text{-}29.6}$, Fe/Mn=88±16, Al_2O_3 (wt%)=7.6±1.6, TiO_2 (wt%)=1.6±0.9, n=6; olivine $Fa_{55.4\pm13.7}Lrn3.5\pm1.6$, range $Fa_{28.7\text{-}78.6}$, Fe/Mn=87±6, n=8; kirschsteinite $Fa_{49.7}Lrn_{45.8}$, Fe/Mn=81, n=1; plagioclase $An_{99.4\pm0.1}$, n=5.
Classification: Angrite based on Fe/Mn, and presence of fassaite, kirschsteinite, and nearly pure anorthite. Paired with NWA 10463.
Specimens: 2.9 g including a probe mount on deposit at *UNM*, Dustin Dickens holds the main mass.

Northwest Africa 10647 (NWA 10647)
(Northwest Africa)

Purchased: 2015 Dec
Classification: HED achondrite (Eucrite, unbrecciated)
History: Purchased by John Curchin in December 2015 from a Moroccan dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Subophitic texture. Composed predominantly of prismatic, simply-twinned grains of exsolved pigeonite (up to 4 mm long) and laths of calcic plagioclase with accessory silica polymorph, ilmenite, stained Ni-free metal, troilite and rare zircon. Microfaults are present in places.
Geochemistry: Low-Ca pyroxene host ($Fs_{56.8\text{-}61.5}Wo_{6.1\text{-}2.9}$, FeO/MnO = 29-30, N = 3), clinopyroxene exsolution lamellae ($Fs_{26.0\text{-}26.3}Wo_{43.6\text{-}43.5}$, FeO/MnO = 28, N = 2), plagioclase ($An_{88.8\text{-}91.6}Or_{0.3\text{-}0.2}$, N = 2).
Classification: Eucrite (unbrecciated).
Specimens: 23.57 g including one polished thin section at *UWB*; remainder with Mr. J. Curchin.

Northwest Africa 10649 (NWA 10649)
(Northwest Africa)
Purchased: 2015 Dec
Classification: Lunar meteorite (feldspathic breccia)
History: Purchased by Fabien Kuntz in December 2015 from a dealer in Zagora, Morocco.
Physical characteristics: A single dark gray, uncrusted stone (41.3 g) with visible whitish clasts.
Petrography: (A. Irving and S. Kuehner, *UWS*) Fragmental breccia composed of mineral clasts of anorthite, olivine, pigeonite, diopside, exsolved pigeonite, troilite, kamacite, taenite, ilmenite, fayalite and chromite in a finer matrix of the same minerals.
Geochemistry: Olivine ($Fa_{25.0\text{-}33.7}$; $Fa_{82.9}$; FeO/MnO = 82-87, N = 3), pigeonite ($Fs_{45.8}Wo_{6.8}$, FeO/MnO = 58), diopside ($Fs_{7.6}Wo_{44.9}$, FeO/MnO = 24, Cr_2O_3 = 0.8 wt.%), orthopyroxene host ($Fs_{42.4}Wo_{3.8}$, FeO/MnO = 50), clinopyroxene lamella ($Fs_{19.4}Wo_{40.9}$, FeO/MnO = 39), plagioclase ($An_{96.3\text{-}96.5}Or_{0.1}$, N = 2).
Classification: Lunar (feldspathic breccia).
Specimens: A 8.53 g polished endcut piece is at *PSF*; remainder with *Kuntz*.

Northwest Africa 10651 (NWA 10651)
(Northwest Africa)
Purchased: 2016 Jan
Classification: Carbonaceous chondrite (CK5)
History: Purchased in January 2016 by Fabien Kuntz from Steve Arnold (Chicago), who had acquired the stone from a Moroccan source.
Petrography: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules (apparent diameter up to 1.6 mm) set in a recrystallized matrix containing abundant orange-stained Cr-rich magnetite.
Geochemistry: Olivine ($Fa_{34.7\text{-}35.6}$, FeO/MnO = 106-111, N = 3), clinopyroxene ($Fs_{8.3\text{-}8.7}Wo_{47.5\text{-}48.5}$, N = 3).
Classification: Carbonaceous chondrite (CK5).
Specimens: 20.08 g including one polished thin section at *PSF*; remainder with *Kuntz*.

Northwest Africa 10653 (NWA 10653)
(Northwest Africa)
Purchased: 2015-May
Classification: Ordinary chondrite (L5/6)

History: Purchased by Fabien Kuntz in May 2015 from a dealer in Erfoud, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Mostly recrystallized and in part poikiloblastic with some large relict chondrules.
Geochemistry: Olivine ($Fa_{25.2-25.3}$, N = 3), orthopyroxene ($Fs_{20.6-20.9}Wo_{1.6-2.0}$, N = 3), clinopyroxene ($Fs_{7.0-7.9}Wo_{45.4-45.2}$, N = 2).
Classification: Ordinary chondrite (L5/6).
Specimens: 26.84 g including one polished thin section at *PSF*; remainder with *Kuntz*.

Northwest Africa 10654 (NWA 10654)
(Northwest Africa)
Purchased: 2015 Dec
Classification: Carbonaceous chondrite (CO3)
History: Purchased by Xavier Gonzales in December 2015 from a dealer in Agadir, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Small chondrules (apparent diameter 150±100 μm), mineral fragments and very fine grained CAI set in a dark brown matrix (~30 vol.%).
Geochemistry: Olivine ($Fa_{0.2-60.7}$; Cr_2O_3 in ferroan examples 0.26-0.36 wt.%, mean 0.31±0.03 wt.%, N = 8), orthopyroxene ($Fs_{1.5-14.8}Wo_{0.9-2.1}$, N = 3), clinopyroxene ($Fs_{1.1-1.8}Wo_{38.0-41.1}$).
Classification: Carbonaceous chondrite (CO3).
Specimens: 5.71 g including one polished thin section at *PSF*; remainder with Mr. X. Gonzales.

Northwest Africa 10656 (NWA 10656)
(Northwest Africa)
Purchased: 2016 Jan
Classification: Lunar (diabase)
History: Purchased by Darryl Pitt in January 2016 from a Mauritanian dealer.
Physical characteristics: A single stone (262.5 g) lacking fusion crust. The fresh interior is relatively coarse grained and is dominated by brown, pale green and white grains.
Petrography: (A. Irving and S. Kuehner, *UWS*) Intersertal texture (mean grainsize ~1.5 mm). Composed of simply-twinned clinopyroxene (both pigeonite and subcalcic augite), olivine (with secondary brown staining along fractures), laths of calcic plagioclase (birefringent but with undulose extinction) and accessory ilmenite, chromite, baddeleyite and zirconolite.
Geochemistry: Olivine ($Fa_{33.8-34.0}$, FeO/MnO = 92; $Fa_{45.9}$, FeO/MnO = 87; N = 3), pigeonite ($Fs_{25.3}Wo_{9.7}$; $Fs_{33.6}Wo_{11.9}$; FeO/MnO = 48-51, N = 2), subcalcic augite ($Fs_{15.8-17.5}Wo_{36.3-34.2}$, FeO/MnO = 38-41, N = 3), plagioclase ($An_{88.3-91.6}Or_{4.1-3.4}$, N = 2). Bulk composition (R. Korotev, *WUSL*) INAA of whole rock powder gave (in wt.%) FeO 19.7, Na_2O 0.18; (in ppm) Sc 34.3, Cr 3190, La 12.4, Sm 5.9, Eu 0.43, Yb 4.0, Lu 0.59, Hf 4.3, Th 1.9.
Classification: Lunar (olivine diabase). This specimen has affinities with NWA 2977, NWA 6950 and NWA 8127 based on mineralogical and bulk compositional similarities, but differs in texture from those meteorites
Specimens: 22 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 10657 (NWA 10657)
Zagora, Morocco
Purchased: 1999
Classification: Ureilite (polymict)

Petrography: The sample is a fragmental breccia dominated by mineral and lithic clasts of various ureilitic materials (olivine with reduced rims, pyroxenes, minor Fe,Ni metal, troilite, and carbon phases). Additionally, there are minor feldspathic clasts, dark (carbonaceous chondrite-like) clasts, and ordinary chondrite clasts.
Geochemistry: For ureilitic clasts, olivine core compositions range from Fa_{10} to $Fa_{25.}$ Olivine rims are reduced as low as $Fa_{1.}$ Pyroxenes include orthopyroxene ($Wo_{<5}Fs_{14}$), pigeonite ($Wo_{5-11}Fs_{4-23}$) and augite ($Wo_{38}Fs_{6}$). Because of the polymict nature of the sample, the average compositions of minerals are not meaningful. Sulfides are mostly Cr-bearing troilite.
Specimens: 18.5 g at *TCU*.

Northwest Africa 10658 (NWA 10658)
(Northwest Africa)
Purchased: 2014
Classification: HED achondrite (Eucrite, polymict)
History: A 319 g meteorite was purchased by Michael Farmer from a Moroccan dealer at the 2014 Tucson Gem and Mineral show.
Physical characteristics: Exterior is shiny, pitted and heavily sandblasted. Sawn surface shows a gray matrix hosting abundant rounded to sub-angular clasts up to 1 cm, though most are <2 mm across. Clasts show a range of colors from white to black.
Petrography: (A. Wittmann, L.A.J. Garvie, and C. Fudge *ASU*) In thin section, the stone exhibits a breccia texture of up to 4 mm angular to sub-rounded clasts. Some areas of the breccia matrix are filled with aphanitic melt containing troilite droplets. Most clasts are pyroxene-rich composed of blocky orthopyroxene crystals with >10 μm-thick lamellae of augite-diopside. The largest clast is a 4 mm plagioclase that poikilitically encloses up to 1 mm orthopyroxene oikocrysts that display 20 μm-thick lamellae of augite-diopside. The largest pyroxene clast is 3 mm long. Another clast component consists of 0.4 mm euhedral pigeonite and augite intergrown with equant, tabular plagioclase crystals riddled with tiny, crystallized melt inclusions. Ilmenite, SiO_2, Cr-Fe-Ti spinel, and troilite are minor mineral components in these clasts. SiO_2 occurs as <0.7 mm clasts and grains that are frequently intergrown with small opaque grains and pyroxene. Raman spectroscopy indicates the presence of coesite coexisting with silica glass in some grains; matrix and/or melt domains surrounding SiO_2 grains show characteristic radial fractures. Accessory components are Cr-Fe-Ti spinel, ilmenite, troilite, and Fe-Ni metal. Most clasts are shocked showing mechanical twinning of pyroxene, plagioclase with planar deformation features, and partial to full transformation to maskelynite.
Geochemistry: (A. Wittmann, *ASU*) Electron microprobe analysis shows feldspar clasts with $An_{88-93}Or_{0.1-0.6}$, such with abundant crystallized melt inclusions are $An_{82-87}Or_{0.7-2.6}$; typical, blocky orthopyroxene crystals have Mg# 54-55, and are $Fs_{29-48}Wo_{2-4}$, with Fe/Mn 29-35; pigeonite associated with melt-inclusion-rich plagioclase has Mg# 37-38, and are $Fs_{59}Wo_{5.1-6.3}$, with Fe/Mn 31-35; augite-diopside has Mg# 69, and are $Fs_{16-17}Wo_{44-45}$, with Fe/Mn 22-24. EDS-analysis suggests Fe-metal contains up to 2 wt% Ni.
Classification: Achondrite (polymict eucrite), components are moderately shocked (S4).
Specimens: 43.2 g and one thin secion at *ASU*.

Northwest Africa 10659 (NWA 10659)
Morocco
Purchased: 2015

Classification: Martian meteorite (Nakhlite)
History: Found near the Algeria-Mauritania border in Morocco, and sold by a Moroccan nomad/dealer. 7.2 g from a larger mass, of unknown quantity, was purchased by Jaouad Chaoui in Laayoune, Morocco.
Physical characteristics: Five individual stones of granular, friable material. One of the stones (3.870 g) still retained ~17.5 mm^2 of fusion crust on its surface. The interior grains are dark green, dark grey, light beige, with red-brown components.
Petrography: (J.C. Bridges and L.J. Hicks, UoL) Cumulate texture. Consists of compositionally zoned tabular pyroxenes (~65%), up to 1.5 mm in length, and larger grains of fayalite olivine (~5%). There is an interstitial mesostasis of albite and orthoclase feldspar (~30%), with exsolved Ti-rich magnetite and phosphate grains. Both olivine and mesostasis contain a secondary phase iron-silicate alteration material, compositionally resembling the ferric saponite and serpentine found in other nakhlites (Hicks et al, 2014).
Geochemistry: Olivine (cores $Fa_{63.3-77.6}$, N = 12); pyroxene (cores $Fs_{20.2-39.0}Wo_{39.2-42.3}$, N = 16; rims $Fs_{25.1-45.7}Wo_{37.4-42.4}$, N = 8); plagioclase ($An_{13.8-28.3}Or_{3.7-6.8}$, N = 22); alteration phase in olivine fractures (average of 72 analyses in wt.%, normalized to 100% anhydrous): SiO_2 56.9, Al_2O_3 0.3, FeO[Total] 37.0, MgO 3.0, CaO 1.6, Na_2O 0.2, K_2O 0.3, SO3 0.8); alteration phase in mesostasis fractures (average of 66 analyses in wt.%, normalized to 100% anhydrous): SiO_2 57.1, Al_2O_3 4.3, FeO[Total] 31.0, MgO 2.8, CaO 2.6, Na_2O 0.3, K_2O 1.0, P_2O_5 0.3, SO3 0.6); Oxygen isotopes with acid wash, average of 2 powder analyses (2 mg each) on same sample (100 mg powder): $\delta^{17}O$: 2.990; $\delta^{18}O$: 5.139; $\Delta^{17}O$: 0.317 (R.C. Greenwood, I.A. Franchi, *OU*)
Classification: Martian meteorite, nakhlite. Possibly paired with NWA 10153.
Specimens: 5.6 g in 3 pieces, plus three polished sections at *ULei*. The remaining material is held by G. Ensor.

Northwest Africa 10660 (NWA 10660)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (H3)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules (apparent diameter 350±200 µm) in a recrystallized matrix containing altered metal.
Geochemistry: Olivine ($Fa_{0.6-19.0}$; Cr_2O_3 in ferroan examples 0.01-0.06 wt.%, mean 0.03±0.01 wt.%, N = 7), orthopyroxene ($Fs_{4.7-30.4}Wo_{0.4-2.1}$, N = 3), pigeonite ($Fs_{14.9}Wo_{16.1}$), subcalcic augite ($Fs_{10.6}Wo_{33.3}$).
Classification: Ordinary chondrite (H3).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10662 (NWA 10662)
(Northwest Africa)
Purchased: 2016 Jan
Classification: Ordinary chondrite (LL3)
History: Purchased by Fabien Kuntz in January 2016 from a dealer in Zagora, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Closely-packed, well-formed chondrules (apparent diameter 700±400 µm, several 3 mm) with little matrix.

Geochemistry: Olivine ($Fa_{0.2-38.0}$; Cr_2O_3 in ferroan examples 0.04-0.08 wt.%, mean 0.06±0.01 wt.%, N = 7), orthopyroxene ($Fs_{4.0-8.8}Wo_{0.3-0.5}$, N = 3), pigeonite ($Fs_{15.6}Wo_{5.5}$), subcalcic augite ($Fs_{8.2-8.5}Wo_{35.6-30.8}$, N = 2).
Classification: Ordinary chondrite (LL3).
Specimens: 29.31 g including one polished thin section at *PSF*; remainder with *Kuntz*.

Northwest Africa 10664 (NWA 10664)
(Northwest Africa)
Purchased: 2016 Feb
Classification: Ordinary chondrite (H4)
History: Purchased by Darryl Pitt in February 2016 from a Moroccan dealer at the Tucson Gem and Mineral Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively small chondrules (mean apparent diameter 0.3 mm) occur in a relatively coarse grained, recrystallized matrix containing stained metal.
Geochemistry: Olivine ($Fa_{19.2-19.4}$, N = 3), orthopyroxene ($Fs_{16.3-16.4}Wo_{1.0-1.2}$, N = 3), clinopyroxene ($Fs_{5.2-5.8}Wo_{45.7-44.9}$, N = 2).
Classification: Ordinary chondrite (H4).
Specimens: 22.2 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 10665 (NWA 10665)
(Northwest Africa)
Purchased: 2016 Mar
Classification: Lunar meteorite (feldspathic breccia)
History: Purchased by Fabien Kuntz in March 2016 from a dealer in Zagora, Morocco.
Physical characteristics: A single dark stone (24.73 g) lacking fusion crust. The fresh interior contains ~30 vol% of white and beige clasts in a fine-grained black matrix.
Petrography: (A. Irving and S. Kuehner, *UWS*) Relatively fine-grained breccia composed of mineral fragments (anorthite, pigeonite, exsolved pigeonite, olivine, augite, chromite, ilmenite, troilite, kamacite) plus some glass fragments in a finer grained matrix.
Geochemistry: Olivine ($Fa_{7.3}$; $Fa_{26.7}$; $Fa_{38.2}$; FeO/MnO = 74-87, N = 3), orthopyroxene host in exsolved pigeonite ($Fs_{34.3}Wo_{3.2}$, FeO/MnO = 48), pigeonite ($Fs_{33.0}Wo_{7.2}$, FeO/MnO = 49), augite ($Fs_{16.3-18.0}Wo_{35.1-37.8}$; $Fs_{11.0}Wo_{42.3}$; FeO/MnO = 36-42, N = 3), plagioclase ($An_{96.7-97.3}Or_{0.1}$, N = 2).
Classification: Lunar (feldspathic breccia).
Specimens: 5.01 g in the form of one polished endcut at *PSF*; remainder with *Kuntz*.

Northwest Africa 10667 (NWA 10667)
(Northwest Africa)
Purchased: 2015 Nov
Classification: HED achondrite (Eucrite, monomict)
History: Four slices from a single stone (total weight 94.2 g) were purchased by John Shea in November 2015 from a dealer in Lexington, Kentucky, who had acquired the material from a Moroccan merchant.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of basaltic eucrite clasts and related crystalline debris. Minerals are exsolved pigeonite (pale orange in thin section with some

brown zones), calcic plagioclase (with undulose extinction), silica polymorph, ilmenite, Ti-chromite, and secondary calcite and barite.
Geochemistry: Orthopyroxene host ($Fs_{58.9-63.0}Wo_{4.9-2.5}$, FeO/MnO = 31-33, N = 3), clinopyroxene exsolution lamella ($Fs_{28.1}Wo_{42.2}$, FeO/MnO = 33), clinopyroxene host in exsolved pigeonite ($Fs_{26.9}Wo_{43.4}$, FeO/MnO = 30), plagioclase ($An_{89.7-89.9}Or_{0.3-0.5}$, N = 2).
Classification: Eucrite (basaltic breccia, shocked).
Specimens: 24.3 g including one polished thin section at *UWB*; remainder with Mr. J. Shea.

Northwest Africa 10668 (NWA 10668)
(Northwest Africa)
Purchased: 2015 Dec
Classification: Ordinary chondrite (H4)
History: Purchased by John Shea in December 2015 from John Higgins, who had acquired the stone from a Moroccan dealer in Laayoune in September 2015.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively small chondrules (apparent diameter 250 ± 150 µm) occur in a recrystallized matrix containing abundant altered metal.
Geochemistry: Olivine ($Fa_{19.5-20.0}$, N = 3), orthopyroxene ($Fs_{17.1-17.2}Wo_{1.2-1.3}$, N = 3), clinopyroxene ($Fs_{5.9-6.3}Wo_{45.8-45.3}$, N = 2).
Classification: Ordinary chondrite (H4).
Specimens: 15.3 g including one polished thin section at *UWB*; remainder with Mr. J. Shea.

Northwest Africa 10669 (NWA 10669)
Morocco
Purchased: 2016
Classification: Ordinary chondrite (LL3)
History: Purchased from Mr. Adnan Chafai, Zagora, Morocco in January 2016.
Physical characteristics: A single stone with no fusion crust, orange-brown oxidized surface with some desert caliche. A saw cut reveals numerous, densely packed, mm-sized chondrules, some up to 4 mm, set in an orange-brown matrix.
Petrography: (C. Agee, *UNM*) This meteorite has many porphyritic chondrules, with mesostasis or glass, set in an opaque matrix.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Chondrule olivine $Fa_{21.7}$?10.7, Fe/Mn=65±25, Cr_2O_3=0.07±0.05 (wt%), n=27; low-Ca pyroxene $Fs_{11.5±8.7}Wo_{1.4±1.3}$, Fe/Mn=25±14, n=20; aluminous augite $Fs_{4.0±0.1}Wo_{37.6±1.3}$, Fe/Mn=2±0, Al_2O_3=4.4±0.4 (wt%), n=2.
Classification: Ordinary chondrite (LL3), likely in the range type 3.4 to 3.2 based on Cr_2O_3 mean value in ferroan olivine which is similar to Chainpur and GRO 95502 (Grossman and Brearley, 2005).
Specimens: 48.2 g on deposit at *BajaAO*, 2.4 g including a probe mount at *UNM*, *ZKereszty* holds the main mass.

Northwest Africa 10670 (NWA 10670)
Mauritania
Find: 2014
Classification: Carbonaceous chondrite (CV3)

History: The stone was discovered in Mauritania in 2014 and was purchased from a Moroccan dealer at the Munich mineral fair in the same year.
Physical characteristics: One brown stone of 887 g. Surface shows cavities of eroded chondrules in various colors and of white CAIs.
Petrography: (R. Bartoschewitz, *Bart*) Microscopic examination of a thin section shows brown fine-grained groundmass, chondrules up to 1 mm (avg. 0.6 mm), and CAIs up to 15 mm. Chondrule/matrix ratio ~0.9.
Geochemistry: (R. Bartoschewitz, *Bart*, P. Appel and B. Mader, *Kiel*) Olivine, $Fa_{9.0\pm7.4}$ (n=58); pyroxene, $Fs_{0.6\pm0.1}Wo_{1.3\pm0.9}$ (n=6); Ca-pyroxene, $En_{77\pm18}Fs_{2.5\pm1.5}Wo_{21\pm12}$ (n=3). Kamacite Ni=5.0-6.7, Co=0.6 wt.-% (n=10). O-isotopes (R. Greenwood and I. Franchi, *OU*): $\delta^{17}O$ = -1.517, $\delta^{18}O$ = 2.759 (permil). Magnetic susceptibility (R. Bartoschewitz, *Bart*) log χ ($\times 10^{-9}$ m^3/kg) = 3.16.
Classification: Carbonaceous chondrite (CV3). Probably paired with NWA 2086.

Northwest Africa 10671 (NWA 10671)
(Northwest Africa)
Purchased: Mar 2016
Classification: Carbonaceous chondrite (CK6)
History: The meteorite was bought March 2016 from a meteorite dealer in Hamada of Zag, Morocco.
Physical characteristics: The meteorite shows a fresh grayish-greenish sawn surface.
Petrography: The meteorite is largely composed of recrystallized olivine-dominated matrix with few scattered chondrules still being discernible. Maximum chondrule diameter observed is 1.6 mm. Intermediate plagioclase occurs frequently in the matrix and is up to 150 μm in size. Cr-rich magnetite is abundant. Minor phases include low-Ca pyroxene, Ca-pyroxene and troilite.
Geochemistry: olivine: $Fa_{30.9\pm0.2}$, n=16; low-Ca pyroxene: $Fs_{26.4}Wo_{0.6}$ (N=3); Ca-pyroxene: $Fs_{11.4}Wo_{46.0}$ (N=3); Cr_2O_3 in magnetite: 4.7 wt% (N=3)

Northwest Africa 10673 (NWA 10673)
(Northwest Africa)
Purchased: 2016
Classification: Pallasite
History: The meteorite was bought in 2016 from Moroccan meteorite dealer, Youssef Ait El Caid.
Petrography: The meteorite is composed of large up to 6 mm sized, rounded to subrounded olivine crystals mantled by partly altered Fe-Ni metal. Metal makes up approximately 40-50% of the sample. Ni-poor regions contain about 6 and Ni-rich regions up to 17.8 wt% Ni. Accessories include chromite and schreibersite.

Northwest Africa 10674 (NWA 10674)
(Northwest Africa)
Purchased: 2015 Oct
Classification: HED achondrite (Eucrite, polymict)
History: Purchased by Marc Jost from a Moroccan dealer in Brügg, Switzerland, in October 2015.
Petrography: (A. Irving and S. Kuehner, *UWS*) Complex breccia composed mainly of eucrite clasts and related debris, but with a significant component (20 vol.%) of dark, metal-bearing

vitric breccia clasts, plus sparse (~2 vol.%) diogenite clasts. The eucrite clasts have textures ranging from subophitic to microgabbroic to granulitic, and consist of exsolved pigeonite and calcic plagioclase with accessory silica polymorph, chromite, ilmenite, troilite and fayalite. The vitric breccia clasts consist of angular grains of magnesian orthopyroxene, magnesian olivine and stained kamacite within glass.
Geochemistry: Orthopyroxene host ($Fs_{61.4}Wo_{2.6}$, FeO/MnO = 27), clinopyroxene exsolution lamellae ($Fs_{25.9\text{-}26.8}Wo_{40.2\text{-}42.8}$, FeO/MnO = 25-27, N = 2), plagioclase ($An_{89.5\text{-}90.5}Or_{0.3}$, N = 2), orthopyroxene in vitric clast ($Fs_{15.2}Wo_{1.1}$, FeO/MnO = 36), olivine in vitric clast ($Fa_{14.4\text{-}16.7}$, FeO/MnO = 31-38, N = 2), diogenitic orthopyroxene ($Fs_{23.3\text{-}26.7}Wo_{2.2\text{-}2.7}$, FeO/MnO = 26-27, N = 2).
Classification: Eucrite (polymict breccia, anomalous). The vitric breccia clasts containing magnesian silicate minerals and kamacite are a very unusual feature of this specimen.
Specimens: 41.3 g including one polished thin section at *UWB*; remainder held by *SJS*.

Northwest Africa 10675 (NWA 10675)
(Northwest Africa)
Purchased: 2016 Jan
Classification: Carbonaceous chondrite (CO3)
History: Purchased by Aras Jonikas in January 2016 from a Moroccan dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Small chondrules (apparent diameter 200±100 μm), mineral fragments and amoeboid CAI are set in a deep brown matrix (~40 vol.%).
Geochemistry: Olivine ($Fa_{1.6\text{-}59.2}$; Cr_2O_3 in ferroan examples 0.08-0.17 wt.%, mean 0.13±0.04 wt.%, N = 8), orthopyroxene ($Fs_{1.0\text{-}4.5}Wo_{1.1\text{-}3.4}$, N = 3), diopside ($Fs_{1.3}Wo_{37.1}$; $Fs_{3.5}Wo_{51.4}$).
Classification: Carbonaceous chondrite (CO3).
Specimens: 21.4 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

Northwest Africa 10676 (NWA 10676)
(Northwest Africa)
Purchased: 2015 Oct
Classification: HED achondrite (Diogenite, polymict)
History: Purchased by Marc Jost from a Moroccan dealer in Brügg, Switzerland in October 2015.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular grains of orthopyroxene (some compositionally zoned), sparse polymineralic lithic diogenite clasts, and sparse basaltic eucrite clasts (up to 1 cm in size) within a very fine grained matrix. Accessory minerals include chromite, ilmenite, calcic plagioclase, olivine, silica polymorph and Ni-free metal.
Geochemistry: Orthopyroxene ($Fs_{22.7\text{-}26.1}Wo_{2.1\text{-}3.3}$, FeO/MnO = 28, N = 3),orthopyroxene host ($Fs_{50.6}Wo_{3.8}$, FeO/MnO = 27), clinopyroxene exsolution lamella ($Fs_{22.9}Wo_{41.0}$, FeO/MnO = 23), orthopyroxene in eucrite clast ($Fs_{52.1}Wo_{3.8}$, FeO/MnO = 27), clinopyroxene ($Fs_{16.0}Wo_{44.3}$, FeO/MnO = 24), olivine ($Fa_{43.5}$, FeO/MnO = 43).
Classification: Diogenite (polymict breccia).
Specimens: 22.3 g including one polished thin section at *UWB*; remainder held by *SJS*.

Northwest Africa 10677 (NWA 10677)
(Northwest Africa)

Purchased: 2015 Oct
Classification: Ordinary chondrite (LL(L)3)
History: Purchased by Marc Jost from a Moroccan dealer at the Munich Show in October 2015.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well formed, fairly closely-packed chondrules (apparent diameter 600 ± 400 μm) are set in a finer grained brown matrix.
Geochemistry: Olivine ($Fa_{2.9-45.8}$; Cr_2O_3 in ferroan examples 0.00-0.09 wt.%, mean 0.08±0.01 wt.%, N = 8), orthopyroxene ($Fs_{2.9-13.4}Wo_{0.4-1.7}$, N = 3), subcalcic augite ($Fs_{7.6}Wo_{33.6}$), diopside ($Fs_{1.4}Wo_{40.2}$).
Classification: Ordinary chondrite (LL(L)3).
Specimens: 20.2 g including one polished thin section at *UWB*; remainder held by *SJS*.

Northwest Africa 10678 (NWA 10678)
(Northwest Africa)
Purchased: 2016 Feb
Classification: Lunar meteorite (feldspathic breccia)
History: Purchased by Gary Fujihara in February 2016 from a dealer in Ouarzazate, Morocco.
Physical characteristics: A single stone (49.15 g) lacking fusion crust. Interior slices exhibit separated white clasts and rare small metal grains set in a black matrix (~60 vol.%).
Petrography: (A. Irving and S. Kuehner, *UWS*) Olivine-poor feldspathic breccia composed of angular mineral grains in a finer matrix. Minerals are anorthite, orthopyroxene, pigeonite, augite, rare olivine, ilmenite, Ti-chromite, troilite, taenite and zirconolite.
Geochemistry: (P. Carpenter, *WUSL*; S. Kuehner, *UWS*) Orthopyroxene ($Fs_{39.9}Wo_{4.8}$, FeO/MnO = 54), pigeonite ($Fs_{31.8}Wo_{14.7}$, FeO/MnO = 49), subcalcic augite ($Fs_{21.2}Wo_{33.9}$, FeO/MnO = 44), low-Ca pyroxene host ($Fs_{43.8}Wo_{10.8}$, FeO/MnO = 67), clinopyroxene exsolution lamella ($Fs_{28.4}Wo_{33.9}$, FeO/MnO = 57), anorthite ($An_{95.0-98.2}Or_{0.1}$, N = 4), olivine ($Fa_{24.8-47.7}$, FeO/MnO = 83-97, N = 4). Bulk composition (R. Korotev, *WUSL*) INAA of subsamples gave (in wt.%) FeO 3.8, Na_2O 0.39; (in ppm) Sc 7.2, Cr 490, Co 13, La 6.2, Sm 2.8, Eu 0.91, Yb 1.8, Lu 0.25, Hf 2.0, Th 0.9.
Classification: Lunar (feldspathic breccia).
Specimens: 9.85 g including one slice and a polished mount at *UWB*; remainder with Mr. G. Fujihara.

Northwest Africa 10679 (NWA 10679)
(Northwest Africa)
Purchased: 2015 Oct
Classification: Ordinary chondrite (LL(L)3)
History: Purchased by Marc Jost from a Moroccan dealer at the Munich Show in October 2015.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well formed, fairly closely-packed chondrules (apparent diameter 600±400 μm) are set in a finer grained brown matrix.
Geochemistry: Olivine ($Fa_{2.2-41.6}$; Cr_2O_3 in ferroan examples 0.08-0.21 wt.%, mean 0.13±0.05 wt.%, N = 7), orthopyroxene ($Fs_{6.9}Wo_{0.3}$), pigeonite ($Fs_{20.7}Wo_{14.6}$), subcalcic augite ($Fs_{25.8}Wo_{29.4}$), diopside ($Fs_{1.8}Wo_{42.1}$).
Classification: Ordinary chondrite (LL(L)3).
Specimens: 21.7 g including one polished thin section at *UWB*; remainder held by *SJS*.

Northwest Africa 10680 (NWA 10680)

(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (L6)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Mostly recrystallized with rare relict chondrules and altered metal.
Geochemistry: Olivine ($Fa_{25.8\text{-}26.6}$, N = 3), orthopyroxene ($Fs_{20.9\text{-}21.4}Wo_{2.3\text{-}2.7}$, N = 3), clinopyroxene ($Fs_{8.6\text{-}11.2}Wo_{45.2\text{-}43.0}$, N = 2).
Classification: Ordinary chondrite (L6).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10681 (NWA 10681)
(Northwest Africa)
Purchased: 2016 Feb
Classification: HED achondrite (Eucrite, monomict)
History: Purchased by Aras Jonikas in February 2016 from a Moroccan dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Monomict breccia consisting of closely packed, fine grained basaltic clasts in a sparse dark matrix. Minerals are exsolved pigeonite, calcic plagioclase, Ti-chromite, ilmenite, silica polymorph, plus secondary calcite and barite.
Geochemistry: Orthopyroxene host ($Fs_{59.6\text{-}61.3}Wo_{5.6\text{-}2.5.6}$, FeO/MnO = 30-31, N = 2), clinopyroxene exsolution lamella ($Fs_{26.2}Wo_{43.9}$, FeO/MnO = 29), clinopyroxene host ($Fs_{26.4}Wo_{43.9}$, FeO/MnO = 26).
Classification: Eucrite (monomict breccia)
Specimens: 20.0 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

Northwest Africa 10682 (NWA 10682)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (L6)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Mostly recrystallized with rare relict chondrules and altered metal.
Geochemistry: Olivine ($Fa_{24.7\text{-}25.0}$, N = 3), orthopyroxene ($Fs_{20.8\text{-}21.0}Wo_{1.4\text{-}1.8}$, N = 3), clinopyroxene ($Fs_{8.2\text{-}8.3}Wo_{44.9\text{-}43.6}$, N = 2).
Classification: Ordinary chondrite (L6).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10683 (NWA 10683)
(Northwest Africa)
Purchased: 2016 Feb
Classification: Ordinary chondrite (LL6)
History: Purchased by Aras Jonikas in February 2016 from a Moroccan dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular clasts which are mostly recrystallized with rare relict partial chondrules.

Geochemistry: Olivine ($Fa_{31.3-31.7}$, N = 3), orthopyroxene ($Fs_{25.0-26.0}Wo_{2.5-2.6}$, N = 3), clinopyroxene ($Fs_{8.8-11.0}Wo_{45.4-43.0}$, N = 2).
Classification: Ordinary chondrite (LL6 breccia).
Specimens: 22.76 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

Northwest Africa 10684 (NWA 10684)
(Northwest Africa)
Purchased: 2016 Feb
Classification: HED achondrite (Eucrite, monomict)
History: Purchased by Aras Jonikas in February 2016 from a Moroccan dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Very fresh specimen consisting of diabase clasts within a matrix of related debris. Minerals are exsolved pigeonite, orthopyroxene, clinopyroxene, calcic plagioclase, silica polymorph, ilmenite, troilite and minor Ti-chromite.
Geochemistry: Orthopyroxene ($Fs_{59.1-59.5}Wo_{1.6-1.7}$, FeO/MnO = 31-32, N = 3), clinopyroxene exsolution lamella ($Fs_{25.2}Wo_{42.6}$, FeO/MnO = 31), discrete clinopyroxene ($Fs_{24.0}Wo_{44.9}$, FeO/MnO = 26), plagioclase ($An_{84.8-86.3}Or_{0.9-0.8}$, N = 2).
Classification: Eucrite (monomict diabasic breccia).
Specimens: 20.47 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

Northwest Africa 10686 (NWA 10686)
(Northwest Africa)
Purchased: 2016 Mar
Classification: Ordinary chondrite (L3)
History: Purchased by John Higgins in March 2016 from a dealer in Zagora, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Fairly closely packed, well-formed chondrules (apparent diameter 400±300 μm, but some up to 6 mm) occur in a relatively coarse grained matrix containing altered metal. Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.24.
Geochemistry: Olivine ($Fa_{0.6-43.6}$; Cr_2O_3 in ferroan examples 0.04-0.31 wt.%, mean 0.10±0.09, N = 8), orthopyroxene ($Fs_{0.6-18.8}Wo_{1.0-4.3}$), subcalcic augite ($Fs_{14.8}Wo_{26.2}$), diopside ($Fs_{0.6}Wo_{45.6}$).
Classification: Ordinary chondrite (L3).
Specimens: 36 g including one polished thin section at *UWB*; remainder with Mr. J. Higgins.

Northwest Africa 10687 (NWA 10687)
(Northwest Africa)
Purchased: 2016 Apr
Classification: Ureilite
History: Purchased in Temara, Morocco by Adam Aaronson in April 2016.
Petrography: (A. Irving, *UWS*) Composed of olivine and low-Ca pyroxene with grain boundary zones of blebby Fe metal and microdiamond. Both olivine and pyroxene have been completely recrystallized to very fine grained, polygranular aggregates.
Geochemistry: (P. Carpenter, *WUSL*) Olivine ($Fa_{13.0-15.0}$, N = 3), orthopyroxene ($Fs_{5.3}Wo_{4.4}$), pigeonite ($Fs_{2.0}Wo_{8.9}$).
Classification: Ureilite (recrystallized).
Specimens: 20.3 g including one polished thin section at *UWB*; remainder with *Aaronson*.

Northwest Africa 10688 (NWA 10688)

(Northwest Africa)
Purchased: 2016 Apr
Classification: Ordinary chondrite (L4)
History: Purchased in Temara, Morocco, by Adam Aaronson in April 2016.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules (apparent diameter 600±200 μm, but some up to 7 mm) occur in a relatively coarse-grained matrix containing stained metal.
Geochemistry: Olivine ($Fa_{25.5-26.0}$, N = 3), orthopyroxene ($Fs_{20.2-21.2}Wo_{1.8-1.4}$, N = 3), clinopyroxene ($Fs_{7.6-8.5}Wo_{45.3-45.0}$, N = 2).
Classification: Ordinary chondrite (L4).
Specimens: 26 g including one polished thin section at *UWB*; remainder with *Aaronson*.

Northwest Africa 10689 (NWA 10689)
(Northwest Africa)
Purchased: 2016 Feb
Classification: Mesosiderite
History: Purchased by Aras Jonikas in February 2016 from a Moroccan dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Medium-grained aggregate consisting of orthopyroxene, calcic plagioclase, olivine, silica polymorph, kamacite, taenite, ilmenite and chromite. Metal constitutes ~55 vol.% of the specimen.
Geochemistry: Orthopyroxene ($Fs_{34.3-34.4}Wo_{2.7-2.1}$, FeO/MnO = 22-24, N = 3), olivine ($Fa_{15.4}$, FeO/MnO = 41; $Fa_{27.3}$, FeO/MnO = 36), plagioclase ($An_{91.0-95.3}Or_{0.2-0.1}$, N = 2).
Classification: Mesosiderite.
Specimens: 17.75 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

Northwest Africa 10690 (NWA 10690)
(Northwest Africa)
Purchased: 2016 Mar
Classification: Ordinary chondrite (LL7)
History: Purchased by Fabien Kuntz in March 2016 from a dealer in Ouarzazate, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Very fresh specimen with poikiloblastic texture and no evidence of relict chondrule structures. Minerals are olivine, orthopyroxene, clinopyroxene, sodic plagioclase, potassium feldspar, taenite, chromite, troilite and rare chlorapatite. Some feldspar consists of perthitic intergrowths of potassic and sodic phases.
Geochemistry: Olivine ($Fa_{29.9-30.0}$, N = 3), orthopyroxene ($Fs_{23.4-23.5}Wo_{3.7-3.6}$, N = 3), clinopyroxene ($Fs_{10.3-12.1}Wo_{42.5-38.9}$, N = 2), plagioclase ($An_{6.4-7.2}Or_{3.2-3.5}$, N = 2), potassium feldspar ($Or_{83.6-87.3}An_{6.1-5.7}$, N = 2).
Classification: Ordinary chondrite (LL7, K-feldspar-bearing).
Specimens: 20.45 g including one polished thin section at *PSF*; remainder with untz.

Northwest Africa 10691 (NWA 10691)
(Northwest Africa)
Purchased: 2016 Mar
Classification: Carbonaceous chondrite (CK4)
History: Purchased by Aras Jonikas in March 2016 from a Moroccan dealer.

Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, separated chondrules containing Cr-magnetite occur in a matrix with stained Cr-magnetite in addition to olivine, orthopyroxene, clinopyroxene and intermediate plagioclase.
Geochemistry: Olivine ($Fa_{29.3-29.5}$, N = 3), orthopyroxene ($Fs_{19.9-21.9}Wo_{0.8-0.5}$, N = 3), clinopyroxene ($Fs_{9.1-9.8}Wo_{47.3-46.0}$, N = 2).
Classification: Carbonaceous chondrite (CK4).
Specimens: 20.01 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

Northwest Africa 10692 (NWA 10692)
(Northwest Africa)
Purchased: 2013 Jul
Classification: Ordinary chondrite (H4)
History: Purchased by John Shea in July 2013 from a German dealer, who had obtained it from a Moroccan source.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules (apparent diameter 300±100 μm) occur in a relatively coarse grained-matrix containing relatively abundant stained metal.
Geochemistry: Olivine ($Fa_{19.7-19.8}$, N = 3), orthopyroxene ($Fs_{16.8-16.9}Wo_{1.5-1.4}$, N = 3), clinopyroxene ($Fs_{6.5-6.7}Wo_{44.2-42.6}$, N = 2).
Classification: Ordinary chondrite (H4).
Specimens: 20.83 g including one polished thin section at *UWB*; remainder with Mr. J. Shea.

Northwest Africa 10693 (NWA 10693)
(Northwest Africa)
Purchased: 2016 Mar
Classification: Martian meteorite (Shergottite)
History: Purchased by Darryl Pitt in March 2016 from a dealer in Ouarzazate, Morocco.
Physical characteristics: A single rounded stone (111 g) almost completely coated by black fusion crust. The interior is light gray with randomly-distributed, larger dark grains.
Petrography: (A. Irving and S. Kuehner, *UWS*) Porphyritic texture. Subhedral to anhedral olivine macrocrysts are set in a relatively coarse grained groundmass composed mostly of twinned prismatic pyroxene and maskelynite with accessory Ti-rich chromite, Ti-poor chromite, ilmenite, Mg-bearing merrillite and pyrrhotite (some Ni-bearing). Olivine grains contain quenched melt inclusions surrounded by radial fractures. Pockets of brown shock melt are present.
Geochemistry: (S. Kuehner, *UWS*; P. Carpenter, *WUSL*) Olivine ($Fa_{31.2-35.2}$, FeO/MnO = 47-54; rim $Fa_{42.5}$; FeO/MnO = 49; N = 5), pigeonite ($Fs_{24.1-28.6}Wo_{7.6-11.2}$; $Fs_{23.4-23.9}Wo_{16.5-15.8}$; FeO/MnO = 24-28; N = 5), subcalcic augite ($Fs_{9.8}Wo_{26.8}$; $Fs_{9.2-15.7}Wo_{39.1-36.2}$, FeO/MnO = 19-32, N = 4), maskelynite ($An_{52.2-58.8}Or_{1.9-0.5}$, N = 3).
Classification: Martian (shergottite, olivine-phyric).
Specimens: 21.4 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 10694 (NWA 10694)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (L3-6)

History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to the *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia consisting of angular clasts containing well-formed chondrules (apparent diameter 400±200 μm) plus some recrystallized chondrite clasts (containing rare relict chondrules) in a finer grained matrix.
Geochemistry: Olivine ($Fa_{0.7\text{-}24.7}$, N = 5), orthopyroxene ($Fs_{2.5\text{-}23.9}Wo_{0.4\text{-}1.9}$, N = 4), subcalcic augite ($Fs_{16.6}Wo_{29.7}$), augite ($Fs_{8.0\text{-}9.6}Wo_{44.8\text{-}43.6}$, N = 3).
Classification: Ordinary chondrite (L3-6 breccia).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10696 (NWA 10696)
(Northwest Africa)
Purchased: 2015
Classification: Ordinary chondrite (L4)
History: Found near Tissint, Morocco, during the search for the Sidi Ali Ou Azza fall in 2015. Purchased in Zagora by Adam Aaronson and donated to the the Geology and Mining Museum of the Moroccan Ministry of Energy, Mines Water and Environment in Rabat.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules occur in a coarsely recrystallized matrix.
Geochemistry: Olivine ($Fa_{24.4\text{-}24.7}$, N = 3), orthopyroxene ($Fs_{20.5\text{-}20.6}Wo_{1.4\text{-}1.7}$, N = 3), clinopyroxene ($Fs_{7.9\text{-}8.5}Wo_{44.8\text{-}43.9}$, N = 2).
Classification: Ordinary chondrite (L4).
Specimens: 21.5 g including two polished thin sections at *UWB*; the remainder is housed in the Geology and Mining Museum of the Moroccan Ministry of Energy, Mines Water and Environment in Rabat.

Northwest Africa 10697 (NWA 10697)
(Northwest Africa)
Purchased: 2016 Mar
Classification: Martian meteorite (Shergottite)
History: Purchased by Darryl Pitt in March 2016 from a dealer in Erfoud, Morocco.
Physical characteristics: Partly fusion-crusted stone (151 g). The interior exhibits dispersed, beige prismatic grains in a khaki-colored matrix.
Petrography: (A. Irving and S. Kuehner, *UWS*) Poikilitic texture. Olivine chadacrysts are enclosed in relatively large, prismatic, simply-twinned pyroxene grains (up to 5 mm long with undulose extinction) accompanied by lath-like maskelynite grains (some in sheaf-like bundles with more acicular pyroxene). Accessory phases are Ti-poor chromite, Ti-rich chromite, ilmenite, Mg-bearing merrillite, pyrrhotite (some Ni-bearing) and minor baddeleyite.
Geochemistry: Olivine ($Fa_{34.1\text{-}36.0}$, FeO/MnO = 48-49; $Fa_{46.4}$, FeO/MnO = 46; N = 3), pigeonite ($Fs_{34.8\text{-}37.5}Wo_{8.7\text{-}7.0}$; $Fs_{27.3}Wo_{11.1}$; FeO/MnO = 27-31; N = 4), augite ($Fs_{17.3\text{-}19.1}Wo_{38.0\text{-}31.7}$, FeO/MnO = 23-26, N =3), subcalcic augite ($Fs_{21.8}Wo_{24.4}$, FeO/MnO = 25), maskelynite ($An_{50\text{-}52.7}Or_{1.9\text{-}1.4}$, N = 2).
Classification: Martian (shergottite, poikilitic).
Specimens: 20.1 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 10698 (NWA 10698)

(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (H5)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to the *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Sparse spherical chondrules (up to 3 mm in diameter) and relict partial chondrules are set in a recrystallized, relatively metal-rich matrix
Geochemistry: Olivine ($Fa_{19.6\text{-}19.7}$, N = 3), orthopyroxene ($Fs_{17.0\text{-}17.2}Wo_{1.2\text{-}1.4}$, N = 3), clinopyroxene ($Fs_{5.6\text{-}7.7}Wo_{45.7\text{-}37.8}$, N = 2).
Classification: Ordinary chondrite (H5).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10699 (NWA 10699)
(Northwest Africa)
Purchased: 2016 Mar
Classification: Ordinary chondrite (LL(L)3)
History: Purchased by John Higgins in March 2016 from a dealer in Guelmim, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Closely packed, well-formed chondrules (apparent diameter 600±200 μm) are set in a sparse matrix containing altered metal.
Geochemistry: Olivine ($Fa_{0.7\text{-}86.5}$; Cr_2O_3 in ferroan examples 0.05-0.14 wt.%, mean 0.09±0.03, N = 7), orthopyroxene ($Fs_{5.5}Wo_{0.2}$), pigeonite ($Fs_{17.2}Wo_{8.1}$), subcalcic augite ($Fs_{9.4}Wo_{29.2}$), augite ($Fs_{11.3}Wo_{36.2}$).
Classification: Ordinary chondrite (LL(L)3).
Specimens: 27 g including one polished thin section at *UWB*; remainder with Mr. J. Higgins.

Northwest Africa 10700 (NWA 10700)
(Northwest Africa)
Purchased: 2015 Aug
Classification: Ordinary chondrite (LL4-6)
History: Purchased by John Higgins in August 2015 from a dealer in Laayoune, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular to rounded clasts in a relatively coarse grained matrix. Some clasts have well-formed chondrules (type 4), whereas other clasts are progressively more recrystallized with sparse to rare chondrules (types 5 and 6).
Geochemistry: Olivine ($Fa_{28.0\text{-}32.1}$, N = 3), orthopyroxene ($Fs_{10.9}Wo_{0.2}$; $Fs_{20.7\text{-}21.8}Wo_{2.0\text{-}0.7}$; N = 3), clinopyroxene ($Fs_{10.3\text{-}11.2}Wo_{43.0\text{-}42.0}$, N = 2).
Classification: Ordinary chondrite (LL4-6 breccia).
Specimens: 24 g including one polished thin section at *UWB*; remainder with Mr. J. Higgins.

Northwest Africa 10701 (NWA 10701)
(Northwest Africa)
Purchased: 2015 Sep
Classification: Ordinary chondrite (H3)
History: Purchased by John Higgins in September 2015 from a dealer in Laayoune, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively small chondrules (apparent diameter 300±100 μm) are set in a finer matrix containing relatively abundant altered metal.

Geochemistry: Olivine ($Fa_{2.2-32.8}$, Cr_2O_3 in ferroan examples 0.02-0.09 wt.%, mean 0.05±0.02 wt.%, N = 7), orthopyroxene ($Fs_{15.8-19.4}Wo_{0.8-1.6}$, N = 3), subcalcic augite ($Fs_{20.0}Wo_{30.7}$), augite ($Fs_{17.6}Wo_{37.4}$).
Classification: Ordinary chondrite (H3).
Specimens: 28 g including one polished thin section at *UWB*; remainder with Mr. J. Higgins.

Northwest Africa 10702 (NWA 10702)
(Northwest Africa)
Purchased: 2015 Aug
Classification: Ordinary chondrite (L4/5)
History: Purchased by John Higgins in August 2015 from a dealer in Laayoune, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Fairly well-formed chondrules (up to 2 mm in diameter) occur in a recrystallized matrix containing lightly stained metal.
Geochemistry: Olivine ($Fa_{26.2-26.3}$, N = 3), orthopyroxene ($Fs_{20.5-20.6}Wo_{1.4-1.7}$, N = 3), clinopyroxene ($Fs_{7.1-7.7}Wo_{45.7-44.9}$, N = 2).
Classification: Ordinary chondrite (L4/5).
Specimens: 24.2 g including one polished thin section at *UWB*; remainder with Mr. J. Higgins.

Northwest Africa 10703 (NWA 10703)
(Northwest Africa)
Purchased: 2015 Sep
Classification: Martian meteorite (Shergottite)
History: Purchased by Eric Twelker in September 2015 from a dealer at the Denver Show.
Physical characteristics: The stone (111 g) exhibits a semi-glossy, green and black, wind-ablated exterior. The interior is notable for the presence of relatively abundant pockets of dark, vesicular glass.
Petrography: (A. Irving and S. Kuehner, *UWS*) Diabasic texture. Composed mainly of zoned clinopyroxene and maskelynite with accessory ilmenite, ulvöspinel, pyrrhotite, chlorapatite, Fe-bearing merrillite and silica polymorph (associated with maskelynite), plus pockets of shock glass (light brown in thin section with a swirled appearance).
Geochemistry: Pigeonite ($Fs_{43.9-44.2}Wo_{15.3-14.3}$; $Fs_{65.8}Wo_{13.8}$; FeO/MnO = 30-35; N = 3), subcalcic augite ($Fs_{20.7-21.1}Wo_{35.3-33.9}$, FeO/MnO = 24-25; $Fs_{55.5}Wo_{23.3}$, FeO/MnO = 34 ; N = 3), maskelynite ($An_{44.5-54.4}Or_{5.4-1.3}$, N = 3).
Classification: Martian (shergottite, diabasic). Paired with NWA 8656 and NWA 8657.
Specimens: 22.2 g including one polished thin section at *UWB*; remainder with *Twelker*.

Northwest Africa 10704 (NWA 10704)
Western Sahara
Purchased: Jan 2016
Classification: Ureilite
History: Purchased in January 2016; reportedly found in El-Hamada, November 2015.
Physical characteristics: Single stone with no fusion crust. A saw-cut surface shows a coarse-grained mosaic of dark-gray silicate grains.
Petrography: (C. Agee, *UNM*) Olivine is the major mineral in this meteorite. Minor pigeonite is present. Olivines show reduced rims typical of ureilites. Graphite and metal occupy grain boundaries. Most olivine grains range in size from 1000-1500 μm.

Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine rim $Fa_{14.0}$, Fe/Mn=30, n=1; Olivine cores $Fa_{21.3\pm1.1}$, Fe/Mn=50±3, Cr_2O_3=0.55±0.02 (wt%), CaO=0.32±0.02 (wt%), n=7; Pigeonite $Fs_{18.5\pm0.1}Wo_{10.2\pm0.0}$, Fe/Mn=28±1, n=2.
Classification: Ureilite
Specimens: 20.08 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10705 (NWA 10705)
Western Sahara
Purchased: Jan 2016
Classification: Carbonaceous chondrite (CO3)
History: Purchased in January 2016; reportedly found in El-Hamada, November 2015.
Physical characteristics: Single stone. Weathered fusion-crusted exterior. A saw cut reveals many small chondrules in a brown matrix.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous chondrules, most fragmental or irregular, apparent mean diameter 110±70 μm (n=30). Approximately >95% of the chondrules are FeO-poor, Type I. One CAI (~2000 × 1000 μm) was observed in the probe section. Fine-grained matrix makes up about 50% of this meteorite.
Geochemistry: (C. Agee and M. Spilde, *UNM*) All chondrule olivine $Fa_{1.2\pm1.3}$, Cr_2O_3=0.31±0.20, n=21; ferroan chondrule olivine (>2 wt.% FeO) $Fa_{3.3\pm2.0}$, Cr_2O_3=0.57±0.08, n=4; low-Ca pyroxene $Fs_{2.4\pm2.2}Wo_{1.3\pm1.1}$, n=11; aluminous diopside $Fs_{1.3}Wo_{42.9}$, Al_2O_3=6.3 wt%, n=1.
Classification: Carbonaceous chondrite (CO3), with an estimated sub-type of 3.0 based on mean value and sigma of Cr_2O_3 in ferroan olivine (n=4) (Grossman and Brearley, 2005).
Specimens: 7 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10706 (NWA 10706)
Western Sahara
Purchased: Jan 2016
Classification: HED achondrite (Diogenite)
History: Purchased in January 2016; reportedly found in the valleys of Lemtareg, Western Sahara, November 2015.
Physical characteristics: Single stone with fusion crust. A saw-cut surface shows scattered green, fragmental pyroxenes, some up to 4 mm, set in a fine grained, light colored, orange-brown groundmass.
Petrography: (C. Agee, *UNM*) This is a breccia with dominant fragmental pyroxene grains in a wide range of sizes (10-3000 μm). There is approximately 5-10% olivine present, grains range in size from approximately 20-200 μm.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{29.3\pm0.8}$, Fe/Mn=54±4, n=3; low-Ca pyroxene $Fs_{24.3\pm0.2}Wo_{2.7\pm0.2}$, Fe/Mn=30±1, n=7.
Classification: Olivine-bearing diogenite
Specimens: 20.24 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10707 (NWA 10707)
Western Sahara
Purchased: Jan 2016
Classification: HED achondrite (Eucrite, polymict)
History: Purchased in January 2016; reportedly found in El-Hamada, November 2015.

Physical characteristics: Single stone with fresh fusion crust. A saw-cut surface shows a very fine-grained breccia with light gray color.
Petrography: (C. Agee, *UNM*) This is a polymict breccia with at least two distinct lithologies: 1) equilibrated type 6 basaltic eucrite and 2) cumulate eucrite. Ubiquitous sulfide and chromite present. Some shock melt was observed.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Cumulate low-Ca pyroxene $Fs_{36.1\pm2.8}Wo_{2.8\pm1.0}$, Fe/Mn=31±0, n=2; basaltic eucrite low-Ca pyroxene $Fs_{52.1\pm2.6}Wo_{5.1\pm2.7}$, Fe/Mn=31±1, n=9; basaltic eucrite high-Ca pyroxene $Fs_{25.7\pm4.1}Wo_{38.6\pm6.0}$, Fe/Mn=29±4, n=2; plagioclase $An_{79.6\pm6.7}$, n=4.
Classification: Polymict eucrite
Specimens: 5 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10708 (NWA 10708)
Western Sahara
Purchased: Jan 2016
Classification: HED achondrite (Howardite)
History: Purchased in January 2016; reportedly found in Bir-Ghanem by a local bedouin, November 2015.
Physical characteristics: Single stone with fusion crust. A saw-cut surface shows a breccia with fragmental light and dark clasts set in a light-gray groundmass. Numerous metal grains are scattered throughout the surface some up to 3 mm.
Petrography: (C. Agee, *UNM*) This is a polymict breccia with at least three distinct lithologies: ~50% diogenite, ~25% equilibrated basaltic eucrite and ~25% cumulate eucrite. Ubiquitous iron-nickel metal, Fe-sulfide and chromite present.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Diogenite pyroxene $Fs_{25.2\pm1.8}Wo_{2.3\pm0.9}$, Fe/Mn=29±2, n=10; cumulate low-Ca pyroxene $Fs_{40.6\pm3.2}Wo_{2.8\pm2.0}$, Fe/Mn=29±4, n=4; basaltic eucrite pigeonite $Fs_{49.6\pm8.5}Wo_{10.7\pm5.8}$, Fe/Mn=30±1, n=4; basaltic eucrite high-Ca pyroxene $Fs_{38.1\pm13.3}Wo_{38.5\pm4.0}$, Fe/Mn=33±1, n=3; plagioclase $An_{88.9\pm6.5}$, n=5.
Classification: Howardite, metal-rich.
Specimens: 19 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10709 (NWA 10709)
Western Sahara
Purchased: Jan 2016
Classification: Rumuruti chondrite (R3-6)
History: Purchased in January 2016; reportedly found in El-Hamada, December 2015.
Physical characteristics: Single stone with weathered fusion crust. A saw-cut surface shows a few scattered chondrules and some dark-colored clasts set in an orange-brown fine grained groundmass.
Petrography: (C. Agee, *UNM*) This meteorite contains at least two petrologic type domains, R6 and R3. R6 is primarily the olivine-rich domains with indistinct chondrules, the R3 is characterized by domains with distinct porphyritic chondrules containing mesostasis or glass.
Geochemistry: (C. Agee and M. Spilde, *UNM*) R6 olivine $Fa_{39.2\pm0.3}$, Fe/Mn=84±5, NiO=0.21±0.08 wt%, n=17; R3 olivine $Fa_{17.3\pm12.7}$, Fe/Mn=63±25, n=5; low-Ca pyroxene $Fs_{10.9\pm6.0}Wo_{0.6\pm0.7}$, Fe/Mn=24±19, n=6; high-Ca pyroxene $Fs_{12.3\pm2.4}Wo_{40.8\pm6.4}$, Fe/Mn=40±1, n=3;

pigeonite $Fs_{27.2}Wo_{7.4}$, Fe/Mn=53, n=1; oligoclase $Ab_{86.9\pm6.5}An_{9.7\pm2.0}Or_{4.1\pm1.4}$, n=3; labradorite $Ab_{34.1}An_{65.7}Or_{0.2.}$
Classification: Rumuruti chondrite (R3-6)
Specimens: 20.81 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10710 (NWA 10710)
Mauritania
Purchased: Jan 2016
Classification: HED achondrite (Eucrite, unbrecciated)
History: Purchased in January 2016; reportedly found in El-Hamra, Mauritania, December 2015.
Physical characteristics: Single stone with no fusion crust. A saw-cut surface shows a mosaic of feldspar and pyroxene grains interspersed with fine-grained opaques.
Petrography: (C. Agee, *UNM*) This meteorite is an unbrecciated basaltic meteorite with ~50% pyroxene, ~40% plagioclase. Most pyroxenes show exsolution lamellae. Fe-metal, silica, and chromite are ubiquitous.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Low-Ca pyroxene $Fs_{58.4\pm1.5}Wo_{3.4\pm1.5}$, Fe/Mn=29±0, n=4; high-Ca pyroxene $Fs_{37.6\pm11.0}Wo_{28.8\pm13.7}$, Fe/Mn=29±2, n=9; plagioclase $An_{89.0\pm0.7}$, n=4.
Classification: Eucrite (unbrecciated)
Specimens: 25.35 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10711 (NWA 10711)
Western Sahara
Purchased: Jan 2016
Classification: HED achondrite (Eucrite, monomict)
History: Purchased in January 2016; reportedly found in El-Hamada, November 2015.
Physical characteristics: Single stone with fresh fusion crust. A saw-cut surface shows a breccia with light and dark clasts of varying grain size.
Petrography: (C. Agee, *UNM*) This meteorite is an equilibrated monomict basaltic meteorite with ~50% pyroxene, ~50% plagioclase. Most pyroxenes show exsolution lamellae.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Low-Ca pyroxene $Fs_{59.0\pm2.1}Wo_{3.2\pm2.2}$, Fe/Mn=33±1, n=6; high-Ca pyroxene $Fs_{28.4\pm2.8}Wo_{40.6\pm2.4}$, Fe/Mn=32±2, n=7; plagioclase $An_{91.2\pm2.1}$, n=5.
Classification: Eucrite (monomict)
Specimens: 11 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10712 (NWA 10712)
Western Sahara
Purchased: Jan 2016
Classification: HED achondrite (Eucrite, melt breccia)
History: Purchased in January 2016; reportedly found near the Algerian border, December 2015.
Physical characteristics: Single stone with no fusion crust. A saw-cut surface shows a breccia with light colored clasts, up to 1 cm, set in a dark, shock-melt groundmass, a few small vesicles are present.
Petrography: (C. Agee, *UNM*) This meteorite is an equilibrated monomict basaltic meteorite with ~60% pyroxene, ~35% plagioclase. Most domains are very fine grained (~20 μm) with

scattered larger fragmental pyroxenes and plagioclase up to ~700 μm. There are prominent shock melt veins throughout the meteorite. Chromite is ubiquitous.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Low-Ca pyroxene $Fs_{63.4\pm0.8}Wo_{2.1\pm0.3}$, Fe/Mn=33±1, n=9; high-Ca pyroxene $Fs_{27.6\pm0.3}Wo_{43.2\pm0.1}$, Fe/Mn=34±2, n=4; plagioclase $An_{89.2\pm2.0}$, n=5.
Classification: Eucrite (melt breccia)
Specimens: 30.52 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10713 (NWA 10713)
Western Sahara
Purchased: Jan 2016
Classification: Lunar meteorite (feldspathic breccia)
History: Purchased in January 2016; reportedly found near the Algerian border, November 2015.
Physical characteristics: Single stone with no fusion crust. Saw-cut and broken surfaces show a light gray, very fine-grained texture, with sparse small feldspar fragments ~2 mm, and scattered opaques.
Petrography: (C. Agee, *UNM*) This meteorite is an equilibrated, possibly recrystallized, feldspathic breccia. Most olivines and pyroxenes are very fine grained, 5-10 μm, with a few up to 200 μm, poikiolitically enclosed in much larger plagioclase grains.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{24.4\pm0.4}$, Fe/Mn=106±8, n=12; pigeonite $Fs_{20.6\pm1.1}Wo_{7.9\pm0.7}$, Fe/Mn=60±6, n=6; plagioclase $An_{93.3\pm3.4}$, n=6.
Classification: Lunar feldspathic breccia, granulitic.
Specimens: 12.2 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10714 (NWA 10714)
Mauritania
Purchased: 2015 Dec 1
Classification: Carbonaceous chondrite (CO3)
History: Purchased 1 Dec 2015 in Mauritania. Recovered from near the border region of Western Sahara, Mauritania and Algeria.
Physical characteristics: Single stone. Weathered dark brown exterior; saw cut reveals many small chondrules in a dark brown matrix.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous chondrules, some fragmental or irregular, most in the size range 50-200 μm, a few up to 400 μm. Scattered metal/sulfide blebs, fine-grained matrix makes up about 35% of this meteorite.
Geochemistry: (C. Agee and M. Spilde, *UNM*) All chondrule olivine $Fa_{19.8\pm20.0}$, Fe/Mn=62±43, Cr_2O_3=0.24±0.12, n=16; Type I chondrule olivine $Fa_{1.1\pm0.5}$, Cr_2O_3=0.21±0.06, n=6; ferroan chondrule olivine $Fa_{31.0\pm17.1}$, Fe/Mn=81±43, Cr_2O_3=0.26±0.15, n=10; Type I chondrule low-Ca pyroxene $Fs_{1.3\pm0.5}Wo_{1.2\pm0.8}$, n=7; Type II chondrule low-Ca pyroxene $Fs_{31.0}Wo_{2.9}$, Fe/Mn=43, n=1; aluminous diopside $Fs_{1.1\pm0.5}Wo_{40.4\pm7.7}$, n=5.
Classification: Carbonaceous chondrite (CO3), likely type 3.1 based on mean value and sigma of Cr_2O_3 in ferroan olivine (Grossman and Brearley, 2005), however there were too few Type II chondrules present (n=10) in the probe section to obtain good statistics.
Specimens: 21 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10715 (NWA 10715)

Mauritania
Purchased: 2015 Dec 1
Classification: Rumuruti chondrite (R3)
History: Purchased 1 Dec 2015 in Mauritania. Recovered from near the border region of Western Sahara, Mauritania, and Algeria.
Physical characteristics: Single stone. Weathered dark brown exterior; saw cut reveals many chondrules of variable size, some up to 1 mm, set in a dark brown matrix.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows abundant matrix olivines and numerous porphyritic and BO chondrules, most with mesostasis or glass, are present. Chondrules are 300-1000 μm with an average close to the 400 μm average for R. Finally there were no CAIs observed in this sample and no magnetite. Ni-sulfide observed.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{30.0\pm14.9}$, Fe/Mn=112±92, Cr_2O_3=0.08±0.11 wt%, NiO=0.21±0.23, n=22; low-Ca pyroxene $Fs_{8.3\pm7.2}Wo_{3.2\pm2.7}$, Fe/Mn=43, n=5; augite $Fs_{11.1\pm0.9}Wo_{42.2\pm5.3}$, n=2.
Classification: Rumuruti chondrite (R3). R based on Fe/Mn, presence of nickel bearing olivine, absence of magnetite and CAIs, and nickel-bearing sulfide.
Specimens: 15.4 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10716 (NWA 10716)
Mauritania
Purchased: 2015 Dec 1
Classification: HED achondrite (Eucrite, monomict)
History: Purchased 1 Dec 2015 in Mauritania. Recovered from near the border region of Western Sahara, Mauritania and Algeria.
Physical characteristics: Single stone with no fusion crust. A saw-cut surface shows a fine-grained mixture of plagioclase and pyroxene, with light brown color. Some mild brecciation is present.
Petrography: (C. Agee, *UNM*) Pyroxene (~60%) and plagioclase (~35%) are the major minerals in this meteorite. Pyroxenes show exsolution lamellae. Most grains range in size from 20-500 μm.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Low-Ca pyroxene $Fs_{59.4\pm0.9}Wo_{5.0\pm1.1}$, Fe/Mn=32±1, n=9; high-Ca pyroxene $Fs_{30.8\pm5.2}Wo_{38.9\pm6.0}$, Fe/Mn=33±1, n=4; plagioclase $An_{88.8\pm0.9}$, n=4.
Classification: Monomict eucrite
Specimens: 20.3 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10717 (NWA 10717)
Mauritania
Purchased: 2015 Dec 1
Classification: Ureilite
History: Purchased 1 Dec 2015 in Mauritania. Recovered from near the border region of Western Sahara, Mauritania and Algeria.
Physical characteristics: Single stone with no fusion crust. A saw-cut surface shows a coarse-grained mixture of olivine and pyroxene, with dark-gray color.

Petrography: (C. Agee, *UNM*) Olivine and pigeonite are the major minerals in this meteorite. Olivines show reduced rims typical of ureilites. Graphite and metal occupy grain boundaries. Most grains range in size from 500-1500 μm.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine rims $Fa_{4.2\pm1.8}$, Fe/Mn=7±3, n=2; Olivine cores $Fa_{14.2\pm2.1}$, Fe/Mn=30±7, Cr_2O_3=0.69±0.04, n=5; Pigeonite $Fs_{13.8\pm0.1}Wo_{6.0\pm0.0}$, Fe/Mn=21±1, n=6.
Classification: Ureilite
Specimens: 6.5 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10718 (NWA 10718)
Mauritania
Purchased: 2015 Dec 1
Classification: Carbonaceous chondrite (CO3.0)
History: Purchased 1 Dec 2015 in Mauritania. Recovered from near the border region of Western Sahara, Mauritania and Algeria.
Physical characteristics: Single stone. Weathered fusion crust exterior, small chondrule pits, saw cut reveals many small chondrules and some CAIs in a dark-gray matrix.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous chondrules, many fragmental or irregular, most in the size range 50-200 μm. Scattered matrix olivines, metal/sulfide blebs, and CAIs were observed throughout.
Geochemistry: (C. Agee and M. Spilde, *UNM*) All olivine $Fa_{15.6\pm17.1}$, Fe/Mn=55±33, Cr_2O_3=0.28±0.12, n=22; ferroan chondrule olivine $Fa_{22.3\pm16.9}$, Fe/Mn=67±30, Cr_2O_3=0.34±0.11, n=14; low-Ca pyroxene $Fs_{4.6\pm2.1}Wo_{2.9\pm1.1}$, n=6; aluminous diopside $Fs_{1.3}Wo_{43.4}$, n=1.
Classification: Carbonaceous chondrite (CO3.0), type 3.0 based on mean value and sigma of Cr_2O_3 in ferroan olivine (Grossman and Brearley, 2005), these values are similar to Acfer 094 and MIL 07687 (Davidson et al., 2014).
Specimens: 4 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10719 (NWA 10719)
Mauritania
Purchased: 2015 Dec 1
Classification: Carbonaceous chondrite (CK5)
History: Purchased 12/1/15 in Mauritania. Recovered from near the border region of Western Sahara, Mauritania and Algeria.
Physical characteristics: Single stone. Weathered exterior; saw cut of the deposit sample reveals a few distinct chondrules set in a fine grained, dark-gray matrix. One CAI, 5 × 2 mm, was observed.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows a few distinct chondrules, most in the size range 500-1500 μm. Matrix olivines, iron-oxide and sulfide blebs were observed throughout.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{31.9\pm0.5}$, Fe/Mn=107±7, Cr_2O_3=0.01±0.01 wt%, NiO=0.38±0.04 wt%, n=21; low-Ca pyroxene $Fs_{27.4\pm1.3}Wo_{0.7\pm0.1}$, n=11.
Classification: Carbonaceous chondrite (CK5), CK based on presence of high Ni-content in olivine and iron-oxide.
Specimens: 21 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10720 (NWA 10720)
Mauritania
Purchased: 2015 Dec 1
Classification: Martian meteorite (Nakhlite)
History: Purchased 1 Dec 2015 in Mauritania. Recovered from near the border region of Western Sahara, Mauritania and Algeria.
Physical characteristics: Several identical appearing stones. The exterior is partially covered by black fusion crust. Freshly broken surfaces reveal a mixture of mm-size, dark-green pyroxene grains and interstitial cream-colored feldspar.
Petrography: (C. Agee, *UNM*) This meteorite has an ophitic texture consisting of 75% augite, 15% feldspar, and 5% olivine. Some augite crystals are prismatic and up to 2 mm in length. There are two feldspars present, oligoclase and alkali feldspar, no maskelynite was observed; feldspar commonly occupies interstices between augite grains. Augites show igneous zoning with Fs-rich rims, olivines are fayalitic and fairly uniform in composition. Apatite was observed.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{86.9\pm0.8}$, Fe/Mn=44±2, n=5; augite $Fs_{29.0\pm7.4}Wo_{39.9\pm1.3}$, range $Fs_{23.0\text{-}48.1}Wo_{38.4\text{-}41.1}$, Fe/Mn=35±3, n=20; plagioclase $An_{21.8\pm2.2}Ab_{72.8\pm1.5}Or_{5.4\pm1.4}$, n=7; alkali feldspar $An_{6.7\pm0.4}Ab_{73.0\pm1.2}Or_{20.3\pm1.6}$, n=3. Oxygen isotopes (K. Ziegler, *UNM*) All samples were acid-washed and analyzed by laser fluorination $\delta^{18}O$ = 4.581, 4.903, 4.802; $\delta^{17}O$ = 2.669, 2.854, 2.800; $\Delta^{17}O$ = 0.250, 0.265, 0.265 (linearized, all per mil).
Classification: Martian (nakhlite). This is a martian meteorite based on the oxygen isotope values and the Fe/Mn of augite and olivine. It is a nakhlite based on the high percentage of augite present. Paired with NWA 10153.
Specimens: 23.96 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10723 (NWA 10723)
(Northwest Africa)
Purchased: Dec 2016
Classification: Carbonaceous chondrite (CK5)
History: The meteorite was bought in 2016 from a meteorite dealer in Zagorra, Morocco.
Physical characteristics: The meteorite displays a light-grayish to greenish interior.
Petrography: Sparse, clearly defined and separated chondrules are set into abundant matrix dominantly composed of olivine and less abundant intermediate feldspar, Cr-rich magnetite, low-Ca pyroxene and Ca-pyroxene. All mafic minerals are compositionally equilibrated. Chondrules measure up to 1.2 mm; feldspar grains are 100-150 μm in size.
Geochemistry: olivine: $Fa_{31.2\pm0.2}$, FeO/MnO is 137.8±17.3, n=21; low-Ca pyroxene: $Fs_{27.6}Wo_{1.9}$ (N=2); Ca-pyroxene: $Fs_{10.2}Wo_{43.9}$ (N=32); Cr_2O_3 in magnetite: 4.6 wt% (N=5).

Northwest Africa 10724 (NWA 10724)
(Northwest Africa)
Purchased: Dec 2016
Classification: Carbonaceous chondrite (CK6)
History: The meteorite was bought in 2016 from a meteorite dealer in Zagorra, Morocco.
Physical characteristics: The meteorite displays a dark-grayish to black interior.
Petrography: The meteorite is almost completely composed of coarse-grained recrystallized matrix with only few poorly defined chondrules visible. Olivine is the most abundant mineral

followed by feldspar, Cr-rich magnetite, Ca-pyroxene and minor pyrrhotite. Intermediate plagioclase is up to 200 μm in size.
Geochemistry: olivine: $Fa_{28.5\pm0.3}$, FeO/MnO is 120.4±14.2, n=12; Ca-pyroxene: $Fs_{8.9}Wo_{46.0}$ (N=2)

Northwest Africa 10726 (NWA 10726)
(Northwest Africa)
Purchased: 2016
Classification: Pallasite
History: The meteorite was bought in 2016 from Mohamed Aid, Morocco.
Petrography: The meteorite consists of large up to 1 cm sized angular to subrounded olivine crystals surrounded and crossed by a matrix of brownish iron oxides or hydroxides. Only few small patches of primary Fe-Ni metal were detected. One large schreibersite grain was found in the section studied.

Northwest Africa 10727 (NWA 10727)
(Northwest Africa)
Purchased: 2016
Classification: Ordinary chondrite (H3)
History: A complete 90.3 g fusion crusted stone was purchased in Erfoud, Morocco, Feb. 2016. Thomas Webb acquired the stone from a meteorite prospector in 2016.
Physical characteristics: The irregularly shaped stone is 95% crusted with a brownish-black fusion crust. Interior of cut face shows numerous distinct chondrules and abundant fresh metal (~10 vol%). Matrix material on cut face is light to dark brown.
Petrography: Description and classification (A. Love, *App*): Sample is dark-colored and displays numerous close-packed unequilibrated chondrules of varying size (avg. diam. 453 μm, 120-1552 μm, N=87). Porphyritic chondrules show zoned phenocrysts, isotropic glass and turbid mesostasis. Many chondrules display fine-grained rims composed of clastic materials, metals and sulfides. Matrix occurs as a mixture of clastic and amorphous silicates and fine-grained metals.
Geochemistry: (A. Love, *App*) $Fa_{17.6\pm12.6}$ ($Fa_{0.7\text{-}33.4}$) N=20, Cr_2O_3 in ferroan olivine is 0.12±0.20; Low Ca pyroxene $Fs_{16.1\pm10.2}Wo_{2.0\pm1.7}$ ($Fs_{2.1\text{-}36.0}$, N=25).
Classification: Ordinary Chondrite (H3 S1 W1) Chondrule size and abundant metal are consistent with H chondrites. Isotropic glass in porphyritic chondrule mesostasis is present 3.3-3.5. Red CL in chondrule olivine is present, but not common 3.2-3.4 (Huss et al., 2006). Yellow mesostasis present CL in mesostasis 3.2-3.4. Based on histograms Cr_2O_3 contents within ferroan olivines from Fig. 4 in Grossman and Brearley (2005), the sample is above type 3.2. Matrix is opaque and textural equilibration is cryptic if present. PMD of olivine=63.9. PMD of Opx=30.79 <3.1. Petrologic subtype is estimated as H3.3.
Specimens: *Webb* holds the main mass. Two slices weighing 18.56 g and one polished thin section are on deposit at *App*.

Northwest Africa 10728 (NWA 10728)
(Northwest Africa)
Purchased: 2016
Classification: Martian meteorite (Shergottite)

History: Purchased by Suzanne Morrison and Kevin Witts from a Moroccan meteorite dealer in Tucson in 2016.
Physical characteristics: Single stone; saw-cut surfaces show a green-gray-colored, diabasic texture, with elongate pyroxene crystals set in a finer matrix of maskelynite laths. Some sections show up to ~30%, by volume, black, shock melt pockets, many with mm-sized vesicles.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows ~60% pyroxene, ~30% maskelynite. Pyroxenes have igneous core-to-rim zonation in BSE images. Pyroxene grain size ranges up to several mm in length and 300-600 μm wide, maskelynite domains range from ~500-1500 μm. Shock melt veins and pockets with vesicles are ubiquitous. Accessory Ti-magnetite, iron-sulfide, ilmenite, and silica were observed.
Geochemistry: (C. Agee and M. Spilde, *UNM*). There are two distinct pyroxene compositional trends (pigeonite and augite) that are typical of mafic shergottites. Pigeonite $Fs_{54.4\pm12.4}Wo_{15.8\pm2.8}$, Fe/Mn=36±3, n=10; augite $Fs_{23.5\pm3.9}Wo_{32.8\pm2.4}$, Fe/Mn=29±2, n=11; maskelynite $Or_{2.0\pm0.6}Ab_{47.5\pm2.9}An_{50.6\pm3.5}$, n=6.
Classification: Martian (diabasic shergottite), Shergotty-like pyroxene compositional trends. Likely paired with NWA 8656, NWA 8657, and NWA 10016.
Specimens: 20.1 g including a probe mount on deposit at *UNM*, Suzanne Morrison and Kevin Witts hold the main mass.

Northwest Africa 10729 (NWA 10729)
(Northwest Africa)
Purchased: 2016
Classification: Ordinary chondrite (LL3-6)
History: One 72.4 g meteorite found in Morocco in 2016. David Holden acquired the sample from a meteorite prospector in Erfoud 2016.
Physical characteristics: The oriented stone, with rollover lipping, is roughly rectangular and ~80% covered with a dark brown weathered fusion crust. The stone exhibits several broad shallow regmaglypts.
Petrography: (A. Love, *App*): Sample is a breccia composed of distinct, white recrystallized clasts, fragments of chondrules and shock-darkened and shock-melted fragments set within a gray-colored host of distinct chondrules with turbid mesostasis, indistinct chondrules with recrystallized mesostasis and fragments that have an average diameter of 566 μm (n=84). Metal appears more abundant within host (~3 vol%) as compared to clasts (~2 vol%). Recrystallized clasts lack relict chondrules.
Geochemistry: (A. Love, *App*) Olivine: host $Fa_{23.6\pm9.8}$ (1.3-34.8), N=16; recrystallized clasts $Fa_{29.2\pm0.3}$, N=3; low Ca pyroxene: host $Fs_{17.8\pm6.4}Wo_{2.5\pm2.4}$ ($Fs_{7.9\text{-}26.0}$, N=11); clasts $Fs_{29.2\pm0.3}Wo_{2.7\pm0.2}$, N=3.
Classification: Ordinary chondrite (LL3-6, S3, W1). Mineral compositions and metal abundance suggest this is an LL chondrite. Poorly equilibrated compositions of olivine and pyroxene coupled with textures of equilibrated chondrules within host, suggest host is composed of a mixture of type 3 and higher petrologic grades of materials. Textures and equilibrated compositions within clasts suggest clasts are LL6.
Specimens: One polished thin section and a 14.5 g type specimen are on deposit at *App*. David Holden holds the main mass.

Northwest Africa 10731 (NWA 10731)

(Northwest Africa)
Purchased: Feb 2009
Classification: Ordinary chondrite (L3-6)
Petrography: Much of the thin section is composed of a fragmental lithology, which is mostly opaque in transmitted light due to the presence of small melt regions containing metal/sulfide droplets, patches of FeS containing angular silicate fragments, FeS-rims around chondrules, abundant FeS veins and FeS in the interiors of chondrules. BSE imaging shows that the main lithology is an intimate mixture of fragmental material containing a high proportion (~20%) of type 3 material (zoned magnesian and ferroan olivine and pyroxene grains surrounded by glass). With the exception of some small patches of an unusual matrix containing euhedral to subhedral albite crystals intergrown with Fe-rich olivine, the main lithology lacks typical type 3 matrix. Instead, material between chondrules, clasts, and grains is composed of smaller chondrule and mineral fragments. In addition to the main lithology, the section contains two igneously textured light inclusions (one roughly circular and ~3 mm in diameter; the other roughly triangular and ~6 × 3.5 mm in length and width), as well as a large triangular-shaped type 6 inclusion (~6.5 mm in length and width), two small rectangular type 6 inclusions (the larger is ~ 0.5 mm wide and ~3.5 mm long). Metal abundance for the entire section (excluding the two igneous inclusions, which lack metal or sulfide) was estimated from a reflected light mosaic at 3.6 %. Silica polymorph, chlorapatite, merrillite, chromite-plagioclase objects, metallic copper, and an Fe-Ni carbide phase were observed.
Geochemistry: (M. Hutson and A. Ruzicka, *Cascadia*) Main lithology: (mixture of unequilibrated and equilibrated grains) olivine ($Fa_{23.0\pm6.3}$, N=168, median $Fa_{25.2}$), low-Ca pyroxene ($Fs_{18.6\pm7.0}Wo_{1.6\pm1.2}$, N= 101, median $Fs_{21.4}$). Large triangular type 6 clast: olivine ($Fa_{25.8\pm1.2}$, N=36), low-Ca pyroxene ($Fs_{21.4\pm1.3}Wo_{1.8\pm0.7}$, N=20). Rectangular type 6 clast: olivine ($Fa_{26.0\pm0.8}$, N=12), low-Ca pyroxene ($Fs_{22.0\pm0.8}Wo_{2.1\pm0.4}$, N=11).
Classification: The main lithology represents an intimate mixture of fragmental material. Type 3 is inferred from presence of zoned magnesian and ferroan olivine grains and abundant glass; type 6 from coarse (>50 μm) plagioclase feldspar grains. Type 6 clasts are inferred from coarseness of feldspar and degree of integration. The most equilibrated clast is right on the boundary between L and LL and other parameters (e.g., metal abundance) are also transitional. Sample is classified as an L3-6 genomict breccia.
Specimens: *Cascadia* holds 65.7 g in multiple pieces, in addition to one polished thin section and a mounted butt.

Northwest Africa 10732 (NWA 10732)
(Northwest Africa)
Purchased: Mar 2016
Classification: HED achondrite (Eucrite, polymict)
History: The meteorite was bought in 2016 from a meteorite dealer in Erfoud, Morocco.
Petrography: The meteorite is a polymict breccia composed of lithic and mineral clasts set into a more fine grained clastic matrix. Lithic fragments include basaltic and gabbroic eucrite lithologies and up to 1 cm sized impact melt clasts. Mineral fragments are dominantly exsolved pyroxenes and calcic plagioclase. Minor components include diogenitic orthopyroxene, chromite and SiO_2 polymorphs.
Geochemistry: pyroxene host to augite lamellae: $Fs_{51.6\pm5.1}Wo_{2.9\pm0.7}$ ($Fs_{46.9\text{-}58.3}Wo_{2.3\text{-}4.2}$, n=10, FeO/MnO=32-36); Ca-pyroxene: $Fs_{39.4\pm7.5}Wo_{29.4\pm8.1}$ ($Fs_{30.6\text{-}48.8}Wo_{21.0\text{-}39.8}$, n=13, FeO/MnO=31-

35); diogenitic pyroxene: $Fs_{24.4\pm0.9}Wo_{2.7\pm0.6}$ ($Fs_{23.3\text{-}25.3}Wo_{2.1\text{-}3.3}$, n=10, FeO/MnO=27-32); calcic plagioclase: $An_{93.1\pm2.7}$ ($An_{88.8\text{-}95.7}$, n=15).

Northwest Africa 10733 (NWA 10733)
(Northwest Africa)
Purchased: Apr 2016
Classification: HED achondrite (Howardite)
History: The meteorite was bought in 2016 from a meteorite dealer in Marrakesh, Morocco.
Petrography: The meteorite is a fragmental breccia of dominantly mineral and less abundant lithic clasts (fine and coarse grained basaltic, gabbroic, impact melt clasts) set into finer grained matrix. Main minerals are exsolved pyroxene, unequilibrated eucrite low-Ca pyroxene ($Fs_{22.3\text{-}45.1}Wo_{1.6\text{-}3.1}$, n=15), diogenetic orthopyroxene (10-15%) and calcic plagioclase. Accessory phases include chromite, silica, and FeNi metal.
Geochemistry: Pyroxene host to augite lamellae: $Fs_{59.4\pm3.0}Wo_{3\pm0.6}$ ($Fs_{57.4\text{-}63.2}Wo_{2.3\text{-}4.2}$, n=24, FeO/MnO=30-38); Ca-pyroxene: $Fs_{32.1\pm2.2}Wo_{38.2\pm2.7}$ ($Fs_{28.3\text{-}36.6}Wo_{32.9\text{-}42.4}$, n=12, FeO/MnO=27-39); diogenitic pyroxene: $Fs_{25.6\pm0.8}Wo_{3.6\pm0.4}$ ($Fs_{24.2\text{-}27.1}Wo_{3.2\text{-}4.4}$, n=8, FeO/MnO=31-35); calcic plagioclase: $An_{88.2\pm5.1}$ ($An_{78.8\text{-}93.5}$, n=15).

Northwest Africa 10734 (NWA 10734)
(Northwest Africa)
Purchased: 2016
Classification: HED achondrite (Eucrite, brecciated)
History: The meteorite was bought in 2016 from a local meteorite dealer in Erfoud, Morocco.
Petrography: The meteorite is brecciated eucrite composed of basaltic and melt clasts set into a more fine-grained clastic matrix. Dominant minerals are exsolved pyroxene, pigeonite displaying compositional zoning and plagioclase grains of variable grain size ranging from 0.1 to 0.5 mm. Accessories include chromite and silica.
Geochemistry: Pyroxene host to augite lamellae: $Fs_{58.5\pm0.8}Wo_{3.4\pm1.5}$ ($Fs_{57.2\text{-}59.5}Wo_{2.1\text{-}6.1}$, n=10, FeO/MnO=32-38); Ca-pyroxene: $Fs_{33.8\pm1.8}Wo_{35.3\pm2.2}$ ($Fs_{19.6\text{-}27.6}Wo_{35.7\text{-}46.4}$, n=14, FeO/MnO=30-37); zoned pigeonite: $Fs_{43.1\pm8.3}Wo_{8.8\pm3.3}$ ($Fs_{33.0\text{-}56.2}Wo_{6.4\text{-}18.3}$, n=19, FeO/MnO=30-34); calcic plagioclase: $An_{91.4\pm2.0}$ ($An_{87.7\text{-}93.4}$, n=15)

Northwest Africa 10735 (NWA 10735)
(Northwest Africa)
Purchased: 2016
Classification: Ordinary chondrite (LL3-5)
History: The meteorite was bought in 2016 from a local meteorite dealer in Erfoud, Morocco.
Petrography: The meteorite is a chondritic breccia consisting of an LL3 host and LL5 clasts. Plagioclase grain size in LL5 clasts is about 40 μm.
Geochemistry: Olivine and pyroxene in LL3 host are highly unequilibrated with $Fa_{15.6\pm8.3}$ ($Fa_{2.9\text{-}29.4}$, n=27) and $Fs_{13.6\pm6.7}Wo_{0.8\pm0.8}$ ($Fs_{3.1\text{-}23.8}Wo_{0.2\text{-}3.5}$, n=24). In LL5 clasts olivine and pyroxene are equilibrated at $Fa_{29.7\pm0.4}$, n=15 and $Fs_{24.3\pm0.4}Wo_{2.6\pm0.3}$, n=14.

Northwest Africa 10736 (NWA 10736)
Morocco
Purchased: 2015

Classification: Ordinary chondrite (L6)
History: Purchased from a local dealer in Quarzazate in 2015.
Physical characteristics: One stone of 237 g. Cut face is dark gray with some lighter gray to brown chondrule like objects, many reddish inclusions, troilite, and fresh metal.
Petrography: (R. Bartoschewitz, *Bart*) Microscopic examination of a thin section shows recrystallized and shocked matrix: mosaicism in olivine, undulatory extinction in plagioclase, strong metal/sulfide penetration in silicate fractures. Chondrules poor developed (0.8 mm).
Geochemistry: (R. Bartoschewitz, *Bart*, P. Appel and B. Mader, *Kiel*) Olivine $Fa_{24.6\pm0}$,2 (n=10); pyroxene $Fs_{20.5\pm0.2}Wo_{1.9\pm0.1}$(n=5). Kamacite Ni=8.9, Co=1.0 wt.-%). Magnetic susceptibility (R. Bartoschewitz, *Bart*) log χ ($\times 10^{-9}$ m^3/kg) = 4.92.
Classification: Ordinary chondrite (L6)
Specimens: 20.1 g on deposit at *Kiel*, main mass Dieter Janek, Eppan

Northwest Africa 10751 (NWA 10751)
(Northwest Africa)
Purchased: 2013 Sep
Classification: Ordinary chondrite (L4)
History: Purchased by Dr. David Gregory in September 2013 from a Moroccan dealer at the Denver Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, equilibrated chondrules and stained metal.
Geochemistry: Olivine ($Fa_{24.6\text{-}25.3}$, N = 3), orthopyroxene ($Fs_{20.6\text{-}20.8}Wo_{1.1\text{-}1.5}$, N = 3), clinopyroxene ($Fs_{6.5\text{-}7.7}Wo_{46.5\text{-}44.9}$, N = 2).
Classification: Ordinary chondrite (L4).
Specimens: 8 g plus one polished thin section at *ROM*; remainder with *Gregory*.

Northwest Africa 10753 (NWA 10753)
(Northwest Africa)
Purchased: 2015 Sep
Classification: Ordinary chondrite (L4)
History: Purchased by Ray Watts in September 2015 from a Moroccan dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules and altered metal.
Geochemistry: Olivine ($Fa_{25.0\text{-}25.2}$, N = 3), orthopyroxene ($Fs_{19.8\text{-}20.5}Wo_{4.5\text{-}1.7}$, N = 3), clinopyroxene ($Fs_{7.0\text{-}8.1}Wo_{44.7\text{-}41.1}$, N = 2).
Classification: Ordinary chondrite (L4).
Specimens: 20.5 g plus one polished thin section at *ROM*; remainder with Mr. R. Watts.

Northwest Africa 10754 (NWA 10754)
(Northwest Africa)
Purchased: 2015 Mar
Classification: Angrite
History: Purchased by Scott Perekslis in March 2015 from a Moroccan dealer in Paris.
Petrography: (A. Irving and S. Kuehner, *UWS*) Recrystallized breccia composed of olivine (some in polygonal-textured aggregates), aluminous clinopyroxene (pinkish in thin section), spinel (purplish-brown in thin section), altered kamacite, troilite and sparse large anorthite clasts. Secondary iron hydroxides occur along grain boundaries.

Geochemistry: Olivine ($Fa_{39.9-42.6}$, CaO = 0.9-1.4 wt.%, N = 4), clinopyroxene ($Fs_{10.2-10.9}Wo_{51.6-52.9}$, Al_2O_3 = 4.5-7.7 wt.%, TiO_2 = 0.9-1.5 wt.%, N = 3), plagioclase ($An_{99.2-99.3}Or_{0.1}$, N = 2).
Classification: Angrite (breccia, metal-bearing). Paired with NWA 2999 and other stones.
Specimens: 21.5 g including one polished thin section at *UWB*; remainder with Mr. S. Perekslis.

Northwest Africa 10755 (NWA 10755)
(Northwest Africa)
Purchased: 2016 May
Classification: Ordinary chondrite (L(LL)3)
History: Purchased in Temara, Morocco by Adam *Aaronson* in May 2016.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, closely-packed chondrules (apparent diameter 500 ± 400 µm) and stained metal.
Geochemistry: Olivine ($Fa_{0.3-49.8}$; Cr_2O_3 in ferroan examples 0.06-0.30 wt.%, mean 0.15±0.10 wt.%; N = 8), orthopyroxene ($Fs_{2.5-16.1}Wo_{0.2-0.7}$, N = 3), subcalcic augite ($Fs_{9.7-13.6}Wo_{35.7-35.5}$, N = 2).
Classification: Ordinary chondrite, L(LL)3.
Specimens: 21.5 g including one polished thin section at *UWB*; remainder with *Aaronson*.

Northwest Africa 10756 (NWA 10756)
(Northwest Africa)
Purchased: 2015 Sep
Classification: Lunar meteorite (feldspathic breccia)
History: Purchased by Eric Twelker in September 2015 from a Moroccan dealer at the Denver Show.
Physical characteristics: A single stone (125 g) lacking fusion crust and consisting of beige, white and red-brown stained clasts in a dark-gray matrix.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of shocked gabbroic clasts and related crystalline debris, plus sparse devitrified glass clasts in a finer matrix containing vesicular glass. Minerals are olivine, pigeonite, exsolved pigeonite, augite, anorthite, Ti-poor chromite, Ti-rich chromite and ilmenite. Minor secondary calcite veinlets and barite are present.
Geochemistry: Olivine ($Fa_{19.1-41.9}$, FeO/MnO = 69-78, N = 4), pigeonite ($Fs_{41.0}Wo_{5.2}$, FeO/MnO = 51), augite ($Fs_{9.8}Wo_{42.8}$, FeO/MnO = 36), low-Ca pyroxene host ($Fs_{56.7}Wo_{5.6}$, FeO/MnO = 56), clinopyroxene exsolution lamella ($Fs_{30.2}Wo_{39.1}$, FeO/MnO = 52), anorthite ($An_{96.8}Or_{0.2}$).
Classification: Lunar (feldspathic breccia).
Specimens: 20.5 g including one polished thin section at *UWB*; remainder with *Twelker*.

Northwest Africa 10757 (NWA 10757)
(Northwest Africa)
Purchased: 2016 May
Classification: Ordinary chondrite (H4)
History: Purchased in Temara, Morocco by Adam Aaronson in May 2016.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively small chondrules and altered metal.
Geochemistry: Olivine ($Fa_{18.0-18.1}$, N = 3), orthopyroxene ($Fs_{15.9-16.4}Wo_{0.8-0.7}$, N = 3), clinopyroxene ($Fs_{9.2-10.4}Wo_{30.3-28.2}$, N = 2).
Classification: Ordinary chondrite (H4).

Specimens: 21 g including one polished thin section at *UWB*; remainder with *Aaronson*.

Northwest Africa 10759 (NWA 10759)
(Northwest Africa)
Purchased: 2015 Sep
Classification: Ordinary chondrite (LL5)
History: Purchased by John Higgins in September 2015 from a dealer in Laayoune, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Largely recrystallized with sparse chondrules and chondrule remnants plus stained metal grains.
Geochemistry: Olivine ($Fa_{30.2\text{-}30.5}$, N = 3), orthopyroxene ($Fs_{23.3\text{-}24.4}Wo_{1.8\text{-}1.7}$, N = 3), clinopyroxene ($Fs_{10.2\text{-}11.5}Wo_{43.5\text{-}43.0}$, N = 2).
Classification: Ordinary chondrite (LL5).
Specimens: 23.9 g including one polished thin section at *UWB*; remainder with Mr. J. Higgins.

Northwest Africa 10760 (NWA 10760)
(Northwest Africa)
Purchased: 2016 Feb
Classification: Ordinary chondrite (L(LL)3)
History: Purchased by Bob Falls in February 2016 from a Moroccan dealer at the Tucson Gem and Mineral Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well formed, fairly closely packed chondrules (apparent diameter 700 ± 500 μm) in a finer grained matrix containing altered metal.
Geochemistry: Olivine ($Fa_{1.1\text{-}50.5}$; Cr_2O_3 in ferroan examples 0.09-0.18 wt.%, mean 0.12±0.04 wt.%; N = 8), orthopyroxene ($Fs_{6.8\text{-}28.4}Wo_{0.2\text{-}0.1}$, N = 3), subcalcic augite ($Fs_{34.2}Wo_{33.5}$), augite ($Fs_{12.2}Wo_{41.4}$).
Classification: Ordinary chondrite (L(LL)3).
Specimens: 24.2 g including one polished thin section at *UWB*; remainder with Mr. R. Falls.

Northwest Africa 10761 (NWA 10761)
(Northwest Africa)
Purchased: 2016 Apr
Classification: Martian meteorite (Shergottite)
History: Purchased by Darryl Pitt in April 2016 from a dealer in Ouarzazate, Morocco.
Physical characteristics: Dark, ellipsoidal, coarse grained specimen (473 g) characterized by prominent elongate prismatic, pale yellow-green grains and patches of black vesicular glass.
Petrography: (A. Irving and S. Kuehner, *UWS*) Composed of very large, zoned and twinned clinopyroxene (as prismatic grains up to 2.3 cm in length) with interstitial regions of interleaved, finer grained pyroxene and maskelynite plus Fe-Ti oxides (some with finely exsolved ilmenite + ulvöspinel), pyrrhotite, Fe-bearing merrillite, fayalite, silica polymorph, baddeleyite and intergrowths of fayalite+hedenbergite+silica (after pyroxferroite). Shock pockets composed mainly of vesicular glass (sepia brown in thin section) are present.
Geochemistry: Low-Ca pyroxene ($Fs_{20.2\text{-}23.6}Wo_{2.7\text{-}3.9}$, FeO/MnO = 29-31, N = 4), high-Ca pyroxene ($Fs_{22.8\text{-}32.6}Wo_{30.9\text{-}26.2}$, FeO/MnO = 26-29, N = 4), pigeonite ($Fs_{46.3}Wo_{13.0}$, FeO/MnO = 34), ferropigeonite ($Fs_{62.1\text{-}73.3}Wo_{19.8\text{-}19.1}$; $Fs_{85.7}Wo_{13.1}$; FeO/MnO = 38-42; N = 3), ferroan subcalcic augite ($Fs_{59.9}Wo_{34.8}$, FeO/MnO = 38), fayalite ($Fa_{97.5\text{-}99.4}$, FeO/MnO = 44-56, N = 2), maskelynite ($An_{52.2\text{-}52.3}Or_{1.0\text{-}0.7}$, N = 2).

Classification: Martian (shergottite, gabbroic).
Specimens: 21.5 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 10762 (NWA 10762)
(Northwest Africa)
Purchased: 2015 Feb
Classification: Ordinary chondrite (H3)
History: Purchased by Dr. David Gregory in February 2008 from a Moroccan dealer at the Tucson Gem and Mineral Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules (apparent diameter 400±300 μm) in a relatively coarse grained matrix containing relatively abundant altered metal. Silica polymorph is present in some chondrules.
Geochemistry: Olivine ($Fa_{18.3\text{-}19.2}$, Cr_2O_3 <0.03 wt.%; relict cores $Fa_{0.9}$; N = 5), orthopyroxene ($Fs_{3.2\text{-}17.3}Wo_{0.3\text{-}1.1}$, N = 3), subcalcic augite ($Fs_{10.2}Wo_{32.1}$), augite ($Fs_{5.1}Wo_{41.0}$).
Classification: Ordinary chondrite (H3). The presence of relict forsteritic cores in olivine and the compositional range in pyroxenes suggest that this is a H3.9 rather than H4 chondrite.
Specimens: 261.2 g plus one polished thin section at *ROM*; remainder with *Gregory*.

Northwest Africa 10763 (NWA 10763)
(Northwest Africa)
Purchased: 2016 Feb
Classification: HED achondrite (Diogenite)
History: Purchased by Bob Falls in February 2016 from a Moroccan dealer at the Tucson Gem and Mineral Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Recrystallized breccia composed mainly of larger angular orthopyroxene grains in a fairly coarse grained matrix. Accessory minerals include chromite, troilite and stained Ni-free metal.
Geochemistry: Orthopyroxene ($Fs_{27.4\text{-}27.5}Wo_{2.9\text{-}3.4}$, FeO/MnO = 25-27, N = 3).
Classification: Diogenite (recrystallized breccia).
Specimens: 20.3 g including one polished thin section at *UWB*; remainder with Mr. R. Falls.

Northwest Africa 10764 (NWA 10764)
(Northwest Africa)
Purchased: 2016 Feb
Classification: Ordinary chondrite (L(LL)3)
History: Purchased by Bob Falls in February 2016 from a Moroccan dealer at the Tucson Gem and Mineral Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well formed, fairly closely packed chondrules (apparent diameter 500 ± 300 μm) in a finer grained matrix containing altered metal.
Geochemistry: Olivine ($Fa_{1.5\text{-}43.8}$; Cr_2O_3 in ferroan examples 0.02-0.08 wt.%, mean 0.04±0.02 wt.%; N = 8), orthopyroxene ($Fs_{1.0\text{-}40.2}Wo_{1.0\text{-}2.3}$, N = 3), clinopyroxene ($Fs_{9.8\text{-}15.2}Wo_{37.7\text{-}41.7}$, N = 2).
Classification: Ordinary chondrite (L(LL)3).
Specimens: 21.0 g including one polished thin section at *UWB*; remainder with Mr. R. Falls.

Northwest Africa 10765 (NWA 10765)

(Northwest Africa)
Purchased: 2014 Feb
Classification: Mesosiderite
History: Purchased by Dr. David Gregory in February 2008 from a Moroccan dealer at the Tucson Gem and Mineral Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Aggregate of predominantly orthopyroxene plus ~30 vol.% metal (kamacite plus minor taenite) and ~5 vol.% anorthite with accessory merrillite, chromite, troilite and silica polymorph (as tiny included grains in some plagioclase).
Geochemistry: Orthopyroxene ($Fs_{26.7\text{-}27.1}Wo_{2.3\text{-}2.0}$, FeO/MnO = 28-29, N = 3), plagioclase ($An_{92.1\text{-}92.9}Or_{0.4}$, N = 2). Oxygen isotopes (K. Ziegler, *UNM*): analysis of acid-washed subsamples by laser fluorination gave, respectively, $\delta^{17}O$ 1.638, 1.664, 1.645; $\delta^{18}O$ 3.675, 3.733, 3.579; $\Delta^{17}O$ -0.302, -0.307, -0.245 per mil.
Classification: Mesosiderite.
Specimens: 11.27 g plus one polished thick section at *ROM*; remainder with *Gregory*.

Northwest Africa 10766 (NWA 10766)
(Northwest Africa)
Purchased: 2016 Feb
Classification: Ordinary chondrite (L3)
History: Purchased by Bob Falls in February 2016 from a Moroccan dealer at the Tucson Gem and Mineral Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well formed, fairly closely packed chondrules (apparent diameter 500 ± 300 μm) in a finer grained matrix containing altered metal.
Geochemistry: Olivine ($Fa_{5.0\text{-}51.6}$; Cr_2O_3 in ferroan examples 0.02-0.14 wt.%, mean 0.04±0.02 wt.%; N = 8), orthopyroxene ($Fs_{3.8\text{-}20.2}Wo_{0.4\text{-}0.7}$, N = 3), subcalcic augite ($Fs_{14.4}Wo_{33.2}$).
Classification: Ordinary chondrite (L3).
Specimens: 27.4 g including one polished thin section at *UWB*; remainder with Mr. R. Falls.

Northwest Africa 10768 (NWA 10768)
(Northwest Africa)
Purchased: 2016 May
Classification: Carbonaceous chondrite (CO3)
History: Purchased in Temara, Morocco by Adam Aaronson in May 2016.
Petrography: (A. Irving and S. Kuehner, *UWS*) Small, well-formed chondrules (apparent diameter 300 ± 200 μm), mineral fragments and CAI are set in a finer grained matrix (~30 vol%).
Geochemistry: Olivine ($Fa_{0.7\text{-}53.9}$; Cr_2O_3 in ferroan examples 0.07-0.14 wt.%, mean 0.10±0.03 wt.%; N = 8), orthopyroxene ($Fs_{2.1\text{-}22.9}Wo_{0.3\text{-}0.8}$, N = 3), subcalcic augite ($Fs_{11.1}Wo_{28.6}$), augite ($Fs_{12.9}Wo_{44.2}$).
Classification: Carbonaceous chondrite (CO3).
Specimens: 20.1 g including one polished thin section at *UWB*; remainder with *Aaronson*.

Northwest Africa 10769 (NWA 10769)
Western Sahara
Purchased: Mar 2015
Classification: Ungrouped chondrite

History: Collected by nomads in Western Sahara and purchased by Nicola Castellano at the Bologna Mineral Fair in March 2015 from a Moroccan dealer.
Physical characteristics: A single piece weighing 149 g partially covered by fusion crust. The sawn surface displays chondrules set in a red-brown matrix with no metal spots.
Petrography: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*): The thin section displays a chondritic texture, with several chondrules set in a fine-grained matrix, mainly consisting of olivine and pyroxene. Chondrules range from 0.2 to 0.7 mm in diameter and are mainly PP type, with minor RP and C. Pyroxene crystals in PP chondrules are often rimmed by pigeonite. Chondrules account for about 70% of the total surface of the section. Opaque phases account for about 5% of the total area and are mainly pentlandite and Ni-rich pyrrhotite, partially weathered to iron oxides, while kamacite is very rare.
Geochemistry: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Matrix: olivine ($Fa_{24.7\pm3.5}$, Fe/Mn=55±4, n=8, MD=1.76, PMD=7.76); low-Ca pyroxene ($Fs_{14.6\pm5.0}En_{84.4\pm5.2}Wo_{0.9\pm0.2}$, 0.2 TiO_2, 0.2 Al_2O_3, 0.2 Cr_2O_3, all wt. %; Fe/Mn=21±5, n=6 MD=2.47, PMD=25.48); Chondrules: olivine ($Fa_{23.4\pm3.6}$, Fe/Mn=58±4, n=6, MD=2.38, PMD=11.06); low-Ca pyroxene ($Fs_{14.4\pm5.1}En_{84.6\pm4.9}Wo_{0.9\pm0.2}$, 0.2 TiO_2, 0.2 Al_2O_3, 0.2 Cr_2O_3, all wt. %; Fe/Mn=21±5, n=8 MD=2.49, PMD=25.52); pigeonite ($Fs_{23.1\pm2.7}En_{72.8\pm5.1}Wo_{4.1\pm2.4}$, 0.2 TiO_2, 0.8 Al_2O_3, 0.9 Cr_2O_3, all wt. %); Oxygen isotopes: (I. Franchi, R. Greenwood, *OU*) $\delta^{17}O$ = 3.65 ‰, $\delta^{18}O$ = 5.95 ‰, $\Delta^{17}O$ = 0.55 ‰ (mean of two runs, bulk rock, 1 chip weighing 0.5 g); oxygen isotopes plot in a region above the TFL distinct from ordinary chondrites and at relatively high $\delta^{18}O$ values.
Classification: The chondritic texture together with the presence of pentlandite and pyrrhotite and the absence of troilite point to a classification as an ungrouped chondrite; isotopic data and the compositional variability of Fa and Fs contents point to petrologic type 3.8; S1; W3
Specimens: A total of 20.8 g specimen is on deposit at MSN-Fi. Castellano holds two thin sections and the main mass.

Northwest Africa 10770 (NWA 10770)
Western Sahara
Purchased: Mar 2015
Classification: Enstatite chondrite (EL6)
History: Collected by nomads in Western Sahara and purchased by Nicola Castellano at the Bologna Mineral Fair in March 2015 from a Moroccan dealer.
Physical characteristics: A single piece weighing 171 g without fusion crust.
Petrography: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*): Matrix contains pyroxene, minor plagioclase and rare relict chondrules. Iron oxides/hydroxides veinlets are present, ranging in width from 140 to 180 μm. Relict chondrules are mainly RP type. Opaque phases are mainly kamacite and troilite, partially weathered to iron oxides. Alabandite and daubreelite as blades in troilite are accessory phases.
Geochemistry: EMP (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Orthopyroxene ($Fs_{0.5}En_{98.2}Wo_{1.3}$), plagioclase ($An_{13.8}Or_{3.4}$); Si in kamacite = 0.6 wt.%, Ti in troilite = 5.7 wt.%
Classification: The presence of alabandite, An content of plagioclase, and Si content of kamacite point to a classification as an enstatite chondrite (EL6); S2; W3
Specimens: A total of 28.0 g specimen is on deposit at MSN-Fi. Castellano holds the main mass and one thin section.

Northwest Africa 10773 (NWA 10773)

Western Sahara
Purchased: May 2015
Classification: Enstatite chondrite (EL6)
History: Collected by nomads in Western Sahara and purchased by Nicola Castellano at the Genova Mineral Fair in May 2015 from a Moroccan dealer.
Physical characteristics: A single piece weighing 3120 g partially covered by fusion crust.
Petrography: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*): The meteorite consists of a fine-grained, pyroxene-dominant matrix, with minor plagioclase. No chondrules are visible. Kamacite and troilite are the main opaque phases, partially weathered to iron oxides. Accessory phases are alabandite and daubreelite as blades in troilite.
Geochemistry: EMP (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Orthopyroxene ($Fs_{0.2}En_{98.3}Wo_{1.5}$), plagioclase ($An_{14.3}Or_{4.1}$); Si in kamacite = 0.5 wt.%, Ti in troilite = 6.3 wt.%
Classification: The presence of alabandite, An content of plagioclase and Si content of kamacite point to a classification as enstatite chondrite (EL6); S2; W3
Specimens: A total of 84.0 g and one thin section is on deposit at MSN-Fi. Castellano holds the main mass.

Northwest Africa 10774 (NWA 10774)
Morocco, Dahkla, (Northwest Africa)
Purchased: Oct 2015
Classification: Ordinary chondrite (L3)
History: Collected by nomads in Western Sahara and purchased by Nicola Castellano at the Torino Mineral Fair in October 2015 from a Moroccan dealer.
Physical characteristics: Single stone, dark brown crust. The sawn surface shows dark-gray, very fine-grained, shock-melted veins up to 1 mm wide intersecting the coarse grained, brown chondritic matrix.
Petrography: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) The thin section displays several chondrules set in a medium grained matrix. The matrix is consisting of pyroxene and olivine and displays several melted portions, black in polarized light. Chondrules types are various (RP, BO, PO, POP, PP and C). Opaque phases account for about 10% of the total area and are mainly consisting of kamacite, taenite with minor troilite and iron oxides/hydroxides. Well distinguishable chondrules and the variability of Fa and Fs contents point to a petrologic type 3.7.
Geochemistry: EMP (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Olivine ($Fa_{24.3\pm2.0}$, Fe/Mn=49±2, n=16; MD=0.76 PMD=2.40); low-Ca pyroxene ($Fs_{14.4\pm8.6}En_{84.9\pm8.7}Wo_{0.7\pm0.5}$; Fe/Mn=31±2, n=15; MD=2.8 PMD=28.1); diopside ($Fs_{15.0}En_{65.0}Wo_{19.9}$; 1.9 Al_2O_3, 1.8 Cr_2O_3, 1.1 MnO, all wt. %); plagioclase ($Ab_{14.3}An_{82.4}Or_{3.3}$); Oxygen isotopes: (I.Franchi, R.Greenwood, *OU*) $\delta^{17}O$ = 3.84 ‰, $\delta^{18}O$ = 5.39 ‰, $\Delta^{17}O$ = 1.03 ‰.
Classification: Ordinary Chondrite (L3) with suggested sub-type 3.7; S3; W2
Specimens: A total of 23.1 g specimen is on deposit at MSN-Fi. Castellano holds the main mass and one thin section.

Northwest Africa 10776 (NWA 10776)
Morocco
Purchased: 2002
Classification: HED achondrite (Eucrite)

History: The meteorite was bought in 2002 in Sainte-Marie-aux-Mines, France, from a Moroccan dealer.
Physical characteristics: A single crusted stone. Cut surface reveals a gray interior with 500 μm to 1 mm dark clasts.
Petrography: Magmatic rock with ophitic to subophitic texture, dominated by pyroxenes (some zoned, some exsolved) and plagioclase with typical grain size 250 μm. Accessory troilite, chromite, ilmenite, silica polymorph. Rare metal. The rock contains quenched and shock-darkened clasts to mm.
Geochemistry: Pyroxene $Fs_{46.7\pm4.7}Wo_{6.2\pm1.1}$, FeO/MnO=35.3±1.7 (N=3). Plagioclase $An_{69.0-89.1}Ab_{28.6-10.6}Or_{2.6-0.3}$ (N=2). Magnetic susceptibility log χ (× 10^{-9} m^3/kg)=2.66.
Classification: Achondrite (eucrite). Minimal weathering.
Specimens: 3.2 g and a polished section at *CEREGE*. Main mass with N. Tourment.

Northwest Africa 10777 (NWA 10777)
Morocco
Purchased: 2002
Classification: Carbonaceous chondrite (CV3)
History: The meteorite was bought in 2002 in Sainte-Marie-aux-Mines, France, from a Moroccan dealer.
Physical characteristics: A single partially crusted dark stone. Cut surface reveals large chondrules (to several mm) and CAIs (to 5 mm) set in an abundant dark matrix.
Petrography: Chondrules (mostly type I, average apparent diameter 1060±590 μm, N=30) and CAIs set in a fine-grained iron-rich matrix (about 50 vol%). The matrix has a macroscopic foliation. Opaques are sulfides and magnetite. Rare metal.
Geochemistry: Chondrule olivine $Fa_{2.3\pm2.1}$, PMD 46%, range $Fa_{0.8-8.3}$, N=12. Cr_2O_3 in ferroan olivine 0.38±0.10 wt.% (N=5). Magnetic susceptibility log χ (× 10^{-9} m^3/kg) = 4.40.
Classification: Carbonaceous chondrite (CV3, oxidized subgroup).
Specimens: 2.4 g and a polished section at *CEREGE*. Main mass with N. Tourment.

Northwest Africa 10779 (NWA 10779)
(Northwest Africa)
Purchased: May 2015
Classification: HED achondrite (Diogenite)
History: Bought in Erfoud, Morocco, in May 2015.
Physical characteristics: A single crusted stone. Cut surface shows a gray interior with brecciated texture.
Petrography: Brecciated igneous rock with mineral clasts to several mm in a clastic matrix. Main minerals are pyroxenes (exsolved or not). Accessory plagioclase, olivine, chromite to 3280 μm, phosphate, troilite (aligned as inclusions in some large silicate crystals), Fe-Ni metal to 60 μm.
Geochemistry: Orthopyroxene $Fs_{23.3\pm1.5}Wo_{2.3\pm0.35}$, FeO/MnO=32.8±2.1 (N=5). Olivine $Fa_{42.2}$, FeO/MnO=52.3 (N=1). Plagioclase $An_{88.7}Ab_{10.8}Or_{0.5}$ (N=1). Chromite Cr/(Cr+Al) = 0.72. Magnetic susceptibility log χ (× 10^{-9} m^3/kg) = 2.94.
Classification: Achondrite (Diogenite)
Specimens: 15 g and a polished section at *CEREGE*. Main mass with *Labenne*.

Northwest Africa 10780 (NWA 10780)
(Northwest Africa)
Purchased: Sept 2014
Classification: Mesosiderite
History: Bought in Casablanca, Morocco, in September 2014.
Physical characteristics: A single brownish stone with fusion crust. Cut surface shows a coarse brownish interior with mm metal grains.
Petrography: Crystalline rock with recrystallized texture (triple junctions). Silicates are mainly orthopyroxene (typical size 400 μm) with lower amount of plagioclase and Ca-pyroxene. Abundant metal in elongated grains up to 2 mm. Metal is also found as microscopic grains aligned within silicates. Other minerals: chromite, silica, troilite (to 600 μm), merrillite. Modal abundances: pyroxene 72%, plagioclase 12%, FeNi metal 13%, troilite 4% (from point counting, N=162).
Geochemistry: Orthopyroxene $Fs_{27.3\pm0.6}Wo_{3.1\pm0.1}$, FeO/MnO=27.0±1.4 (N=3). Plagioclase $An_{93.0\pm2.7}Ab_{6.7\pm2.6}Or_{0.3\pm0.1}$ (N=2). Chromite Cr/(Cr+Al) = 0.77. Magnetic susceptibility log χ (× 10^{-9} m^3/kg) = 5.92.
Classification: Mesosiderite (type C). Low weathering.
Specimens: 5 g and a polished section at *CEREGE*. Main mass with *Labenne*.

Northwest Africa 10781 (NWA 10781)
Morocco
Purchased: 2015 Oct
Classification: HED achondrite (Howardite)
History: Bought by Jean Redelsperger from Abdellah Afiniss in Agadir in October 2015.
Physical characteristics: A single grayish stone without fusion crust. Darker clasts to cm are visible at the surface. Cut surface reveals a light-gray interior with dark clasts.
Petrography: Brecciated rock with cataclastic matrix. Clasts to 1 cm, some with coarse sub-ophitic texture. Main minerals are pyroxenes (some zoned, some exsolved), plagioclase. Accessory olivine, troilite (sometimes as tiny grains aligned in silicates), chromite (to 700 μm) in matrix and silicate clasts, ilmenite, silica polymorph, Fe-Ni metal.
Geochemistry: Pyroxenes: diogenitic orthopyroxene $Fs_{27.8\pm1.1}Wo_{3.2\pm0.1}$ (N=4), eucritic Ca-pyroxene $Fs_{46.6\pm7.9}Wo_{15.5\pm5.0}$ (N=3), FeO/MnO=32.5±4.3 (N=7). Plagioclase $An_{84.2\pm2.2}Ab_{15.2\pm2.2}Or_{0.6\pm0.1}$ (N=4). Olivine $Fa_{60.5}$, FeO/MnO=47.0 (N=1). Magnetic susceptibilty log χ (× 10^{-9} m^3/kg) = 3.26.
Classification: Achondrite (Howardite).
Specimens: 18.4 g at *CEREGE*. Main mass with Jean Redelsperger.

Northwest Africa 10782 (NWA 10782)
(Northwest Africa)
Purchased: 2015 May 01
Classification: Lunar (regolith breccia)
History: Found in the region of Almabas near the frontier between Morocco and Algeria.
Physical characteristics: One stone with no visible fusion crust. Recognized as a lunar breccia by L. Labenne.
Petrography: (R. Hewins, S. Pont, B. Zanda, *MNHNP*) This is a breccia composed mainly of crystal clasts a few hundred μm in size, with a few glassy to dendrite-bearing spherules about 1

mm in size. Matrix is very fine-grained, in some cases glass with schlieren, with vugs or vesicles. There are a few breccia clasts up to 4 mm, very fine grained (1-2 μm) and in some cases with igneous textures (i.e. clast-laden melt rock clasts). Breccia clasts contain feldspathic igneous clasts with intersertal textures resembling Apollo 14310 but finer, as well as crystal clasts and rare lithic chips. Some pyroxene clasts show exsolution. Accessory minerals include troilite, ilmenite, a silica phase and, in the largest melt-rock, Ni-bearing metal.
Geochemistry: Mineral compositions and Geochemistry: (R. Hewins ans S. Pont, *MNHNP*) The pyroxene compositions are $Fs_{36.7}Wo_{7.6}$ to $Fs_{55.3}Wo_{19.6}$, and the atomic Fe/Mn falls just below the *UNM* lunar line with average ratio 71. Both magnesian and ferroan olivine clasts are present, with FeO/MnO of 103 falling just below the lunar value. Spinel contains ~40 wt% Cr_2O_3. Plagioclase is $An_{93.6}Ab_{6.2}Or_{0.2.}$ The glassy matrix is basaltic (sensu lato).
Classification: (R. Hewins *MNHN*) Lunar breccia. The meteorite contains anorthite with olivine and pyroxene Fe/Mn ratios matching lunar. As it contains Ni-rich metal, glass spherules and breccia clasts it is classified as a regolith breccia.
Specimens: The main mass (31 g) is held by *Labenne*. The type specimen consists of 0.977 g and 6.88 g at *MNHNP*.

Northwest Africa 10783 (NWA 10783)
(Northwest Africa)
Purchased: 2015 May 1
Classification: Lunar meteorite (anorth)
History: Found in the Almahbas region near the frontier between Morocco and Algeria.
Physical characteristics: The stone is a breccia with no visible fusion crust. The type specimen is mostly light colored with metal specks, and there is a dark zone at one end.
Petrography: (R. Hewins, S. Pont, B. Zanda, *MNHNP*) Most of the prepared section is a poikilitic anorthosite resembling Apollo 77017. It consists of plagioclase phenocrysts up to 2 mm in length set in pyroxene poikilitic to stubby tiny plagioclase laths (down to 20 μm) and to olivine granules (~50 μm). Both pigeonite and augite are present, but with no obvious exsolution. Minor minerals include chromite, ilmenite, baddeleyite, taenite and kamacite. There is a dark sliver of breccia matrix at the end of the section containing a huge variety of clast types, 1 mm or smaller. These include crystal clasts (olivine, pigeonite, augite, anorthite, chromite and a silica polymorph), breccia clasts, and lithic clasts often with elongated plagioclase laths.
Geochemistry: Mineral compositions and Geochemistry: (R. Hewins and S. Pont, *MNHNP*) The olivine composition is $Fa_{34.1\pm1.5}$, with FeO/MnO 119±14. Pyroxenes are pigeonite $Fs_{25.4}Wo_{11.1}$ and augite $En_{49.6}Fs_{19.2}Wo_{31.2.}$ Plagioclase is $An_{94.0\pm0.6}Ab_{5.5\pm0.6}Or_{0.5\pm0.2.}$ Taenite contains ~37% Ni. Mineral compositions are similar to those of Apollo 77017, but olivine is a little less ferroan.
Classification: (R. Hewins *MNHN*, L. *Labenne* Paris) Lunar poikilitic anorthositic breccia.
Specimens: The type specimen consists of 3.78 g and 0.63 g at *MNHNP*. The remaining 17.6 g minus sawdust has been sold in the form of thin slices by *Labenne*.

Northwest Africa 10784 (NWA 10784)
(Northwest Africa)
Purchased: 2015 May 1
Classification: HED achondrite (Eucrite, brecciated)
History: Found in the region of Er-Rich to the north of Errachidia.

Physical characteristics: One flat stone consisting of breccia, with fusion crust on the lower part protected from ablation by wind.
Petrography: (R. Hewins, S. Pont, B. Zanda, *MNHNP*) This is a breccia with lithic clasts clasts up to 4 mm in size. The main minerals are othopyroxene, augite and plagioclase, with a silica phase, chromite, ilmenite, zircon and rare kamacite both Ni-free and Ni-bearing. The grain size is up to 1.5 mm in the subophitic clast, with augite lamellae up to 80 μm in width. Plagioclase laths are more elongated in finer grained clasts, but there are also granoblastic clasts containing 50 μm grains with up to 2 μm exsolution lamellae. Exsolution lamellae in orthopyroxene are commonly bent and/or displaced up to 25 μm by fracturing. Large plagioclase grains have crystallographically controlled pyroxene inclusions, whereas much plagioclase in fine grained matrix is smooth and featureless except for vugs. The matrix varies from granoblastic to clasts embedded in smooth plagioclase. A vein of melt crosses the section and invades the matrix. It is a nanophyric intergrowth of 1 μm pyroxene and plagioclase crystals, though locally with plagioclase dendrites, containing clasts mainly of pyroxene, and blobs and schlieren of melted plagioclase. The meteorite contains traces of calcite and barite.
Geochemistry: Mineral compositions and Geochemistry: (R. Hewins and S. Pont, *MNHNP*) The pyroxene compositions are $Fs_{57.2}Wo_{2.2}$ to $Fs_{64.9}Wo_{4.9}$, and $Fs_{25.8}Wo_{41.7}$ to $Fs_{29.6}Wo_{44.1.}$ Fe and Mn are equilibrated between the two pyroxenes, with atomic ratio 31.2±1.9 (n=13) plotting on the *UNM* eucrite line. Plagioclase is $An_{89.3\text{-}87.8}Or_{0.3\text{-}0.6.}$ Chromite has ~49% Cr_2O_3.
Classification: (R. Hewins *MNHN*) Basaltic eucrite breccia. The meteorite contains anorthite, and pyroxene with Fe/Mn ratios matching eucrite, plus typical eucrite textures.
Specimens: The type specimen consists of 20.63 and 0.93 g at *MNHNP*. The main mass (937 g) is held by *MHNN*. *Labenne* retains 202.6 g and the rest (in the form of caliche crust, crumbs and saw dust) was discarded.

Northwest Africa 10785 (NWA 10785)
(Northwest Africa)
Purchased: 2015 May 1
Classification: Ungrouped achondrite
History: Purchased in Agadir, with no details on provenance.
Physical characteristics: A half-stone covered by fusion crust, with 2 cm yellow blocks in a whitish matrix. Recognized as similar to NWA 7835 by L. Labenne.
Petrography: (R. Hewins, S. Pont, B. Zanda, *MNHNP*) The dominant minerals are olivine and orthopyroxene, in a polished section that shows a blocky zone and a pseudo-porphyritic zone. Olivine grains in the blocky zone are at least 6 mm in maximum dimension, and are separated by patches and sparse veinlets of mesostasis. Olivine-orthopyroxene contacts are irregular, often with plagioclase (glass?) separating the two phases, with olivine-rich veinlets invading the pyroxene. Outside the blocky zone, angular grains of olivine and orthopyroxene are supported in a mesostasis with 10-20 μm roundish granules of orthopyroxene embedded in plagioclase probably glass. Minor minerals in the mesostasis are augite, chromite, taenite and troilite.
Geochemistry: Mineral compositions and Geochemistry: (R. Hewins, S. Pont, *MNHNP* and J.-A. Barrat, *UBrest*) The olivine is $Fa_{26.1\pm0.4}$, with FeO/MnO 53.8±3.4. The orthopyroxene composition is $En_{77.5\pm1.1}Fs_{21.0\pm0.7}Wo_{1.6\pm0.4}$, with Fe/Mn atomic ratio 38.9±3.3. "Plagioclase" is $An_{15.1\pm1.1}Ab_{80.6\pm0.6}Or_{4.3\pm0.7.}$ These compositions are almost identical to those of NWA 7835 (Irving et al., 2014), though differences in the descriptions of the textures might mean different thermal history. Taenite contains ~37% Ni.

Classification: (R. Hewins *MNHN*, L. *Labenne*, Paris) (Harzburgitic) ungrouped achondrite. Possibly paired with NWA 7835.
Specimens: The main mass (57 g) is held by *Labenne*. The type specimen of 10.87 g and 3.74 g is at *MNHNP*.

Northwest Africa 10786 (NWA 10786)
Western Sahara
Purchased: Oct 2015
Classification: Ordinary chondrite (LL3)
History: Collected by nomads in Western Sahara and purchased by Mario Di Martino at the Torino Mineral Fair in October 2015 from a Moroccan dealer.
Physical characteristics: Single stone, dark brown crust. The sawn surface shows a medium grained, brown chondritic matrix.
Petrography: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) The thin section displays a medium-grained matrix with several chondrules. The matrix is mainly consisting of pyroxene and olivine, with minor plagioclase.Chondrules range from 250 to 800 μm in diameter. Chondrules types are various (BO, PO, PP and C). Opaque phases, mainly consisting of kamacite, taenite with minor troilite and iron oxides/hydroxides, account for about 5% of the total area. Distinct chondrules and the variability of Fa and Fs contents point to high petrologic type 3.
Geochemistry: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Chondrules: olivine ($Fa_{27.0\pm4.6}$, Fe/Mn=61±6, n=14; MD=1.4 PMD=5.7); low-Ca pyroxene ($Fs_{19.0\pm6.9}En_{80.5\pm7.0}Wo_{0.5\pm0.1}$; Fe/Mn=32±2, n=7; MD=1.6 PMD=12.4); matrix: low-Ca pyroxene ($Fs_{24.0\pm0.2}En_{74.0\pm0.2}Wo_{2.0\pm0.5}$; Fe/Mn=40±1, n=5; MD=0.2 PMD=0.9); diopside ($Fs_{17.3}En_{79.4}Wo_{3.3}$; 1.6 Al_2O_3, 0.8 Cr_2O_3, 0.3 MnO, all wt. %); Oxygen isotopes: (I. Franchi, R. Greenwood, *OU*) $\delta^{17}O$ = 3.66 ‰, $\delta^{18}O$ = 5.28 ‰, $\Delta^{17}O$ = 0.91 ‰
Classification: Ordinary Chondrite (LL3); S1; W2;
Specimens: A total of 38.0 g specimen and one thin section are on deposit at *MSN-FI*. Di Martino holds the main mass.

Northwest Africa 10787 (NWA 10787)
(Northwest Africa)
Purchased: Oct 2015
Classification: Ordinary chondrite (H4, melt breccia)
History: Collected by nomads in Western Sahara and purchased by Compagnucci at the Torino Mineral Fair in October 2015 from a Moroccan dealer.
Physical characteristics: Single stone, dark brown crust. The sawn surface shows a black matrix with scattered metal spots and shock-melted veins.
Petrography: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) The thin polished section displays a brecciated texture with chondritic clasts in a melted matrix; the clasts show several chondrules of various types (mostly RP, PP and C) ranging in size from 200 to 600 μm in diameter within a dark, very fine-grained black matrix. The matrix contains scattered grains of metal and rounded troilite blebs. Shock stages are S3 for clasts and S5 for matrix.
Geochemistry: EMP (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Olivine ($Fa_{18.3\pm1.1}$, Fe/Mn=41±7, n=6; PMD=2.3); low-Ca pyroxene ($Fs_{19.4\pm5.2}En_{79.9\pm5.6}Wo_{0.7\pm0.3}$; Fe/Mn=27±6, n=6;

PMD=10.9); diopside ($Fs_{15.5}En_{60.3}Wo_{24.2}$; 1.3 Al_2O_3, 1.2 Cr_2O_3, 0.7 MnO, all wt. %); Oxygen isotopes: (I.Franchi, R.Greenwood, *OU*) $\delta^{17}O = 3.15$ ‰, $\delta^{18}O = 4.42$ ‰, $\Delta^{17}O = 0.85$ ‰.
Classification: Ordinary chondrite (H4-melt breccia); S3; W1.
Specimens: A total of 48.7 g specimen and one thin section are on deposit at *MSN-FI*. Compagnucci holds the main mass.

Northwest Africa 10792 (NWA 10792)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (L4)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently acquired by the Hollis Collection.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia consisting mostly of well-formed chondrules plus some lithic clasts in a recrystallized matrix containing altered metal and minor merrillite.
Geochemistry: Olivine ($Fa_{25.0\text{-}25.7}$, N = 3), orthopyroxene ($Fs_{21.1\text{-}21.2}Wo_{1.4\text{-}1.6}$, N = 3), clinopyroxene ($Fs_{7.6\text{-}7.7}Wo_{45.6\text{-}45.1}$, N = 2).
Classification: Ordinary chondrite (L4).
Specimens: 20.1 g including one polished thin section at *PSF*; remainder in the Hollis Collection.

Northwest Africa 10793 (NWA 10793)
(Northwest Africa)
Purchased: 2005
Classification: Mesosiderite
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Aggregate of predominantly orthopyroxene, altered metal (kamacite plus taenite) and anorthitic plagioclase with accessory olivine, pigeonite, silica polymorph and merrillite.
Geochemistry: Olivine ($Fa_{24.6}$, FeO/MnO = 44), orthopyroxene ($Fs_{23.1\text{-}24.1}Wo_{4.0\text{-}2.2}$, FeO/MnO = 15-27), pigeonite ($Fs_{33.8}Wo_{7.3}$, FeO/MnO = 26), plagioclase ($An_{91.9\text{-}92.1}Or_{0.1}$, N = 2).
Classification: Mesosiderite.
Specimens: The entire specimen polished on one side is at *PSF*.

Northwest Africa 10794 (NWA 10794)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (LL4)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively large chondrules are set in a relatively coarse grained, recrystallized matrix containing stained metal and minor chlorapatite.
Geochemistry: Olivine ($Fa_{28.7\text{-}28.9}$, N = 3), orthopyroxene ($Fs_{23.0\text{-}23.7}Wo_{1.6\text{-}1.3}$, N = 3), clinopyroxene ($Fs_{13.7}Wo_{35.0}$; $Fs_{8.5}Wo_{45.7}$, N = 2).

Classification: Ordinary chondrite (LL4).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10795 (NWA 10795)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (H4)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently acquired by the Hollis Collection.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively small chondrules are set in a relatively coarse grained, recrystallized matrix containing altered metal.
Geochemistry: (S. Kuehner, *UWS*; P. Carpenter, *WUSL*) Olivine ($Fa_{17.2\text{-}17.8}$, N = 4), orthopyroxene ($Fs_{15.0\text{-}16.1}Wo_{0.7\text{-}3.0}$, N = 4), subcalcic augite ($Fs_{9.4\text{-}9.5}Wo_{33.2\text{-}30.0}$, N = 2), augite ($Fs_{5.5}Wo_{46.4}$).
Classification: Ordinary chondrite (H4).
Specimens: 20.1 g including one polished thin section at *PSF*; remainder in the Hollis Collection.

Northwest Africa 10796 (NWA 10796)
(Northwest Africa)
Purchased: 2016 Jan
Classification: Carbonaceous chondrite (CK3/4)
History: Purchased by Matéo Made Météor Gonzales in January 2016 from a dealer in Ouarzazate, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Irregularly shaped, separated chondrules (apparent diameter 600±400 μm) containing Cr-magnetite plus sparse fine grained CAI are set in a fine grained, reddish-brown matrix containing intermediate plagioclase, Cr-magnetite (altered to Fe hydroxides) and Ni-bearing troilite. Highly magnesian cores are present in some olivine grains.
Geochemistry: Olivine ($Fa_{1.3\text{-}33.0}$, N = 3), orthopyroxene ($Fs_{3.2\text{-}16.0}Wo_{1.3\text{-}1.0}$, N = 3), clinopyroxene ($Fs_{1.5}Wo_{40.4}$; $Fs_{11.9}Wo_{48.5}$; N = 2). Semi-quantitative EDS spectra show that magnetite contain minor amount of Cr at levels typical for CK chondrites.
Classification: Carbonaceous chondrite (CK3/4).
Specimens: 10.33 g including one polished thin section at *UWB*; remainder with Mr. M. Gonzales.

Northwest Africa 10797 (NWA 10797)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (H4)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to *PSF*.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively small chondrules are set in a relatively coarse grained, recrystallized matrix containing altered metal.
Geochemistry: Olivine ($Fa_{19.1\text{-}19.2}$, N = 3), orthopyroxene ($Fs_{16.9\text{-}17.0}Wo_{1.4\text{-}1.0}$, N = 3), clinopyroxene ($Fs_{5.6\text{-}6.5}Wo_{46.3\text{-}46.1}$, N = 2).

Classification: Ordinary chondrite (H4).
Specimens: The entire specimen including one polished thin section is at *PSF*.

Northwest Africa 10798 (NWA 10798)
(Northwest Africa)
Purchased: 2016 May
Classification: Lunar meteorite (feldspathic breccia)
History: A stone was purchased by Ben Hoefnagels in May 2016 from a dealer in Ouarzazate, Morocco. Subsequently additional material was found at the same find site by the same nomad, and purchased by Ben Hoefnagels in August and September 2016.
Physical characteristics: Six larger stones (110.9, 82.1, 32.6, 30.8, 16.9, and 15.4 g) plus many smaller stones (total 29.9 g). All stones have the same distinctive appearance, lacking fusion crust but mostly coated by orange weathering products. The fresh interior exhibits whitish clasts in a light-gray matrix with visible vesicles.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia consisting of rounded to angular gabbroic anorthositic clasts, related crystalline debris, rare mare basalt clasts and very fine grained devitrified glassy clasts in a fine grained, partly vesicular matrix composed of quenchiform crystals plus glass. Minerals are anorthite, exsolved pigeonite, olivine (some forsteritic), augite, subcalcic augite, magnesian orthopyroxene, unexsolved pigeonite, ilmenite, Ti-chromite, troilite, minor primary Ba-Ca-K feldspar and secondary barite.
Geochemistry: Olivine ($Fa_{6.0}$, FeO/MnO = 129; $Fa_{53.7\text{-}60.6}$, FeO/MnO = 86-95; N = 4), pigeonite ($Fs_{29.2}Wo_{7.7}$, FeO/MnO = 47; $Fs_{45.3}Wo_{5.6}$, FeO/MnO = 53; N = 2), augite ($Fs_{18.1}Wo_{39.3}$, FeO/MnO = 41), orthopyroxene host ($Fs_{59.4}Wo_{2.1}$, FeO/MnO = 62), clinopyroxene exsolution lamella ($Fs_{25.3}Wo_{41.0}$, FeO/MnO = 45), plagioclase ($An_{96.2\text{-}97.3}Or_{0}$, N = 2).
Classification: Lunar (feldspathic regolith breccia).
Specimens: 20.66 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

Northwest Africa 10799 (NWA 10799)
(Northwest Africa)
Purchased: 2016 Feb
Classification: Ordinary chondrite (L3)
History: Purchased by Matthew Martin in February 2016 from a Moroccan dealer at the Tucson Gem and Mineral Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Closely-packed, well-formed chondrules (apparent diameter 500±400 μm) are set in a sparse fine grained, black matrix.
Geochemistry: Olivine ($Fa_{1.2\text{-}49.9}$, Cr_2O_3 in ferroan examples 0.08-0.23 wt.%, mean 0.16±0.05 wt.%, N = 8), orthopyroxene ($Fs_{1.9\text{-}6.7}Wo_{0.4\text{-}2.3}$, N = 3), pigeonite ($Fs_{39.1}Wo_{5.9}$), subcalcic augite ($Fs_{8.9\text{-}14.2}Wo_{36.7\text{-}32.0}$, N = 2).
Classification: Ordinary chondrite (L3).
Specimens: 20.65 g including one polished thin section at *UWB*; 423 g with Mr. M. Martin; 2832 g main mass with Mr. R. Falls.

Northwest Africa 10800 (NWA 10800)
(Northwest Africa)
Purchased: 2016 Feb

Classification: HED achondrite (Eucrite, monomict)
History: Purchased by Matthew Martin in February 2016 from a Moroccan dealer at the Tucson Gem and Mineral Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Rounded clasts of shocked basaltic eucrite occur in a sparse dark brown, fine grained matrix. Minerals are exsolved pigeonite (some with orange-brown cores), calcic plagioclase (polycrystalline), silica polymorph, ilmenite and Ti-chromite, with rare zircon (grains up to 5 μm), troilite and minor secondary barite.
Geochemistry: Low-Ca pyroxene host ($Fs_{58.9-60.5}Wo_{5.0-2.7}$, FeO/MnO = 29-32, N = 3), clinopyroxene exsolution lamellae ($Fs_{26.5-28.6}Wo_{43.5-41.7}$, FeO/MnO = 29-30, N = 2).
Classification: Eucrite (monomict breccia).
Specimens: 41.49 g including one polished thin section at *UWB*; remainder with Mr. M. Martin.

Northwest Africa 10801 (NWA 10801)
(Northwest Africa)
Purchased: 2012 Sep
Classification: Ordinary chondrite (L4)
History: Purchased by Dr. David Gregory in February 2008 from a Moroccan dealer at the Tucson Gem and Mineral Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules are set within a relatively coarse grained matrix containing altered metal.
Geochemistry: Olivine ($Fa_{25.1-25.2}$, N = 3), orthopyroxene ($Fs_{20.7-20.9}Wo_{1.8-1.9}$, N = 3), clinopyroxene ($Fs_{7.2-8.3}Wo_{45.5-44.4}$, N = 2).
Classification: Ordinary chondrite (L4).
Specimens: 888 g plus one polished thin section at *ROM*; remainder with *Gregory*.

Northwest Africa 10802 (NWA 10802)
(Northwest Africa)
Purchased: 2016 Apr
Classification: HED achondrite (Eucrite, unbrecciated)
History: Purchased in Temara, Morocco by Adam Aaronson in April 2016.
Petrography: (A. Irving and S. Kuehner, *UWS*) Fresh specimen with microgabbroic texture. Composed predominantly of exsolved pigeonite and calcic plagioclase with accessory silica polymorph, Ti-chromite and slightly stained Ni-free metal.
Geochemistry: Orthopyroxene host ($Fs_{59.3-60.0}Wo_{3.9-2.6}$, FeO/MnO = 27-28, N = 3), clinopyroxene exsolution lamellae ($Fs_{27.6-27.8}Wo_{42.0-41.4}$, FeO/MnO = 25-26, N = 2), plagioclase ($An_{89.3-89.4}Or_{0.4}$, N = 2).
Classification: Eucrite (unbrecciated, microgabbroic).
Specimens: 20.7 g including one polished thin section at *UWB*; remainder with *Aaronson*.

Northwest Africa 10803 (NWA 10803)
(Northwest Africa)
Purchased: 2010
Classification: Ordinary chondrite (H4)
History: Purchased by Dr. David Gregory in February 2008 from a Moroccan dealer at the Tucson Gem and Mineral Show.

Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules are set within a relatively coarse grained matrix containing abundant altered metal.
Geochemistry: Olivine ($Fa_{18.8-18.9}$, N = 3), orthopyroxene ($Fs_{16.2-16.3}Wo_{1.3-1.2}$, N = 3), clinopyroxene ($Fs_{5.9-6.4}Wo_{44.6-44.4}$, N = 2).
Classification: Ordinary chondrite (H4).
Specimens: 184.6 g plus one polished thin section at *ROM*; remainder with *Gregory*.

Northwest Africa 10804 (NWA 10804)
(Northwest Africa)
Purchased: 2016 May
Classification: Carbonaceous chondrite (CV3)
History: Purchased in Temara, Morocco by Adam Aaronson in May 2016.
Petrography: (A. Irving and S. Kuehner, *UWS*) Relatively large (apparent diameter 0.2-3 mm, mean 1.7 mm), round to irregularly shaped, granular chondrules (some with multiple rims), irregularly shaped fine grained CAI and some isolated olivine grains occur in a fine grained orange-brown matrix (~20 vol.%). One CAI consists of hibonite+gehlenite+spinel+tiny grains of osmium metal.
Geochemistry: Olivine ($Fa_{0.3-47.4}$; $Fa_{87.0}$, N = 4), orthopyroxene ($Fs_{0.6}Wo_{0.9}$), pigeonite ($Fs_{0.7}Wo_{14.1}$), subcalcic augite ($Fs_{4.3}Wo_{28.6}$), augite ($Fs_{0.6}Wo_{43.5}$).
Classification: Carbonaceous chondrite (CV3).
Specimens: 21.3 g including one polished thin section at *UWB*; remainder with *Aaronson*.

Northwest Africa 10805 (NWA 10805)
(Northwest Africa)
Purchased: 2016 May
Classification: Ordinary chondrite (L4)
History: Purchased in Temara, Morocco by Adam Aaronson in May 2016.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules are set within a relatively coarse-grained matrix containing stained metal.
Geochemistry: Olivine ($Fa_{25.8-25.9}$, N = 3), orthopyroxene ($Fs_{21.1-21.3}Wo_{1.7-1.9}$, N = 3), clinopyroxene ($Fs_{8.7-8.8}Wo_{43.1-43.7}$, N = 2).
Classification: Ordinary chondrite (L4).
Specimens: 22.7 g including one polished thin section at *UWB*; remainder with *Aaronson*.

Northwest Africa 10806 (NWA 10806)
(Northwest Africa)
Purchased: 2016 May
Classification: HED achondrite (Eucrite, brecciated)
History: Purchased in Temara, Morocco by Adam Aaronson in May 2016.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of sparse lithic eucrite clasts (mostly with microgabbroic texture but also some with finer subophitic texture) plus related crystalline debris in a finer grained matrix. All pyroxene (finely exsolved pigeonite) is pale clove-brown in thin section. Other minerals are calcic plagioclase, silica polymorph, ilmenite, troilite and Ni-fee metal.
Geochemistry: Orthopyroxene host ($Fs_{60.1-60.3}Wo_{2.9-2.7}$, FeO/MnO = 31, N = 3), clinopyroxene exsolution lamellae ($Fs_{29.7-32.2}Wo_{38.0-40.2}$, FeO/MnO = 31-33, N = 2).

Classification: Eucrite (genomict breccia).
Specimens: 6.3 g including one polished thin section at *UWB*; remainder with *Aaronson*.

Northwest Africa 10807 (NWA 10807)
(Northwest Africa)
Purchased: 2016 May
Classification: Ordinary chondrite (L4/5)
History: Purchased in Temara, Morocco by Adam Aaronson in May 2016.
Petrography: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules (some well-formed) occur within a recrystallized matrix containing altered metal and red-brown staining along grain boundaries.
Geochemistry: Olivine ($Fa_{25.5-27.6}$, N = 3), orthopyroxene ($Fs_{20.5-20.8}Wo_{1.1-1.3}$, N = 3), clinopyroxene ($Fs_{8.2-10.9}Wo_{44.0-43.2}$, N = 2).
Classification: Ordinary chondrite (L4/5).
Specimens: 20.3 g including one polished thin section at *UWB*; remainder with *Aaronson*.

Northwest Africa 10808 (NWA 10808)
(Northwest Africa)
Purchased: 2016 Apr
Classification: Martian meteorite (Shergottite)
History: Purchased by Darryl Pitt in April 2016 from a dealer in Ouarzazate, Morocco.
Physical characteristics: Tan colored stone (188 g) with partial black fusion crust.
Petrography: (A. Irving and S. Kuehner, *UWS*) Poikilitic texture. Composed mainly of zoned clinopyroxene (pigeonite, augite and subcalcic augite), olivine and interstitial, lath-like maskelynite with accessory ilmenite, Mg-bearing merrillite and pyrrhotite (some Ni-bearing) and baddeleyite. Some olivine occurs as anhedral chadacrysts within larger pyroxene grains. Olivine grains contain quenched melt inclusions (composed of glass with aluminous clinopyroxene crystallites). Some small shock melt pockets composed of dark glass are present.
Geochemistry: Olivine ($Fa_{30.3-32.2}$, FeO/MnO = 42-44, N = 3), pigeonite ($Fs_{24.7-26.6}Wo_{9.3-8.4}$, FeO/MnO = 25-26, N = 4), augite and subcalcic augite ($Fs_{13.7-16.2}Wo_{40.0-31.4}$, FeO/MnO = 21-24, N = 4), maskelynite ($An_{50.6-50.7}Or_{1.5-1.8}$, N = 2). Oxygen isotopes (K. Ziegler, UNM): analysis of acid-washed subsamples by laser fluorination gave, respectively, d17O = 2.810, 2.812, 2.751, 2.683; d18O = 4.780, 4.779, 4.602, 4.660; D17O = 0.286, 0.289, 0.321, 0.223 per mil.
Classification: Martian (shergottite, poikilitic).
Specimens: 20.67 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 10809 (NWA 10809)
(Northwest Africa)
Purchased: 2016 May
Classification: Ordinary chondrite (L4)
History: Purchased in Temara, Morocco, by Adam Aaronson in May 2016.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, fairly closely-packed chondrules within a sparse matrix containing altered metal.
Geochemistry: Olivine ($Fa_{23.9-24.6}$, N = 3), orthopyroxene ($Fs_{19.5-21.0}Wo_{0.7-0.6}$, N = 3), clinopyroxene ($Fs_{12.2-17.3}Wo_{33.0-27.8}$, N = 2).
Classification: Ordinary chondrite (L4).

Specimens: 22.7 g including one polished thin section at *UWB*; remainder with *Aaronson*.

Northwest Africa 10810 (NWA 10810)
Mauritania
Purchased: 2016
Classification: Lunar meteorite
History: Two stones weighing 126.2 and 276.2 g were found in Mauritania and subsequently purchased in Rissani in 2015. J. Donald Cline and John Sinclair acquired the samples from a meteorite prospector at the Tucson Gem and Mineral Show in February 2016.
Physical characteristics: Sample has an irregular-ovoid shape and lacks fusion crust. The exterior surface is weathered and light orangish-gray in color. One half of the stone shows an obvious brecciated texture composed of dominant light-colored clasts in a dark matrix. The other half appears to have been buried and contains an orangish layer of caliche. One edge has a window cut into the stone showing a mixture of rounded dark and light-colored lithic and mineral clasts in a dark brown matrix. One slice contains an FeNi grain.
Petrography: Description and classification (A. Love, *App*): Sample is a polymict breccia composed of 5 mm sub-rounded to angular lithic clasts and mineral clasts set within a micro-vesicular black glassy matrix. Up to 5 mm subrounded to subangular clasts of olivine gabbro with exsolved pyroxenes, troctolite, subophitic olivine basalt and exsolved pyroxenes, granulitic anorthosite and poikolitic crystalline impact melt breccia are the dominant lithic fragments represented in the sample. Additionally, the sample contains mineral grains, and symplectites composed of fayalite, Si-rich grains and Ca-pyroxene in addition to glassy spherules and flow-banded agglutinates. Accessory minerals ilmenite, ferroan chromite, fayalite and a silica polymorph.
Geochemistry: (A. Love, *App*): Olivine ($Fa_{23.1\text{-}45.3}$; FeO/MnO=95.8-114.7, N=20), pigeonite ($Fs_{25.8\text{-}30.1}Wo_{16.3\text{-}7.3}$ N=14; $Fs_{46.4\text{-}57.2}Wo_{20.0\text{-}7.8}$; FeO/MnO=54.4-73.5, N=4); augite ($Fs_{16.5\text{-}21.5}Wo_{23.8\text{-}38.5}$; FeO/MnO=47.2-52.0, N=9); fayalite ($Fa_{90.7\text{-}97.6}$; FeO/MnO=93.3-96.8, N=6); plagioclase $An_{95.0\pm2.7}Or_{0.2\pm0.2}$, N=13). Bulk Composition: (R. Korotev, *WUSL*): INAA of 100 mg gave (in wt%) Na_2O 0.4, FeO 10.9; (in ppm) Sc 19.7, Cr 17.8, Co 42.1, Ni 220, La 7.3, Sm 3.3, Eu 0.91, Yb 2.3, Lu 0.3, Hf 2.5, Th 1.1.
Classification: Lunar (mingled regolith breccia)
Specimens: *PARI* holds the main masses (276.2 and 89.07 g). A slice and an end cut weighing 20.82 g and one polished thin section are on deposit at *App*.

Northwest Africa 10811 (NWA 10811)
Algeria
Purchased: 2016
Classification: HED achondrite (Eucrite)
History: One stone weighing 285.1 g was found in Algeria. Thomas Webb purchased the stone from meteorite dealer in Morocco in February 2016.
Physical characteristics: The stone is lacking an obvious fusion crust. The exterior is irregular in shape and contains numerous depressions that are clasts. The interior viewed from a cut face shows green-colored clasts up to 3.5 cm in diameter set within in a dark-gray matrix containing small vesicles.
Petrography: Description and classification (A. Love, *App*): Sample is a monomict breccia composed of subrounded clasts of very fine-grained, (pyroxenes and ~200 μm lath-shaped

plagioclase) ophitic-textured clasts. Pyroxenes are 50-100 μm and exsolved. Lath-shaped plagioclase crystals are ~200 μm and have been partially converted to maskelynite. Melt matrix is composed of lithic fragments and mineral grains set within a quenched, dark-colored glass. Accessory minerals are ilmenite, troilite, a Si polymorph, chromite.
Geochemistry: (A. Love, *App*): Augite $Fs_{27.2\pm1.3}Wo_{42.0\pm1.6}$ Fe/Mn=30.2-34.3 N=13 appears as individual grains and exsolution lamellae within orthopyroxene. Orthopyroxene $Fs_{60.6\pm1.2}Wo_{2.8\pm1.0}$ Fe/Mn=31.1-33.4, N=13 also appears as individual grains and exsolution lamellae within Cpx. Anorthite $An_{89.7\pm0.4}$ N=5
Classification: Mineralogy, geochemistry and textures are consistent with equilibrated eucrites. Quenched vesicular melt matrix with entrained mineral and lithic clasts indicates this is a monomict eucrite impact melt breccia. Quenched vesicular melt matrix with entrained mineral and lithic clasts indicates this is a monomict eucrite impact melt breccia.
Specimens: *Webb* holds the main mass. A polished thin section, two slices and two small fragments weighing 20.85g are on deposit at *App*.

Northwest Africa 10812 (NWA 10812)
(Northwest Africa)
Purchased: 2016
Classification: Ordinary chondrite (LL5)
History: One stone weighing 126.5 g was found in Morocco in 2016. David Holden acquired the sample from a meteorite prospector in Erfoud 2016.
Physical characteristics: The stone is dark brown in color, has a flattened rectangular shape and is ~95% covered by a weathered fusion crust containing contraction cracks. The interior cut face shows a texture composed of a light-colored, football-shaped region surrounded by a darker brown weathered area. Weathered and unweathered flakes of FeNi and FeS are visible on the surface.
Petrography: Description and classification (A. Love, *App*): Sample displays distinct and indistinct chondrules with an average diameter of 687 μm (n=42), within a recrystallized matrix. Chondrule have turbid to devitirified mesostasis. Many chondrules are surrounded by rims of Fes and FeNi metal. Sample contains ~3 vol% FeNi metal grains.
Geochemistry: (A. Love, *App*) Olivine $Fa_{26.9\pm0.5}$, N=6; low Ca pyroxene $Fs_{23.6\pm0.3}Wo_{1.7\pm0.1}$, N=6.
Classification: Ordinary chondrite (LL5, S4, W2)
Specimens: An endcut and 2 slices and several small fragments weighing 21.4 g, and a polished thin section are currently on deposit at *App*. David Holden has the remaining mass.

Northwest Africa 10813 (NWA 10813)
Northwest Africa
Purchased: 2016
Classification: Ordinary chondrite (H5)
History: One stone weighing 32.1 g was found in Morocco in 2016. David Holden acquired the sample from a meteorite prospector in Erfoud 2016.
Physical characteristics: The stone is brown in color and irregular-ovoid shaped. The stone has a weathered patina covering about 40% of its exterior. The interior of the stone is mottled light brown-brown in color and displays numerous chondrules, fragments and fresh flakes of metal.
Petrography: Description and classification (A. Love, *App*): Sample displays well formed, distinct chondrules with an average diameter of 454 μm, within a crystalline matrix. Chondrule

have turbid to devitirified mesostasis. Matrix materials are recrystallized but appear dark in some areas due to FeOH staining FeNi metal grains are abundant (~10 vol%).
Geochemistry: (A. Love, *App*) Olivine $Fa_{20.9\pm0.3}$, N=6; low Ca pyroxene $Fs_{18.9\pm0.2}Wo_{1.7\pm0.2}$, N=6.
Classification: Ordinary chondrite (H5 S3 W2)
Specimens: An endcut and one slice weighing 7.44 g, and a polished thin section are currently on deposit at *App*. David Holden has the remaining mass.

Northwest Africa 10814 (NWA 10814)
Northwest Africa
Purchased: 2016
Classification: HED achondrite (Eucrite, polymict)
History: One stone weighing 148.8 g was found near Jrifia and subsequently purchased from the finder in Temara in 2015. Don Cline and John Sinclair acquired the samples from a meteorite prospector at the Tucson Gem and Mineral Show in February of 2016.
Physical characteristics: The fragment is irregularly shaped and 35% of its surface is covered in a black fusion crust. The fusion crust contains contraction cracks and a few small areas with relict flow lines. The exterior surface is light orangish-gray and displays a clastic texture composed of lithic and mineral fragments. One side is lightly coated in caliche.
Petrography: Description and classification (A. Love, *App*): Sample is a breccia composed of ≤4 mm rounded to angular clasts with many different basaltic and cumulate textures and mineral fragements set within a fine-grained matrix of fragmental debris. At least one basaltic clast appears to be recrystallized. Minerals: pigeonite with augite exsolution lamellae, augite with pigeonite exsolution lamellae, normally zoned Ca-poor orthopyroxene, Si polymorph, ilmenite, chrome spinel, plagioclase. Sample contains ~5 vol% diogenite as individual mineral grains and fragments.
Geochemistry: (A. Love, *App*) Low-Ca pyroxene $Fs_{52.9\pm3.4}Wo_{3.4\pm1.4}$ ($Fs_{38.4\text{-}62.7}Wo_{1.3\text{-}5.0}$, FeO/MnO=31.6-38.2, N=22); pigeonite host $Fs_{50.2\pm5.1}Wo_{10.1\pm3.1}$ ($Fs_{41.9\text{-}59.2}Wo_{6.1\text{-}16.8}$, Fe/Mn=30.7-33.3, N=28); high-Ca pyroxene exsolution lamellae $Fs_{27.9\pm9.1}Wo_{37.1\pm7.5}$ ($Fs_{13.6\text{-}41.6}Wo_{22.5\text{-}44.9}$, FeO/MnO=21.9-35.1, N=12); plagioclase $An_{84.0\pm6.5}Or_{0.8\pm0.6}$ ($An_{73.4\text{-}92.6}$, N=20); diogenitic orthopyroxene $Fs_{27.5\pm3.1}Wo_{3.8\pm0.8}$ ($Fs_{24.0\text{-}33.0}Wo_{2.2\text{-}5.5}$, FeO/MnO=28.5-37.0, N=12).
Classification: Achondrite (Eucrite, polymict)
Specimens: *PARI* holds the 123.3 g main mass. A 21.1g type specimen and one polished thin section are on deposit at *App*.

Northwest Africa 10816 (NWA 10816)
(Northwest Africa)
Purchased: Feb 2009
Classification: Ordinary chondrite (LL5)
History: Purchased by James Tobin in February 2009 from a dealer at the Tucson Gem show
Petrography: Easily discerned chondrules and chondrule fragments (up to 2 mm, with 1-1.5 mm diameter not infrequent) in a recrystallized matrix. Contains roughly 1-2% metal, and numerous chromite-plagioclase assemblages.
Geochemistry: Olivine ($Fa_{26.1\pm0.7}$, N=47); orthopyroxene ($Fs_{22.2\pm1.0}Wo_{1.7\pm0.5}$, N=22); plagioclase feldspar ($Ab_{84.2\pm1.8}Or_{5.5\pm2.2}$, N=5)
Classification: Ordinary chondrite (LL5) based on olivine and pyroxene compositions and large chondrule sizes.

Specimens: *Cascadia* holds 186.7 g in multiple pieces, in addition to one polished thin section and a mounted butt

Northwest Africa 10817 (NWA 10817)
(Northwest Africa)
Purchased: 2016
Classification: Ordinary chondrite (LL5)
History: Purchased by Larry Sloan in Tucson from Ahmed Pani, 2016.
Physical characteristics: Single stone with weathered exterior; saw cut shows scattered chondrules set in reddish-brown matrix.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows some distinct chondrules, plagioclase up to ~20 μm.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{27.6\pm0.1}$, Fe/Mn=54±2, n=13; low-Ca pyroxene $Fs_{22.7\pm0.2}Wo_{1.4\pm0.4}$, Fe/Mn=32±1, n=7.
Classification: Ordinary chondrite (LL5)
Specimens: 22.27 g including a probe mount on deposit at *UNM*, Larry Sloan holds the main mass

Northwest Africa 10818 (NWA 10818)
(Northwest Africa)
Purchased: April 2016
Classification: Martian meteorite (Shergottite)
History: Found by meteorite hunters at the Mauritanian/Algerian border region.
Physical characteristics: Weathered exterior. A saw cut reveals a fine-grained, green-brown interior, some grains up to ~1 mm. A single, dark, shock melt vein was present in the deposit sample, ~0.25 mm thick.
Petrography: (C. Agee, *UNM*) This is an ultramafic rock with olivine (~40%), pigeonite + augite (~40%) and maskelynite (~10%). The olivines, pigeonites and clinopyroxenes show fairly tight compositional ranges. Accessory ilmenite, Ti-Cr-Fe spinel, and Fe-sulfide were observed throughout the sample. The maskelynite commonly displays altered rims.
Geochemistry: (C. Agee and M.Spilde, *UNM*) Olivine $Fa_{36.0\pm1.6}$, Fe/Mn=51±3, n=21; pigeonite $Fs_{27.0\pm2.2}Wo_{10.0\pm3.0}$, Fe/Mn=29±1, n=16; augite $Fs_{17.6\pm0.6}Wo_{33.3\pm1.2}$, Fe/Mn=26±1, n=5; maskelynite $An_{53.7\pm2.2}Ab_{44.6\pm4.2}Or_{1.6\pm0.3}$, n=7.
Classification: Martian (shergottite). This is a martian meteorite based on Fe/Mn of orthopyroxene, clinopyroxene and olivine, and the An-Ab-Or content of maskelynite. This is an ultramafic shergotitte based on the mineral proportions of olivine, pyroxene and plagioclase (maskelynite). Presence of maskelynite in this meteorite is typical for shergottites.
Specimens: 23.5 g including a probe mounts on deposit at *UNM, DPitt* holds the main mass.

Northwest Africa 10819 (NWA 10819)
(Northwest Africa)
Purchased: 2015
Classification: Ordinary chondrite (L5)
Petrography: Monomict breccia, shock-darkened. Small amounts of crystallized sulfide-rich melt occurs interstitial to chondrules and clasts.

Classification: Shock-darkened, monomictly brecciated ordinary chondrite. L chondrite based on mineral chemistry. Petrologic type 5 due to the equilibrated state of olivine and pyroxene. Many chondrules still observable.

Northwest Africa 10822 (NWA 10822)
(Northwest Africa)
Purchased: 2016
Classification: Lunar meteorite (feldspathic breccia)
History: Reportedly found in 2015, purchased by Matt Morgan and Lee Morgan in Morocco on June 26, 2016.
Physical characteristics: Single stone; saw cuts reveal a feldspathic breccia with numerous white feldspar clasts (1-4 mm) set in a dark-gray matrix. There are also scattered orange-brown clasts up to ~4 mm that consist primarily of pyroxene.
Petrography: (C. Agee, *UNM*) This meteorite is mixture of a fine-grained domains, large fragmental plagioclase crystals, and shock melt veins; some of the veins have ~100 μm-size vesicles. There are orange-brown domains consisting of pigeonite grains with augite exsolution lamellae and interstitial plagioclase or melt veins.
Geochemistry: (C. Agee and M.Spilde, *UNM*) olivine $Fa_{32.7\pm9.0}$, Fe/Mn=97±4, n=11; pigeonite $Fs_{40.7\pm4.8}Wo_{8.2\pm3.5}$, Fe/Mn=59±6, n=5; augite $Fs_{24.9\pm14.2}Wo_{37.6\pm4.7}$, Fe/Mn=53±10, n=5; orange-brown pyroxene: pigeonite $Fs_{36.4\pm1.6}Wo_{5.2\pm3.0}$, Fe/Mn=61±6, n=4; augite $Fs_{18.3\pm0.3}Wo_{39.4\pm0.3}$, Fe/Mn=54±9, n=2; plagioclase $An_{96.4\pm0.7}Ab_{3.5\pm0.7}Or_{0.1\pm0.1}$, n=6.
Classification: Lunar (feldspathic breccia)
Specimens: 11.7 g including a probe mount on deposit at *UNM*, *MtMorgan* and Lee Morgan hold the main mass.

Northwest Africa 10823 (NWA 10823)
(Northwest Africa)
Purchased: 2016
Classification: Lunar meteorite (feldspathic breccia)
History: Reportedly found in Western Sahara. Purchased by Steve Arnold from a Moroccan meteorite dealer in 2016.
Physical characteristics: Two identical appearing stones, weathered exterior with no fusion crust. Saw cuts reveal a polymict, feldspathic breccia with numerous white feldspar clasts, many in the range 1-5 mm, set in a dark gray matrix. There are also scattered cm-sized feldspathic clasts present. Some dark-colored domains have only sparse, fine grained, feldspathic clasts.
Petrography: (C. Agee, *UNM*) This meteorite is a mixture of domains with fine-grained groundmasses of pyroxene+olivine+plagioclase+opaques. Large fragmental plagioclase grains were observed throughout, shock melt veins are also present.
Geochemistry: (C. Agee and M.Spilde, *UNM*) olivine $Fa_{47.7\pm9.5}$, Fe/Mn=95±7, n=11; pigeonite $Fs_{41.9\pm9.8}Wo_{4.9\pm3.3}$, Fe/Mn=61±8, n=12; augite $Fs_{24.9\pm14.2}Wo_{37.5\pm6.8}$, Fe/Mn=61±13, n=10; plagioclase $An_{95.8\pm0.6}Ab_{4.0\pm0.6}Or_{0.2\pm0.1}$, n=7.
Classification: Lunar (feldspathic breccia)
Specimens: 20.02 g including a probe mount on deposit at *UNM*, Steve Arnold holds the main mass.

Northwest Africa 10826 (NWA 10826)

(Northwest Africa)
Purchased: 2015
Classification: Ordinary chondrite (L3.15)
History: Purchased by Gary Fujihara from Morocco, 2015.
Physical characteristics: Single stone, no fusion crust, saw cut shows many densely packed chondrules set in a brown matrix.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous porphyritic chondrules, most with mesostasis or glass. Abundant opaque matrix. Apparent mean chondrule diameter 450±250 μm, n=39, and metal abundance consistent with L.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Chondrule ferroan olivine $Fa_{15.3\pm8.6}$, Fe/Mn=42±16, Cr_2O_3=0.19±0.15 (wt%), n=30; chondrule low-Ca pyroxene $Fs_{14.9\pm9.6}Wo_{1.4\pm1.5}$, Fe/Mn=22±11, n=10.
Classification: Ordinary chondrite (L3.15), subtype 3.15 based on mean values of Fa and Fs and 1-sigma standard deviation, and on the ferroan olivine mean value of Cr_2O_3 and 1-sigma standard deviation, similar to Bishunpur (3.15) (Grossman and Brearley, 2005).
Specimens: 20.76 g including a probe mount on deposit at *UNM*, Gary Fujihara holds the main mass.

Northwest Africa 10827 (NWA 10827)
(Northwest Africa)
Purchased: 2016
Classification: Carbonaceous chondrite (CM2)
History: Purchased by Gary Fujihara from Morocco, 2016.
Physical characteristics: Single stone, fusion-crusted. A saw cut shows a few scattered chondrules, crystal fragments, and small CAIs set in a dark-colored matrix.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows a low density of porphyritic chondrules (most, irregular in shape), chondrule fragments, and olivine grains. Phyllosilicate-bearing matrix makes up approximately 75% of this meteorite.
Geochemistry: (C. Agee and M. Spilde, *UNM*) All olivine $Fa_{15.4\pm19.0}$, n=27; ferroan olivine $Fa_{31.0\pm16.5}$, Fe/Mn=93±36, Cr_2O_3=0.36±0.10 (wt%), n=13; forsterite $Fa_{0.8\pm0.3}$, n=14; enstatite $Fs_{1.1\pm0.4}Wo_{1.0\pm0.2}$, n=10.
Classification: Carbonaceous chondrite (CM2)
Specimens: 6.61 g including a probe mount on deposit at *UNM*, Gary Fujihara holds the main mass.

Northwest Africa 10828 (NWA 10828)
(Northwest Africa)
Purchased: 2009 Feb
Classification: Ordinary chondrite (H4)
History: Purchased by James Tobin in February 2009 from a dealer at the Tucson Gem show.
Petrography: Chondrules and chondrule fragments surrounded by secondary calcite, iron oxides, and void spaces. Secondary material and void spaces occasionally replace chondrule mesostases. Roughly 5-10% of the original metal is still present.
Geochemistry: Olivine ($Fa_{19.9\pm1.0}$, N=32); orthopyroxene ($Fs_{17.7\pm1.4}Wo_{1.2\pm0.7}$, N=33).
Specimens: *Cascadia* holds 23.8 g in two pieces, in addition to one polished thin section and a mounted butt.

Northwest Africa 10830 (NWA 10830)
Morocco
Purchased: Feb 2016
Classification: Ordinary chondrite (LL3)
History: One fragment of 42.3 g was found in Morocco and was purchased in Morocco February, 2016
Petrography: The sample consists of abundant well-defined chondrules and chondrule fragments and a low abundance of matrix. Some of the chondrules still have mesostasis glass clearly indicating petrologic type 3. Low metal abundance. Mean chondrule size is >500 μm. The olivines show undulatory extinction and planar fractures indicating a S3 shock degree classification. The sample is quite fresh (W1).
Geochemistry: Olivine, $Fa_{1–33}$ (n=32); low-Ca pyroxene, Fs_{1-28} (n = 48)
Classification: LL3 ordinary chondrite.
Specimens: 8.4 g and 1 thin section

Northwest Africa 10831 (NWA 10831)
(Northwest Africa)
Purchased: 2015 Nov
Classification: Ordinary chondrite (LL3)
History: Purchased by Kally Wombacher in November 2015 from a dealer in Erfoud, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Closely packed, well-formed chondrules (apparent diameter 800±400 μm) are set in a sparse fine grained, black matrix.
Geochemistry: Olivine ($Fa_{1.7-44.5}$, Cr_2O_3 in ferroan examples 0.05-0.18 wt.%, mean 0.10±0.04 wt.%, N = 8), orthopyroxene ($Fs_{3.1-23.7}Wo_{0.4-1.6}$, N = 3), subcalcic augite ($Fs_{6.6}Wo_{31.2}$), augite ($Fs_{3.3}Wo_{41.1}$). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 3.80.
Classification: Ordinary chondrite (LL3).
Specimens: 22 g including one polished thin section at *UWB*; remainder with Mr. K. Wombacher.

Northwest Africa 10832 (NWA 10832)
(Northwest Africa)
Purchased: 2014 Oct
Classification: Carbonaceous chondrite (CV3)
History: Purchased in Erfoud, Morocco by Said Haddany in October 2014.
Petrography: (A. Irving and S. Kuehner, *UWS*) Large, round to irregularly shaped, granular chondrules (apparent diameter 700±400 μm, some rimmed) and irregularly shaped, fine grained CAI (some containing Al-Ti-diopside and andradite garnet) are set in an orange-brown matrix (~30 vol.%) containing primary calcite, Cu-bearing pyrrhotite, taenite and rare Cr-magnetite.
Geochemistry: Olivine ($Fa_{0.3-50.0}$, N = 3), orthopyroxene ($Fs_{0.5-1.0}Wo_{1.0-1.2}$, N = 2), clinopyroxene ($Fs_{0.8}Wo_{31.6}$; $Fs_{0.5}Wo_{40.0}$; N = 2), Al-Ti-diopside in CAI ($Fs_{0.2}Wo_{62.2}$, Al_2O_3 16.2 wt.%, TiO_2 4.7 wt.%).
Classification: Carbonaceous chondrite (CV3).
Specimens: 210 g including one polished thin section at *UWB*; 1687 g with Mr. R. Falls; remainder with Mr. S. Haddany.

Northwest Africa 10833 (NWA 10833)
(Northwest Africa)
Purchased: 2014 Oct
Classification: Ordinary chondrite (H4/5)
History: Purchased in Erfoud, Morocco by Said Haddany in October 2014.
Petrography: (A. Irving and S. Kuehner, *UWS*) Sparse, relatively small chondrules (some well-formed) are set in a coarse-grained recrystallized matrix containing abundant stained metal.
Geochemistry: Olivine ($Fa_{19.1-19.2}$, N = 3), orthopyroxene ($Fs_{16.9-17.0}Wo_{1.4-1.0}$, N = 3), clinopyroxene ($Fs_{5.6-6.5}Wo_{46.3-46.1}$, N = 2).
Classification: Ordinary chondrite (H4/5).
Specimens: 28.76 g including one polished thin section at *UWB*; remainder with Mr. S. Haddany.

Northwest Africa 10834 (NWA 10834)
(Northwest Africa)
Purchased: 2016 July
Classification: Carbonaceous chondrite (CM1/2)
History: Purchased by Darryl Pitt in July 2016 from Aziz Habibi in Agadir, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Very small (apparent diameter 150±50 μm), mostly serpentinized chondrules (some with remnant forsteritic olivine grain cores) and tiny mafic silicate mineral grains occur within a very dark matrix containing irregular shrinkage cracks. Other phases identified include pyrrhotite, Ni-bearing pyrrhotite, pentlandite, Ni-poor kamacite and Mn-Fe-bearing dolomite.
Geochemistry: Olivine ($Fa_{0.5-0.6}$, N = 3). Oxygen isotopes (K. Ziegler, *UNM*): analysis of a clean sample (unwashed, not pre-fluorinated) by laser fluorination gave, respectively, $\delta^{17}O = 3.282$; $\delta^{18}O = 10.797$; $\Delta^{17}O = -2.419$ per mil.
Classification: Carbonaceous chondrite (CM1/2).
Specimens: 14.9 g including one polished thin section and one polished thick section at *UWB*; remainder with *DPitt*.

Northwest Africa 10835 (NWA 10835)
(Northwest Africa)
Purchased: 2016 May
Classification: Ordinary chondrite (L6)
History: Purchased by John Higgins in May 2016 from a dealer in Zagora, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Mostly recrystallized with sparse chondrules and chondrule remnants plus stained and altered metal grains. Minor chlorapatite was noted in the matrix.
Geochemistry: Olivine ($Fa_{25.1-25.7}$, N = 3), orthopyroxene ($Fs_{20.9-21.0}Wo_{1.4-1.5}$, N = 3), clinopyroxene ($Fs_{10.8-12.2}Wo_{36.1-43.2}$, N = 2).
Classification: Ordinary chondrite (L6).
Specimens: 97 g including one polished thin section at *UWB*; remainder with Mr. J. Higgins.

Northwest Africa 10836 (NWA 10836)
(Northwest Africa)
Purchased: 2016 May

Classification: Ordinary chondrite (LL3)
History: Purchased by John Higgins in May 2016 from a dealer in Zagora, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Closely-packed, well-formed chondrules (apparent diameter 500±300 μm) are set in a sparse matrix containing altered metal.
Geochemistry: Olivine ($Fa_{4.0\text{-}37.7}$; Cr_2O_3 in ferroan examples 0.05-0.09 wt.%, mean 0.07±0.01 wt.%, N = 7), orthopyroxene ($Fs_{3.5\text{-}12.9}Wo_{0.4\text{-}0.3}$, N = 3), clinopyroxene ($Fs_{3.1}Wo_{41.8}$). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 3.36.
Classification: Ordinary chondrite (LL3).
Specimens: 21.8 g including one polished thin section at *UWB*; remainder with Mr. J. Higgins.

Northwest Africa 10837 (NWA 10837)
(Northwest Africa)
Purchased: 2016 May
Classification: Ureilite
History: Purchased by Darryl Pitt in May 2016 from a Moroccan dealer in Copenhagen.
Petrography: (A. Irving and S. Kuehner, *UWS*) Protogranular aggregate of olivine (~60 vol.%) and pigeonite (~40 vol.%). Olivine has narrow, reduced magnesian rims and pigeonite contains more magnesian, curvilinear bands. Narrow zones of Fe metal occur along grain margins.
Geochemistry: Olivine ($Fa_{22.9\text{-}23.1}$; rim $Fa_{10.5}$; N = 3), pigeonite ($Fs_{18.4\text{-}18.7}Wo_{11.6\text{-}11.5}$; band $Fs_{8.7}Wo_{13.4}$; N = 3).
Classification: Ureilite.
Specimens: 13.21 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 10838 (NWA 10838)
(Northwest Africa)
Purchased: 2016 Apr
Classification: Ordinary chondrite (L4)
History: Purchased by John Higgins in April 2016 from a dealer in Zagora, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Closely-packed, well-formed chondrules (apparent diameter 500±200 μm) are set in a sparse matrix containing altered metal.
Geochemistry: Olivine ($Fa_{22.0\text{-}22.1}$, N = 3), orthopyroxene ($Fs_{5.2\text{-}19.0}Wo_{0.3\text{-}2.9}$, N = 3), subcalcic augite ($Fs_{13.4}Wo_{34.8}$), augite ($Fs_{13.8}Wo_{39.3}$).
Classification: Ordinary chondrite (L4).
Specimens: 21.8 g including one polished thin section at *UWB*; remainder with Mr. J. Higgins.

Northwest Africa 10839 (NWA 10839)
(Northwest Africa)
Purchased: 2016 Jun
Classification: Carbonaceous chondrite (CK6)
History: Purchased by Aziz Habibi in June 2016 from a Mauritanian dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Sparse, separated chondrules occur within a recystallized matrix containing relatively abundant, orange-stained Cr-magnetite. Minor calcite veinlets are present.
Geochemistry: Olivine ($Fa_{27.8\text{-}28.3}$, N = 3), orthopyroxene ($Fs_{24.7\text{-}25.1}Wo_{0.6\text{-}0.9}$, Al_2O_3 = 5.1-5.8 wt.%, N = 3), clinopyroxene ($Fs_{12.0}Wo_{40.9}$; $Fs_{12.5}Wo_{48.3}$; N = 2).

Classification: Carbonaceous chondrite (anomalous CK6). The orthopyroxene in this specimen is unusually aluminum-rich (almost 6 wt.% Al_2O_3) compared with that in typical CK chondrites.
Specimens: 24.4 g including one polished thin section at *UWB*; remainder with Mr. A. Habibi.

Northwest Africa 10840 (NWA 10840)
(Northwest Africa)
Purchased: 2016 Feb
Classification: Ordinary chondrite (L4)
History: Found in Morocco and purchased in Laayoune, Morocco by Aziz Habibi in February 2016.
Physical characteristics: A single very large (210 kg), dark stone lacking fusion crust.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules occur within a relatively coarse-grained matrix containing altered metal. Silicate phases exhibit undulose extinction and are darkened by the presence of very fine grained included metal blebs.
Geochemistry: Olivine ($Fa_{23.4\text{-}23.5}$, N = 3), orthopyroxene ($Fs_{19.8\text{-}20.2}Wo_{1.8\text{-}1.4}$, N = 3), clinopyroxene ($Fs_{7.6\text{-}7.8}Wo_{45.7\text{-}44.1}$, N = 2).
Classification: Ordinary chondrite (L4).
Specimens: 94 g including one polished thin section at *UWB*; remainder with Mr. A. Habibi.

Northwest Africa 10850 (NWA 10850)
Tachlayaft in Tinduf, Algeria
Find: 2015 Aug 25
Classification: Carbonaceous chondrite (CV3)
Petrography: (A. Patchen, *UTenn*) This meteorite contains CAIs, AOAs, and chondrules each up to 2 mm in maximum dimension. Matrix constitutes 20-30% of the sample and is primarily fine grained (<10 μm) olivine. Metal, primarily found in the matrix (<1%), is predominately awaruite(Ni3Fe) with a few grains of kamacite (<6.8 wt% Ni) observed. Other minerals observed in the matrix include andradite, magnetite, calcite, barite, hedenbergite, chromite, pentlandite, and troilite. CAIs and AOAs occur from nearly spherical objects to highly irregular in shape. Phases observed within CAIs include melilite, spinel, perovskite, hibonite, diopside, plagioclase, olivine, nepheline, hedenbergite, sodalite, calcite, and barite. Olivine in AOAs and chondrules is zoned, being more fayalitic along grain and object boundaries. Chondrules include barred olivine, granular olivine and/or pyroxene, and porphyritic olivine and/or pyroxene types. Pyroxene in chondrules is predominately enstatite, with minor clinopyroxene. Calcite is present throughout the sample, often surrounding chondrules and within CAIs. Barite occurs scattered throughout, usually as <10 μm grains.
Geochemistry: Mineral Compositions and geochemistry: All analyses by EMP at *UTenn*. All values are in weight percent. Olivine in the matrix is $Fa_{46.4\pm2.2}$ (n=28). Olivine in chondrules, AOAs, and CAIs vary from forsteritic cores ($Fa_{0.3}$) to fayalitic rims up to about Fa_{40} with an average of $Fa_{7.8\pm11.1}$ (n=146). Chondrule enstatite has a smaller range of compositions ($Fs_{1.2\pm0.4}Wo_{2.7\pm1.6}$, n=20). Clinopyroxenes are diopside $Fs_{1.0\pm0.4}Wo_{46.0\pm3.8}$ (n=33) ranging from low Al_2O_3 (2-3%) up to Al_2O_3 =11%. Plagioclase is of low abundance and is $An_{80\text{-}89}$ in chondrules and $An_{96\text{-}99}$ in CAIs. Metals are predominately awaruite (Ni = 68-74, Co = 1.4-2.7, Fe = 28-31) in both matrix and included objects. Spinel is found in all CAIs and is often zoned. Zonation of CAI spinels is seen as Fe enrichment toward the rims of grains (core Al_2O_3 = 71.1, MgO = 28.6, FeO = 0.08, V_2O_3 = 0.3; rim Al_2O_3 = 63.6, MgO = 13.8, FeO = 21.4, V_2O_3 = 0.3). Chromite

(Cr#76-82) and magnetite are also present in matrix and non-CAI objects. Additional CAI minerals include melilite (Ak_{4-13}), perovskite, hibonite (Al_2O_3 = 89.4, CaO = 8.6, TiO_2 = 1.2, MgO = 0.6, FeO = 0.6), hedenbergite ($Fs_{48.4}Wo_{50.6}$).
Classification: Carbonaceous chondrite (CV3), oxidized-Allende subgroup.

Northwest Africa 10851 (NWA 10851)
(Northwest Africa)
Purchased: 2002 Jan
Classification: Primitive achondrite (Winonaite)
History: (I. Nicklin, *ROM*) Dr. David Gregory donated a lot of 345 meteorites to *ROM* in 2009. The pieces ranged in size from 14 × 11 × 8.5 cm to less than 1 × 1 × 1 cm, with an aggregate weight of 57.2 kg. These had been purchased from Dean Bessey in 2002 as NWA 869 material, acquired in Morocco. Based upon visual inspection of each piece, it was apparent that 18 of the specimens are unlike the predominant NWA 869 pieces, and most of these have subsequently been identified as other types of ordinary chondrites (e.g. H4 NWA 6998). However, the stone designated as M48964 and described here was clearly different.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of clasts exhibiting triple grain junction textures within a coarse grained matrix exhibiting similar texture. The grainsize in individual clasts varies and ranges from 0.1 mm to 0.2 mm. Minerals are predominantly enstatite with accessory forsterite, stained Ni-poor kamacite, schreibersite, daubreelite, troilite and pentlandite.
Geochemistry: Enstatite ($Fs_{0.4-0.5}Wo_{0.6-0.7}$, N = 3), forsterite ($Fa_{0.2-0.3}$, N = 2). Oxygen isotopes (K. Ziegler, *UNM*): analysis of acid-washed subsamples by laser fluorination gave, respectively, $\delta^{17}O$ 2.345, 2.149, 2.224; $\delta^{18}O$ 5.438, 5.078, 5.242; $\Delta^{17}O$ -0.526, -0.532, -0.544 per mil.
Classification: Winonaite (breccia).
Specimens: 8.18 g including one polished thin section at *ROM*; remainder with *Gregory*.

Northwest Africa 10852 (NWA 10852)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (H4)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently acquired by the Hollis Collection.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively small chondrules occur within a recrystallized matrix containing relatively abundant altered metal.
Geochemistry: Olivine ($Fa_{19.4-19.8}$, N = 3), orthopyroxene ($Fs_{16.8-16.9}Wo_{1.7-1.8}$, N = 3), clinopyroxene ($Fs_{6.4-7.7}Wo_{45.2-42.1}$, N = 2).
Classification: Ordinary chondrite (H4).
Specimens: 127 g including one polished thin section at *PSF*; remainder in the Hollis Collection.

Northwest Africa 10853 (NWA 10853)
(Northwest Africa)
Purchased: 2016 July
Classification: Carbonaceous chondrite (CM1)
History: Purchased by Darryl Pitt in July 2016 from Aziz Habibi in Agadir, Morocco.
Physical characteristics: A single fragile, black stone (109.3 g) mostly covered by fusion crust.

Petrography: (A. Irving and S. Kuehner, *UWS*) Small (apparent diameter 200±150 μm), completely serpentinized chondrules plus tiny mineral grains occur in a very dark matrix. No olivine was found. Accessory minerals include pentlandite and Ni-bearing pyrrhotite.
Geochemistry: Serpentine (in wt.%) SiO_2 38.5-38.6 , FeO 15.8-19.3, MnO 0.2, MgO 29.2-27.2, SUM 83.7-85.3, N = 2. Oxygen isotopes (K. Ziegler, *UNM*): analysis of a clean sample (unwashed, not pre-fluorinated) by laser fluorination gave, respectively, $\delta^{17}O$ 5.286; $\delta^{18}O$ 13.538; $\Delta^{17}O$ -1.862 per mil.
Classification: Carbonaceous chondrite (CM1).
Specimens: 20.2 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 10854 (NWA 10854)
(Northwest Africa)
Purchased: 2016 May
Classification: Ordinary chondrite (L3)
History: Purchased by Aras Jonikas in May 2016 from a Moroccan dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Closely packed, well-formed chondrules (apparent diameter 700±400 μm) are set in a sparse fine grained, black matrix.
Geochemistry: Olivine ($Fa_{0.6\text{-}47.0}$, Cr_2O_3 in ferroan examples 0.06-0.19 wt.%, mean 0.13±0.05 wt.%, N = 8), orthopyroxene ($Fs_{2.5\text{-}20.9}Wo_{0.4\text{-}1.8}$, N = 3), subcalcic augite ($Fs_{23.3}Wo_{33.8}$), augite ($Fs_{15.1}Wo_{38.4}$). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.81.
Classification: Ordinary chondrite (L3).
Specimens: 21.82 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

Northwest Africa 10855 (NWA 10855)
(Northwest Africa)
Purchased: 2016 May
Classification: HED achondrite (Diogenite)
History: Purchased by Beat Booz in May 2016 from a Moroccan dealer.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of orthopyroxene-rich clasts and related crystalline debris. Orthopyroxene exhibits undulose extinction. Accessory minerals include chromite, clinopyroxene, troilite and stained Fe metal.
Geochemistry: Orthopyroxene ($Fs_{26.4\text{-}27.3}Wo_{3.1\text{-}3.9}$, FeO/MnO = 27-28, N = 3), clinopyroxene ($Fs_{9.4\text{-}12.0}Wo_{45.9\text{-}44.7}$, FeO/MnO = 19-24, N = 2)
Classification: Diogenite (breccia).
Specimens: 24.23 g including one polished thin section at *UWB*; remainder with Mr. B. Booz.

Northwest Africa 10856 (NWA 10856)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (H4/5)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently acquired by the Hollis Collection.
Petrography: (A. Irving and S. Kuehner, *UWS*) Recrystallized but some relatively well-formed, small chondrules are present. Thin goethite veinlets crosscut the specimen.
Geochemistry: Olivine ($Fa_{18.7\text{-}18.8}$, N = 3), orthopyroxene ($Fs_{16.4\text{-}16.8}Wo_{1.0\text{-}4.3}$, N = 3), clinopyroxene ($Fs_{7.3\text{-}9.7}Wo_{44.9\text{-}43.6}$, N = 2).

Classification: Ordinary chondrite (H4/5).
Specimens: 20.1 g including one polished thin section at *PSF*; remainder in the Hollis Collection.

Northwest Africa 10857 (NWA 10857)
(Northwest Africa)
Purchased: 2015 Oct
Classification: Primitive achondrite (Lodranite)
History: Purchased by Marc Jost in October 2015 from a Moroccan dealer at the Munich Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Heterogeneous, highly recrystallized and partly annealed breccia composed of polymineralic clasts and related mineral debris. Some deformed orthopyroxene grains are up to 4 mm in size, but most mineral grains are much smaller and variable in size. Minerals are olivine, orthopyroxene, clinopyroxene, chromite, altered Ni-poor kamacite and troilite.
Geochemistry: Olivine ($Fa_{10.6\text{-}10.9}$, FeO/MnO = 33-35, N = 3), orthopyroxene ($Fs_{9.9\text{-}10.0}Wo_{1.0\text{-}2.2}$, FeO/MnO = 18-19, N = 2), clinopyroxene ($Fs_{3.6\text{-}4.4}Wo_{46.3\text{-}43.5}$, FeO/MnO = 10-13, N = 2).
Classification: Lodranite (recrystallized breccia).
Specimens: 20.1 g including one polished thin section at *UWB*; remainder with *SJS*.

Northwest Africa 10858 (NWA 10858)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (L3)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently acquired by the Hollis Collection.
Petrography: (A. Irving and S. Kuehner, *UWS*) Closely packed, well-formed chondrules (apparent diameter 400±300 μm, one 1.9 mm) are set in a sparse fine grained, black matrix. Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.79.
Geochemistry: Olivine ($Fa_{1.6\text{-}51.0}$, Cr_2O_3 in ferroan examples 0.02-0.31 wt.%, mean 0.11±0.12 wt.%, N = 9), orthopyroxene ($Fs_{4.0\text{-}19.8}Wo_{0.3\text{-}1.8}$, N = 3), pigeonite ($Fs_{46.0}Wo_{13.3}$), augite ($Fs_{7.7}Wo_{45.2}$).
Classification: Ordinary chondrite (L3).
Specimens: 107 g including one polished thin section at *PSF*; remainder in the Hollis Collection.

Northwest Africa 10860 (NWA 10860)
(Northwest Africa)
Purchased: 2013
Classification: Ordinary chondrite (LL6)
History: Purchased by Gregor Pacer in 2013 from a dealer in Erfoud, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Some remnant chondrules are present, but the fresh specimen is mostly recrystallized to fine grained, poikiloblastic aggregates.
Geochemistry: Olivine ($Fa_{31.5\text{-}31.7}$, N = 3), orthopyroxene ($Fs_{25.3\text{-}25.6}Wo_{2.8\text{-}2.7}$, N = 3), clinopyroxene ($Fs_{12.3\text{-}12.5}Wo_{40.6\text{-}40.3}$, N = 2).
Classification: Ordinary chondrite (LL6 breccia).
Specimens: 20.3 g including one polished thin section at *UWB*; remainder with Mr. G. Pacer.

Northwest Africa 10863 (NWA 10863)
(Northwest Africa)
Purchased: 2015
Classification: HED achondrite (Eucrite, polymict)
History: The meteorite was bought in 2015 from a local meteorite dealer in Morocco.
Physical characteristics: The individual is partly covered with fusion crust and shows a dark-grayish interior.
Petrography: The meteorite is a breccia composed of up to 2 cm sized lithic and mineral clasts set into a fine-grained, clastic matrix. Lithic clasts include basaltic and dark melt clasts, dominant minerals are exsolved pyroxene and calcic plagioclase. Minor phases are FeS, chromite, SiO_2 polymorphs and metallic iron. Some shock melt veins are present.
Geochemistry: low-Ca pyroxene: $Fs_{40.5\pm10.0}Wo_{2.3\pm0.6}$ ($Fs_{28.8-61.9}Wo_{1.6-4.0}$, n=41, FeO/MnO=27-34); Ca-pyroxene: $Fs_{14.8\pm2.7}Wo_{44.6\pm0.8}$ ($Fs_{12.6-24.7}Wo_{43.2-46.3}$, n=16, FeO/MnO=22-30); calcic plagioclase: $An_{86.3\pm4.0}$ ($An_{79.7-90.9}$, n=30)

Northwest Africa 10864 (NWA 10864)
(Northwest Africa)
Purchased: 2015
Classification: Primitive achondrite (Lodranite)
History: The meteorite was bought in 2015 from a local meteorite dealer in Morocco.
Physical characteristics: The individuals lack any fusion crust and display a light to dark brownish-orange interior.
Petrography: The meteorite is a breccia dominantly composed of up to 2 mm sized angular olivine, orthopyroxene and clinopyroxene grains. Clinopyroxene often shows a greenish colour. Other phases include FeNi metal and chromite.
Geochemistry: olivine: $Fa_{11.4\pm0.1}$ ($Fa_{11.2-11.6}$, n=23, FeO/MnO=24-30); low-Ca pyroxene: $Fs_{10.4\pm0.1}Wo_{3.7\pm0.4}$ ($Fs_{10.2-10.5}Wo_{2.9-4.2}$, n=17, FeO/MnO=13-17); Ca-pyroxene: $Fs_{4.7\pm0.4}Wo_{43.4\pm1.1}$ ($Fs_{4.3-5.7}Wo_{39.5-44.7}$, n=20, FeO/MnO=9-13)
Classification: Lodranite breccia. Likely paired with NWA 8118, NWA 8216 and NWA 8251.

Northwest Africa 10866 (NWA 10866)
(Northwest Africa)
Purchased: 2016
Classification: HED achondrite (Eucrite, monomict)
History: The meteorite was bought in 2016 from a local meteorite dealer in Erfoud, Morocco.
Physical characteristics: The individual is partly covered with fusion crust and shows a white-grayish speckled interior.
Petrography: The meteorite displays a characteristic basaltic texture of up to 1.5 mm sized exsolved pyroxenes and equally sized lath-shaped calcic plagioclase. Minor phases include FeS, chromite, SiO_2 polymorphs and metallic iron.
Geochemistry: low-Ca pyroxene: $Fs_{60.8\pm0.3}Wo_{2.1\pm0.2}$ ($Fs_{60.1-61.2}Wo_{1.9-2.6}$, n=15, FeO/MnO=30-33); Ca-pyroxene: $Fs_{26.4\pm1.5}Wo_{44.0\pm1.7}$ ($Fs_{24.8-32.4}Wo_{38.5-45.6}$, n=38, FeO/MnO=28-34); calcic plagioclase: $An_{88.3\pm0.8}$ ($An_{86.4-89.5}$, n=20)

Northwest Africa 10868 (NWA 10868)
(Northwest Africa)

Purchased: June 2016
Classification: Ordinary chondrite (L5, melt breccia)
History: The meteorite was purchased in 2016 from a meteorite dealer at the mineral fair in St.Marie aux mines, France.
Petrography: The meteorite displays a dark-grayish interior and is composed of chondritic fragments separated from each other by abundant up to 8 mm wide shock melt veins. Chondritic fragments are of L type and contain some relict chondrules; plagioclase grains size is 40 μm.

Northwest Africa 10869 (NWA 10869)
(Northwest Africa)
Purchased: June 2016
Classification: HED achondrite (Eucrite, brecciated)
History: The meteorite was purchased in 2016 from a meteorite dealer at the mineral fair in St.Marie aux mines, France.
Physical characteristics: The individual lacks any fusion crust and shows a grayish interior.
Petrography: The meteorite is a breccia dominantly composed of coarse- and more fine-grained basaltic clasts and minor clastic matrix. Calcic plagioclase and exsolved pyroxenes are the dominant mineral phases and are up to 1 mm in size. Minor phases are FeS, chromite, ilmenite, SiO_2 and metallic iron. The meteorite contains shock melt veins.
Geochemistry: low-Ca pyroxene: $Fs_{60.8\pm0.6}Wo_{2.6\pm0.4}$ ($Fs_{60.0\text{-}61.9}Wo_{2.0\text{-}3.6}$, n=15, FeO/MnO=30-32); Ca-pyroxene: $Fs_{26.2\pm0.4}Wo_{43.8\pm0.8}$ ($Fs_{25.6\text{-}27.2}Wo_{42.8\text{-}45.1}$, n=14, FeO/MnO=28-32); calcic plagioclase: $An_{89.0\pm1.7}$ ($An_{85.8\text{-}93.8}$, n=15)

Northwest Africa 10870 (NWA 10870)
(Northwest Africa)
Purchased: June 2016
Classification: Ureilite
History: The meteorite was purchased in 2016 from a meteorite dealer at the mineral fair in St.Marie aux mines, France.
Petrography: The rock shows a fine-grained, equigranular texture of olivine and orthopyroxene with frequent triple junctions at adjoining mineral grains. Olivine is compositionally homogeneous and orthopyroxene show slight zoning. Although intensely recrystallized the outlines of the original minerals are still visible. Also several characteristic reduced rims are preserved at olivine-carbon contacts. The sample contains lamellar intergrowths of daubreelite and troilite.
Geochemistry: reduced rims in olivine: $Fa_{2.6\text{-}5.7}$; Cr_2O_3 in ol: ~0.5 wt%
Classification: Ureilite, melt rock.

Northwest Africa 10871 (NWA 10871)
(Northwest Africa)
Purchased: June 2016
Classification: HED achondrite (Eucrite, polymict)
History: The meteorite was purchased in 2016 from a meteorite dealer at the mineral fair in St. Marie aux Mines, France.
Physical characteristics: The individual lacks any fusion crust and shows a sand-colored interior.

Petrography: The meteorite is a brecciated eucrite composed of up to 5 mm sized basaltic and melt clasts set into abundant, fine-grained, clastic matrix. Dominant minerals in basaltic clasts and matrix are exsolved pyroxene and calcic plagioclase grains of highly variable grain size, ranging from about 10 to 500 μm. Accessory minerals include chromite, FeS, silica and metallic iron.
Geochemistry: low-Ca pyroxene: $Fs_{41.4\pm11.6}Wo_{3.3\pm1.0}$ ($Fs_{18.4\text{-}58.7}Wo_{1.6\text{-}4.8}$, n=19, FeO/MnO=27-44); Ca-pyroxene: $Fs_{27.0\pm3.7}Wo_{41.0\pm1.3}$ ($Fs_{14.8\text{-}29.6}Wo_{39.3\text{-}44.3}$, n=13, FeO/MnO=25-33); calcic plagioclase: $An_{88.7\pm7.0}$ ($An_{71.6\text{-}93.8}$, n=15)

Northwest Africa 10872 (NWA 10872)
(Northwest Africa)
Purchased: June 2016
Classification: Carbonaceous chondrite (CO3)
History: The meteorite was purchased in 2016 from a meteorite dealer at the mineral fair in St.Marie aux mines, France.
Physical characteristics: The individual lacks any fusion crust and displays a light brownish interior.
Petrography: The meteorite exhibits a chondritic texture of abundant small chondrules, CAIs, and mineral fragments in a fine-grained matrix. Chondrules are dominantly porphyritic type I and typically 0.1-0.2 mm in diameter. Contains sulfides and FeNi metal in matrix and chondrules.

Northwest Africa 10882 (NWA 10882)
(Northwest Africa)
Purchased: 2016
Classification: Mesosiderite (group A2)
History: Purchased by Steve Arnold in May 2106 from a meteorite dealer in Morocco.
Physical characteristics: Single mass. Saw cut shows a stony-iron breccia with silicate clasts up to ~1 cm, metal veins and nodules up to ~1 cm, however many domains are fine-grained mixtures of metal and silicate.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows approximately a 50-50 mix of metal/sulfide and silicate. Most silicate clasts have pyroxene and plagioclase present, and are approximately 70% "basaltic" pyroxenes (pigeonite and augite) and 30% anorthitic plagioclase. The dominant metal phase is kamacite (~90%), with inclusions of taenite (~10%).
Geochemistry: (C. Agee and M. Spilde, *UNM*) Pigeonite $Fs_{46.2\pm6.7}Wo_{11.1\pm4.8}$, Fe/Mn=31±3, n=8; augite $Fs_{28.7\pm0.6}Wo_{36.9\pm0.3}$, Fe/Mn=30±1, n=2; plagioclase $An_{93.3}$, n=7.
Classification: Mesosiderite-A2. "A" based on plagioclase abundance, basaltic clast abundance, and pyroxene compositions; "2" based on moderate recrystallization of breccia clasts.
Specimens: 20.4 g including a probe mount on deposit at *UNM*, Steve Arnold holds the main mass

Northwest Africa 10883 (NWA 10883)
Morocco
Purchased: April 2012
Classification: Ordinary chondrite (H4)

History: Purchased in Alnif, Morocco, in April 2012 by Fred *Olsen*, who was told it had been found near Zagora, Morocco. Material for classification subsequently donated to *Cascadia*.
Physical characteristics: A single stone 40% black crusted, with abundant chondrules visible on broken surface. Cut face shows brown interior with chondritic texture and abundant metal.
Petrography: Contains abundant metal and troilite (approximately 10% metal and 5% troilite) with minimal (roughly 5%) replacement by weathering product. Chondrules are well-defined with a mean diameter of 0.4±0.2 mm (N=150). Olivine grains display uniform extinction in cross-polarized light. Contains chromite-plagioclase assemblages and clinoenstatite.
Geochemistry: Olivine ($Fa_{18.8\pm0.8}$, N = 90), low-Ca pyroxene ($Fs_{17.0\pm1.4}Wo_{1.1\pm0.9}$, N = 76), high-Ca pyroxene ($Fs_{6.6\pm2.7}Wo_{45.0\pm5.1}$, N = 24)
Specimens: *Cascadia* holds 27.1 g, a polished thin section, and a mounted butt. Fred *Olsen* holds the main mass.

Northwest Africa 10884 (NWA 10884)
Morocco
Purchased: 20 May 2013
Classification: Ordinary chondrite (H5)
History: Purchased via eBay from *GHupé*/Nature's Vault on May 20, 2013. Seller said sample was found in Morocco in 2012. Material for classification donated to *Cascadia*.
Physical characteristics: Already cut face has heavily stained brown interior and exterior. Some metal visible.
Petrography: Consists of readily distinguished chondrules set in a largely transparent matrix, crosscut by numerous weathering veins. Olivine shows undulatory extinction with only a few grains displaying a single set of planar fractures. Troilite, minor metal, and grain-shaped patches of iron-bearing weathering product (~65% of total opaques) make up approximately 15% of the thin section.
Geochemistry: Olivine ($Fa_{19.4\pm1.4}$, N = 33), low-Ca pyroxene ($Fs_{16.7\pm0.8}Wo_{1.4\pm0.32}$, N = 18), high-Ca pyroxene ($Fs_{6.7\pm1.4}Wo_{46.8\pm2.0}$, N = 12).
Specimens: *Cascadia* holds 96.3 g in several pieces, a polished thin section, and a mounted butt. John Shea holds the main mass.

Northwest Africa 10885 (NWA 10885)
(Northwest Africa)
Purchased: 3 May 2013
Classification: Ordinary chondrite (L6)
History: Purchased on eBay from Adam Bates/BC Meteorites on May 3, 2013. Seller said he purchased this in Erfoud, Morocco, in September 2012 as part of a lot from an anonymous Moroccan dealer. A portion of the sample was donated for classification to *Cascadia*.
Physical characteristics: Fusion crust has weathered to a gray-brown. Interior has chondritic texture and rust haloes. Some veins are visible. Overall gray-tan color.
Petrography: Contains ~ 7% trolite and ~5% metal, with minor (~1-2% of metal) rims of weathering product on some metal grains. Chondrules are poorly defined and grade into coarse-grained transparent matrix. Olivine shows weak mosaic extinction. Chromite occurs as coarse single fractured grains as well as small grains in chromite-plagioclase assemblages. A small FeS-bearing shock vein occurs near one edge of the section.

Geochemistry: Olivine ($Fa_{25.7\pm0.7}$, N = 21), low-Ca pyroxene ($Fs_{22.3\pm1.2}Wo_{1.7\pm0.5}$, N = 17), high-Ca pyroxene ($Fs_{8.0\pm1.6}Wo_{45.1\pm2.3}$, N = 10).
Specimens: *Cascadia* holds 41.7 g in two pieces, a polished thin section, and a mounted butt. John Shea holds the main mass.

Northwest Africa 10886 (NWA 10886)
(Northwest Africa)
Purchased: 2016
Classification: HED achondrite (Eucrite, monomict)
History: Purchased by Gary Fujihara in Morocco, June 2016.
Physical characteristics: Single stone, weathered exterior without fusion crust. A cut and polished surface reveals a breccia with clasts up to 1.5 cm set in a dark-gray shock-melted groundmass.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows a fragmental breccia with basaltic clasts bounded by zones of shock melt.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Low-Ca pyroxene $Fs_{60.1\pm3.6}Wo_{3.6\pm1.4}$, Fe/Mn=31±1, n=7; augite $Fs_{27.4\pm0.7}Wo_{42.5\pm0.3}$, Fe/Mn=33±2, n=3; plagioclase $An_{89.2\pm0.6}$, n=4.
Classification: Eucrite (monomict), equilibrated basaltic clasts of a single lithology with compositional separation of low Ca-pyroxene and augite.
Specimens: 31.72 g including a probe mount on deposit at *UNM*, Gary Fujihara holds the main mass.

Northwest Africa 10887 (NWA 10887)
(Northwest Africa)
Purchased: 2016
Classification: HED achondrite (Eucrite, monomict)
History: Purchased by Gary Fujihara from Morocco, April 2016.
Physical characteristics: Single stone, partial fusion-crusted exterior. A saw cut surfaces reveal a fine-grained mix of white and gray plagioclase and pyroxene with mild brecciation. Scattered, black shock melt domains, up to 1 cm, are present throughout.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows an approximately 50-50 mix of plagioclase and pyroxene. The pyroxene grains show exsolution lamellae. Shock melt domains consist of fine grained quench crystals, with rafted clasts from the main lithology.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Low-Ca pyroxene $Fs_{60.3\pm1.2}Wo_{3.4\pm1.5}$, Fe/Mn=31±1, n=6; augite $Fs_{28.1\pm2.2}Wo_{41.8\pm2.4}$, Fe/Mn=32±2, n=5; plagioclase $An_{88.9\pm0.6}$, n=5.
Classification: Eucrite (monomict), equilibrated, single lithology with compositional separation of low Ca-pyroxene and augite. Shock melt present.
Specimens: 12.28 g including a probe mount on deposit at *UNM*, Gary Fujihara holds the main mass.

Northwest Africa 10888 (NWA 10888)
(Northwest Africa)
Purchased: 2016
Classification: Carbonaceous chondrite (CK6)
History: Purchased by Gary Fujihara in Morocco, May 2016.

Physical characteristics: Weathered fusion crust exterior. A saw cut reveals a gray surface with dark-gray, scattered, faint, chondrules. A few, very small CAIs are visible.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows a equilibrated, relict chondrules ~1 mm in diameter, ubiquitous magnetite and feldspar.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{32.3\pm0.4}$, Fe/Mn=116±11, NiO=0.45±0.07 (wt%), n=16; high-Ca pyroxene $Fs_{10.7\pm3.6}Wo_{41.7\pm9.0}$, Fe/Mn=63±17, n=4.
Classification: Carbonaceous chondrite (CK6)
Specimens: 20.45 g including a probe mount on deposit at *UNM*, Gary Fujihara holds the main mass.

Northwest Africa 10889 (NWA 10889)
(Northwest Africa)
Purchased: 2016
Classification: Ordinary chondrite (L6)
History: Purchased by Gary Fujihara from Morocco, June 2016.
Physical characteristics: Fusion crust covered exterior; a saw cut reveals scattered chondrules, some distinct, others faint, set in a light-gray groundmass, metal and sulfides show minimal weathering, some orange colored staining present throughout.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows primarily equilibrated, relict chondrules, ubiquitous metal and sulfide, plagioclase grains up to 200 μm.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{24.4\pm0.1}$, Fe/Mn=48±3, n=6; low-Ca pyroxene $Fs_{20.4\pm0.3}Wo_{1.6\pm0.4}$, Fe/Mn=63±17, n=7.
Classification: Ordinary chondrite (L6)
Specimens: 20.42 g including a probe mount on deposit at *UNM*, Gary Fujihara holds the main mass.

Northwest Africa 10890 (NWA 10890)
Mauritania
Purchased: April 2016
Classification: Ureilite
History: Found by meteorite hunters during an expedition near the Western Saharan, Algerian and Mauritanian border region. Purchased in Mauritania.
Physical characteristics: Single stone with no fusion crust, irregular exterior surface. Saw-cut surfaces show a mosaic of dark colored olivine grains.
Petrography: (C. Agee, *UNM*) This meteorite has a modal abundance of ~95% olivine. The olivine shows reduction rims with fine-grained iron metal; ubiquitous graphite present. No pyroxene was detected in the probe section.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine cores $Fa_{14.0\pm0.0}$, Fe/Mn=35±2, Cr_2O_3=0.69±0.02 (wt%), CaO=0.28±0.01 (wt%), n=5; Olivine rims $Fa_{2.9\pm2.3}$, Fe/Mn=7±6, Cr_2O_3=0.69±0.19 (wt%), CaO=0.33±0.01 (wt%), n=2.
Classification: Ureilite (dunitic)
Specimens: 20.5 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10891 (NWA 10891)
Mauritania
Purchased: April 2016

Classification: Carbonaceous chondrite (CO3.2)
History: Found by meteorite hunters during an expedition near the Western Saharan, Algerian and Mauritanian border region. Purchased in Mauritania.
Physical characteristics: Single stone. Weathered fusion crust exterior. A saw cut reveals many very small chondrules and a few small CAIs set in a dark brown matrix.
Petrography: : (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous chondrules, many fragmental or irregular, most in the size range 50-200 μm. Scattered matrix olivines and CAIs were observed throughout. Fine grained matrix makes up approximately 40% of this meteorite.
Geochemistry: (C. Agee and M. Spilde, *UNM*) All olivine $Fa_{15.8\pm15.5}$, n=19; coarse ferroan olivine $Fa_{19.7\pm15.2}$, Fe/Mn=90±39, Cr_2O_3=0.09±0.09 (wt%), n=15; enstatite $Fs_{1.9\pm1.3}Wo_{2.0\pm1.4}$, n=8; diopside $Fs_{4.1\pm0.1}Wo_{38.1\pm6.6}$, n=2.
Classification: Carbonaceous chondrite (CO3.2), type 3.2 based on mean value and sigma of Cr_2O_3 in ferroan olivine (Grossman and Brearley, 2005), the values are similar to Rainbow (CO3.2).
Specimens: 20.6 g including a probe mount on deposit at *UNM*. *DPitt* holds the main mass.

Northwest Africa 10892 (NWA 10892)
Mauritania
Purchased: April 2016
Classification: Carbonaceous chondrite (CK3)
History: Found by meteorite hunters during an expedition near the Western Saharan, Algerian and Mauritanian border region. Purchased in Mauritania.
Physical characteristics: Weathered exterior A saw cut reveals scattered chondrules and CAIs set in a gray-brown groundmass.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows a variety of chondrule types, fine grained, recrystallized groundmass makes up ~60% of this meteorite. Aluminous diopside, aluminous enstatite, and two distinct plagioclase compositions detected; magnetite present.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{29.9\pm4.7}$, Fe/Mn=133±14, NiO=0.27±0.13 (wt%), Cr_2O_3=0.05±0.04 (wt%), n=10; Orthopyroxene $Fs_{1.9}Wo_{6.3}$, Aluminous diopside $Fs_{4.7\pm7.4}Wo_{43.2\pm2.8}$, Al_2O_3=6.8±3.7 (wt%) n=5; bytownite $An_{83.4\pm1.2}Ab_{16.4\pm1.2}Or_{0.3\pm0.0}$, n=2; andesine $An_{39.5\pm2.1}Ab_{58.4\pm2.1}Or_{2.2\pm0.0}$, n=2.
Classification: Carbonaceous chondrite (CK3)
Specimens: 20.0 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10893 (NWA 10893)
Mauritania
Purchased: April 2016
Classification: Ureilite
History: Found by meteorite hunters during an expedition near the Western Saharan, Algerian and Mauritanian border region. Purchased in Mauritania.
Physical characteristics: Single stone with no fusion crust, irregular exterior surface. A saw-cut surface shows a mosaic of brown and gray colored silicate grains.

Petrography: (C. Agee, *UNM*) This meteorite has approximately 70% olivine and 25% pyroxene. The olivine grain boundaries contain fine-grained iron metal and oxidized iron. No plagioclase was detected.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{21.9\pm0.3}$, Fe/Mn=49±4, Cr_2O_3=0.42±0.02 (wt%), CaO=0.27±0.01 (wt%), n=6. Pigeonite $Fs_{18.6\pm0.1}Wo_{9.0\pm0.1}$, Fe/Mn=28±2, n=6.
Classification: Ureilite based on iron reduction in rims and grain boundaries of olivines, Cr_2O_3 and CaO content of olivine, and typical ureilite mineralogy of olivine + pigeonite.
Specimens: 22 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10894 (NWA 10894)
Mauritania
Purchased: April 2016
Classification: HED achondrite (Eucrite, cumulate)
History: Found by meteorite hunters during an expedition near the Western Saharan, Algerian and Mauritanian border region. Purchased in Mauritania.
Physical characteristics: Single stone. Partial fusion crusted exterior. A saw cut reveals mm-size white feldspar and light green pyroxene grains, a few oxide-stained metal grains present. Friable.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows approximately equal amounts of pyroxene and plagioclase, unbrecciated, shock melt pockets with vesicles are present. Accessory low-Ni iron metal and chromite observed.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Pigeonite $Fs_{37.3\pm2.4}Wo_{8.2\pm3.7}$, Fe/Mn=26±1, n=12; plagioclase $An_{96.0\pm0.2}$, n=7; shock melt (proxy for bulk composition) SiO_2=46.7±0.3, TiO_2=0.01±0.01, Al_2O_3=14.3±0.4, Cr_2O_3=0.31±0.02, MgO=11.1±0.2, FeO=13.5±0.2, MnO=0.52±0.03, NiO=0.02±0.02, CaO=10.3±0.2, Na_2O=0.19±0.02, K_2O=0.02±0.01 (all wt%), Mg#=59.3±0.1, n=3.
Classification: Achondrite (cumulate eucrite).
Specimens: 20.1 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10895 (NWA 10895)
Mauritania
Purchased: April 2016
Classification: Primitive achondrite (Acapulcoite)
History: Found by meteorite hunters during an expedition near the Western Saharan, Algerian and Mauritanian border region. Purchased in Mauritania.
Physical characteristics: Single stone. A saw cut shows a mosaic of dark gray grains, most of which appear to be less than 1 mm in diameter.
Petrography: (C. Agee, *UNM*) This meteorite consists primarily of high-Ca pyroxene and olivine with most grain sizes in the probe section in the range 200-500 μm, there were also a few percent low-Ca pyroxene and plagioclase detected. Fe-Ni metal and oxidized metal is abundant, particularly as veins and along grain boundaries.
Geochemistry: : (C. Agee and M. Spilde, *UNM*) High-Ca pyroxene $Fs_{6.1\pm0.4}Wo_{42.0\pm1.8}$, Fe/Mn=11±1, Cr_2O_3=1.4±0.2 (wt%), n=5; olivine $Fa_{13.8\pm0.3}$, Fe/Mn=25±1, n=6; plagioclase $Ab_{76.7\pm2.7}An_{20.5\pm3.2}Or_{2.8\pm0.5}$, n=3.

Classification: Acapulcoite, not a lodranite, based on grain size of pyroxene and olivine, and the presence of plagioclase.
Specimens: 22 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

Northwest Africa 10896 (NWA 10896)
(Northwest Africa)
Purchased: 2015
Classification: Carbonaceous chondrite (CK5)
History: Purchased in 2015 by Brahim Tahiri in Morocco and sent to his partner Sean Tutorow for analysis.
Physical characteristics: Weathered fusion-crusted exterior. Saw cuts reveal dark gray, distinct, chondrules set in a lighter-gray groundmass.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows equilibrated chondrules, recrystallized groundmass, ubiquitous Cr-magnetite.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{29.2\pm1.3}$, Fe/Mn=111±15, NiO=0.42±0.10 (wt%), n=18; low-Ca pyroxene $Fs_{25.9\pm2.1}Wo_{0.8\pm0.6}$, Fe/Mn=66±4, n=4.
Classification: Carbonaceous chondrite (CK5)
Specimens: 13.5 g including a probe mount on deposit at *UNM*, Sean Tutorow holds the main mass.

Northwest Africa 10899 (NWA 10899)
(Northwest Africa)
Purchased: 2015
Classification: Carbonaceous chondrite (CO3.2)
History: Purchased in 2015 by Brahim Tahiri in Morocco and sent to his partner Sean Tutorow for analysis.
Physical characteristics: Nine identical appearing stones. Weathered fusion crust exterior with numerous sub-millimeter chondrule outlines. A saw cut reveals many very small chondrules and a few small CAIs set in a dark brown matrix.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous chondrules, many fragmental or irregular, most in the size range 50-200 μm. Scattered matrix olivines and CAIs were observed throughout. Fine grained matrix makes up approximately 40% of this meteorite.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{11.6\pm16.3}$, Fe/Mn=68±39, Cr_2O_3=0.11±0.06 (wt%), n=15; low-Ca pyroxene $Fs_{3.3\pm3.5}Wo_{1.7\pm1.2}$, Fe/Mn=13±4, n=6.
Classification: Carbonaceous chondrite (CO3.2), type 3.2 based on mean value and sigma of Cr_2O_3 in ferroan olivine (Grossman and Brearley, 2005), the values are similar to Rainbow and Kainsaz (CO3.2).
Specimens: 28.36 g including a probe mount on deposit at *UNM*, Sean Tutorow holds the main mass.

Northwest Africa 10900 (NWA 10900)
(Northwest Africa)
Purchased: 2015
Classification: Ureilite

History: Purchased in 2015 by Brahim Tahiri in Morocco and sent to his partner Sean Tutorow for analysis.
Physical characteristics: Single stone with no fusion crust, irregular exterior surface. A sawn surface shows a mosaic of gray-colored silicate grains.
Petrography: (C. Agee, *UNM*) This meteorite has predominantly olivine and pigeonite. The olivine grain boundaries contain fine-grained iron metal and oxidized iron. Silica-rich melt inclusions are present. Graphite is ubiquitous. No plagioclase was detected.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine cores $Fa_{22.5\pm0.1}$, Fe/Mn=50±4, Cr_2O_3=0.68±0.03 (wt%), CaO=0.37±0.03 (wt%), n=4; olivine reduction rims $Fa_{8.5\pm0.7}$, Fe/Mn=16±0, Cr_2O_3=0.96±0.12 (wt%), CaO=0.44±0.02 (wt%), n=2; Pigeonite $Fs_{17.0\pm2.4}Wo_{11.3\pm3.2}$, Fe/Mn=27±3, n=5; pigeonite reduction rim $Fs_{9.3}Wo_{15.7}$, Fe/Mn=10, n=1.
Classification: Ureilite based on iron reduction in rims and grain boundaries of olivines, Cr_2O_3 and CaO content of olivine, typical ureilite mineralogy of olivine + pigeonite, and presence of graphite.
Specimens: 20.54 g including a probe mount on deposit at *UNM*, Sean Tutorow holds the main mass.

Northwest Africa 10901 (NWA 10901)
(Northwest Africa)
Purchased: 2015
Classification: Lunar meteorite
History: Purchased in 2015 by Brahim Tahiri in Morocco and sent to his partner Sean Tutorow for analysis.
Physical characteristics: Single stone, irregular exterior, no fusion crust. A saw cut reveals light-gray feldspathic clasts (up to 2 cm) and some smaller fragmental white plagioclase grains set in a dark-gray groundmass.
Petrography: (C. Agee, *UNM*) This is a polymict feldspathic breccia showing several different textural domains: 1) large (centimeter-sized) poikilitic plagioclase with olivine and pyroxene inclusions, 2) zones of fragmental plagioclase, olivine, and pyroxene, 3) cataclastic zones of fine-grained silicates, 4) vesicular shock melt veins and pockets. Iron metal detected, the largest grain observed was ~150 μm in diameter.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{42.0\pm13.4}$, Fe/Mn=98±7, n=6; pigeonite $Fs_{54.7\pm9.1}Wo_{7.0\pm2.3}$, Fe/Mn=63±3, n=5; augite $Fs_{28.7}Wo_{40.3}$, Fe/Mn=56, n=1; plagioclase $An_{96.6\pm0.4}$, n=4; Shock melt (proxy for bulk meteorite composition): SiO_2=44.7, TiO_2=0.37, Al_2O_3=24.1, Cr_2O_3=0.16, MgO=7.2, FeO=7.2, MnO=0.10, CaO=14.7, NiO=b.d.l., Na_2O=0.31, K_2O=0.02 (all wt%), n=1.
Classification: Lunar meteorite. Intermediate breccia based on FeO and Al_2O_3 content.
Specimens: 13.76 g including a probe mount on deposit at *UNM*, Sean Tutorow holds the main mass.

Northwest Africa 10902 (NWA 10902)
(Northwest Africa)
Purchased: 2015
Classification: Lunar meteorite
History: Purchased in 2015 by Brahim Tahiri in Morocco and sent to his partner Sean Tutorow for analysis.

Physical characteristics: Two identical appearing stones, irregular exterior, no fusion crust. A saw cut reveals scattered light-gray feldspathic clasts set in a very dark groundmass.
Petrography: (C. Agee, *UNM*) This is a polymict breccia showing several different textural domains: 1) basaltic clasts with phenocrysts and quench crystals, 2) zones of fragmental plagioclase, olivine, and pyroxene, 3) cataclastic zones of fine-grained silicates, 4) shock melt veins and pockets.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{43.1\pm1.1}$, Fe/Mn=100±3, n=4; pigeonite $Fs_{41.0\pm8.0}Wo_{16.7\pm5.7}$, Fe/Mn=59±5, n=9; augite $Fs_{29.5}Wo_{44.1}$, Fe/Mn=60, n=1; plagioclase $An_{95.9\pm0.8}$, n=4; Shock melt (proxy for bulk meteorite composition): SiO_2=44.2±0.7, TiO_2=0.36±0.07, Al_2O_3=24.6±1.5, Cr_2O_3=0.19±0.04, MgO=8.5±1.0, FeO=8.3±1.0, MnO=0.11±0.02, CaO=13.7±0.7, NiO=0.06±0.05, Na_2O=0.36±0.06, K_2O=0.10±0.03 (all wt%), n=9.
Classification: Lunar meteorite. Intermediate breccia based on FeO and Al_2O_3 content.
Specimens: 7.4 g including a probe mount on deposit at *UNM*, Sean Tutorow holds the main mass.

Northwest Africa 10903 (NWA 10903)
(Northwest Africa)
Purchased: 2015
Classification: Carbonaceous chondrite (CV3)
History: Purchased in 2015 by Brahim Tahiri in Morocco and sent to his partner Sean Tutorow for analysis.
Physical characteristics: 208 identically appearing stones and fragments: sandblasted exterior, many mm-sized chondrules visible, CAIs are present, matrix dark gray.
Petrography: (C. Agee, *UNM*) Numerous porphyritic chondrules observed, and fine-grained matrix makes up approximately 50% of this meteorite.
Geochemistry: (C. Agee and M. Spilde, *UNM*) All olivine $Fa_{4.7\pm5.4}$, Fe/Mn=75±41, n=16; ferroan olivine $Fa_{8.8\pm5.4}$, Fe/Mn=99±32, Cr_2O_3=0.25±0.32 (wt%), n=7; aluminous low-Ca pyroxene $Fs_{22.2\pm26.2}Wo_{2.4\pm2.1}$, Al_2O_3=6.7±1.6 (wt%), n=2; aluminous diopside $Fs_{0.8\pm0.5}Wo_{43.3\pm1.2}$, Al_2O_3=7.3±3.4 (wt%), n=3; plagioclase $An_{86.5\pm0.5}Ab_{13.4\pm0.6}$, n=2.
Classification: Carbonaceous chondrite (CV3)
Specimens: 20.16 g including a probe mount on deposit at *UNM*, Sean Tutorow holds the main mass.

Northwest Africa 10904 (NWA 10904)
(Northwest Africa)
Purchased: 2015
Classification: Ordinary chondrite (L3)
History: Purchased in 2015 by Brahim Tahiri in Morocco and sent to his partner Sean Tutorow for analysis.
Physical characteristics: Eleven identical appearing stones. Weathered fusion-crusted exterior. Saw cuts reveal well defined, densely packed chondrules, mean apparent diameter 600±200 μm, n=14.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous porphyritic chondrules, most with glass or mesostasis. Abundant fine-grained, opaque matrix.

Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{22.3\pm10.4}$, Fe/Mn=58±21, Cr_2O_3=0.05±0.03 (wt%), n=30; low-Ca pyroxene $Fs_{14.5\pm8.6}Wo_{2.2\pm4.5}$, Fe/Mn=22±6, n=10; plagioclase $An_{79.6}Ab_{19.8}Or_{0.6.}$
Classification: Ordinary chondrite (L3), subtype ~3.5 based on mean values of Fa and Fs and 1-sigma standard deviation, and on the ferroan olivine mean value of Cr_2O_3 and 1-sigma standard deviation, Chainpur (3.4) and Tieschitz (3.6) (Grossman and Brearley, 2005).
Specimens: 22.33 g including a probe mount on deposit at *UNM*, Sean Tutorow holds the main mass.

Northwest Africa 10905 (NWA 10905)
(Northwest Africa)
Purchased: 2016
Classification: HED achondrite (Eucrite, monomict)
History: Purchased by Morten Bilet, April 2016, from a Moroccan meteorite dealer.
Physical characteristics: Single stone with fusion crust, saw cut shows a fine-grained mix of white plagioclase and gray pyroxene. Mild brecciation.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows approximately 60% pyroxene and 35% plagioclase. Most grains are in the size range 200-500 μm, with a few plagioclase grains up to 1 mm.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Low-Ca pyroxene $Fs_{61.7\pm0.5}Wo_{2.8\pm1.6}$, Fe/Mn=31±1, n=6, high-Ca pyroxene $Fs_{33.5\pm8.1}Wo_{36.4\pm9.1}$, Fe/Mn=31±2, n=7, plagioclase $An_{87.4\pm2.0.}$
Classification: Monomict eucrite
Specimens: 20.7 g including a probe mount on deposit at *UNM*, Morten Bilet holds the main mass.

Northwest Africa 10906 (NWA 10906)
(Northwest Africa)
Purchased: 2016
Classification: HED achondrite (Howardite)
History: Purchased by Morten Bilet, June 2016, in Ensisheim, from a Moroccan meteorite dealer.
Physical characteristics: Single stone with fusion crust, saw cut shows a polymict breccia with light and dark clasts set in a fine-grained matrix.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows three distinct lithologies: 1) diogenitic (~28%), 2) cumulate eucritic (~44%), 3) basaltic eucritic (~28%). Most pyroxene and plagioclase are fragmental to fine-grained cataclastic, although there are some larger diogenitic clasts with relatively coarse pyroxene grains. Exsolution lamellae in pyroxene is common. There are two distinct plagioclase populations, anorthitic and bytownitic.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Diogenite low-Ca pyroxene $Fs_{28.9\pm3.9}Wo_{3.8\pm1.2}$, Fe/Mn=31±2, n=6, eucrite-cm low-Ca pyroxene$Fs_{46.2\pm4.3}Wo_{4.6\pm3.1}$, Fe/Mn=33±2, n=9; eucrite pigeonite $Fs_{51.9\pm5.4}Wo_{12.2\pm4.7}$, Fe/Mn=32±1, n=6; anorthite $An_{93.0\pm1.5}$, n=5; bytownite $An_{84.7\pm2.4}$, n=2.
Classification: Howardite
Specimens: 20 g including a probe mount on deposit at *UNM*, Morten Bilet holds the main mass.

Northwest Africa 10909 (NWA 10909)
Morocco, Western Sahara
Find: 2015 Aug
Classification: HED achondrite (Eucrite, monomict)
History: Six complete stones covered with dark fusion crust were found in the desert by a nomad. The stones (originally 201.3, 110.9, 121.7, 127.1, 100.3, and 152 g) were sent to *MCM* for study. After the first studies, several grams were sent to *UPC*, where analysis was performed by Dr. J. Llorca in October 2015.
Petrography: The meteorite displays a basaltic texture with up to 1.5 mm sized exsolved pyroxenes and equally sized lath-shaped calcic plagioclase. Minor phases include chromite, SiO_2 polymorphs, ilmenite and metallic iron.
Geochemistry: (J.Llorca, *UPC*) Orthopyroxene; $Fs_{57.4\pm0.9}$, $Wo_{2.2\pm1.4}$, FeO/MnO = 32±1, n=19. Plagioclase; $An_{87.1\pm2.6}$, n=21.
Classification: Monomict eucrite.
Specimens: The remaining masses are in the private collection of Javier Franco, Las Palmas de Gran Canaria, Spain, and 90.9 g at *MCM*. Repository sample: 20 g *UPC*.

Northwest Africa 10910 (NWA 10910)
(Northwest Africa)
Purchased: 2016
Classification: R4-6
History: Two stones weighing 56.7 and 60.1 g were found and subsequently purchased in Morocco in 2015. Don Cline and John Sinclair acquired the samples from a meteorite prospector at the Tucson Gem and Mineral Show in February of 2016.
Physical characteristics: Samples have an ovoid shape with a few shallow regmaglypts. Sample 95% covered by a lightly weathered dark brown-black fusion crust, which contains contraction cracks. Small cracks in the fusion crust from both samples show interior is dark green in color.
Petrography: (A. Love, *App*) Sample has a brecciated texture. Chondrules have an average diameter of 390 μm (N=86). Some clasts display distinct chondrules in a recrystallized matrix while other clasts have been completely recrystallized and lack recognizable chondrules. Chondrule olivines show undulatory to weak mosaic extinction and some contain irregular and multiple sets of planar fractures. Olivine chondrules and fragments are dominant. Accessory minerals are pentlandite, pyrrhotite, Cr-spinel and Na-feldspar.
Geochemistry: (A. Love, *App*) Olivine: $Fa_{41.2\pm0.3}$, N=16; low Ca pyroxene $Fs_{32.3\pm6.3}Wo_{1.7\pm0.4}$ ($Fs_{11.3\text{-}34.7}$, N=12); high-Ca pyroxene $Fs_{12.3\pm0.3}Wo_{49.4\pm0.5}$, N=5.
Classification: Rumuruti chondrite (R4-6, S4, W0). Mineral compositions and extensive sulfides suggest this is an R chondrite. Brecciated texture, equilibrated compositions of olivine and poorly equilibrated composition of pyroxenes suggest host is composed of a mixture of type 4 and higher petrologic grades of materials. Textures and equilibrated compositions within clasts suggest clasts are R5-6.
Specimens: *PARI* holds the main masses (116.8 and 29.2 g). A 22.1 g type specimen and one polished thin section are on deposit at *App*.

Northwest Africa 10911 (NWA 10911)
Morocco
Purchased: August 2015

Classification: Ordinary chondrite (H5)
History: Purchased by the owner in August 2015 from the finder, who reportedly found it whilehe was metal detecting for mining exploration in the Oumjrane region of Morocco.
Physical characteristics: A single stone mostly covered in fusion crust. Minor red-brown oxidation is visible on the exterior surface and around metal grains on cut surfaces.
Petrography: Weathering grade according to Zurfluh et al. (2016).
Geochemistry: (C. Herd, *UAb*) Data obtained by EMP examination of carbon-coated thin section: Olivine $Fa_{18.1\pm0.4}$ (n=38); Low-Ca Pyroxene $Fs_{16.2\pm0.3}Wo_{1.3\pm0.2}$ (n=41).
Specimens: A 23.6 g specimen, including one thin section, is at *UAb*. Main mass is with the owner.

Northwest Africa 10912 (NWA 10912)
Morocco
Purchased: August 2015
Classification: Ordinary chondrite (H5)
History: Purchased by the owner in August 2015 from the finder, who reportedly found it while he was metal detecting for mining exploration in the Oumjrane region of Morocco.
Physical characteristics: A single, dark brown stone with caliche coating over 2/3 of the surface, cross-cut by numerous calcite-filled fractures, and a smaller, 12 g piece which fits onto the side of the main mass.
Petrography: Brecciation is evident in thin section, and the sample is cross-cut by numerous dark brown to black shock veins. Host rock is shock stage 3. Weathering grade according to Zurfluh et al. (2016).
Geochemistry: (C. Herd, *UAb*) Data obtained by EMP examination of carbon-coated thin section: Olivine $Fa_{19.2\pm0.5}$ (n=9); Low-Ca Pyroxene $Fs_{17.1\pm0.5}Wo_{1.3\pm0.2}$ (n=34).
Specimens: A 24.7 g specimen, including one thin section, is at *UAb*. Main mass is with the owner.

Northwest Africa 10913 (NWA 10913)
Morocco
Purchased: August 2015
Classification: Ordinary chondrite (H4-6)
History: Purchased by the owner in August 2015 from the finder, who reportedly found it while he was metal detecting for mining exploration in the Oumjrane region of Morocco.
Physical characteristics: A single stone almost completely covered in a glossy black/dark brown fusion crust. Minor red-brown oxidation is visible on the exterior surface and around metal grains on cut surfaces.
Petrography: A breccia of predominantly type 4 with at least one type 6 clast. Weathering grade according to Zurfluh et al. (2016).
Geochemistry: (C. Herd, *UAb*) Data obtained by EMP examination of carbon-coated thin section: Olivine $Fa_{18.8\pm4.1}$ (n=78); Low-Ca Pyroxene $Fs_{17.2\pm3.1}Wo_{1.4\pm1.0}$ (n=54).
Specimens: A 21.8 g specimen, including one thin section, is at *UAb*. Main mass is with the owner.

Northwest Africa 10914 (NWA 10914)
Morocco

Purchased: August 2015
Classification: Ordinary chondrite (H5)
History: Purchased by the owner in August 2015 from the finder, who reportedly found it while he was metal detecting for mining exploration in the Oumjrane region of Morocco.
Physical characteristics: A single rounded stone mostly covered in two generations of black/dark brown fusion crust. Minor red-brown oxidation is visible on the exterior surface and around metal grains on cut surfaces.
Petrography: Weathering grade according to Zurfluh et al. (2016).
Geochemistry: (C. Herd, *UAb*) Data obtained by EMP examination of carbon-coated thin section: Olivine $Fa_{19.2\pm0.3}$ (n=35); Low-Ca Pyroxene $Fs_{17.0\pm0.2}Wo_{1.6\pm0.1}$ (n=28).
Specimens: A 22.8 g specimen, including one thin section, is at *UAb*. Main mass is with the owner.

Northwest Africa 10915 (NWA 10915)
Morocco
Purchased: 2015
Classification: HED achondrite (Eucrite, monomict)
History: Purchased by A. Jonikas from an unknown Moroccan dealer in early (March?) 2015, then sold to the owner by S. Arnold (of Chicago, Illinois) in October 2015. Likely recovered shortly before initial sale.
Physical characteristics: A single stone mostly covered in black fusion crust. Interior is chalky white. No weathering is evident.
Petrography: (C. Herd, *UAb*) A fragmental breccia consisting of clasts of very fine-grained (<100 μm) equigranular plagioclase and pyroxene set in a matrix with the same mineralogy. Some clasts are coarser-grained (<1 mm) and plagioclase-phyric. Texture throughout is granoblastic (abundant 120° junctions) and annealed. Pyroxene (high or low-Ca) are commonly exsolved. Accessory minerals are chromite, ilmenite, silica polymorph, and troilite.
Geochemistry: (C. Herd and S. Kampel, *UAb*) Low-Ca pyroxene $Fs_{60.7\pm0.8}Wo_{2.6\pm0.6}$ (n=25), high-Ca pyroxene $Fs_{26.4\pm0.7}Wo_{43.2\pm0.6}$ (n=19), plagioclase $An_{88.7\pm2.4}$ (n=30), chromite (5-7 wt% TiO_2).
Classification: Eucrite (granulitic monomict breccia)
Specimens: A 5.4 g specimen, including one thin section, is at *UAb*. Main mass is with the owner.

Northwest Africa 10916 (NWA 10916)
Morocco
Purchased: 2013
Classification: Carbonaceous chondrite (CO3.0)
History: Purchased by G. Catterton (Boone, North Carolina) from an unknown Moroccan dealer in early (March?) 2013. Subsequently sold to the owner in April 2013.
Physical characteristics: A single stone partially covered in dark brown fusion crust. Saw cut reveals many small chondrules and some light-colored CAIs in a dark gray-brown matrix.
Petrography: (C. Herd, *UAb*) Microprobe and petrographic examination of thin section shows numerous chondrules in the range 50-750 μm (most ~200 μm), with CAIs/AOAs and isolated olivine and pyroxene grains observed throughout. Sulfides are present, but rare. Small amount of FeNi metal was found as grains up to about 250 um in the matrix, as well as small grains as inclusions in Type I olivine. Matrix ~35% of mode (estimated).

Geochemistry: (C. Herd and S. Kampel, *UAb*) All olivine $Fa_{25\pm20}$ (n=55); ferroan olivine (chondrule and isolated grains) $Fa_{32\pm18}$, Cr_2O_3=0.40±0.07 (n=42); low-Ca pyroxene (Type II chondrules) $Fs_{18\pm13}Wo_{0.8\pm0.8}$ (n=19).
Classification: Carbonaceous chondrite (CO3.0), type 3.0 based on the mean value and standard deviation of Cr_2O_3 in ferroan olivine (Grossman and Brearley, 2005); these values are similar to ALHA77307.
Specimens: A 6.6 g specimen, including one thin section, is at *UAb*. Main mass is with the owner.

Northwest Africa 10917 (NWA 10917)
Morocco
Purchased: 2015 Oct
Classification: Rumuruti chondrite (R3)
History: Purchased by S. Arnold (of Chicago, Illinois) in October 2015 from Aziz Habibi. Subsequently sold to the owner in the same month. Likely recovered shortly before initial sale.
Physical characteristics: A single stone partially covered in a glossy, dark brown fusion crust. Saw cut reveals chondrules and clasts of variable size (up to ~2 mm) in a red-brown to grey matrix.
Petrography: (C. Herd, *UAb*) Microprobe and petrographic examination of thin section shows numerous chondrules in the range 150-1400 μm (most ~200-600 μm) comprising ~75% of mode (estimated). Fe-Ni sulfide and magnetite also observed. The rock does not appear to be brecciated.
Geochemistry: (C. Herd and S. Kampel, *UAb*) All olivine $Fa_{39.3\pm6.1}$ (n=59); chondrule olivine $Fa_{34.6\pm9.6}$, range $Fa_{1.3\text{-}41.5}$ (n=18), matrix olivine $Fa_{41.4\pm0.7}$ (n=41); low-Ca pyroxene $Fs_{11.9\pm2.9}$, $Wo_{0.5\pm0.2}$ (n=3); high-Ca pyroxene $Fs_{10.8\pm1.4}$, $Wo_{46.3\pm1.3}$ (n=7), plagioclase $An_{6\text{-}17}Or_{4\text{-}9}$ (n=4).
Classification: R3 chondrite, suggested sub-type 3.8, based on range of chondrule mineral compositions, and olivine-rich matrix. Range of chondrule sizes comparable to other R chondrites (e.g., Hammadah al Hamra 119; see Bischoff et al., 2011).
Specimens: A 6.8 g specimen, including one thin section, is at *UAb*. Main mass is with the owner.

Northwest Africa 10918 (NWA 10918)
(Northwest Africa)
Purchased: 2013
Classification: Carbonaceous chondrite (CV3)
History: A meteorite was purchased by Mike Miller in 2013 at the Tucson Gem and Mineral Show and subsequently acquired by the Center for Meteorite Studies, *ASU*.
Physical characteristics: A single 61.86 g angular stone with shiny black (possibly sand-blasted) exterior; chondrules and CAIs visible on the surface. Sawn surface is orange stained, and shows an abundance of chondrules and CAIs set in a dark matrix.
Petrography: (E. Dunham and J. Zalesky, *ASU*) In a 2 × 3 cm section, there are ~80 chondrules (average 1.2 mm n=20, largest ~ 3 mm), and four CAIs (to ~ 1 cm in diameter), set in a dark, fine-grained matrix that accounts for ~32% of the section. Chondrules are predominantly POP, and a few BO, PP, and olivine fragments. Some chondrules are surrounded by a rim of FeS and weathered metal. Mesostasis rare within chondrules, but where present consists of anorthite (An_{93}). Most chondrules have an irregular outline, but the boundary between them and matrix is

distinct. The thin section contains a Type B CAI composed of melilite, pyroxene, and spinel surrounded by rim of pyroxene and hibonite, and a compact Type A (CTA) CAI dominated by coarse melilite with small perovskite blebs and surrounded by a <50 μm rim including pyroxene, and a very fine-grained object (possibly a CAI). The shock grade is low and weathering high.
Geochemistry: The compositional range for olivine in chondrules is $Fa_{0.7\pm0.3}$, 0.3-1.4 (Cr_2O_3 = 0.08-0.51 wt.%). Olivine phenocrysts from nine POP chondrules is $Fa_{0.3\text{-}1}$, and olivine phenocrysts from one intact PO chondrule is $Fa_{0.8\text{-}1.4}$. The POP chondrules contain pyroxene with a compositional range $Fs_{46\pm6.8}Wo_{72.2\pm24.0}$ ($Fa_{0.2\text{-}23}Wo_{38\text{-}97}$). The Type B CAI is composed of Al-rich melilite and pyroxene $Fs_{3.6\pm2.3}Wo_{64.2\pm8.3}$ ($Fs_{0.5\text{-}5}Wo_{47\text{-}67}$). The CTA CAI is primarily composed of melilite Ak~5-15 with a rim of Ca- Ti- rich pyroxene $Fs_{0.6\text{-}1.8}Wo_{62\text{-}64.}$
Classification: Carbonaceous chondrite CV3, high weathering, low shock.
Specimens: One polished thin section, two thick sections, the main mass is held by *ASU*

Northwest Africa 10919 (NWA 10919)
(Northwest Africa)
Purchased: 2016
Classification: HED achondrite (Eucrite, monomict)
History: A 54.5 g stone, half covered in dark fusion crust was acquired by Michael Farmer from a Moroccan meteorite dealer at the 2016 Tucson Gem and Mineral show.
Physical characteristics: Moderately angular, monomict breccia stone with well-developed fusion crust. Sawn surface is light colored with anastomosing pattern of darker shock veins and rounded clasts of unshocked material. Low weathering and sparse iron staining observed.
Petrography: (S. Ray and T. Gabriel, *ASU*) Typical basaltic texture dominated by roughly equal proportions of pyroxene and plagioclase, with regions showing ophitic texture. Pyroxene commonly with exsolution lamellae (low-Ca lamellae within high-Ca host and vice-versa). In unshocked regions, size of pyroxene grains and plagioclase laths to 800 μm. Plagioclase has abundant 5-10 μm inclusions and many laths feature scalloped margins. Accessories include troilite, ilmenite, chromite, and silica. Sparse Ni-free iron metal grains (about 10 μm) occur with assemblage of accessories. Locally, pyroxene and plagioclase shows undulatory extinction, alteration to glass, and extensive fracturing.
Geochemistry: Low-Ca pyroxene (N=6): $Fs_{55.8\pm5.0}Wo_{11.5\pm5.6}$ ($Fs_{49.1\text{-}61.0}Wo_{5.6\text{-}18.4}$, FeO/MnO = 32-33); High-Ca pyroxene (N=7): $Fs_{33.9\pm3.6}Wo_{37.9\pm4.2}$ ($Fs_{31.7\text{-}42.0}Wo_{28.6\text{-}40.6}$ FeO/MnO = 30-38); Plagioclase (n=13): $An_{87.9\pm0.2}$ ($An_{87.7\text{-}88.1}$).
Classification: Eucrite (monomict breccia), low weathering, moderate shock.
Specimens: 11.1 g and a polished thin section at *ASU*. Main mass with *MFarmer*

Northwest Africa 10920 (NWA 10920)
(Northwest Africa)
Purchased: 2013
Classification: Ordinary chondrite (H4)
History: A 3020.3 g meteorite was purchased by Mike Miller from a Moroccan dealer at the Tucson Gem and Mineral show in 2013. The complete mass was subsequently acquired by *ASU*.
Physical characteristics: (M. Healy, *ASU*) Sawn surface is dark, shows heavy fracturing and an even distribution of small metal grains. Chondrules are abundant (rarely to 1.6 mm), metal and sulfide grains are visible (800 μm and 500 μm, respectively). There is noticeable iron oxide weathering and one surface displays well-developed regmaglypts.

Petrography: (A. Perez, *ASU*) Polished thin section shows abundant well-defined chondrules in an opaque matrix. Chondrule types include PO, POP, RP, BO, and CC. The most abundant chondrules display porphyritic textures with euhedral to subhedral olivine and pyroxene phenocrysts. Metal and troilite show extensive weathering indicative of W4. BSE imaging shows rare zoned olivine phenocrysts. Olivine shows straight extinction indicating a low shock stage, S1. Reflected-light imaging shows extensive networking of iron oxides and some of the chondrules are rimmed in sulfide. Dominant phases include olivine, pyroxene, troilite, and Fe-Ni metal.
Geochemistry: (W. Feng and A. Perez, *ASU*) EPMA. Olivine: $Fa_{18.7\text{-}19.1}$ ($Fa_{18.8\pm0.2}$, Fe/Mn=39±1, n=6). Low-Ca pyroxene: $Fs_{15.7\text{-}17.9}Wo_{0.6\text{-}1.57}$ ($Fs_{16.7\pm0.8}Wo_{0.95\pm0.4}$, Fe/Mn=25±1, n=5).
Classification: Ordinary chondrite, H4, W4, S1.
Specimens: 3020.3 g meteorite at *ASU*.

Northwest Africa 10921 (NWA 10921)
(Northwest Africa)
Purchased: 2016
Classification: HED achondrite (Diogenite)
History: Purchased by Mendy Ouzillou from a Moroccan meteorite dealer in 2016.
Physical characteristics: Single stone, partially fusion crusted. Black fusion crust up to ~1 mm thick. Broken surfaces show centimeter-size green pyroxene grains, many with cleavage faces.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows approximately 98% orthopyroxene with accessory silica, chromite, Fe-metal, and Fe-sulfide. No olivine or plagioclase observed.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Low-Ca pyroxene $Fs_{28.0\pm0.3}Wo_{3.2\pm0.2}$, Fe/Mn=29±1, n=8.
Classification: Orthopyroxenitic diogenite
Specimens: 20.14 g including a probe mount on deposit at *UNM*, Mendy Ouzillou holds the main mass.

Northwest Africa 10922 (NWA 10922)
(Northwest Africa)
Purchased: 2013
Classification: Martian meteorite (basaltic breccia)
History: Purchased by Jay Piatek from Adam *Aaronson* in Morocco, 2013.
Physical characteristics: Single stone. The stone appears to have been sitting in the desert soil only half exposed for a relatively long time, as one side appeared smoothed and shiny, with a sand-blasted, black exterior, while the other side was covered with light-yellow caliche. Upon removal of the caliche with diluted glacial acetic acid, a preserved, brown colored, glassy, flow-lined, fusion crust was revealed. Saw cut shows a breccia with numerous dark and light colored fragmental crystals and polycrystalline lithologies, scattered spherules and spherical objects. An unusual trapezium-shaped object (~ 5mm) was observed, containing dark red concentric layers or zones, with a spherule at its center. Groundmass is dark gray, fine-grained, with scattered opaques throughout.
Petrography: (C. Agee, *UNM*) Microprobe examination of the polished deposit sample shows a polymict breccia with fragmental feldspar and pyroxene crystals up to 5 mm, iron-oxide-rich spherules, silicate-rich spherules, all set in a very fine-grained groundmass composed of feldspar,

pyroxene, oxides, phosphates, zircon, baddeleyite, and sulfides. The trapezium-shaped object described above consisted of distinct zones or layers of very fine-grained mixture of feldspars, pyroxenes and opaques. The sphere at the center of the trapezium shaped object contained euhedral olivine grains set in a quench-melt groundmass.
Geochemistry: (C. Agee, M. Spilde, M. Habermann *UNM*) plagioclase $Ab_{54.8\pm5.7}An_{43.1\pm6.3}Or_{2.1\pm0.6}$, n=9; albitic feldspar $Ab_{84.0}An_{2.7}Or_{13.3}$, n=1; potassium feldspar $Ab_{24.5\pm2.6}An_{3.7\pm1.5}Or_{71.7\pm4.1}$, n=2; low-Ca pyroxene $Fs_{31.2\pm7.7}Wo_{3.7\pm2.1}$, Fe/Mn=35±3, n=17; augite $Fs_{24.1\pm8.3}Wo_{38.6\pm7.5}$, Fe/Mn=32±5, n=2; olivine $Fa_{34.3\pm0.5}$, Fe/Mn=38±2, NiO=0.53±0.05 (wt%), n=5. Oxygen isotopes (K. Ziegler, *UNM*) acid-washed material analyzed in 4 replicates by laser fluorination gave, respectively $\delta^{18}O$= 6.192, 5.992, 5.746, 5.960; $\delta^{17}O$= 3.826, 3.750, 3.588, 3.714; $\Delta^{17}O$= 0.557, 0.586, 0.554, 0.567 (linearized, all per mil).
Classification: Martian (basaltic breccia). Paired with NWA 7034. This specimen is the only known NWA 7034 pairing with documented glassy fusion crust.
Specimens: 22 g on deposit at *UNM*, Jay Piatek holds the main mass.

Northwest Africa 10923 (NWA 10923)
(Northwest Africa)
Purchased: 2016
Classification: Carbonaceous chondrite (C1/2, ungrouped)
History: The meteorite was bought in 2016 from Aziz Habibi, Morocco.
Physical characteristics: The small black individual is partly covered by fusion crust.
Petrography: The meteorite appears strongly brecciated and is composed of chondrule pseudomorphs (30-400 μm in diameter), hydrated mineral fragments, carbonates and Fe,Ni sulfides all sent into a fine-grained Fe-rich matrix. Some chondrules are surrounded by dust rims. In the section studied, no anhydrous silicates, e.g., olivine or pyroxene have been found. Also, no metal has been detected. Very low totals of defocused matrix analyses attest to high porosity and the presence of hydrous phases, i.e., phyllosilicates.
Geochemistry: Mean values of defocused matrix analyses (all wt%; N=50): SiO_2: 24.8, TiO_2: 0.13; Na_2O: 0.1; K_2O: 0.03, Cr_2O_3: 0.47, MgO: 16.7, MnO: 0.15, CaO: 0.62, FeO: 22.6, Al_2O_3: 2.44, NiO: 1.8, P_2O_5: 0.26, S: 2.24, Total: 72.14; Ca-carbonates contain about 2 wt% FeO.
Classification: Due to the lack of anhydrous silicates but preserved chondrule pseudomorphs, a C1/2 classification is suggested.

Northwest Africa 10928 (NWA 10928)
(Northwest Africa)
Purchased: 2015
Classification: HED achondrite (Eucrite, polymict)
History: On 2015, meteorite specimens were purchased by José Antonio Sanchez Santana in the Saharawi refugee camps in Tindouf, Algeria.
Physical characteristics: Eighty-eight brownish to dark gray stones weighing 148 g in total were found in the desert. Each individual specimen weights between 0.5 and 10 g. Irregular exterior, no fusion crust. A saw cut reveals a polymict breccia with numerous fragmental light and dark clasts.
Petrography: Petrographic description (J. Llorca, *UPC*). The meteorite is a microbreccia of clasts in a semi-opaque dark brown microcrystalline impact melt matrix. The matrix is heterogeneous and is composed of mono and polymineralic fragments. Clast/matrix ratio is

approximately 85/15. The larger clasts (maximum dimension 5 mm) are mainly of pyroxenitic, anorthositic and basaltic lithologies; many have been shocked and partly granulated. The smaller clasts (minimum dimension less than 0.1 mm) are individual mineral grains (mainly pyroxene and plagioclase). The most abundant minerals are low-Ca pyroxene, all white thick pigeonite exsolution lamellae, and anorthite. Olivine is scarce and occurs in small amounts as fine grains. Accessory minerals are ilmenite and Al-Ti-bearing chromite.
Geochemistry: Mineral compositions (Rafael Pablo Lozano, *IGME*). Microprobe analyses show plagioclase ranges from An_{92-95} with a mean of $An_{94.1\pm1.2}$ (n=9). Pyroxene is variable in composition: low-Ca pyroxene ($Fs_{42-69}Wo_{2-4}$; Fe/Mn=26-36) with a mean of $Fs_{58.2\pm8.4}$ (10), contain pigeonite exsolution lamellae ($Fs_{23-36}Wo_{29-44}$; Fe/Mn=28-38) with a mean of $Fs_{29.9\pm4.0}$ (n=11). Low-Ca pyroxene and pigeonite grains have Fe/(Fe+Mg)=0.607–0.846 with Ti/(Ti+Cr)=0.52–0.99. Olivine: Fo_{14-27} (mean: $Fo_{21.6\pm4.5}$; n=11) has Fe/Mn=39-49 and chromite has Cr/(Cr+Al)=0.87. Bulk chemistry (J. Reyes, *IGME*). One gram of sample for the analysis. XRF of two specimens gave average abundances of (in wt.%): SiO_2=46.46, TiO_2=0.67, Al_2O_3=12.10, Fe_2O_3=20.45, MgO=6,09, CaO=11.39 and K_2O<0.25. Na_2O= 0.42 wt.% by AAS. Trace elements were measured with ICP-MS (all in ppm): Be=0.24, V=54.4, Cr=1369, Co=4.71, Ni=2.23, Cu=2.49, Zn=5.06, As=0.84, Se=3.10, Mo<0.5, Ag<0.1, Cd=2.61, Sb=0.38, Ba=1645, Tl<0.1, Pb=2.89, Th=0.30 and U=0.18.
Classification (R. P. Lozano, *IGME*). Achondrite, polymict eucrite. Terrestrial weathering is moderate with carbonate veins.
Specimens. Twelve specimens (25.4 g in total) and two probe mounts are on deposit at Museo Geominero (*IGME*). A thin section is on deposit at *UPC*. José Antonio Sánchez Santana holds the main mass.

Northwest Africa 10929 (NWA 10929)
(Northwest Africa)
Purchased: 2015
Classification: HED achondrite (Diogenite)
History: On 2015, meteorite specimens were purchased by José Antonio Sanchez Santana in the Saharawi refugee camps in Tindouf, Algeria.
Physical characteristics: Three stone fragments (34, 23 and 3 g) with black fusion crust covering 10% of the stones. A saw cut and broken surface reveals numerous mm-sized green crystals set in light-yellow groundmass.
Petrography: Petrographic description (J. Llorca, *UPC*). The meteorite is a orthopyroxene-rich breccia dominated by <1 to 4 mm grains set in a fine-grained cataclastic orthopyroxene matrix. The section contains about 99 vol.% orthopyroxene with accessory kamacite (50-400 ?m), troilite (30-50 ?m), Al-rich chromite (10-50 ?m) and Ca-rich pyroxene (50-100 ?m). Most accessory minerals surround large orthopyroxene grains. The section is notable for the absence of olivine and plagioclase.
Geochemistry: Mineral compositions (R.P. Lozano, *IGME*). Large grains and matrix unzoned orthopyroxene have the same compositions. Microprobe analyses show orthopyroxene ranges from $Fs_{25-30}Wo_{1-2}$ with a mean of $Fs_{26.4\pm1.2}Wo_{1.7\pm0.2}$ and Fe/Mn=35-47 (mean Fe/Mn=40.3±3.7) (n=17). Ca-rich pyroxene ranges are $Fs_{9-11}Wo_{44-46}$ (means: $Fs_{9.4\pm1.0}Wo_{44.5\pm0.8}$) and Fe/Mn=24-75 (mean: Fe/Mn=39.5±19.4) (n=6). The metal is kamacite whit Ni=1.3-1.5 and Co=1.1-1.2 (all in wt.%; n=16). Chromite has mean Cr/(Cr+Al)=0.93 (n=3). Bulk chemistry (J. Reyes, *IGME*). 0.5 grams of sample for analysis. XRF of subsample gave abundances of (in wt.%): SiO_2=53.56,

TiO_2<0.10, Al_2O_3=0.52, Fe_2O_3=17.04, MgO=26.09, CaO=1.16 and K_2O<0.10. Na_2O= 0.05 wt.% by AAS. Trace elements were measured with ICP-MS (all in ppm): Be<0.1, V=85.3, Cr=2960, Co=10.7, Ni=13.9, Cu<0.5, Zn<2, As=0.14, Se<1, Mo<0.5, Ag<0.1, Cd=3.2, Sb=0.15, Ba=12.3, Tl<0.1, Pb<2, Th<0.1 and U<0.1.
Classification (R. P. Lozano, *IGME*). Achondrite, diogenite. Terrestrial weathering is not significant.
Specimens: Type specimen (11 g), two co-type specimens (1.0 + 2.1 g) and a probe mount are on deposit at Museo Geominero (*IGME*). A thin section is on deposit at *UPC*. José Antonio Sánchez Santana holds the main mass.

Northwest Africa 10930 (NWA 10930)
(Northwest Africa)
Purchased: 2016
Classification: Ordinary chondrite (LL6)
History: Purchased by Morten Bilet, January 2016 from a Moroccan meteorite dealer.
Physical characteristics: Single stone with weathered exterior. A saw cuts shows faint chondrules and scattered opaques set in a gray-brown matrix.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows relict chondrules and plagioclase grains up to 150 μm.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{28.6\pm0.2}$, Fe/Mn=56±3, n=6; low-Ca pyroxene $Fs_{24.8\pm0.2}Wo_{2.1\pm0.2}$, Fe/Mn=35±2, n=6.
Classification: Ordinary chondrite (LL6)
Specimens: 20.5 g including a probe mount on deposit at *UNM*, Morten Bilet holds the main mass.

Northwest Africa 10931 (NWA 10931)
(Northwest Africa)
Purchased: 2013
Classification: Carbonaceous chondrite (CO3.1)
History: Purchased by Aziz Habibi in Gulomim from a nomad.
Physical characteristics: Smooth fusion crust exterior with numerous sub-millimeter chondrule outlines. A saw cut reveals many very small chondrules and a few small CAIs set in a dark-brown matrix.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous chondrules, many fragmental or irregular, most in the size range 50-200 μm. Scattered matrix olivines and CAIs were observed throughout. Fine grained matrix makes up approximately 50% of this meteorite.
Geochemistry: (C. Agee and N. Muttik, *UNM*) All olivine $Fa_{25.7\pm18.2}$, Fe/Mn=98±41, n=38; ferroan chondrule olivine $Fa_{28.5\pm17.0}$, Fe/Mn=105±37, Cr_2O_3=0.14±0.15 (wt%), n=34; enstatite $Fs_{4.5\pm3.9}Wo_{2.4\pm1.5}$, n=10; diopside $Fs_{3.1\pm3.8}Wo_{38.6\pm8.6}$, n=6
Classification: Carbonaceous chondrite (CO3.1), type 3.1 based on mean value and sigma of Cr_2O_3 in ferroan olivine (Grossman and Brearley, 2005), the values are midway between Colony (CO3.0) and Rainbow (CO3.2).
Specimens: 25.0 g including a probe mount on deposit at *UNM*, Aziz Habibi holds the main mass.

Northwest Africa 10932 (NWA 10932)
(Northwest Africa)
Purchased: 2016
Classification: Primitive achondrite (Brachinite)
History: Purchased by Aziz Habibi in Agadir.
Physical characteristics: Weathered exterior. Fresh broken surfaces reveal brown, sub-millimeter olivine grains.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows a texturally equilibrated mosaic of olivine and pyroxene grains with many triple junction grain boundaries. Olivine makes up approximately 90% of this meteorite. Cl-rich apatite, merrilite, and Ni-bearing sulfide are present. No plagioclase detected.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Olivine $Fa_{30.6\pm0.2}$, Fe/Mn=64±4, n=7; low-Ca pyroxene $Fs_{25.0\pm9.1}Wo_{2.2\pm0.0}$, Fe/Mn=39±2, n=5; high-Ca pyroxene $Fs_{10.4\pm0.1}Wo_{43.4\pm0.6}$, Fe/Mn=39±2, n=5.
Classification: Brachinite based on the high olivine/pyroxene ratio, relatively high Fa-content of olivine, and the observed equlilbrated texture typical for brachinites.
Specimens: 20.5 g including a probe mount on deposit at *UNM*, Aziz Habibi holds the main mass.

Northwest Africa 10933 (NWA 10933)
(Northwest Africa)
Purchased: 2015
Classification: Carbonaceous chondrite (CK4)
History: One stone weighing 116.2 g was found and subsequently purchased in Morocco in 2015. Don Cline and John Sinclair acquired the sample from a meteorite prospector at the Tucson Gem and Mineral Show in February 2016.
Physical characteristics: The windowed sample is tabular in shape and has a few shallow regmaglypts. Sample 70% covered by a lightly weathered, dark-brown fusion crust which contains orange contraction cracks. The cut face shows a dark-green, friable interior with dark-gray-colored chondrules and dark-green clasts and magnetite.
Petrography: Description and classification (A. Love, *App*): Sample is a breccia composed of lithic fragments that show chondritic texture, sparsely distributed (avg. dia. 484 μm) chondrules (many display igneous rims), fragments and rare CAIs in a recrystallized matrix. Sample lacks sulfide but contains abundant chromium magnetite, augite and rare clinoenstatite.
Geochemistry: (A. Love, *App*) Olivine $Fa_{31.0\pm0.7}$ ($Fa_{29.1\text{-}32.2}$), N=12; Low-Ca pyroxene $Fs_{23.1\pm2.5}Wo_{0.8\pm0.1}$, N=9; Ca-pyroxene $Fs_{13.6\pm0.1}Wo_{44.2\pm5.6}$, N=2.
Classification: Based on textural relationships and mineral compositions, dominance of olivine and presence of of Cr-magnetite, this is a CK4, S2, W2 carbonaceous chondrite.
Specimens: *PARI* holds the 82.2 g main mass. A 20.8 g type specimen and one polished thin section are on deposit at *App*.

Northwest Africa 10952 (NWA 10952)
(Northwest Africa)
Purchased: 2005
Classification: Enstatite chondrite (EL4)

History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently acquired by the Hollis Collection.
Physical characteristics: (P. Sipiera, *PSF*) A "6 sided" individual stone (17208 g) with a rounded triangular or pyramid shape, and approximate dimensions of 29 × 24 × 28 cm. Exterior surfaces range from brown-colored, smooth fusion crusted areas to rough eroded regions to a rusty-orange colored area. A cut surface reveals a dark brown interior with numerous altered metal grains and obvious round chondrules.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed RP chondrules (apparent diameter 500-1800 μm, mean 800 μm) are set in a relatively coarse-grained matrix containing prismatic enstatite grains and altered metal. Apart from predominant enstatite, accessory minerals include diopside, kamacite, daubreelite, troilite, schreibersite and oldhamite (partly altered to gypsum).
Geochemistry: Enstatite ($Fs_{0.4\text{-}1.2}Wo_{0.5\text{-}0.6}$, N = 3), diopside ($Fs_{0.2}Wo_{47.8}$), metal (in wt.%, Si 0.20-0.21, Ni 5.5-5.9, Co 0.43-0.50, N = 4). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.87.
Classification: Enstatite chondrite (EL4).
Specimens: 177 g including one polished thin section at *PSF*; remainder in the Hollis Collection.

Northwest Africa 10955 (NWA 10955)
(Northwest Africa)
Purchased: 2016 May
Classification: Ureilite
History: Purchased by Ben Hoefnagels in May 2016 from a dealer in Ouarzazate, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Protogranular aggregate of subequal amounts of olivine (with dark, metal-rich rims) and pyroxene (some exhibiting polysynthetic twinning). Some of the pyroxene is augite and the low-Ca pyroxene could be either orthopyroxene or pigeonite.
Geochemistry: Olivine (cores $Fa_{12.5\text{-}12.8}$, rim $Fa_{6.7}$, N = 3), low-Ca pyroxene ($Fs_{11.0\text{-}11.1}Wo_{4.7\text{-}4.8}$, N = 2), augite ($Fs_{6.3\text{-}6.6}Wo_{37.3\text{-}36.9}$, N = 2).
Classification: Ureilite. The rather magnesian olivine, lack of typical more calcic pigeonite, and presence of both low-Ca pyroxene and augite are anomalous features.
Specimens: 6.1 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

Northwest Africa 10956 (NWA 10956)
(Northwest Africa)
Purchased: 2013 Jul
Classification: Ordinary chondrite (H4)
History: Purchased by John Shea in July 2013 from Steve Witt, who obtained the stone from a Moroccan dealer in 2013.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules (apparent diameter 450±300 μm, several larger than 2 mm) occur within a recrystallized matrix containing abundant altered metal. Several chondrules containing silica polymorph and orthopyroxene were observed.
Geochemistry: Olivine ($Fa_{17.8\text{-}18.0}$, N = 3), orthopyroxene ($Fs_{15.4\text{-}16.3}Wo_{0.7\text{-}1.0}$, N = 3), clinopyroxene ($Fs_{7.8}Wo_{44.3}$, $Fs_{8.3}Wo_{36.3}$, N = 2).
Classification: Ordinary chondrite (H4).
Specimens: 31.2 g including one polished thin section at *UWB*; remainder with Mr. J. Shea.

Northwest Africa 10957 (NWA 10957)
(Northwest Africa)
Purchased: 2016 Jun
Classification: Carbonaceous chondrite (CM1/2)
History: Purchased by Luc Labenne from a Moroccan dealer at the Ensisheim Show in June 2016.
Physical characteristics: A single, black stone (12.8 g) notable for its unusually low density and evident porosity.
Petrography: (A. Irving and S. Kuehner, *UWS*) Porous aggregate of very small, partly serpentinized chondrules (apparent diameter 150±100 μm) and angular mafic silicate grains (some compositionally zoned) in a fine grained matrix (deep red-brown in thin section) composed mainly of serpentine with accessory pentlandite, pyrrhotite, rare chromite and kamacite.
Geochemistry: Olivine ($Fa_{0.9\text{-}54.5}$, N = 5), orthopyroxene ($Fs_{1.0\text{-}3.9}Wo_{3.8\text{-}5.0}$, N = 2).
Classification: Carbonaceous chondrite (CM1/2).
Specimens: 2.71 g including one polished thin section at *UWB*; remainder with *Labenne*.

Northwest Africa 10958 (NWA 10958)
(Northwest Africa)
Purchased: 2016 May
Classification: Ordinary chondrite (H4, melt breccia)
History: Purchased by Ben Hoefnagels in May 2016 from a dealer in Ouarzazate, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia consisting of rounded chondrite clasts within a much finer grained, dark matrix containing blebby metal and sulfides. The clasts contain well-formed, relatively small chondrules set in a recrystallized matrix containing abundant stained metal.
Geochemistry: Olivine ($Fa_{20.2\text{-}20.7}$, N = 3), orthopyroxene ($Fs_{17.2\text{-}18.3}Wo_{1.3\text{-}1.6}$, N = 3, clinopyroxene ($Fs_{6.1\text{-}7.7}Wo_{46.1\text{-}43.8}$, N = 2).
Classification: Ordinary chondrite (H4 melt breccia).
Specimens: 106.6 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

Northwest Africa 10959 (NWA 10959)
(Northwest Africa)
Purchased: 2016 Jun
Classification: Carbonaceous chondrite (CV3)
History: Purchased by Ben Hoefnagels in June 2016 from a dealer in Ouarzazate, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Ellipsoidal, mostly granular chondrules (apparent diameter 500±300 μm) plus irregularly shaped CAI are set in a black matrix (~30 vol.%). The long axes of chondrules show some preferred orientation.
Geochemistry: Olivine ($Fa_{0.2\text{-}31.6}$, N = 3), orthopyroxene ($Fs_{1.1\text{-}3.2}Wo_{0.6\text{-}1.1}$, N = 3), clinopyroxene ($Fs_{1.2\text{-}3.0}Wo_{42.1\text{-}46.5}$, N = 2).
Classification: Carbonaceous chondrite (CV3).
Specimens: 22.71 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

Northwest Africa 10960 (NWA 10960)
(Northwest Africa)
Purchased: 2016 Jun
Classification: Ordinary chondrite (L4)
History: Purchased by Ben Hoefnagels in June 2016 from a dealer in Ouarzazate, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules (apparent diameter 450±300 μm) are set in a relatively coarse grained matrix containing irregularly shaped grains of altered metal, merrillite and chlorapatite. Tiny blebs of metal are prevalent in the silicate phases (rendering them very dark in thin section) and thin, glassy shock veins transect the specimen in places.
Geochemistry: Olivine ($Fa_{24.6\text{-}24.9}$, N = 3), orthopyroxene ($Fs_{20.3\text{-}20.7}Wo_{2.2\text{-}1.5}$, N = 3), clinopyroxene ($Fs_{7.2\text{-}8.1}Wo_{45.9\text{-}44.4}$, N = 2).
Classification: Ordinary chondrite (L4, highly shocked).
Specimens: 177.2 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

Northwest Africa 10962 (NWA 10962)
(Northwest Africa)
Find: 2015
Classification: HED achondrite (Eucrite, unbrecciated)
History: Purchased by Fayssal Mezgouri in 2015 from a nomad in northwest Africa and sold to Dustin Dickens in 2016.
Physical characteristics: Two stones of approximately equal mass with glassy, partially oxidized fusion crust on one side of each and sand-ablated patina on the remaining surfaces.
Petrography: (Z. Guo, *UWO*) Medium grained igneous rock. Modal abundances and corresponding grain sizes: plagioclase 60% (400-500 μm), pyroxene 40% (300-1000 μm) and metal ~1% (100-200 μm). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 3.81. Undulatory extinction is present in some plagioclase. Metal has a narrow oxide rim.
Geochemistry: Mineral composition and geochemistry: Pyroxenes: low-Ca $Fs_{58.6\pm1.4}Wo_{3.6\pm1.8}$ (N=6), High-Ca: $Fs_{29.3\pm2.1}Wo_{39.9\pm2.4}$ (N=9), Fe/Mn ratio of 27.3±0.8 (N=15). Plagioclase: $An_{89.7\pm0.3}$ (N=10).
Classification: Eucrite, unbrecciated.
Specimens: 21.9 g at *UWO* including a thin section.

Northwest Africa 10963 (NWA 10963)
(Northwest Africa)
Find: 2012
Classification: Ordinary chondrite (H5)
History: Purchased by Fayssal Mezgouri from nomads in 2012; sold to Dustin Dickens in 2016.
Physical characteristics: Single stone with an elongated egg shape.
Petrography: (Z. Guo, *UWO*) The size of chondrules ranges between 200 and 600 μm.. Undulutory extinction is observed in some plagioclase. The metal contributes ~5% of the volume and is oxidized.
Geochemistry: Mineral composition and geochemistry: Olivine $Fa_{19.0\pm0.7}$ (N=30). Orthopyroxene $Fs_{16.6\pm0.2}Wo_{1.1\pm0.2}$, Fe/Mn ratio of 22.7±1.0 (N=30). Feldspar plagioclase $An_{12.7\pm4.4}$ (N=10).
Classification: H5

Specimens: 28.0 g at *UWO* including a thin section.

Northwest Africa 10964 (NWA 10964)
(Northwest Africa)
Find: 2015
Classification: Lunar meteorite (feldspathic breccia)
History: Purchased by Dustin Dickens from a nomad in Morocco, 2016.
Petrography: (Z. Guo, *UWO*) Dark impact melt with xenocrysts of plagioclase, olivine, and pyroxene and igneous clasts. A few metal grains are dispersed within the breccia. Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 3.38.
Geochemistry: Mineral composition and geochemistry: Fayalitic olivine $Fa_{93.4\pm6.1}$ with Fe/Mn ratio of 77.4±7.4 (N=4); Ferroan olivine $Fa_{49.7\pm10.4}$ with Fe/Mn ratio of 53.5±5.8 (N=6). Augite pyroxene $Fs_{27.5\pm9.9}Wo_{30.5\pm14.5}$, with Fe/Mn ratio of 63.0±13.8 (N=10). Plagioclase $An_{96.6\pm0.5}$ (N=11).
Classification: Lunar, feldpathic breccia
Specimens: 5.3 g at *UWO* including a thin section.

Northwest Africa 10965 (NWA 10965)
(Northwest Africa)
Purchased: 2016
Classification: Ordinary chondrite (H4)
History: Purchased by Ben Hoefnagels in April 2016 from a dealer in Ouarzazate, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively small chondrules (apparent diameter 300±200 μm) are set in a recrystallized matrix containing abundant stained metal.
Geochemistry: Olivine ($Fa_{20.7\text{-}20.8}$, N = 3), orthopyroxene ($Fs_{15.3\text{-}15.5}Wo_{0.2\text{-}0.3}$, N = 3), clinopyroxene ($Fs_{8.9\text{-}9.6}Wo_{35.1\text{-}37.4}$, N = 2). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 5.53.
Classification: Ordinary chondrite (H4).
Specimens: 24.69 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

Northwest Africa 10966 (NWA 10966)
(Northwest Africa)
Purchased: 2016 May
Classification: HED achondrite (Eucrite, unbrecciated)
History: Purchased by Ben Hoefnagels in May 2016 from a dealer in Ouarzazate, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Very fresh, unbrecciated specimen exhibiting intersertal texture with domains of varying grainsize plus fine-grained mesostasis. The major minerals are exsolved pigeonite and calcic plagioclase with accessory silica polymorph, ilmenite, troilite and rare zircon.
Geochemistry: Orthopyroxene host ($Fs_{61.9\text{-}63.4}Wo_{1.9\text{-}1.8}$, FeO/MnO = 29-30, N = 3), clinopyroxene exsolution lamellae ($Fs_{26.2\text{-}27.3}Wo_{44.5\text{-}43.6}$, FeO/MnO = 30-32, N = 2), plagioclase ($An_{90.5\text{-}91.2}Or_{0.6\text{-}0.2}$, N = 2).
Classification: Eucrite (unbrecciated, intersertal).
Specimens: 25.84 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

Northwest Africa 10967 (NWA 10967)
(Northwest Africa)
Purchased: 2016 May
Classification: Ordinary chondrite (L3)
History: Purchased by Ben Hoefnagels in May 2016 from a dealer in Ouarzazate, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Unequilibrated with well-formed, closely packed chondrules (apparent diameter 400±300 μm) set in a finer matrix containing stained metal and minor merrillite.
Geochemistry: Olivine ($Fa_{2.5\text{-}75.9}$, Cr_2O_3 in ferroan examples 0.03-1.17 wt.%, mean 0.33±0.40 wt.%, N = 14), orthopyroxene ($Fs_{2.8}Wo_{0.8}$; $Fs_{16.3}Wo_{4.0}$), clinopyroxene ($Fs_{6.1}Wo_{27.1}$; $Fs_{9.4}Wo_{38.0}$). Magnetic susceptibility log χ (× 10^{-9} m^3/kg) = 4.63.
Classification: Ordinary chondrite (L3). The wide range in olivine composition coupled with the very wide range in measured Cr_2O_3 contents in ferroan olivine implies a very low petrologic subtype, quite similar to that determined for L3.1/3.2 chondrite Meteorite Hills 96503 by Grossman and Brearley (2005, Figs. 4 and 15a).
Specimens: 25.07 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

Northwest Africa 10971 (NWA 10971)
(Northwest Africa)
Purchased: 2016 May
Classification: HED achondrite (Eucrite, monomict)
History: Purchased by Ben Hoefnagels in May 2016 from a dealer in Ouarzazate, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of microgabbroic eucrite clasts and related debris. Minerals are exsolved pigeonite (pale orange in thin section), calcic plagioclase (polycrystalline), silica polymorph, ilmenite, Ti-poor chromite, troilite and altered Ni-free metal. Calcite veins are present.
Geochemistry: Orthopyroxene host ($Fs_{57.8}Wo_{5.1}$, FeO/MnO = 29), clinopyroxene exsolution lamella ($Fs_{27.7}Wo_{42.4}$, FeO/MnO = 28), clinopyroxene host ($Fs_{26.1}Wo_{44.0}$, FeO/MnO = 28), orthopyroxene exsolution lamella ($Fs_{62.2}Wo_{1.9}$, FeO/MnO = 29), plagioclase ($An_{89.1\text{-}89.8}Or_{0.3\text{-}0.4}$, N = 2).
Classification: Eucrite (monomict breccia, microgabbroic, shocked).
Specimens: 34.89 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

Northwest Africa 10972 (NWA 10972)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (L3)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently acquired by the Hollis Collection.
Petrography: (A. Irving and S. Kuehner, *UWS*) Unequilibrated with more magnesian cores in olivine and orthopyroxene. Well-formed, fairly closely packed chondrules (apparent diameter 450±300 μm) are set in a finer matrix containing stained metal and minor merrillite.

Geochemistry: Olivine (predominantly $Fa_{24.6-29.6}$, magnesian core $Fa_{8.8}$, Cr_2O_3 < 0.04 wt.%, N = 7), orthopyroxene ($Fs_{7.4-19.2}Wo_{0.2-1.0}$, N = 3), clinopyroxene ($Fs_{8.4-10.7}Wo_{43.6-42.6}$, N = 2). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.62.
Classification: Ordinary chondrite (L3).
Specimens: 121 g including one polished thin section at *PSF*; remainder in the Hollis Collection.

Northwest Africa 10973 (NWA 10973)
(Northwest Africa)
Purchased: 2016 Sep
Classification: Lunar meteorite (feldspathic breccia)
History: Purchased by John Higgins in September 2016 from a dealer in Nouakchott, Mauritania.
Physical characteristics: A single dark stone (25 g) lacking fusion crust. The fresh interior exhibits small white clasts within a dominant, dark-gray matrix containing sparse vesicles.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of small angular mineral clasts of anorthite, bytownite, pigeonite, olivine, orthopyroxene, Mg-merrillite, ilmenite and kamacite in a finer matrix containing sparse vesicles.
Geochemistry: Olivine ($Fa_{40.1-47.0}$, FeO/MnO = 84-88, N = 3), orthopyroxene ($Fs_{24.2-36.7}Wo_{4.9-4.1}$, FeO/MnO = 52-56, N = 2), pigeonite ($Fs_{24.8}Wo_{14.7}$, FeO/MnO = 46; $Fs_{43.4}Wo_{17.6}$, FeO/MnO = 54), plagioclase ($An_{90.3}Or_{0.4}$; $An_{81.5}Or_{1.4}$; N = 2).
Classification: Lunar (feldspathic regolith breccia).
Specimens: 5.01 g including one polished slice at *UWB*; remainder with Mr. J. Higgins.

Northwest Africa 10974 (NWA 10974)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (L6)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently acquired by the Hollis Collection.
Petrography: (A. Irving and S. Kuehner, *UWS*) Mostly recrystallized with rare remnant chondrules. Silicates are stained brown by weathering products of primary metal. Accessory merrillite and chlorapatite are present.
Geochemistry: Olivine ($Fa_{24.7-25.0}$, N = 3), orthopyroxene ($Fs_{20.9-21.4}Wo_{1.7-1.3}$, N = 3), clinopyroxene ($Fs_{9.2-9.8}Wo_{43.6-43.0}$, N = 2).
Classification: Ordinary chondrite (L6).
Specimens: 59 g including one polished thin section at *PSF*; remainder in the Hollis Collection.

Northwest Africa 10975 (NWA 10975)
(Northwest Africa)
Purchased: 2016 May
Classification: HED achondrite (Diogenite)
History: Purchased by Ben Hoefnagels in May 2016 from a dealer in Taliouine, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of closely packed, fairly coarse, diogenitic orthopyroxene grains with accessory chromite, silica polymorph and troilite.
Geochemistry: Orthopyroxene ($Fs_{27.4-27.5}Wo_{3.6-3.9}$, FeO/MnO = 24-29, N = 3), clinopyroxene ($Fs_{11.5-11.8}Wo_{43.9-44.0}$, FeO/MnO = 17-19, N = 2).

Classification: Diogenite (breccia).
Specimens: 20.6 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

Northwest Africa 10976 (NWA 10976)
(Northwest Africa)
Purchased: 2016 Aug
Classification: Ordinary chondrite (LL3)
History: Puchased in Temara, Morocco by Adam Aaronson in October 2016.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, fairly closely packed chondrules (apparent diameter 600±300 μm) are set in a finer matrix containing stained metal.
Geochemistry: Olivine ($Fa_{7.3-50.0}$, Cr_2O_3 in ferroan examples 0.04-0.15 wt.%, mean 0.09±0.04 wt.%, N = 7), orthopyroxene ($Fs_{2.7-25.1}Wo_{0.3-5.0}$, N = 3), clinopyroxene ($Fs_{7.1-21.8}Wo_{37.5-35.7}$, N = 2). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 3.53.
Classification: Ordinary chondrite (LL3).
Specimens: 20.2 g including one polished thin section at *UWB*; remainder with *Aaronson*.

Northwest Africa 10977 (NWA 10977)
(Northwest Africa)
Purchased: 2016 Aug
Classification: Carbonaceous chondrite (CV3)
History: Purchased by John Shea in August 2016 from Gary Fujihara, who obtained the stone from a Moroccan dealer in 2009.
Petrography: (A. Irving and S. Kuehner, *UWS*) Granular chondrules (some with multiple, concentric rims; apparent diameter 600±400 μm, several larger than 3 mm) and fine to coarse grained CAI are set within a fine grained matrix (~30 vol.%, deep orange in thin section).
Geochemistry: Olivine ($Fa_{1.0-60.9}$, N = 3), orthopyroxene ($Fs_{0.5-0.8}Wo_{0.8-0.9}$, N = 3), clinopyroxene ($Fs_{1.0-1.1}Wo_{34.7-39.6}$, N = 2).
Classification: Carbonaceous chondrite (CV3).
Specimens: 21.3 g including one polished thin section at *UWB*; remainder with Mr. J. Shea.

Northwest Africa 10978 (NWA 10978)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (LL4)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently acquired by the Hollis Collection.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively large chondrules are set in a recrystallized matrix containing stained metal.
Geochemistry: Olivine ($Fa_{28.4-28.5}$, N = 3), orthopyroxene ($Fs_{21.1-21.2}Wo_{1.4-1.5}$, N = 3), clinopyroxene ($Fs_{7.0-7.2}Wo_{45.9-46.0}$, N = 2).
Classification: Ordinary chondrite (LL4).
Specimens: 39 g including one polished thin section at *PSF*; remainder in the Hollis Collection.

Northwest Africa 10979 (NWA 10979)
(Northwest Africa)

Purchased: 2016 Jul
Classification: HED achondrite (Eucrite, monomict)
History: Purchased by Ben Hoefnagels in July 2016 from a dealer in Marrakech, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Monomict breccia composed of basaltic eucrite clasts (with intersertal texture) in a sparse matrix of related debris. Minerals are exsolved pigeonite, calcic plagioclase, silica polymorph, ilmenite, troilite, Ni-free metal and minor barite.
Geochemistry: Orthopyroxene host ($Fs_{56.6\text{-}57.1}Wo_{1.8\text{-}2.1}$, FeO/MnO = 31-34, N = 3), clinopyroxene exsolution lamellae ($Fs_{23.1\text{-}24.0}Wo_{43.9\text{-}44.36}$, FeO/MnO = 28-30, N = 2), plagioclase ($An_{81.2\text{-}85.2}Or_{1.2\text{-}0.5}$, N = 2).
Classification: Eucrite (monomict breccia).
Specimens: 20.1 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

Northwest Africa 10980 (NWA 10980)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (LL3)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently acquired by the Hollis Collection.
Petrography: (A. Irving and S. Kuehner, *UWS*) Unequilibrated with highly magnesian cores in olivine and orthopyroxene. Well-formed, fairly closely packed chondrules (apparent diameter 500-400 μm) are set in a finer matrix containing stained metal and minor chlorapatite.
Geochemistry: Olivine ($Fa_{0.7\text{-}29.9}$, Cr_2O_3 in ferroan examples 0.02-0.13 wt.%, mean 0.06±0.04 wt.%, N = 7), orthopyroxene ($Fs_{1.9\text{-}22.7}Wo_{0.5\text{-}1.8}$, N = 3), pigeonite ($Fs_{19.1}Wo_{12.6}$), subcalcic augite ($Fs_{15.2}Wo_{33.0}$, N = 2). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.41.
Classification: Ordinary chondrite (LL3).
Specimens: The entire sepcimen including one polished thin section is at *PSF*.

Northwest Africa 10982 (NWA 10982)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (L3)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently acquired by the Hollis Collection.
Petrography: (A. Irving and S. Kuehner, *UWS*) Unequilibrated with highly magnesian cores in olivine and orthopyroxene. Well-formed, fairly closely packed chondrules (apparent diameter 450±300 μm) are set in a finer matrix containing stained metal.
Geochemistry: Olivine (predominantly $Fa_{24.9\text{-}25.4}$, magnesian core $Fa_{3.3}$, Cr_2O_3 in ferroan examples <0.05 wt.%, N = 7), orthopyroxene ($Fs_{0.9\text{-}20.9}Wo_{0.8\text{-}1.5}$, N = 3), clinopyroxene ($Fs_{7.6\text{-}8.1}Wo_{44.6\text{-}44.4}$, N = 2). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.88.
Classification: Ordinary chondrite (L3).
Specimens: 75 g including one polished thin section at *PSF*; remainder in the Hollis Collection.

Northwest Africa 10984 (NWA 10984)
(Northwest Africa)
Purchased: 2005

Classification: Ordinary chondrite (H4)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently acquired by the Hollis Collection.
Petrography: (A. Irving and S. Kuehner, *UWS*) Mostly recrystallized with sparse chondrules. Minor merrillite was observed, and cross-cutting veinlets of secondary iron hydroxides are present.
Geochemistry: Olivine ($Fa_{18.7\text{-}19.4}$, N = 3), orthopyroxene ($Fs_{16.5\text{-}16.6}Wo_{1.2\text{-}1.3}$, N = 3), clinopyroxene ($Fs_{5.6\text{-}7.5}Wo_{46.2\text{-}44.4}$, N = 2).
Classification: Ordinary chondrite (H5).
Specimens: The entire sepcimen including one polished thin section is at *PSF*.

Northwest Africa 10985 (NWA 10985)
(Northwest Africa)
Purchased: 2015
Classification: Lunar meteorite (gabbro)
History: Purchased by Jay Piatek in Morocco, 2015.
Physical characteristics: Single stone, weathered exterior without fusion crust. A polished saw cut surface reveals two distinct lithologies separated by a sharp boundary offset, with numerous truncated grains. One lithology is a light colored, medium-grained gabbro with elongate subhedral prismatic yellow-green pyroxenes and white subhedral plagioclase laths. The second lithology is a dark colored, fine-grained breccia with yellow-green pyroxene fragments scattered throughout. Fine shock melt veins visible.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows igneous-zoned pigeonite and augite, plagioclase, olivine, fayalite, hedenbergite, pyroxferroite, Fe-sulfide, ilmenite, chromite, Ti-magnetite, apatite, silica, and symplectites.
Geochemistry: (C. Agee and S. Spilde, *UNM*) Olivine $Fa_{38.1\pm21.2}$, Fe/Mn=95±8, n=31; pigeonite $Fs_{45.9\pm12.2}Wo_{17.8\pm5.5}$, Fe/Mn=63±10, n=29; augite $Fs_{41.2\pm16.9}Wo_{30.8\pm3.9}$, Fe/Mn=63±11, n=18; pyroxferroite $Fs_{84.2\pm1.4}Wo_{14.8\pm1.4}$, Fe/Mn=63±2, n=3; plagioclase $An_{89.5\pm3.4}Ab_{9.8\pm3.1}Or_{0.7\pm0.6}$, n=27; shock melt (proxy for bulk composition) SiO_2=48.0±2.6, TiO_2=1.2±0.7, Al_2O_3=11.3±6.0, Cr_2O_3=0.4±0.2, MgO=11.6±4.3, FeO=16.5±2.7, MnO=0.24±0.05, CaO=10.9±3.0, Na_2O=0.28±0.17, K_2O=0.17±0.11 (all wt%), n=10.
Classification: Lunar gabbro
Specimens: 20.2 g including a probe mount on deposit at *UNM*, Jay Piatek holds the main mass.

Northwest Africa 10986 (NWA 10986)
Grarat Zawi, Western Sahara
Find: 15 Nov 2015
Classification: Lunar meteorite
Physical characteristics: Total mass of the meteorite = 108.2 g and comprises several pieces, the larger weighing 80.5 g.
Petrography: (S. Roberts, *UTenn*) A highland impact-melt breccia with an unusually large amount of impact-generated glass. Displays multiple generations of melting and breccia-in-breccia formation. Brown to black devitrified glass swirls encompass heavily fragmented lithic clasts and mineral fragments. Lithic clasts represent 40% of the meteorite and have been partially to completely consumed during multiple impact and melting events. Clasts are heavily brecciated and range in size from 1.4 to 0.1 mm long. The clasts are plagioclase-rich with pyroxenes,

olivines, spinel, and ilmenite in ophitic to poikilitic textures. Large broken plagioclase grains and small olivines and pyroxenes are found within the matrix. Lithic types range from FANs to Hi-Mg Suite rocks.
Geochemistry: Mineral compositions and geochemistry: Analyses were obtained from both lithic clasts and lose mineral fragments from within the breccia matrix. Plagioclase compositions average $An_{95.7\pm1.7}$ (N=43). Average pyroxene composition is $Fs_{36.6\pm13.3}Wo_{16.4\pm8.2}$ (N=73). Average olivine composition is $Fs_{30.9\pm12.9}$ (N=50). Fe/Mn ratios for pyroxenes are 58.7±8.1 (N= 73) and olivines are 98.8±8.7 (N=50).

Northwest Africa 10987 (NWA 10987)
(Northwest Africa)
Purchased: 2015
Classification: HED achondrite (Eucrite, brecciated)
History: The meteorite was bought in 2015 from a Moroccan meteorite dealer via internet.
Physical characteristics: The individual lacks any fusion crust and shows a brownish interior.
Petrography: The meteorite is a coarse-grained breccia dominantly composed of up to 1-cm sized lithic and mineral clasts set into a fine-grained clastic matrix. Calcic plagioclase and exsolved pyroxenes are the most abundant mineral phases and are up to 1.5 mm in size. Minor phases are FeS, chromite, silica and metallic iron.
Geochemistry: low-Ca pyroxene: $Fs_{57.9\pm1.0}Wo_{5.1\pm1.3}$ ($Fs_{55.9\text{-}59.3}Wo_{3.1\text{-}7.3}$, n=19, FeO/MnO=29-31); Ca-pyroxene: $Fs_{27.8\pm1.3}Wo_{43.2\pm1.3}$ ($Fs_{26.1\text{-}32.3}Wo_{38.1\text{-}44.5}$, n=24, FeO/MnO=27-35); calcic plagioclase: $An_{90.0\pm1.3}$ ($An_{87.3\text{-}91.9}$, n=23).

Northwest Africa 10989 (NWA 10989)
(Northwest Africa)
Purchased: 2015
Classification: Lunar meteorite
History: This stone was one of a group found in northwest Africa, near to the Morocco/Algeria border; exact date and weights of other stones is unknown. Purchased in 2015 from a Moroccan Dealer in Morocco.
Physical characteristics: The total mass of the single stone was 14.4 g, and is dark brown in color with a dark brown/black fusion crust.
Petrography: H. Ashcroft, M. Anand, *OU*. A fragmental breccia containing a variety of mineral (up to 1 mm) and lithic (up to 1 × 3 mm) fragments in a dark matrix composed of finer-grained crystals and a dark, vesicular glass. Both basaltic and feldspathic fragments are present in roughly equal proportions. The breccia has a seriate fabric and the proportion of glass and crystals in the matrix varies throughout the sample. Some crystals exhibit evidence for shock and alteration (offset pyroxene lamellae, recrystallized and maskelynitised plagioclase). Minor secondary calcite veins and barite are seen throughout the sample. Minerals are Olivine (forsteritic and fayalitic), Pyroxene (Orthopyroxene, Pigeonite, Augite), Anorthite and trace amounts of ilmenite, chromite, kamacite, schreibersite, apatite, merrilite, silica.
Geochemistry: Feldspar crystals are anorthitic and vary between $An_{80\text{-}90}$, with an average of An_{94} (N = 184). Some feldspars are recrystallized, and others have been maskelynitised. A continuum of pyroxene compositions (pigeonite to augite) are observed with a range in $Fs_{15\text{-}64}$, and $Wo_{5\text{-}43.}$ Four main clusters in olivine composition are observed with Fa_{37}, Fa_{51} and $Fa_{70.}$ Some Fayalite (Fa_{90}) is also observed. One mafic clast contains orthopyroxene ($Wo_3En_{75}Fs_{22}$), Olivine,

(Fa_{75}) and anorthite (An_{95}). One hedenbergite-fayalite-silica symplectite is observed. The oxygen isotopes (R. Greenwood and I. Franchi, *OU*) are consistent with a lunar origin with $\delta^{17}O$ 3.42 ‰, $\delta^{18}O$ 6.51 ‰, $\Delta^{17}O$ 0.03 ‰. Average FeO/MnO for Olivine is 105, and Pyroxene is 66.
Classification: Lunar (mixed fragmental breccia)
Specimens: Main mass resides with G. Ensor. The type specimen (3.4 g) is deposited in the *OU* meteorite collection.

Northwest Africa 10990 (NWA 10990)
(Northwest Africa)
Purchased: 2012
Classification: Ordinary chondrite (LL6)
History: Purchased by Jay Piatek from Morocco, May 2012.
Physical characteristics: One complete stone, dark brown exterior. A saw cut reveals small chondrules and scattered metal set in a brown matrix.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows BO and POP chondrules up to 3 mm, fine-grained silicate matrix, scattered metal and troilite, some troilite up to 3mm.
Geochemistry: (C. Agee, *UNM*) Olivine $Fa_{29.5\pm0.6}$, Fe/Mn=60±1 n=3; low-Ca pyroxene $Fs_{23.9\pm0.3}Wo_{1.4\pm0.4}$, Fe/Mn=34±2, n=3.
Classification: Ordinary chondrite (LL6)
Specimens: 42.3 g including a probe mount on deposit at *UNM*, Jay Piatek holds the main mass.

Northwest Africa 10991 (NWA 10991)
(Northwest Africa)
Purchased: 2012
Classification: Ordinary chondrite (H6)
History: Purchased by Jay Piatek from Morocco, May 2012.
Physical characteristics: One complete stone, dark brown exterior. A saw cut reveals numerous small chondrules set in a brown matrix.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows equilibrated chondrules, iron metal is completely oxidized.
Geochemistry: (C. Agee, *UNM*) Olivine $Fa_{18.7\pm0.3}$, Fe/Mn=38±1 n=30; low-Ca pyroxene $Fs_{16.8\pm0.3}Wo_{1.3\pm0.2}$, Fe/Mn=23±1, n=30.
Classification: Ordinary chondrite (H6)
Specimens: 28.7 g including a probe mount on deposit at *UNM*, Jay Piatek holds the main mass.

Northwest Africa 10992 (NWA 10992)
(Northwest Africa)
Purchased: 2012
Classification: Ordinary chondrite (H6)
History: Purchased by Jay Piatek from Morocco, May 2012.
Physical characteristics: One complete stone, dark brown, rough exterior. A saw cut reveals abundant fine metal and some small chondrules set in a dark brown matrix.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows a few indistinct, equilibrated chondrules, ubiquitous kamacite, troilite, approximately 50% of metal is oxidized.

Geochemistry: (C. Agee, *UNM*) Olivine $Fa_{19.3\pm0.4}$, Fe/Mn=39±1, n=3; low-Ca pyroxene $Fs_{17.3\pm0.2}Wo_{1.1\pm0.2}$, Fe/Mn=23±1, n=3.
Classification: Ordinary chondrite (H6)
Specimens: 30.8 g including a probe mount on deposit at *UNM*, Jay Piatek holds the main mass.

Northwest Africa 10994 (NWA 10994)
(Northwest Africa)
Purchased: 2015
Classification: Martian meteorite (Shergottite)
History: Purchased by Jay Piatek in Morocco, 2015.
Physical characteristics: Fusion crusted individual. A saw-cut surface reveals gray-green, fine-grained, basaltic texture.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows an ophitic texture with ~60% zoned pyroxene and ~30% maskelynite. Accessory phases include titanomagnetite, ilmenite, Fe-sulfide, and silica.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Pigeonite $Fs_{50.5\pm14.8}Wo_{16.9\pm6.8}$, Fe/Mn=37±3, n=8; augite $Fs_{29.3\pm10.4}Wo_{31.7\pm2.8}$, Fe/Mn=32±4, n=12; maskelynite $Or_{2.8\pm1.1}Ab_{49.8\pm3.9}An_{47.4\pm4.9}$, n=6.
Classification: Martian (shergottite), pyroxene-phyric. Possibly paired with NWA 10016.
Specimens: 1.9 g including a probe mount on deposit at *UNM*, Jay Piatek holds the main mass.

Northwest Africa 10995 (NWA 10995)
(Northwest Africa)
Purchased: 2015
Classification: Ordinary chondrite (L4)
History: Purchased by Jay Piatek from Morocco, 2015.
Physical characteristics: Weathered exterior. A broken surface reveals some chondrules set in a dark-colored groundmass.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous distinct chondrules, fine-grained plagioclase present.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Olivine $Fa_{24.7\pm0.3}$, Fe/Mn=48±1, n=15; low-Ca pyroxene $Fs_{19.4\pm3.2}Wo_{0.8\pm0.7}$, Fe/Mn=30±5, n=14.
Classification: Ordinary chondrite (L4).
Specimens: 34.29 g including a probe mount on deposit at *UNM*, Jay Piatek holds the main mass.

Northwest Africa 10996 (NWA 10996)
(Northwest Africa)
Purchased: 2015
Classification: Carbonaceous chondrite (CR2)
History: Purchased by Jay Piatek in Morocco, 2015.
Physical characteristics: Weathered exterior. A broken surface reveals dark groundmass with some oxidation.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous type I chondrules; two type II chondrules were observed in the mount. Some chondrules are armored with metal/oxide typical of CR. Much of the metal, which makes up 5-10% of the

meteorite, has been oxidized. Gehlenite-akermanite, Al-diopside were observed. Fine grained matrix was found throughout.
Geochemistry: (C. Agee and N. Muttik, *UNM*) Forsterite $Fa_{2.3\pm1.0}$, Cr_2O_3=0.51±0.21 wt%, n=14; enstatite $Fs_{3.5\pm1.5}Wo_{0.7\pm0.3}$, n=15; ferroan olivine in the type II chondrules $Fa_{20.3\text{-}43.0}$, n=4.
Classification: Carbonaceous chondrite (CR2).
Specimens: 20.8 g including a probe mount on deposit at *UNM*, Jay Piatek holds the main mass.

Northwest Africa 10997 (NWA 10997)
Morocco
Purchased: 2015 April
Classification: Ordinary chondrite (LL3)
History: Specimen was purchased in April 2015 in Morocco by S. Tutorow, who holds the main mass.
Physical characteristics: There is no fusion crust on the type specimen. The color of the stone is dark gray, with abundant chondrules that are lighter in color than the matrix. The specimen has been moderately weathered to a rust color in many areas.
Petrography: (E. Bethell, *CUO*) Chondrules display a variety of chondrule types based on petrography and texture, including: porphyritic olivine-pyroxene chondrules, barred olivine chondrules, radial pyroxene chondrules and porphyritic pyroxene chondrules. Porphyritic olivine-pyroxene chondrules appear to be the most abundant chondrule type. Chondrule boundaries remain discernible, however most are degraded and/or fractured. The mean chondrule diameter in the thin section is 1.1±0.7 mm (n=31), extending up to 4.5 mm. Minerals exhibit undulatory extinction, yet no mosaicism was observed in any of the minerals. Moderate weathering is observed in the form of oxidation of opaques (metals) in the matrix, and along fractures in the matrix and within chondrules. Oxidation of silicates and felspar was observed.
Geochemistry: (EMPA) Average mineral compositions (by mol %) for pyroxene are $Fs_{15.8\pm11.2}Wo_{2.7\pm6.6}$ (n=11), olivine $Fa_{26.1\pm10.2}$ (n=13), and plagioclase feldspar $An_{40.2\pm20.6}Ab_{55.5\pm18.2}Or_{4.3\pm2.9}$ (n=8). Cr_2O_3 abundances in ferroan olivine, mean 0.05±0.03 wt.%.
Classification: LL3. Suggested sub-type >3.2 from Cr_2O_3 analyses.
Specimens: 20.4 g including a polished mount and thin section at *UWO*. The remaining mass is with S. Tutorow.

Northwest Africa 10998 (NWA 10998)
Morocco
Purchased: 2015 April
Classification: Ordinary chondrite (L5)
History: Specimen was purchased in April 2015 in Morocco by S. Tutorow, who holds the main mass.
Physical characteristics: Physical Characteristics: The repository stone has no fusion crust and is light brown to beige.
Petrography: (R. E. Sukara, *UWO*). Chondrules do not have clear boundary. There are a few sparse grains of residual metal (less than 1% by count) in a fine grained recrystallized matrix with oxidized dark areas. Veins are filled with iron oxides. The mineralogy is dominated by olivine and pyroxene crystals that exhibit undulatory extinction, and small plagioclase crystals. Chondrules (BO) have a mean size of 0.7 mm.

Geochemistry: (EMPA) Olivine ($Fa_{24.8\pm1.0}$, N=12) low-Ca pyroxene ($Fs_{20.8\pm0.1}Wo_{1.4\pm0.3}$, N=11), and plagioclase $An_{10.6\pm1.2}$Ab=83.4±1.2Or=5.9±0.9 (N=6).
Specimens: 26.5 g including a polished mount and a thin section on deposit at *UWO*. The remaining mass is with S. Tutorow.

Northwest Africa 10999 (NWA 10999)
Morocco
Purchased: 2015 April
Classification: Ordinary chondrite (H5)
History: Specimen was purchased in April 2015 in Morocco by S. Tutorow, who holds the main mass.
Physical characteristics: The surface of the stone is moderately weathered and dark red to brown. There is no fusion crust.
Petrography: (L. Pagé, *UOtt*) The stone is matrix poor (15 vol.%) and chondrule rich (75 vol.%), with an overall recrystallized texture. Some chondrules can be discerned, but many have poorly-defined edges. Chondrules range in size (0.1-1.0 mm), with an average of 0.4 mm. Chondrule types include BO, RP and POP. Mesostasis is recrystallized to plagioclase. Some metal and sulfides (~30%) are oxidized.
Geochemistry: (EPMA) Olivine $Fa_{17.7\pm0.7}$ (n=27). Low-Ca pyroxene $Fs_{15.3\pm0.6}Wo_{1.6\pm2.1}$ (n=22). Plagioclase $An_{16.4\pm14.2}$ (n=12). Cl-apatite (EDS, wt%): Ca=42.5, O=33.1, P=19.1, Cl=5.3. Kamacite (EDS, wt%): Fe=92.8, Ni=7.2. Troilite (EDS, wt%): Fe=64.3, S=35.7.
Specimens: 39.8 g including a polished moutn and thin section at *UWO*. The remaining mass is with S. Tutorow.

Northwest Africa 11000 (NWA 11000)
Morocco
Purchased: 2015 April
Classification: Ordinary chondrite (H4)
History: Specimen was purchased in April 2015 in Morocco by S. Tutorow, who holds the main mass.
Physical characteristics: The type specimen is brown in color with an uneven surface and no evident fusion crust. Observation of the slab show a high abundance of metal grains, with the largest grain measuring ~1 cm in length. An igneous clast is present in the thin section.
Petrography: (E. Ferguson, *UWO*) The largest chondrule size is ~2 mm in diameter, and smallest chondrule size <0.1 mm ranging from well delineated rounded and sub-rounded chondrules to irregular or sub-angular in shape. Porphyritic olivine pyroxene (POP) chondrules dominate. Radial pyroxenes and small (<0.5mm) barred olivine (BO) chondrules were also found. Chondrules vary in size from <0.1mm to ~0.5mm. The specimen contains abundant metal grains with a modal abundance of ~10 vol%. Iron-nickel oxides are abundant and make up a network of irregularly shaped grains. Fe-Ni oxidation is evident around the edges of these grains and throughout the sample, however there is little evidence of silicate weathering. Secondary feldspar grains are <20 μm in size.
Geochemistry: (EMPA) Olivine $Fa_{18.6\pm0.9}$ (n=10), low-Ca pyroxene $Fs_{14.0\pm4.1}Wo_{0.8\pm0.4}$ (n=10), high-Ca pyroxene $Fs_{8.4\pm1.8}Wo_{34.0\pm5.1}$ (n=5).
Specimens: 33.0 g type specimen, including polished mount and thin section at *UWO*. The remaining mass is with S. Tutorow.

Northwest Africa 11001 (NWA 11001)
(Northwest Africa)
Purchased: 2016 May
Classification: HED achondrite (Eucrite, unbrecciated)
History: Brahim Tahiri sent the stones to his partner Sean Tutorow in May 2016 for analysis.
Physical characteristics: The repository specimen has a brown fusion crust.
Petrography: Modal composition: ~50 vol% pyroxene with exsolution lamellae (~500 μm in size) and 50 vol% plagioclase (200-500um). Accessory opaques (oxides and metal). The metal has minor oxide rims.
Geochemistry: Pyroxenes: pigeonite $Fs_{56.2\pm6.3}Wo_{6.6\pm7.3}$ (n=10), augite $Fs_{30.0\pm2.3}Wo_{39.6\pm2.6}$ (n=10), Fe/Mn = 28 ± 1 (n=20). Plagioclase: $An_{90.0\pm0.2}$ (n=15).
Classification: Eucrite, unbrecciated.
Specimens: 103.9 g at *UWO*, including a polished mount and thin section. Remaining mass with Sean Tutorow.

Northwest Africa 11002 (NWA 11002)
Morocco
Purchased: 2016 May
Classification: HED achondrite (Eucrite)
History: Purchased by Ke Zuokai in 2016 from a Moroccan dealer who wants to be anonymous.
Physical characteristics: An irregular stone without fusion crust.
Petrography: The brecciated meteorite displays an overall basaltic texture of exsolved pyroxene and calcic plagioclase ranging from 0.1-1.2 mm. Accessory minerals include ilmenite, chromite,trolite and SiO_2 polymorphs. Melt pockets are small, consisting of crystallite and angular minerals.
Geochemistry: Plagioclase ($An_{82.6\text{-}94.2}Or_{0.1\text{-}0.8}$, n=14; average: $89.9\pm3.3Or_{0.3\pm0.2}$), orthopyroxene ($Fs_{55.3\text{-}64}Wo_{1.9\text{-}5}$, n=14), pigeonite ($Fs_{54.8\text{-}59.8}Wo_{5.5\text{-}7.9}$, n=5), augite ($Fs_{25.1\text{-}37.8}Wo_{39.9\text{-}46.5}$, n=15), pyroxene(FeO/MnO =28.2-33.6, average: 31.7±1.4)

Northwest Africa 11003 (NWA 11003)
Morocco
Purchased: 2016 May
Classification: HED achondrite (Howardite)
History: Purchased by Ke Zuokai in 2016 from a Moroccan dealer who wants to be anonymous.
Physical characteristics: An irregular stone with a fresh partial fusion crust.
Petrography: The sample is a polymict breccia with mineral and lithic clasts (up to ~2 mm) set in a fragmental matrix. Eucritic and diogenitic clasts are composed of orthopyroxene, pigeonite, augite and calcic plagioclase as well as minor olivine. A few pyroxene grains display exsolution lamellae. Other accessories include chromite and SiO_2 polymorphs.
Geochemistry: Plagioclase ($An_{89\pm1.7}Or_{0.4\pm0.2}$), olivine ($Fo_{69.5\text{-}72.7}$, n=2), pyroxene (FeO/MnO =31.2±1.6), olivine (FeO/MnO=61.3±5.4)

Northwest Africa 11005 (NWA 11005)
Morocco
Purchased: 2016

Classification: Mesosiderite
History: Purchased by Ke Zuokai in 2016 from a Moroccan dealer who wants to be anonymous.
Physical characteristics: An irregular stone with a partial fusion crust.
Petrography: Petrographic microscope examination of a thin section shows this meteorite consists of cataclastic lithic clasts and randomly dispersed Fe-Ni metal-troilite grains, with silicate to metal ratio of ~1.5. The lithic clasts are mainly composed of low-Ca pyroxene and anorthite with/without quartz and high-Ca pyroxene. Small amounts of chromite, phosphate, ilmenite and titanium oxides can also be observed.
Geochemistry: Plagioclase ($An_{82.2\text{-}95.0}$, n=14; average: $An_{89.3\pm3.9}$), Pigeonite ($Fs_{32.4\text{-}46.9}Wo_{18.3\text{-}23.4}$, FeO/MnO=22.6-24.0, n=2), orthopyroxene ($Fs_{14.6\text{-}56.9}Wo_{0.7\text{-}10.2}$, FeO/MnO=17.2-27.9, n=10)

Northwest Africa 11006 (NWA 11006)
Morocco
Purchased: Nov. 2016
Classification: lunar, anorthositic impact melt breccia
History: Purchased by Ke Zuokai in Nov. 2016 from a Moroccan dealer.
Physical characteristics: A single stone lacking fusion crust. The section of stone looks gray and the stone has a dark yellow surface. Small white clasts are visible in a pale, finer grained matrix.
Petrography: Lithic clasts and mineral fragments (0.15 to 2 mm) set in a poorly recrystallized anorthositic matrix. The lithic clasts are impact melt clasts and rocks of anorthositic, gabbroic, noritic, and troctolitic composition. Mineral fragments are dominated by pyroxene grains and minor olivine. Some pyroxene grains exhibit exsolved lamella composed of augite $Fs_{23.5}Wo_{40.4}$ and pigeonite $Fs_{43.6}Wo_{10.3.}$ Vesicles occur in the matrix or some clasts with skeletal crystals. Other accessory minerals include chromite, spinel, ilmenite and troilite. The meteorite is moderately weathered with clay minerals filled in irregular cracks.
Geochemistry: Plagioclase ($An_{95.9\pm1.7}Or_{0.3\pm0.3}$, n=21), olivine (FeO/MnO = 83.2-116.5), pyroxene FeO/MnO = 43.9-73.6.

Northwest Africa 11007 (NWA 11007)
Morocco
Purchased: Nov. 2016
Classification: Carbonaceous chondrite (CK3)
History: Purchased by Ke Zuokai in Nov. 2016 from a Moroccan dealer.
Physical characteristics: One single stone. No fusion crust.
Petrography: A few chondrules (0.4 to 2.6 mm) are embedded in olivine-rich matrix (grain size ranging up to 160 μm). Fe-rich olivine is the dominant mineral phase. Most olivine is relatively homogeneous with a mean Fa content of 32.4. However, some of the large olivine grains in chondrules exhibit strong chemical zoning from Mg-rich cores ($Fa_{0.3\text{-}3.3}$) to Fe-rich rims($Fa_{30.0\text{-}33.6}$). Accessory phases include Cr, Al-bearing magnetite and sulfide. Two small CAIs (~40 μm) composed of spinel and fassaite are identified.
Geochemistry: Olivine: equilibrated 32.4±1.3 (n=21), unequilibrated $Fa_{0.3\text{-}33.6}$ (n=18); Fe/Mn 107.7-164.5, plagioclase $Ab_{74.2\pm5.4}Or_{1.2\pm0.3}$ (n=25). Unequilibrated olivines are commonly present in chondrules with a few in the matrix. The PMD of Fa content of all analyzed olivine is 38.9% (n=39), and the PMD of Fs content of orthopyroxene is 6.0% (n=6).

Northwest Africa 11008 (NWA 11008)
Morocco
Purchased: 2016 Nov
Classification: Ordinary chondrite (LL6)
History: Purchased by Ke Zuokai in November 2016 from a Moroccan dealer.
Physical characteristics: One single stone with fusion crust. Minimal weathering.
Petrography: The section shows a granular texture with a few relict barred and porphyritic chondrules with vague boundaries (0.4-1 mm). Most recrystallized minerals in the matrix shows triple junctions, and plagioclase grains size up to ~180 μm. Chromite and troilite are present. The composition of olivine, orthopyroxene and plagioclase are quite uniform with a mean composition of $Fa_{32.6}$, $Fs_{26}Wo_{2.9}$ and $Ab_{83.2}Or_{5.7}$, respectively.
Geochemistry: Plagioclase $Ab_{83.2\pm0.7}Or_{5.7\pm0.5}$ (n=25).

Northwest Africa 11009 (NWA 11009)
Morocco
Purchased: 2016 Nov
Classification: Ordinary chondrite (L5)
History: Purchased by Ke Zuokai in November 2016 from a Moroccan dealer.
Physical characteristics: Two pieces with partial fusion crust.
Petrography: Abundant porphyritic and barred chondrules with diameters ranging from 0.4 to 2.6 mm are visible. Major phases are olivine, orthopyroxene and Na-rich plagioclase. Minor phases include chromite, troilite and FeNi metal. Recrystallization of matrix is extensive. Shock melt veins are present.
Geochemistry: Plagioclase $Ab_{84.0\pm1.1}Or_{5.2\pm0.7}$ (n=14).

Northwest Africa 11010 (NWA 11010)
Northwest Africa
Purchased: 2016
Classification: Iron meteorite (ungrouped)
History: One piece weighing 832.4 g was found in the Sahara and was subsequently purchased in Morocco in 2015. J. Donald Cline and John Sinclair acquired the sample from a meteorite dealer at the Tucson Gem and Mineral Show in February of 2016.
Physical characteristics: Sample has a tabular, irregular shape with a few broad, shallow regmaglypts, halite deposits and oxidized spots.
Petrography: (A. Love, *App*) Cut and etched face shows plessitic structure similar to NWA 859, where plates of kamacite are segregated by plessite fields. Mean kamacite bandwidth 53μm (n=62). No troilite or dormation or reheating features were observed.
Geochemistry: Bulk Composition: (J.T. Wasson, *UCLA*): (INAA): 12.8 mg/g Co, 160.7 mg/g Ni; 11 μg/g Cr, 245 μg/g Cu, 87.5 μg/g Ga, 2666 μg/g Ge, 53 μg/g As, 7.0 μg/g W, 2.5 μg/g W, 41 μg/g Pt, 6.54 μg/g Au; 326 ng/g Sb, 349 ng/g Re. This composition is closely similar to that of NWA 859, synonym Taza, published by Wasson (2011).
Classification: Structural class, plessitic octahedrite. Compositional class is ungrouped, and possible based on high contents of volatile elements, IAB-ungrouped. The "Taza" irons are closely similar to Butler, but otherwise have no close compositional relatives.
Specimens: Pari holds the 711.6 g main mass. 47.7 g (two slices), *UCLA*

Northwest Africa 11011 (NWA 11011)
(Northwest Africa)
Purchased: 2012
Classification: Ordinary chondrite (L5)
History: Purchased by Matt Morgan from a Moroccan meteorite dealer at the Denver Gem and Mineral Show, 2012, and then donated to *UNM*.
Physical characteristics: Complete stone, fusion-crusted, oriented, one side covered with fluted regmaglypts. Broken surface reveals chondrules set in a light-reddish-colored groundmass.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous equilibrated, porphyritic chondrules, plagioclase grains up to ~25 μm, ubiquitous kamacite, troilite, and chromite.
Geochemistry: (C. Agee, *UNM*) Olivine $Fa_{25.6\pm0.3}$, Fe/Mn=50±3, n=24; low-Ca pyroxene $Fs_{21.8\pm0.6}Wo_{1.4\pm0.3}$, Fe/Mn=30±2, n=20.
Classification: Ordinary chondrite (L5)
Specimens: Main mass on display at *UNM*

Northwest Africa 11013 (NWA 11013)
(Northwest Africa)
Purchased: 2016 Aug
Classification: Martian meteorite (Nakhlite)
History: Puchased by Mendy Ouzillou in August 2016 from a dealer in Ouarzazate, Morocco.
Physical characteristics: Several small, friable, brownish-green stones (total weight 20.81 g). The interiors of all stones are grayish green with interstitial reddish-brown and beige components.
Petrography: (A. Irving and S. Kuehner, *UWS*) Cumulate texture. Composed mainly of prismatic augite grains (exhibiting two directions of twinning and more ferroan rims) with subordinate ferroan olivine and accessory ferroaugite, ferropigeonite, exsolved Fe-Ti oxide, ulvöspinel and chlorapatite. Interstitial regions are composed of apparently hydrous iron silicate material (red-brown in thin section) resembling chlorophaeite together with laths of both oligoclase and alkali feldspar.
Geochemistry: Olivine ($Fa_{87.1\text{-}89.7}$, FeO/MnO = 41-42, N = 3), augite (cores $Fs_{23.5\text{-}30.9}Wo_{39.9\text{-}40.0}$; rim $Fs_{39.0}Wo_{40.7}$; FeO/MnO = 29-34, N = 3), ferroaugite ($Fs_{44.7}Wo_{41.3}$, FeO/MnO = 40), ferropigeonite ($Fs_{67.7}Wo_{5.5}$, FeO/MnO = 31), plagioclase ($An_{22.5\text{-}23.9}Or_{4.6\text{-}4.5}$, N = 2), alkali feldspar ($Ab_{60.4}Or_{37.3}An_{2.3}$).
Classification: Martian meteorite (nakhlite). Paired with NWA 10153, NWA 10645, NWA 10659 and NWA 10720.
Specimens: 4.17 g plus one polished thin section at *UWB*; remainder with Mr. M. Ouzillou.

Northwest Africa 11014 (NWA 11014)
(Northwest Africa)
Purchased: 2016 Sep
Classification: Ordinary chondrite (L3)
History: Purchased by Darryl Pitt in September 2016 from a Moroccan dealer at the Denver Show.

Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, closely-packed chondrules (apparent diameter 400±400 μm; several much larger, e.g., 6 mm, 1 cm) are set in a fine-grained, dark matrix.
Geochemistry: Olivine ($Fa_{0.9\text{-}69.9}$, Cr_2O_3 in ferroan examples 0.06-0.14 wt.%, mean 0.10±0.03 wt.%, N = 7), orthopyroxene ($Fs_{1.0\text{-}12.1}Wo_{0.6\text{-}0.2}$, N = 3), subcalcic augite ($Fs_{8.4}Wo_{28.7}$), augite ($Fs_{2.7}Wo_{42.0}$). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 4.80.
Classification: Ordinary chondrite (L3).
Specimens: 22 g including one polished thin section at *UWB*; remainder with *DPitt*.

Northwest Africa 11015 (NWA 11015)
(Northwest Africa)
Purchased: 2016 Aug
Classification: HED achondrite (Eucrite, unbrecciated)
History: Puchased in Temara, Morocco by Adam Aaronson in October 2016.
Petrography: (A. Irving, *UWS* and P. Carpenter, *WUSL*) Subophitic texture. Relatively large, blocky grains of finely exsolved pigeonite containing embedded laths of anorthite are accompanied by accessory silica polymorph, ilmenite and troilite.
Geochemistry: (P. Carpenter, *WUSL*) Low-Ca pyroxene host ($Fs_{56.5\text{-}57.5}Wo_{6.2\text{-}6.5}$, FeO/MnO = 31-35, N = 2), augite exsolution lamellae ($Fs_{27.0\text{-}27.5}Wo_{43.1\text{-}42.7}$, FeO/MnO = 32-33, N = 2), plagioclase ($An_{90.9\text{-}91.4}Or_{0.1}$, N = 2).
Classification: Eucrite (unbrecciated, subophitic).
Specimens: 3.3 g including a polished mount at *UWB*; remainder with *Aaronson*.

Northwest Africa 11016 (NWA 11016)
(Northwest Africa)
Purchased: 2005
Classification: Ordinary chondrite (H4)
History: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently acquired by the Hollis Collection.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively small chondrules are set in a recrystallized matrix contain abundant stained metal and minor chlorapatite.
Geochemistry: Olivine ($Fa_{18.5\text{-}18.6}$, N = 3), orthopyroxene ($Fs_{16.1\text{-}16.6}Wo_{1.5\text{-}0.8}$, N = 3), clinopyroxene ($Fs_{5.3\text{-}5.5}Wo_{46.5\text{-}47.0}$, N = 2).
Classification: Ordinary chondrite (H4).
Specimens: 50 g including one polished thin section at *PSF*; remainder in the Hollis Collection.

Northwest Africa 11017 (NWA 11017)
(Northwest Africa)
Purchased: 2016 Jun
Classification: HED achondrite (Diogenite, polymict)
History: Purchased by Fabien Kuntz in June 2016 from a dealer in Zagora, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of >90 vol.% angular grains of diogenitic orthopyroxene (of several different compositions), sparse grains of olivine, augite, chromite and calcic plagioclase, and rare lithic clasts in a finer-grained matrix of the same minerals plus troilite and stained Ni-free metal. Lithic clasts include sparse polycrystalline diogenite, quench-textured eucrite (containing elongate pigeonite crystals within glassy

mesostasis) and a fine grained breccia lithology. Minor secondary barite occurs in the matrix and some calcite veinlets are present.
Geochemistry: Orthopyroxene ($Fs_{13.8}Wo_{4.2}$; $Fs_{17.9}Wo_{0.7}$; $Fs_{25.8}Wo_{2.5}$; FeO/MnO = 25-30), augite ($Fs_{16.4\text{-}18.7}Wo_{42.6\text{-}42.3}$, FeO/MnO = 23-25), pigeonite in quenched eucrite clast ($Fs_{41.7}Wo_{6.7}$, FeO/MnO = 31). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 3.10.
Classification: Diogenite (polymict breccia). The wide range of Fe/Mg in diogenitic orthopyroxene is an unusual feature.
Specimens: 23.69 g including one polished thin section at *PSF*; remainder with *Kuntz*.

Northwest Africa 11020 (NWA 11020)
(Northwest Africa)
Purchased: 2016 Jun
Classification: HED achondrite (Eucrite, monomict)
History: Purchased by Fabien Kuntz in June 2016 from a dealer in Tan Tan, Morocco.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of basaltic eucrite clasts in a sparse, dark matrix containing minor barite. The mostly rounded clasts consist of exsolved pigeonite (pale orange-brown in thin section) and polycrystalline calcic plagioclase with accessory silica polymorph, fayalitic olivine, Ti-chromite, ilmenite (containing rare inclusions of baddeleyite) and minor Fe-Mg-bearing merrillite.
Geochemistry: Orthopyroxene host ($Fs_{59.2}Wo_{3.9}$, FeO/MnO = 31), clinopyroxene exsolution lamella ($Fs_{27.4}Wo_{42.9}$, FeO/MnO = 29), clinopyroxene host ($Fs_{29.1}Wo_{42.1}$, FeO/MnO = 30), orthopyroxene exsolution lamella ($Fs_{62.9}Wo_{2.3}$, FeO/MnO = 30), fayalitic olivine ($Fa_{83.9\text{-}86.0}$, FeO/MnO = 26-32), plagioclase ($An_{85.0\text{-}90.0}Or_{1.0\text{-}0.3}$, N = 2). Magnetic susceptibility log χ ($\times 10^{-9}$ m^3/kg) = 2.96.
Classification: Eucrite (monomict breccia, shocked).
Specimens: 24.54 g including one polished thin section at *PSF*; remainder with *Kuntz*.

Northwest Africa 11021 (NWA 11021)
(Northwest Africa)
Purchased: 2016 Jun
Classification: Ordinary chondrite (LL7)
History: Purchased by Fabien Kuntz in June 2016 from a Morocan dealer at the Sainte Marie-aux-Mines Mineral Show.
Petrography: (A. Irving and S. Kuehner, *UWS*) Very fresh specimen with poikiloblastic texture and no remnant chondrules. Minerals are orthopyroxene, olivine, clinopyroxene, oligoclase, troilite, chromite, stained kamacite and taenite.
Geochemistry: Olivine ($Fa_{30.1\text{-}30.4}$, N = 3), orthopyroxene ($Fs_{23.8\text{-}24.0}Wo_{4.1\text{-}4.0}$, N = 3), clinopyroxene ($Fs_{12.5\text{-}13.3}Wo_{39.5\text{-}37.8}$, N = 2), plagioclase ($An_{29.0}Or_{1.2}$).
Classification: Ordinary chondrite (LL7).
Specimens: 22.21 g including one polished thin section at *PSF*; remainder with *Kuntz*.

Northwest Africa 11022 (NWA 11022)
(Northwest Africa)
Purchased: 2015
Classification: Ordinary chondrite (L6)

History: Purchased by Jansen Lyons from a Moroccan meteorite dealer at the Tucson Gem and Mineral Show, 2015.
Physical characteristics: Single stone, fusion-crusted. Broken surface reveals chondrules set in a light-green groundmass. At time of purchase, stone was covered with camel hair.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows scattered faint chondrules in a recrystallized matrix, plagioclase grains up to ~100 μm.
Geochemistry: (C. Agee, *UNM*) Olivine $Fa_{25.7\pm0.3}$, Fe/Mn=51±1, n=6; low-Ca pyroxene $Fs_{21.0\pm0.7}Wo_{1.5\pm0.3}$, Fe/Mn=31±2, n=7; plagioclase $Ab_{84.4\pm0.0}An_{10.4\pm0.3}Or_{5.2\pm0.4}$, n=2.
Classification: Ordinary chondrite (L6)
Specimens: 17 g including a probe mount on deposit at *UNM*, Jansen Lyons holds the main mass.

Northwest Africa 11023 (NWA 11023)
(Northwest Africa)
Purchased: 2015
Classification: Ordinary chondrite (L6)
History: Purchased by Jansen Lyons from a Moroccan meteorite dealer at the Tucson Gem and Mineral Show, 2015.
Physical characteristics: Single stone, weathered fusion crust. Saw cut surface scattered chondrules, most indistinct, set in a dark groundmass.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows equilibrated chondrules in a recrystallized matrix, plagioclase grains up to ~100 μm.
Geochemistry: (C. Agee, *UNM*) Olivine $Fa_{25.4\pm1.3}$, Fe/Mn=53±4, n=6; low-Ca pyroxene $Fs_{21.8\pm0.2}Wo_{1.6\pm0.2}$, Fe/Mn=30±1, n=6; plagioclase $Ab_{86.0\pm0.1}An_{9.3\pm0.2}Or_{4.7\pm0.2}$, n=2.
Classification: Ordinary chondrite (L6)
Specimens: 20.5 g including a probe mount on deposit at *UNM*, Jansen Lyons holds the main mass.

Northwest Africa 11025 (NWA 11025)
(Northwest Africa)
Find: 2011
Classification: Ordinary chondrite (H3)
History: Purchased by Dustin Dickens 2011 from a mineral dealer in Midelt, Morocco.
Physical characteristics: Single stone with flat, cracking, partially oxidized fusion crust covering the entire stone
Petrography: (A. Rubin, *UCLA*) Average chondrule size is 300-400 μm, in the H-chondrite range. The olivine distribution has a large peak at $Fa_{17\text{-}18}$, within the H-chondrite range. The low average Fa value is due to a low-FeO tail in the distribution; the large standard deviations in olivine and pyroxene indicate that the rock is somewhat unequilibrated. Chondrules are very sharply defined, but chondrule glass is absent. However, there are shock features in the rock including irregular small troilite grains within metallic Fe-Ni grains, rare small grains of metallic Cu within metal grains and patches containing broken silicate fragments within troilite. This suggests that the rock has been shocked. Taken together with the sharp optical extinction of the olivine grains, it seems likely that the rock was shocked and then annealed. This is consistent with the paucity of polysynthetically twinned low-Ca monoclinic pyroxene grains.

Geochemistry: Mineral composition and geochemistry: olivine $Fa_{15.6\pm4.8}$ (n=14) low-Ca pyroxene $Fs_{14.9\pm3.7}Wo_{1.4\pm0.6}$ (n=12)
Classification: H3
Specimens: 47.5 g at *UCLA*, including a thin section.

Northwest Africa 11026 (NWA 11026)
(Northwest Africa)
Find: 2016
Classification: Ordinary chondrite (LL4)
History: Purchased by Fayssal Mezgouri in Morocco and sold to Dustin Dickens in 2016
Physical characteristics: Single stone with an elongated cylindrical shape displaying a smooth, somewhat mottled, black patina.
Petrography: (A. Rubin, *UCLA*) The rock has well-defined chondrules and some polysynthetically twinned, low-Ca, monoclinic, pyroxene grains. Plagioclase grains are about 15 μm in size. There are no coarse Ca-pyroxene grains. Chondrule glass is absent. There is minor integration between chondrules and matrix, consistent with type 4. About 30% of the metal grains have been transformed into limonite, consistent with W2. Some olivine grains exhibit weak mosaic extinction, consistent with shock-stage S4. Also present are narrow trails of troilite grains that permeate the rock and surround chondrules and chondrule fragments. Maskelynite is absent.
Geochemistry: Mineral composition and geochemistry: olivine $Fa_{27.4\pm0.3}$ (n=16) low-Ca pyroxene $Fs_{22.3\pm0.2}Wo_{1.8\pm0.6}$ (n=9).
Classification: LL4
Specimens: 44.8 g at *UCLA* including a thin section.

Northwest Africa 11035 (NWA 11035)
(Northwest Africa)
Purchased: 2001
Classification: Ordinary chondrite (LL6)
History: One stone weighing 48.3 g was found in Morocco in 2001. David Holden acquired the sample from a meteorite prospector in Erfoud 2001.
Physical characteristics: The oriented sample is dark brown, has a rounded ovoid shape and a weathered fusion crust with a well defined rollover lip. The cut face of the interior is also dark brown and shows weathered flakes of metal.
Petrography: Description and classification (A. Love, *App*): Sample is heavily recrystallized. All relict chondrules are droplet varieties of RP and BO. Chondrules are and have an avg. dia. of 806 μm, n=16. Sample is transected by ringwoodite-bearing opaque shock veins. All secondary plagioclase and mesostasis phases have been transformed into isotropic glass.
Geochemistry: (A. Love, *App*) Olivine $Fa_{28.3\pm0.1}$, N=6; Low Ca pyroxene $Fs_{24.0\pm0.3}Wo_{2.0\pm0.2}$, N=6.
Classification: Ordinary Chondrite (LL6, S6, W3)
Specimens: David Holden holds the main mass. Two slices weighing 10.5 g and one polished thin section are on deposit at *App*.

Northwest Africa 11036 (NWA 11036)
(Northwest Africa)
Purchased: 2016

Classification: Ordinary chondrite (LL6)
History: One stone weighing 70.0 g was found in Morocco in 2016. David Holden acquired the sample from a meteorite prospector in Erfoud 2016.
Physical characteristics: Sample is dark brown and has a weathered patina and irregular shape. The cut face of the interior is also dark brown and shows weathered flakes of metal.
Petrography: Description and classification (A. Love, *App*): Sample is heavily recrystallized. All relict chondrules are droplet varieties of RP and BO. Chondrules are and have an avg. dia. of 943 μm, N=5. Sample is transected by ringwoodite-bearing opaque shock veins. All secondary plagioclase and mesostasis phases have been transformed into isotropic glass.
Geochemistry: (A. Love, *App*) Olivine $Fa_{28.9\pm0.4}$, N=8; Low Ca pyroxene $Fs_{24.5\pm0.5}Wo_{2.2\pm0.2}$, N=6.
Classification: Ordinary Chondrite (LL6, S6, W3)
Specimens: David Holden holds the main mass. Two slices weighing 14.74 g and one polished thin section are on deposit at *App*.

Northwest Africa 11037 (NWA 11037)
(Northwest Africa)
Purchased: 2016
Classification: Ordinary chondrite (LL6)
History: One stone of 100.0 g was purchased in 2016 by Sergey Vasiliev in Ensisheim
Physical characteristics: On the cut surface, the rock shows a brecciated texture with abundant shock veins.
Petrography: (Addi Bischoff, Samuel Ebert). In polished thin section the recrystallized texture of the fragments is visible. Abundant shock veins are present.
Specimens: 20.6 g including a polished thin section are at the *IfP*. Sergey Vasiliev holds the main mass.

Northwest Africa 11038 (NWA 11038)
(Northwest Africa)
Purchased: Feb 2016
Classification: Ordinary chondrite (L3)
History: A single stone weighing 2202 g was purchased in February 2016 from a Moroccan dealer
Petrography: (A. Bischoff, S. Ebert, *IfP*). The rock is unbrecciated. In the studied thin section, abundant well-defined chondrules are visible, sometimes containing mesostasis glass. This indicates a very low degree of secondary alteration. It is an unequilibrated type 3 ordinary chondrite. The chondrules have a size of about 500 μm. The ° of shock and weathering are S2 and W2, respectively.
Geochemistry: Mineral compositions and geochemistry: (K. Klemm and A. Bischoff, *IfP*) Olivine within the rock is unequilibrated and is $Fa_{25.2\pm3.8}$ (range $Fa_{12\text{-}30}$, n=30). The same holds for low-Ca pyroxene, which is also unequilibrated and is $Fs_{13.7\pm10.5}Wo_{1.5\pm2.2}$ ($Fs_{2\text{-}37}Wo_{0.2\text{-}10.4}$, n=30).
Specimens: 30.9 g including a polished thin section are at the *IfP*. Sergey Vasiliev holds the main mass.

Northwest Africa 11039 (NWA 11039)
(Northwest Africa)

Purchased: 2014
Classification: Ordinary chondrite (L4)
History: One stone of 28.8 g was purchased in 2014 by Sergey Vasiliev in Morocco.
Physical characteristics: The cut surface shows well-defined chondrules and a low matrix abundance.
Petrography: (A. Bischoff, S. Ebert, *IfP*). In the polished thin section, numerous mostly porphyritic chondrules were observed embedded in a fine-grained matrix of low abundance, typical of ordinary chondrites. The chondrules are 0.5 mm in apparent diameter, typical for the L-group.
Geochemistry: Mineral compositions and geochemistry: (K. Klemm, A. Bischoff, *IfP*) olivine $Fa_{24.8\pm0.7}$ (n=18); low-Ca pyroxene $Fs_{17.6\pm5.4}Wo_{0.5\pm0.3}$ (n=19).
Specimens: 8.06 g including a polished thin section are at the *IfP*. Sergey Vasiliev holds the main mass.

Nova 015
Chile?
Purchased: 2004
Classification: Iron meteorite (IAB complex)
History: The sample was bought by Dr. Peter Schlathoelter (Ibbenbueren, Germany) as a single piece of 5.37 kg in 2004 in Barri Gotic, a suburb of Barcelona, in a small jewelry store. He was told that the son of the owner would preferentially search for meteorites in the desert of northern Chile, but this find location is not certain.
Petrography: (S. Ebert, A. Bischoff, *IfP*) The iron meteorite contains cm-sized silicate inclusions. The inclusions contain plagioclase, $\sim Ab_{80\text{-}85}$ and low-Ca pyroxene, $\sim Fs_{5.}$
Geochemistry: (C. Proksche and M. Regelous, *FAU*, Mario Fischer-Gödde, *IfP*): Ni: 6.95 wt%; Ir: 5.72 ppm, Pt: 9.67 ppm.
Classification: (A. Bischoff and S. Ebert, *IfP*) Silicate compositions and Ni abundance support classification as IAB.

Nova 016
(Unknown)
Find: 2015
Classification: Ordinary chondrite (L5)
History: Finder thought the meteorite was found in Latvia; Field name is LAT; analyst N.N. Kononkova (*Vernad*)
Physical characteristics: Two fragments (91.8 and 47.7 g) of incomplete individual sample are reddish-brown with red patches of iron oxides. The larger fragment has the remnants of fusion crust.
Specimens: A main mass (two stones 91.8 and 45.5 g) and thin section are on deposit at *Vernad*.

Nuevo Mercurio (d) ~24°27'N, ~102°8'W
Zacatecas, Mexico
Purchased: 1982
Classification: Ordinary chondrite (L6)

History: Purchased by a Mexican opal dealer from a local farmer in 1982, as part of a lot of Nuevo Mercurio stones. The meteorite was identified as distinct from the H chondrite fall by its lower magnetic susceptibility.
Physical characteristics: One stone of 138.6 g covered by 30% fusion crust. The stone is weakly coated by iron hydroxides. Cut face shows light-gray interior with fresh metal specks and black shock veins.
Petrography: (R. Bartoschewitz, *Bart*) Microscopic examination of a thin section shows strong recrystallized and strong shocked matrix (mosaicism and PDFs in olivine, maskelynite). Chondrules poorly preserved.
Geochemistry: (R. Bartoschewitz, *Bart*, P. Appel and B. Mader, *Kiel*) Olivine $Fa_{25.0\pm0.3}$ (n=13); pyroxene $Fs_{21.2\pm0.5}Wo_{1.8\pm0.2}$ (n=18). Kamacite Ni=5.3-7.1, Co=1.0-1.1 wt.-%). Magnetic susceptibility (R. Bartoschewitz, *Bart*) log χ ($\times 10^{-9}$ m^3/kg) = 4.94.
Classification: Ordinary chondrite (L6)
Specimens: 21.4 g on deposit at *Kiel*, main mass *Bart*.

Ooldea 002 30°34’25.10"S, 131°48’5.70"E
South Australia, Australia
Purchased: 2013 Apr 6
Classification: Ordinary chondrite (L5)
History: Several fragments found by A Tomkins over ~80 m^2.
Physical characteristics: Five 5-10 cm red-brown blocks with partial fusion crust and five small fragments.
Petrography: (A. Tait, *Monash*) Few poorly defined chondrules reside in a recrystallized matrix. Relict chondrules included: RP, POP, PP. Relict Chondrule sizes range from 1.5 – 3.0 mm. Olivine grains show a strong undulous extinction but no further indicators of higher shock. All the FeNi/troilite has oxidized in this sample with oxidized grains leaving extensive corrosion cavities. These are interconnected with extensive weathering veins.
Geochemistry: (A. Tait, *Monash*) FEG-SEM analyses show that the olivine composition is uniform, with a moderate deviation in the pyroxene: olivine $Fa_{23.3\text{-}24.5}$, mean= $Fa_{23.9\pm0.4}$, n=7; Low-Ca pyroxene $Fs_{15.8\text{-}20.8}$, mean= $Fs_{17.8\pm1.9}$, n=5.
Classification: Ordinary Chondrite (L5, S2, W4)
Specimens: All specimens and one thin-section held by A. Tomkins.

Ooldea 010 30°34’10.2"S, 131°46’20.4"E
South Australia, Australia
Find: 9 Apr 2013
Classification: Ordinary chondrite (L5)
History: Single fragment with distinct chondrules found by A. Tomkins.
Physical characteristics: No fusion crust, numerous well-formed chondrules visible, 60% of the 5 cm slightly elongate sample covered by lichen.
Petrography: (J. Savage, A. Tait, *Monash*) Chondrule boundaries are difficult to differentiate from the matrix. Large porphyritic chondrules, ~1 mm, can be distinguished from the matrix. The matrix is no longer opaque and has an olivine-pyroxene-plagioclase composition. Matrix still maintains a large porosity. Chondrite mineralogy includes olivine, pyroxene, Fe-Ni Metal, troilite and plagioclase. Chondrule types present are BO, POP, RP, C, PP and PO. Both sharp and undulose extinction are common in olivine, pyroxene and plagioclase grains. Olivine grains

shows mosaicism and conjugate pair fractures, that offset into the matrix in some grains. Fe-Ni metals exists a coarse grains (<0.6 mm) and as fine-grain inclusions in chondrules. Fe-Ni metals show minor oxidation (<10%) and is restricted to the coarse grain metals. Troilite shows <5% weathering.
Geochemistry: (J. Savage, *Monash*) Microprobe analyses show that olivine and pyroxene compositions are uniform: olivine $Fa_{22.0\text{-}23.9}$, mean=$Fa_{22.9\pm1.7}$, n=6; Low-Ca pyroxene $Fs_{23.5}$, n=1.
Classification: Ordinary Chondrite (L5, S2, W1).
Specimens: The main mass and a thin section are held at *Monash*, under the curation of A. Tomkins.

Osceola 30°27.16'N, 82°27.25'W
Florida, USA
Confirmed fall: 2016 Jan 24
Classification: Ordinary chondrite (L6)
History: (Mike Hankey, Larry Atkins, Laura Atkins, Josh Adkins, Brendan Fallon, Robert Matson, Marc Fries) On Sunday Morning 24 January at 10:27 EST (15:27 UTC) a large daytime fireball streaked across the sky in northern Florida. Over 100 eyewitnesses reported the event to the American Meteor Society (Event 2016-266), describing a white sparkling head and plume of white smoke left behind. Fireball researchers Marc Fries and Rob Matson, found the American Meteor Society witness trajectory intersected with a group of radar returns that appeared shortly after the fall. The radar returns were strong, found at multiple altitudes and located on multiple stations: KJAX, KVAX and KTHL. Larry Atkins was the first on the scene. Mike Hankey arrived 5 days after the fall with Brendan Fallon and joined Larry and Laura Atkins in the hunt. On the 6th day, Mike Hankey found the first stone at 8.5 g on the eastern edge of the primary radar return. Within 2 hours Larry Atkins found the second stone (18.5 g) directly under the radar. The next day, two more stones were found: a 5.5 g stone by Laura Atkins and a 48.5 g stone by Mike Hankey. Six days later over 2 miles away from the first find, an 839 g mass was found by Josh Adkins and Brendan Fallon. A week after that, Larry Atkins found another stone, weighing 75.5 g. Then on Feb. 22, 2016, Doug Dawn recovered two stones, 90.5 and 18.6 g. In total 8 stones were found with a combined weight of 1099 g.
Physical characteristics: Thin, well formed shiny fusion crust covers the exterior of four of the stones, while two of them, the 43 g and the 839 g are matte black. This is likely due to submersion in wet sand and/or water prior to recovery. Some small rust spots are evident on some of the stones as well. Small regmaglypts are present on the 43 g and the 839 g stones, and the remaining stones are irregularly shaped with little to no orientation. Some chondrules are visible through the crust. The interior of the meteorites are slightly darkened due to shock. Shock veins are present, some of which are black while others are filled with metal, appearing as long "strings" up to 3 mm long. Though most of the chondrules have been altered and are not well defined, some rare, large chondrules up to 0.8 mm are present.
Petrography: Plagioclase grains are up to 100 μm in size, consistent with type 6. No maskelynite was found. There are numerous chromite-plagioclase assemblages, consistent with moderately strong shock. Chromite grains are fractured. Troilite is polycrystalline. Metallic copper occurs as 2-μm-thick bands at the metal-troilite interface in an opaque assemblage. The chondrules are recrystallized and poorly defined. The only discernible chondrules are large ones, 800-1000 μm across; these are BO and PO textural types.

Geochemistry: Olivine $Fa_{23.7\pm0.3}$ (n=21), Orthopyroxene $Fs_{20.2\pm0.2}Wo_{1.6\pm0.2}$ (n=14). Also present are small grains of diopside: $Fs_{7.4}Wo_{44.9}$ (n=1). Plagioclase has a mean composition of $Ab_{71.7\pm1.6}Or_{8.8\pm2.5}$ (n=8); the low Na and high K values are a result of shock.
Specimens: 21.8 g at *UCLA*

Österplana 065 (Öst 065) 58°35'N, 13°26'E
Skaraborgs, Sweden
Find: 2011 June 26
Classification: Relict meteorite
History: On June 26, 2011, the quarry workers in the Thorsberg Quarry at Kinnekulle, southern Sweden, were removing limestone beds of low industrial quality from the upper part of the quarry. In the uppermost quarried bed, Glaskarten 3, the workers identified an 8 × 6.5 × 2 cm prominent gray clay inclusion as a relict meteorite. All the ca. 100 relict meteorites found so far in the quarry are almost completely replaced mainly by calcite and clay minerals, and spinel minerals are the only common relict components. Based on the chemistry of the spinels in the new meteorite it was soon obvious that it was of another kind than all the other recovered relict meteorites. In order to confirm that it indeed was a relict meteorite and not, e.g., an altered volcanic bomb, $^{187}Os/^{188}Os$ and Os analyses were performed on bulk material. The meteorite is as high in Os as recent chondrites, and has the same Os isotopic composition, clearly establishing that this is an extraterrestrial object. Chromium and oxygen-three isotopic analyses have shown that the meteorite is of a kind not represented in our collection of recent meteorites. For further details, see Schmitz et al. (2014) Earth and Planetary Science Letters 400: 145-152
Classification: Chromium and oxygen-three isotopic studies by Qing-zhu Yin and Matt Sanborn, *UCD*, and Gary Huss and Caroline Caplan, *UHaw*, show that this relict meteorite is the remains of a type of meteorite that has no equivalent among the meteorites falling on Earth today. The oxygen isotopes indicate affinity with primitive achondrites, whereas the chromium isotopes show affinity with the ordinary chondrites.

Parker 34°06.5976'N, 114°12.0030'W
Arizona, United States
Find: 2014 Jul 19
Classification: Ordinary chondrite (H5)
History: Found 19 July 2014 by Jim and Wendy Wooddell while they were hiking on desert pavement surface on the south side of Black Peak, ~9 km southeast of Parker, Arizona.
Physical characteristics: 17.6 g fragment which measures 38 × 26 × 11 mm. Reddish brown in color with altered or no distinguishable fusion crust. A slight bat-wing shape with one edge rounded. A fracture appears filled with terrestial minerals. Sawn surface shows orange-stained chondrules. Metal rare and replaced by iron oxides.
Petrography: Petrographic section shows fairly well-defined chondrules: particularly rich in BO chondrules. Metal altered to Fe-oxides. Troilite remains but also partially altered.
Geochemistry: (L. Garvie, *ASU*) $Fa_{19.2\pm0.9}$, Fe/Mn=38.5±3.6, n=6. Low Ca pyroxene $Fs_{16.8\pm0.5}Wo_{1.2\pm0.1}$, n=6. High Ca pyroxene $Fs_{9.1}Wo_{44.6}$, n=1.
Classification: H5, S2, W4
Specimens: 15.6 g and one thin section at *ASU*.

Ravar 31°53.22'N, 56°53.39'E

Kerman, Iran
Find: 2016 Mar 29
Classification: Ordinary chondrite (H4)
History: The sample was found in the desert by Mr. Kryachko T. V. and Mr. Khatami Majid.
Physical characteristics: one sample covered by brown fusion crust was broken on three pieces.
Petrography: (Verna.) The meteorite has a chondritic texture and consists of chondrules embedded in crystalline matrix. Boundaries between chondrules and matrix are mostly well delineated. The meteorite contains more weathered and fractured lithologies corresponding to W3.
Classification: H4, Ivanova M. A. (*Vernad*)
Specimens: 365 g and a thin section are deposited in *Vernad*. Main mass with Mr. T. V. Kryachko and Mr. V. V. Shumilin private collection

Sariçiçek 38°54.10'N, 40°36.01'E
Bingol, Turkey
Confirmed fall: 2015 Sept 2
Classification: HED achondrite (Howardite)
History: (O. Ünsalan, *UIst*; P. Jenniskens, *SETI*): A bright bolide was seen and heard in Bingol province, Turkey, and recorded on several video security cameras on 2015 Sept 2 at 20:10:30 UT. Shortly after the fireball, small meteorites were heard raining down on houses in the village of Saricicek. The next morning, people found pea-sized meteorites on the street and in yards. Tuğçe Özduman of the police in Bingöl supplied the first video data from traffic cameras in Bitlis, a neighboring city. Dedicated searches were done by Iskender Demirkol, Ibrahim Yasin Erdoğan, Aydın Sükrü Bengü and Vedat Avci of Bingol University. The 27 g meteorite analyzed here was found by Mehmet Nezir Ergün of Sariçiçek the morning of September 4.
Physical characteristics: (O. Ünsalan, *UIst*; P. Jenniskens, *SETI*): The meteorite is fully crusted and has a shiny, light-brown crust. The shape is irregular and rounded, indicative of high altitude fragmentation and ongoing breakup until just before deceleration.
Petrography: (M. Zolensky, *JSC*): Petrographically heterogeneous rock consisting of lithic and mineral clasts in a fine-grained matrix of crushed material. The matrix consists of high-Ca pyroxene (probably clinopyroxene) from the eucritic component, low-Ca pyroxene (probably orthopyroxene) from the diogenitic component, plagioclase, silica, kamacite, troilite, chromite, ilmenite and rare olivine. Clino- and orthopyroxene are present in approximately equal amounts. Single mineral grains and clasts of orthopyroxene, clinopyroxene, plagioclase, and rare olivine, all to a maximum size of 1 mm. Crystals of clinopyroxene frequently contain exsolution lamellae of orthopyroxene, in which both phases can contain oriented chromite inclusions. Three types of rock clasts are distinguished: (1) Clasts consisting plagioclase and silica, the former containing inclusions of chromite and ilmenite, and the latter containing blebs of troilite; (2) clasts consisting of an intergrowth of plagioclase and silica, with both phases hosting large blebs of troilite; (3) ophitic to subophitic basalt clasts consisting of an intergrowth of plagioclase laths and zoned clinopyroxene, in some cases with troilite blebs situated along the boundaries of the plagioclase crystal laths. Eucritic material appears to be more abundant than the diogenitic component. Single mineral grains and clasts show different degrees of shock deformation, including irregular fractures and folded pyroxene lamellae, and a significant fraction of the finest grained matrix appears to be poorly crystalline. Near the fusion crust melted troilite has been injected into cracks in silicates.

Geochemistry: (M. Zolensky, *JSC*): The matrix consists of high-Ca pyroxene (probably clinopyroxene) $Fs_{50\pm18}Wo_{26\pm20}$, FeO/MnO= 21.0-45.9, N=29, from the eucritic component, low-Ca pyroxene (probably orthopyroxene) with $Fs_{28\pm6}Wo_{2\pm1}$, FeO/MnO = 31.1-36.7, n=23 from the diogenitic component and $Fs_{53\pm19}Wo_{3\pm3}$; plagioclase, $An_{83.5\text{-}89.6}Or_{0.2\text{-}4.0}$; olivine, $Fa_{18\text{-}21}$, FeO/MnO= 30.1-43.1, average Fa_{80}, PMD=1.6%, N=4. Single mineral grains and clasts: orthopyroxene, $Fs_{22\text{-}70}Wo_{1\text{-}2}$; clinopyroxene, $Fs_{28\text{-}60}Wo_{6\text{-}36}$, some compositionally zoned; plagioclase, $An_{85.5\text{-}89.6}Or_{0.2\text{-}0.6}$; olivine, $Fa_{21.}$ Basaltic clasts: plagioclase, $An_{85}Or_1$; clinopyroxene, $Fs_{33\text{-}55}Wo_{6\text{-}12.}$
Classification (M. Zolensky, *JSC*): Howardite
Specimens: 27 g sample #SC24 at *UIst*. 27 g sample #SC12, described above, with P. Jenniskens. A list of other finds is maintained at http://turk-met.net/saricicek-meteoritleri/. Small meteorites are at the *UIst*, Department of Physics (Ozan Ünsulan). A small collection of meteorites is at Bingol University (Iskender Demirkol).

Sarvestan 29°18’ N, 53°8’ E
Fars, Iran
Find: 2012
Classification: Iron meteorite (IVA)
History: Found by Ghasem Karimi Dehnavi in 2012 during a meteorite search. The meteorite was abraded on all faces and etched by the finder before being sent to *CEREGE*. Therefore the initial mass can only be estimated.
Physical characteristics: After being abraded and etched by the finder, the meteorite has an ovoid shape and displays a fine Widmansttäten patterns.
Petrography: Fine octahedrite structure with minor fine inclusions of schreibersite and troilite. Bandwith is 0.3-0.5 mm.
Geochemistry: Bulk composition (INAA, John T. Wasson, *UCLA*): Co = 3.89 mg/g; Ni = 77.2 mg/g; Ga = 2.28 μg/g; As = 3.35 μg/g; Ir = 2.57 μg/g; Au = 0.864 μg/g; Ge not determined. The meteorite plots in the IVA fields on element-Au diagrams. Its composition is slightly lower in Au and As but the same in Ni as the mean of two Gibeons used to define the low Au, As end of the Gibeon compositional range.
Classification: Iron, IVA, fine octahedrite
Specimens: Main mass 22 g in *CEREGE*, 0.6 g INAA slab in *UCLA*

Sayh al Uhaymir 529 (SaU 529) 20°31.894’N, 56°39.925’E
Al Wusta, Oman
Find: 2002 Oct 06
Classification: Ordinary chondrite (L3)
History: Discovered by a natural science expedition on Oct. 6, 2002.
Physical characteristics: One nearly black, oriented stone of 32.2 g, covered 100% by fresh fusion crust. Saw cut shows closely packed chondrules.
Petrography: (R. Bartoschewitz, *Bart*) Microscopic examination of a thin section shows clustered chondrules of various types up to 2 mm (avg. 0.6 mm). Chondrule/matrix ratio >10.
Geochemistry: (R. Bartoschewitz, *Bart*, P. Appel and B. Mader, *Kiel*) Olivine, $Fa_{18.4\pm7.4}$ (n=15, Fe/Mn=52); pyroxene, $Fs_{10.3\pm5.9}Wo_{0.5\pm1.1}$ (n=10); feldspar, $An_{3.}Or_{1.6}$; kamacite, Ni=5.9-6.1, Co=0.9-1.1 (wt.%). Magnetic susceptibility (R. Bartoschewitz, *Bart*) log χ ($\times 10^{-9}$ m^3/kg) = 4.47.
Classification: Ordinary chondrite (type L3)

Specimens: 7.0 g on deposit at *Kiel*, main mass *Bart*.

Sidi Ali Ou Azza 29°47’2.9"N, 7°23’21.8"W
Guelmim-Es-Semara, Morocco
Confirmed fall: 28 Jul 2015
Classification: Ordinary chondrite (L4)
History: (H. Chennaoui Aoudjehane *FSAC*, A. Aaranson, A. Bouragaa, A. Bouferra). On Tuesday, 28 July 2015, around 5:30 pm local time (6:30 pm GMT), many people from Tissint and its vicinity heard three sonic booms in the direction of Sidi Ali Ou Azza. Immediately, numerous people begin searching for the meteorite in the area. Two days after the fall, many small pieces from 5 to 109 g (so far: 109, 100, 75, 50, 40, 37, 20, 10, 7, and 5.7 g) were recovered close to Sidi Ali Ou Azza and El Kharoua’ well, a few km west of Tissint. Most pieces are complete and mostly covered by black fusion crust. The interior is dark and brecciated, with a few clear gray zones. Numerous small and well-defined chondrules are visible as well as sulfides and metals. The direction of the fall was from north to south; the strewnfield is ~4 km long.
Physical characteristics: Black and brown patchy fusion crust. A saw cut reveals numerous, distinct chondrules and fine grained metal/sulfide. A dark angular clast, ~5 mm, was also observed.
Petrography: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous porphyritic chondrules, a few BO chondrules, and an enstatite-rich chondrule. Mesostasis and very fine-grained plagioclase is ubiquitous. Kamacite, taenite, troilite, chromite, and a phosphate phase were observed throughout. The dark angular clast described above has an igneous texture with ~50% zoned euhedral olivines (up to 50 μm) and ~50% fine spinifex quench crystals, with sparse scattered metal or sulfide blebs (up to 10 μm).
Geochemistry: (C. Agee and N. Muttik, *UNM*) Chondrule olivine $Fa_{25.7\pm0.9}$, Fe/Mn=50±3, Cr_2O_3=0.03±0.03 (wt%), n=24; chondrule low-Ca pyroxene $Fa_{20.4\pm1.7}$, Fe/Mn=29±1, n=10; chondrule enstatite $Fs_{2.1\pm0.2}Wo_{0.6\pm0.2}$, n=2; plagioclase $An_{8.3\pm3.9}Ab_{86.9\pm3.1}Or_{4.9\pm0.9}$. Clast olivine $Fa_{19.3\pm4.1}$, Fe/Mn=47±4, Cr_2O_3=0.45±0.21 (wt%), n=6.
Classification: Ordinary chondrite, L4
Specimens: 20.8 g, *UNM*; 10.7 g, *FSAC*

Steingarden Nunataks 07009 (STG 07009) 72°17.339’S, 16°03.210’E
Antarctica
Find: 2007
Classification: Iron meteorite (ungrouped)
History: The meteorite was found in 2007 in Antarctica during the Queenmet reconnaissance expedition carried out in the Antarctic field season 2007/08 by the Bundesanstalt für Geowissenschaften und Rohstoffe (*BGR*), Germany.
Physical characteristics: (F. Brandstätter, *NHMV*) One complete 32.6 kg individual with regmaglypts. The grayish-black exterior appears fresh, no oxidation features in the meteorite’s interior.
Petrography: (F. Brandstätter, *NHMV*) The meteorite is a plesstic octahedrite with almost all kamacite spindles (apparent diamter = 0.08±0.03 mm, N = 30) having nuclei of schreibersite.
Classification: (J.T. Wasson, *UCLA*) The meteorite is an ungrouped iron. It has no close relatives. Chemical composition: Cr=20 μg/g; Co=6.76 mg/g; Ni=139.9 mg/g; Cu=282 μg/g;

Ga=10.4 μg/g; Ge=166 μg/g; As=14.8 μg/g; Sb=74 ng/g; W=0.29 μg/g; Re=16 ng/g; Ir=0.129 μg/g; Pt=4.4 μg/g; Au=1.606 μg/g.
Specimens: The main mass (32.2 kg) is on deposit at *BGR*; type specimen (37.3 g) at *NHMV*.

Stubenberg 48°17.7'N, 13°7.0'E
Bayern, Germany
Confirmed fall: 2016 Mar 6
Classification: Ordinary chondrite (LL6)
History: (Pavel Spurný, *CzAS*). A very bright bolide was observed by thousands of eyewitnesses over Austria, Germany and the Czech Republic on March 6, 2016, at 21:36:51-56 UT. It was recorded photographically and photoelectrically by digital all-sky fireball observatories at six Czech stations of the European Fireball Network. A digital photographic spectrum of the bolide was also obtained. Based on these instrumental data, precise results on atmospheric trajectory, heliocentric orbit, and fragmentation history were quickly determined. From this analysis it was evident that this event likely resulted in multiple stones falling: the impact site was modeled and sent to German colleagues four days after the fall. All of the meteorites were found in the predicted location for a given mass.
Physical characteristics: (D. Heinlein). A total mass of 1.473 kg was recovered within the predicted fall site. The largest fragment has a mass of 1.320 kg and was found in a 14-cm-deep impact pit. The remaining 153 g of material consists of several pieces resulting from five different fragments. The first meteorite, 48 g, was found six days after the fall: it was broken into many pieces after hitting a hard surface. The other recovered fragments have masses of 42, 36, 19, and 8 g.
Petrography: (S. Ebert and A. Bischoff, *IfP*). Based on the study of the thin sections, Stubenberg is brecciated. Only highly recrystallized fragments (type 6) were observed, having only very rare, indistinct chondrules. Plagioclase (some >100 μm) and olivine show undulatory extinction, and the olivines show distinct sets of planar fractures indicating that the rock is weakly shocked (S3). Opaque phases include metals (kamacite, taenite), troilite, and chromite. Other accessory phases include Cl-apatite and merrillite. Several shock veins cross the meteorite.
Geochemistry: (S. Ebert and A. Bischoff, *IfP*). The mean composition of olivine is $Fa_{31.4\pm0.3}$ ($Fa_{30.5\text{-}32.2}$, n=54). The low-Ca pyroxenes and Ca-pyroxenes have mean compositions of $Fs_{25.4\pm0.3}$ ($Fs_{24.8\text{-}26.1}$, n= 43) and $Fs_{11.2}Wo_{41.4}$ (n=7), respectively. Mean plagioclase composition is $An_{11.1\pm0.4}Or_{5.5\pm1.2}$ ($An_{10.3\text{-}12.1}$, n= 42). Kamacite has mean Ni and Co concentrations of 3.9 and 6.1 wt%, respectively (n=8). The taenite composition is variable, with Ni content varying from 41.9 to 48.2 wt% (mean: 44.3 wt% Ni, ~1.8 wt% Co, n=38).
Classification: LL chondrite breccia (LL6, S3, W0)
Specimens: Type Specimens: 20.1 g, *IfP*; the main masses are with the finders.

Suzemka 52°20.25'N, 34°3.24'E
Bryanskaya oblast', Russia
Find: 18 Jul 2015
Classification: Iron meteorite (IAB complex)
History: A single piece of iron was found by Mr. and Ms. Bitsyuk on the surface, near the road close to Suzemka in 2015.

Physical characteristics: The meteorite has an irregular, approximately elliptical, but partly ragged shape; it is covered by a shell of carbonates and iron oxides. Fusion crust is not preserved. Total weigh is 9400 g.
Petrography: the meteorite is composed of taenite with thin lamellae of kamacite and inclusions of troilite, shreibersite and rhabdites.
Geochemistry: Mineral compositions and geochemistry: (N. N. Kononkova, *Vernad*) kamacite: Ni =7.95±0.22 (N=13), Co = 1.33±0.12 (N=13); taenite: Ni = 30.6±2.6 (N=21) (all in wt%); (ICP-AS, I. A. Gromyak, ICP-MS, E. S. Toropchenova, *Vernad*, bulk sample) Ni 22.7 wt.%, Co 0.49 wt.%; Au 3.00, Ga 5.25, Ge 10.1, Ir 0.03, Cr 9.82, W 0.06, As 25.4 (all in ppm).
Classification: Iron, IAB complex, sHH sub-group.
Specimens: A 1899 g sample and thick section are on deposit at *Vernad*.

Tank Mountains 33.0961526°N, 113.6315885°W
Arizona, United States
Find: 2010
Classification: Ordinary chondrite (L6)
History: In 2010, Mr. Joe King found ten meteorite fragments while he was prospecting in the vicinity of the Golden Harp Mine, in the Tank Mountains between Yuma and Gila Bend, Arizona. The fragments, with a total mass of 8.05 kg, range from a few grams to several kg; the pieces fit together.
Physical characteristics: The pieces are orange-stained. Remnant fusion crust visible. Stone is angular with a few broad regmaglypts. Sawn surface is orange stained, showing an even distribution of small metal grains, to 1 mm, and a few discernible chondrules to 2 mm. A few thin shock veins traverse the slice.
Petrography: (L. Garvie, *ASU*) Electron microscopic examination of a polished thin section shows few recognizable chondrules. Olivine shows well developed PDFs and mosaicism. Kamacite shocked showing indistinct Neumann bands. Troilite grains single crystal, some polycrystalline. Plagioclase common and to 400 microns. Accessory chromite, Cl-apatite, and merrillite. Chromite extensively fractured. Troilite ~50% altered and kamacite ~25% altered to terrestrial oxides.
Geochemistry: (K. Domanik, *UAz*) Olivine $Fa_{25.2\pm0.5}$, Fe/Mn=47±3, n=21, low-Ca pyroxene $Fs_{21.3\pm0.9}Wo_{1.7\pm0.3}$, Fe/Mn=29±2, n=22, augite $Fs_{7.5\pm0.5}Wo_{45.6\pm0.6}$, Fe/Mn=25±1, n=2, plagioclase $Ab_{83.9\pm0.5}An_{10.0\pm0.2}Or_{6.1\pm0.4}$, n=5, large kamacite grains with 6.39 wt% Ni±0.36, n=10.
Classification: Ordinary chondrite, L6, S3, W2
Specimens: 382 g at *ASU*

Tavn-Gashun 45°59.47’N, 46°24.18’E
Kalmykiya-Khal’mg Tangch, Russia
Find, doubtful fall: 2 Jul 1991
Classification: Ordinary chondrite (H5)
History: On July 2, 1991, at 1-2 a.m. (UTC+3), Mr. D. A. Zharkov was in a tent and heard a whistling sound followed by, a dull sound of something falling. In the morning, Mr. Zharkov found a meteorite within 20-30 m of the tent. He was 37.5 km west of the willage Tavn-Gashun. Macroscopic examination and petrographic study show that this is not a fresh fall. The meteorite is partly covered with carbonates (D. A. Kazakov, private communication). Between 1991 and

2004 the stone was broken into two fragments, one of which (~300 g) was lost. Analyst N.N. Kononkova (*Vernad*)
Physical characteristics: Physical characterisics: A stone of oriented shape with regmaglypted surface, completely covered with brown fusion crust. The mass of the stone is 4240 g.
Petrography: The meteorite contains chondrule fragments (500-1200 μm), a few whole chondrules (250-500 μm), FeNi metal (300-600 μm) and metal-troilite aggregates. Matrix is fine-grained, crystalline, and has granular metamorphic texture. The olivine grains display undulatory extinction and planar deformation features. The metal grains are partly replaced by FeNi hydroxides. The veinlets of FeNi hydroxides cross the rock.

Thiel Mountains 07008 (TIL 07008) 85º09.28'S, 94º36.24'W
Antarctica, Antarctica
Find: 24 Dec 2007
Classification: Carbonaceous chondrite (CM2)
Petrography: This meteorite consists of a few small chondrules (up to 0.7 mm), anhydrous silicate grains (mostly olivine, up to 200 μm), and black matrix with phyllosilicates, carbonates, and sulfides. Fe-Ni metal is very rare.
Geochemistry: Olivine composition is $Fa_{0.8\text{-}28.5.}$ O-isotope composition is $\delta^{17}O$=1.79‰, $\delta^{18}O$=9.66‰, $\Delta^{17}O$=-3.28‰, where $\Delta^{17}O=\delta^{17}O-0.5248*\delta^{18}O$, measured at *KOPRI*.

Thiel Mountains 07009 (TIL 07009) 85º9.98'S, 94º33.54'W
Antarctica, Antarctica
Find: 24 Dec 2007
Classification: Enstatite chondrite (EL6)
Petrography: The meteorite consists largely of pyroxene (nearly enstatite) with minor amounts of Fe-Ni metal and sulfides and lesser amount of plagioclase. Chondrules are not discernible.
Geochemistry: Pyroxene composition is $Fs_{0.3}Wo_{1.5}$; Si abundance in Fe-Ni metal is 0.8±0.1 wt%; ferroan alabandite (FeO = 16.1±1.3 wt%). O-isotope composition: $\delta^{17}O$=2.21‰, $\delta^{18}O$=4.21‰, $\Delta^{17}O$=0.00‰, where $\Delta^{17}O=\delta^{17}O-0.5248*\delta^{18}O$, measured at *KOPRI*.

Thiel Mountains 08004 (TIL 08004) 85º23.39'S, 87º07.69'W
Antarctica, Antarctica
Find: 21 Dec 2008
Classification: Pallasite
Petrography: The meteorite is composed of approximately equal proportion of Fe-Ni metal and coarse olivine (~2 mm to ~1 cm).
Geochemistry: Olivine composition is $Fa_{12.4\pm0.1.}$
Classification: Prob. paired with TIL 07016 and Thiel Mountains, based on their recovery sites and olivine compositions ($Fa_{12.6\pm0.2}$ in TIL 07016 and Fa~13 in Thiel Mountains)

Thiel Mountains 08007 (TIL 08007) 85º9.97'S, 94º39.95'W
Antarctica, Antarctica
Find: 28 Dec 2008
Classification: Carbonaceous chondrite (CM2)

Petrography: This meteorite consists of a few small chondrules (~20 vol%, up to 2 mm in diameter), CAIs (~2 vol%), and matrix (~78 vol%) with carbonate, sulfides, and phyllosilicates. Fe-Ni metal is very rare (<0.1 vol%).
Geochemistry: Olivine is $Fa_{0.2\text{-}59.3}$; low-Ca pyroxene is $Fs_{0.4\text{-}5.9}Wo_{0.3\text{-}3.6.}$

Timbuktu 16.7898, -3.0041
Gao, Mali
Find: 2015
Classification: Mesosiderite (group B4)
History: Found in 2015. Purchased in 2016 by KD Meteorites from Muhammad Sabai in Tucson who acquired from an anonymous finder in Mali. In 2015 an unusual rock was found by a resident of Timbuktu, Mali, near an old trade route north of town. He brought it home with him as an oddity. The rock was shown to Mohamed Sabai, who was visiting friends in Timbuktu, he recognized it as a meteorite, and purchased it from the finder.
Physical characteristics: Single mass with irregular, dark brown, oxidized patina. Saw cut slices reveal a matrix mixture of segregated orange-brown silicate and unoxidized metal with ~1-5 mm grain sizes, there are also scattered cm-sized green-yellow pyroxene xenocrysts, and cm-sized metal nodules. Minimal brecciation.
Petrography: (C. Agee, *UNM*) Silicate matrix domains in this meteorite are approximately 85% low-Ca pyroxene and 15% plagioclase. Minor minerals include augite, chromite, merrillite, silica, schreibersite, and troilite. Kamacite is the dominant metal phase with lesser amounts of taenite present.
Geochemistry: (C. Agee and M. Spilde, *UNM*) Low Ca-pyroxene $Fs_{28.4\pm3.2}Wo_{2.8\pm0.9}$, Fe/Mn=29±3, n=11; plagioclase $An_{90.9\pm1.6}$, n=6.
Classification: Mesosiderite (B4), "B" based on plagioclase abundance, "4" based on low brecciation, and segregated mm-sized silicate and metal grains in matrix.
Specimens: Slices weighing 34, 54, and 104 g on deposit at *UNM*; KD Meteorites and M. Sabai hold the main mass.

Tindouf 002 27.312°N, 7.561°W
Tindouf, Algeria
Find: 2014 May 16
Classification: Martian meteorite (Shergottite)
History: Six similar dark stones were found together by Mr. Alla on May 16, 2014, at a location 80 km SE of Tindouf, Algeria (27.312°N, 7.561°W) and subsequently acquired by Moulay El Bechir Didi. Four of the stones were subsequently purchased in June 2015 by Fabien Kuntz.
Physical characteristics: The stones lack fusion crust and are dark green in color with visible black, vesicular patches.
Petrography: (A. Irving and S. Kuehner, *UWS*) Intersertal texture with some preferred orientation of elongate grains. Major minerals are zoned clinopyroxene and intermediate plagioclase (converted to maskelynite) with accessory ulvöspinel, ilmenite, merrillite, fayalite, pyrrhotite and silica polymorph. Dark glassy, vesicular shock pockets are present.
Geochemistry: High-Ca pyroxene (subcalcic augite, $Fs_{22.8\text{-}61.8}Wo_{31.1\text{-}20.2}$, FeO/MnO = 28-38, N = 6), low-Ca pyroxene (pigeonite, $Fs_{43.0\text{-}62.5}Wo_{14.6\text{-}15.1}$, FeO/MnO = 30-39, N = 3), maskelynite ($An_{46.3\text{-}53.1}Or_{3.7\text{-}1.2}$, N = 3). Hf and Nd isotopes (M. Righter and T. Lapen, *UHou*): analysis of a

subsample gave $\varepsilon^{176}Hf$ = -19.7 and $\varepsilon^{143}Nd$ = -10.0, indicating that this specimen has affinities to enriched shergottites (like Shergotty).
Classification: Martian (mafic shergottite, enriched).
Specimens: 15.84 g including one polished endcut at *UWB*; remaining material with *Kuntz* and an anonymous collector.

Tindouf 004 27.4558°N, 7.7325°W
Tindouf, Algeria
Find: 2013 Oct
Classification: Ordinary chondrite (LL6)
History: Found near "wilaya de Smara", south of Tindouf, Algeria, in October 2013 and subsequently purchased by Mohamed Ali.
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia consisting of closely packed, small, angular clasts, which are highly recrystallized with rare, relatively large partial chondrule remnants and mostly very fresh metal.
Geochemistry: Olivine ($Fa_{31.8-31.9}$, N = 3), orthopyroxene ($Fs_{24.9-25.9}Wo_{4.3-2.1}$, N = 3), clinopyroxene ($Fs_{10.6-11.4}Wo_{42.9-42.0}$, N = 2).
Classification: Ordinary chondrite (LL6 breccia).
Specimens: 22.1 g including one polished thin section at *UWB*; remainder with M. Mohamed Ali.

Watson 017 30°36’19.2"S, 131°33’21.1"E
South Australia, Australia
Find: 2015 Apr 12
Classification: Ordinary chondrite (H5)
History: Initial fragments found by R. Stokes on a claypan. Further fragments, followed by two main masses were found over a ~30 m2 area, by the *Monash* team.
Physical characteristics: Numerous <5 cm fragments were found, almost none showing fusion crust. Two main mass fragments were found next to each other, the largest being 532 g. It has extensive weathering cracks, with loose fragments in the final stages of flaking off. These two masses were covered in lichen and had 40% fusion crust.
Petrography: (A. Tait, *Monash*) Sample contains both Type I and Type II chondrules. Chondrule edges are poorly defined, although a few relict chondrules do exist with well-defined edges, they appear to be fragmented. Chondrule types observed are: BO, POP, RP, PO. The matrix is opaque and extensively recrystallized, no large (>50 μm) secondary feldspars were observed. FeNi metal and trolite exhibits moderate ~30% oxidation around the perimeter of the meteorite. The center of the meteorite shows higher oxidation (~80%) with some corrosion cavities, and extensive wreathing veins. Most olivinea show undulous extinction, approximately 5-10% of olivines show shock lamellae, no higher shock indicators are present.
Geochemistry: (A. Tait, A. Landendam, *Monash*) FEG-SEM analyses show that olivine and pyroxene compositions are uniform: olivine $Fa_{17.9-19.7}$, mean= $Fa_{18.0\pm0.9}$, n=14; Low-Ca pyroxene $Fs_{15.0-18.7}Wo_{1.1-1.9}$, mean= $Fs_{16.3\pm1.0}Wo_{1.3\pm0.3}$, n=13.
Classification: Ordinary Chondrite (H5, S3, W3)
Specimens: All fragments, main mass and a thin section at *Monash*.

Watson 018 30°35’34.7"S, 131°38’23.4"E

South Australia, Australia
Find: 2015 Apr 4
Classification: Ureilite
History: Single partly buried stone found by A Tomkins.
Physical characteristics: Unusual greenish brown fusion crust covers 65% of the sample; coarse 3 mm pyroxene grains can be seen through the fusion crust, defined by distinct cleavage. The broken surfaces reveal coarse elongated, square edged silicate grains exceeding 5 mm, presumably pyroxene crystals, amongst melted black material.
Petrography: (S. Alkemade) This sample contains preferentially oriented, elongate coarse crystals of olivine and pigeonite meeting at triple junctions, with graphite + diamond along grain boundaries. Orthopyroxene and augite were not observed. The crystal sizes range from 1-5 mm, with majority 4-5 mm. Reduction rims affect the margins of all olivine grains, and also occur along trangressive fractures within olivine, characterized by micron sized blebs of metal amongst low FeO olivine.
Geochemistry: (S. Alkemade) Microprobe analysis show: olivine $Fa_{20.4\text{-}20.5}$, mean = $Fa_{20.4\pm0.1}$, n = 4; pigeonite $Fs_{16.9\text{-}17.4}Wo_{8.6}$, mean = $Fs_{17.2}Wo_{8.6}$, n = 3.
Classification: Olivine-pigeonite ureilite
Specimens: 27.9 g at *Monash* including a thin section.

Xilin 44.111664°N, 115.066212°E
Nei Mongol, China
Find: 2015 Mar
Classification: Ordinary chondrite (H4)
History: One 41 kg stone and 6 small fragments were found by Mr. Miao Gui Jun in March 2015, partially buried in a grassland region of Inner Mongolia. All pieces have fusion crust and the smaller fragments seem to have been broken from the main mass.
Petrography: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules occur within a relatively coarse grained matrix containing abundant stained kamacite plus accessory sodic plagioclase, merrillite and troilite.
Geochemistry: Olivine ($Fa_{18.7\text{-}18.8}$, N = 3), orthopyroxene ($Fs_{15.5\text{-}16.2}Wo_{2.0\text{-}1.7}$, N = 3), clinopyroxene ($Fs_{5.4\text{-}6.9}Wo_{46.1\text{-}44.2}$, N = 2).
Classification: Ordinary chondrite (H4).
Specimens: 24.7 g including two polished thin sections at *UWB*; remaining material with the finder.

Yaratkulova 55°11’57"N, 60°25’53"E
Chelyabinskaya oblast’, Russia
Find: 3 May 2016
Classification: Ordinary chondrite (H5)
History: Meteorite was found on 3 May 2016 by Leonid B. Pudovkin and Sergei V. Kolisnichenko on pasture land (formerly plowed land), 3.5 km southwest of Yaratkulova (Argayash district, Chelyabinskaya oblast’). Seven fragments (190, 136, 33.4, 15.6, 16.0, 7.0 and 1.2 g) were found in the 5x6 m soil area at 3-12 cm depth. All fragments are easily integrated in single unit (399.2 g). The meteorite seems to have been broken on impact or during plowing of the land. The date of fall is unknown.

Physical characteristics: The meteorite has rounded to angular shape with apparent stream lines on one side. The surface of the meteorite is light to dark brown in color due to abundant Fe-hydroxides. The fusion crust occurs very locally. Parallel cracks (1-2 mm in thickness) are common on the larger meteorite fragments. Sometimes they are filled with Fe-hydroxides, rarely gypsum.
Petrography: Classification (V. V. Sharygin, *SIGM* and *UrFU*). Meteorite is a chondrite breccia, in which light to dark coarser-grained fragments (0.5-1.5 cm, 30 vol.%) are cemented by dark-brown shocked material (~70 vol.%). Troilite and metal are not abundant and most grains (>60%) are replaced by Fe-hydroxides (weathering grade – W3). The chondritic fragments show coarse- to medium-grained textures with local areas of recrystallized, fine-grained, granular texture. Chondrules (up to 1-1.5 mm) are still distinct, but occur rarely. This indicates a petrological type of 5 for the meteorite. It contains olivine, orthopyroxene, plagioclase (or maskelynite) and individual grains of troilite and metal. Clinopyroxene, chromite, chlorapatite and merrillite occur locally. Three sets of parallel, planar fractures, strong mosaicism, and planar deformation features in olivine and related orthopyroxene, rare polysynthetic twinning in pyroxene, and partial to complete maskelynization of plagioclase indicate a shock stage of S5. The shocked material contains small relics of initial chondrite and chondrules, areas with porphyritic texture (olivine + clinopyroxene-plagioclase skeletal aggregate), melt pockets with skeletal clinopyroxene, vesicles and dark impact melt, which occurs interstitially among the above lithological clasts.
Geochemistry: Mineral composition and Geochemistry: EDS-WDS analyses (C. V. Sharygin, *SIGM* and *UrFU*). The chondrite contains olivine $Fa_{20.3\pm1.3}$ (N=60), orthopyroxene $Fs_{18.9\pm1.2}Wo_{1.2\pm0.4}$ (N=51) and plagioclase $Ab_{83.8}An_{10.3}Or_{5.9.}$ Cr-bearing clinopyroxene $En_{46.9}Fs_{8.0}Wo_{45.1}$, chromite Crt81.6, chlorapatite, merrillite, troilite and Fe-Ni-metals (kamacite, taenite, tetrataenite) are also present. Micrometer-sized grains of an SiO_2 polymorph in Opx-Cpx-Pl chondrule and sarcopside-graftonite globule in a kamacite grain were also found. Secondary weathering products are goethite, “hydrogoethite” and Fe-hydrosulfide, rarely gypsum and Fe-Ni-sulfate.
Classification: (V.V. Sharygin, *SIGM* and *UrFU*). Ordinary chondrite. H5, S5, W3.
Specimens: 25.7 g type specimen (*UrFU*), 33.4 g sample + 18.2 g cut-off fragments (Central Siberian Geological Museum at *SIGM*), and other pieces are in private collections (Sergei V. Kolisnichenko, Igor V. Karlov).

Yucca 032 34°44.17’N, 114°13.05’W
Arizona, United States
Find: 20 Apr 2004
Classification: Ordinary chondrite (H3-5)
History: Found by Jerry A. Baird on April 20, 2004, one of several stones found by him at this location and lumped together as JAB 010.
Physical characteristics: Brownish and yellow-brown weathering patina occurs on rough exterior surfaces. Large fractures filled with a white precipitate are visible cutting across the hand specimen.
Petrography: In thin section, composed mostly of an intimate mixture of mineral and chondrule fragments with diverse (type 3-5) characteristics; one discrete type 3 chondritic clast is present. BSE imaging shows that most of the rock ("host") is composed of type 4-5, with plagioclase up to 50 μm across and equilibrated olivine, but that type 3 fragments including olivine zoned to

more magnesian and ferroan compositions and feldspathic glass also are present. Abundant chromite-plagioclase assemblages are present. Numerous subparallel hydroxide veins cut across the section, with ~70% of the metal and ~40% of opaques overall being replaced, consistent with a high W2 weathering grade. Calcite is present in small void spaces. Elongate metal and sulfide grains are roughly parallel to the weathering veins. Olivine grains are heavily fractured by weathering veins, and most show undulose extinction with irregular to planar fractures, consistent with shock stage S3. A small melt pocket containing metal/sulfide droplets was observed.
Geochemistry: (M. Hutson and A. Ruzicka, *Cascadia*) Host dominated by equilibrated olivine (median $Fa_{17.7}$, N=56) and low-Ca pyroxene (median $Fs_{15.1}$, N=39). Overall average for host including mixture of both equilibrated and more varied compositions is olivine ($Fa_{14.8\pm5.8}$, range $Fa_{0\text{-}23.4}$, N=56), low-Ca pyroxene ($Fs_{13.7\pm4.3}Wo_{1.2\pm1.1}En_{85.1\pm4.3}$, range $Fs_{3.2\text{-}19.5}$, N= 39). Discrete type 3 clast, olivine ($Fa_{13.3\pm8.8}$, N=146), low-Ca pyroxene ($Fs_{10.6\pm9.6}Wo_{1.5\pm3.8}En_{87.9\pm10.8}$, N=108).
Classification: H3-5 finely intermixed genomict breccia. H group implied by prevalent silicate compositions. Type 4-5 lithology implied by maximum feldspar grain size and equilibrated olivine and pyroxene; type 3 lithology implied by presence of feldspathic glass and zoned olivine grains as well as discrete type 3 chondrite clast.
Specimens: *Cascadia* holds 95.4 g in multiple pieces, in addition to two polished thin sections and a mounted butt.

Yucca 033 34°44.213 N, 114°13.722 W
Arizona, United States
Find: 2004 Apr
Classification: Ordinary chondrite (H3-6)
History: Jerry A. Baird purchased the meteorite from a finder, and later donated the entire stone to *Cascadia*.
Physical characteristics: Brownish weathering patina occurs on broken exterior surfaces. Weathered fusion crust covers one side. Three large (0.3 to 0.7 mm across) metal grains containing angular silicates are visible on a cut face, along with numerous much smaller metal grains.
Petrography: In thin section, the sample appears to be relatively integrated, with many chondrule fragments and only a few complete chondrules present; distinct clasts typical of a breccia are absent. The material between chondrule fragments is composed of individual grains and smaller fragments. BSE imaging shows that most of meteorite contains equilibrated silicates, but that there is a fairly large (~10-15 area %) admixture of type 3 material (both magnesian and iron-rich olivine and pyroxene grains). Most of the equilibrated material contains devitrified glass or medium-sized (up to 50 µm) plagioclase feldspar grains, although a few fragments contain coarse (>100 µm) plagioclase grains. Laths of a silica polymorph were observed, as well as two grains of low-Ca pyroxene with relatively high (4.1 – 4.4 wt% Al_2O_3) alumina content, similar to those reported for Buck Mountain Wash. Small chromite-plagioclase objects are present. Many fragments and metal and troilite grains show a rough alignment across the section. Opaques show minor weathering (~5-10% replacement by Fe-hydroxides). Shock effects in olivine are variable from sharp optical extinction to a recrystallized clast, but most olivine grains in the section show undulose extinction with one set of planar fractures, indicating a shock stage of S3. Shock melt with zoned olivine grains set in glass is present.

Geochemistry: (M. Hutson and A. Ruzicka, *Cascadia*) Dominated by equilibrated olivine (median $Fa_{18.9}$, N=164) and low-Ca pyroxene (median $Fs_{15.3}$, N=98). Overall average including mixture of both equilibrated and more varied compositions in different lithologies is olivine ($Fa_{18.2 \pm 4.9}$, range $Fa_{0.9\text{-}35.9}$, N=164), low-Ca pyroxene ($Fs_{13.0\pm6.2}Wo_{1.0\pm0.9}En_{86.0\pm 6.2}$, range $Fs_{0\text{-}24.7}$, N= 98).
Classification: H3-6 finely intermixed genomict breccia. Type 5-6 lithology implied by medium to coarse feldspar grain sizes and equilibrated olivine and pyroxene; type 3 lithology implied by common presence of magnesian and zoned olivine. Paired with Buck Mountain Wash on the basis of mineralogy, mineral chemistry, and texture.
Specimens: *Cascadia* holds 102.5 g in multiple pieces, in addition to two polished thin sections and a mounted butt.

Yucca 035 34°42.063'N, 114°11.259'W
Arizona, United States
Find: 2005 Oct 9
Classification: Ordinary chondrite (H3-6)
History: Dennis Asher found this stone on October 9, 2005, and later donated it to *Cascadia*.
Physical characteristics: All surfaces are covered with weathering products, consisting of patches of orange rust, tan clay and pink caliche. No remnant fusion crust is present.
Petrography: In thin section, composed mostly of an intimate mixture of mineral and chondrule fragments with diverse (type 3-6) characteristics; one discrete type 6 clast is also present. BSE imaging shows that most of the rock ("host") is composed of type 4-6 lithologies, with equilibrated olivine, and plagioclase varying from smaller (to 50 μm across) to rarely coarser (>100 μm) grains; the host also contains ~5-10% material characteristic of type 3 including zoned or more magnesian and ferroan olivine grains, feldspathic glass, and magnesian pyroxene. Discrete type 6 clast contains coarse feldspar (50-100 μm grains). Individual grains of a silica polymorph were observed, as well as three grains of low-Ca pyroxene with relatively high (3.4-4.7 wt% Al_2O_3) alumina content, similar to those reported for Buck Mountain Wash. A number of small chromite-plagioclase objects are present, as are grains of metallic copper. Many fragments and metal and troilite roughly align. Opaques show minor weathering (~5-10% replacement by Fe-hydroxides). Shock effects in olivine are variable across the section, with most grains having undulose extinction and one set of planar fractures, consistent with a shock stage of S3.
Geochemistry: (M. Hutson and A. Ruzicka, *Cascadia*) Host dominated by equilibrated olivine (median $Fa_{18.9}$, N=127), and low-Ca pyroxene (median $Fs_{15.3}$, N=86), but also containing more magnesian and ferroan olivine ($Fa_{2.1\text{-}51.2}$) and low-Ca pyroxene ($Fs_{5.7\text{-}30.8}$). Overall average host including mixture of both equilibrated and more varied compositions is olivine ($Fa_{19.6\pm5.8}$, N=127), low-Ca pyroxene ($Fs_{13.4\pm5.7}Wo_{1.3\pm1.3}En_{85.3\pm5.8}$, N= 86). Type 6 clast olivine ($Fa_{19.4\pm1.3}$, N=7) and low-Ca pyroxene ($Fs_{17.1\pm0.5}En_{81.2\pm1.0}Wo_{1.7\pm0.6}$, N=4).
Classification: H3-6 finely intermixed genomict breccia. Type 5-6 lithology implied by larger feldspar grain sizes and abundant equilibrated olivine and pyroxene as well as discrete type 6 chondrite clast; type 3 lithology implied by common presence of magnesian and zoned olivine and feldspathic glass. Paired with Buck Mountain Wash on the basis of mineralogy, mineral chemistry, and texture.
Specimens: *Cascadia* holds 35.9 g in multiple pieces, in addition to two polished thin sections and a mounted butt.

Yucca 036 34°42.845’N, 114°10.697’W
Arizona, United States
Find: 2006 Oct
Classification: Ordinary chondrite (L6)
History: Found by Dennis Asher in the "Buck Mountains 002 find area," and later donated to *Cascadia*.
Physical characteristics: Brownish weathering patina and remnant fusion crust patches occur on rough exterior surfaces.
Petrography: Well integrated chondritic texture visible optically and in BSE imaging. Plagioclase feldspar grains are >50 μm across, indicative of a type 6 chondrite. A large igneous-textured clast is visible along one edge of the section. Silicates in thin section are stained brown, with about 25% of the metal+sulfide weathered to form hydroxides, suggesting a W2 weathering grade. A shock stage of S3 is indicated by the prevalence of undulose extinction and planar fractures in olivine grains.
Geochemistry: (M. Hutson and A. Ruzicka, *Cascadia*) Olivine ($Fa_{26.1\pm0.7}$, N=16), low-Ca pyroxene ($Fs_{21.4\pm0.1}Wo_{1.8\pm0.1}En_{81.9\pm0.2}$, N= 12).
Classification: L6 based on mineral chemistry and texture.
Specimens: *Cascadia* holds 15.9 g in a single piece, in addition to two polished thin sections and a mounted butt.

Yucca 037 34°44.135’N, 114°13.992’W
Arizona, United States
Find: 2005 Oct 9
Classification: Ordinary chondrite (H3-6)
History: Found Dennis Asher, who donated the stone to *Cascadia*.
Physical characteristics: Dark brown weathering patina with incorporated beige sand grains covers all exterior surfaces. Weathered fusion crust is visible on two surfaces.
Petrography: In thin section, composed of an intimate mixture of mineral and chondrule fragments with diverse (type 3-6) characteristics. BSE imaging shows that most of the rock is composed of type 4-6 lithologies, with equilibrated olivine, and plagioclase grains commonly ? 50 μm across, but that ~5-10% of the section contains zoned or more magnesian or ferroan olivine and pyroxene characteristic of type 3. This resembles the fragmental (main) lithology of Buck Mountain Wash. Along one edge of the section, material with coarse feldspar and equilibrated olivine and pyroxene grades seamlessly (with no hint of a clast boundary) into a fragmental lithology with zoned olivine and magnesian olivine and pyroxene grains. Free copper was observed, along with several chromite-plagioclase intergrowths. Weathering grade is minimal (W1) with ~5-10% of the being replaced by hydroxide weathering product. Olivine shows undulose to slight mosaic extinction with planar fractures, indicative of shock stage of S3.
Geochemistry: (M. Hutson and A. Ruzicka, *Cascadia*) Dominated by equilibrated olivine (median $Fa_{18.5}$, N=63) and low-Ca pyroxene (median $Fs_{16.1}$, N=62), but also containing more magnesian and ferroan olivine ($Fa_{5.0\text{-}34.2}$) and pyroxene ($Fs_{3.8\text{-}19.2}$). Overall average including both equilibrated and more varied compositions in mixture is olivine ($Fa_{17.4\pm5.0}$, N=63), low-Ca pyroxene ($Fs_{15.0\pm3.8}Wo_{1.1\pm0.9}En_{83.9\pm4.0}$, N= 62).
Classification: H3-6 finely intermixed genomict breccia. Type 5-6 lithology implied by larger feldspar grain sizes and abundant equilibrated olivine and pyroxene; type 3 lithology implied by

common presence of magnesian and zoned olivine and pyroxene. Possibly paired with Buck Mountain Wash.
Specimens: *Cascadia* holds 64.9 g in multiple pieces, in addition to two polished thin sections and a mounted butt.

Yucca 038 34°42.845'N, 114°10.697'W
Arizona, United States
Find: 2006 Oct
Classification: Ordinary chondrite (H5)
History: Purchased by Dennis Asher from the finder, John Wolfe, and later donated to *Cascadia*.
Physical characteristics: A dark reddish-brown weathering patina covers all exterior surfaces. Weathered fusion crust covers two sides.
Petrography: Chondrules (mean diameter = 0.67±0.29 mm, N=17) and matrix are well integrated. Chondrule mesostases are crystalline with plagioclase feldspar grains commonly ~5 μm across; larger interchondrule feldspars are 20-40 μm across. The sample contains about 0.3% metal, 1.8% troilite, and 5.3% hydroxide (weathering product, often in veins) based on modes determined from reflected light images Most olivine grains show mild to moderate undulose extinction with irregular or planar fractures, consistent with shock stage S2.
Geochemistry: (M. Hutson and A. Ruzicka, *Cascadia*) Olivine ($Fa_{19.3\pm1.6}$, N=52), low-Ca pyroxene ($Fs_{17.0\pm1.1}Wo_{1.3\pm0.8}En_{81.6\pm1.1}$, N= 19). Variability could be caused in part by unavoidable analysis overlap with weathering products.
Classification: H5 chondrite based on mineral chemistry and texture, although chondrule size, magnetic susceptibility, and potential pre-weathering metal content are more consistent with an L chondrite. A high proportion of hydroxide suggests weathering grade W3.
Specimens: *Cascadia* holds 9.7 g in multiple pieces, in addition to one polished thin section.

Yucca 039 34°45.556'N, 114°14.206'W
Arizona, United States
Find: 28 Feb 2007
Classification: Ordinary chondrite (H3-6)
History: Dennis Asher found this stone on Feb. 28, 2007.
Physical characteristics: Cut surfaces show abundant metal with minor rust stains. Broken exterior surfaces show caliche. Fusion crust and a weathering rind cover unbroken surfaces.
Petrography: In thin section composed of an intimate mixture of mineral and chondrule fragments with diverse (type 3-6) characteristics. BSE imaging shows that most of the rock is composed of type 4-6 lithologies, with equilibrated olivine, and plagioclase grains up to 50 μm and sometimes >50 μm across, but that 10% of the section contains zoned or more magnesian or ferroan olivine and pyroxene characteristic of type 3. This resembles the fragmental (main) lithology of Buck Mountain Wash. Silica polymorph, chromite-plagioclase objects, and metallic copper was observed. Six grains of pyroxene (low- and high-Ca) contain relatively high (4.8-11.9 wt% Al_2O_3) alumina content, similar to those reported for Buck Mountain Wash. Opaques show minor weathering (~5% replacement by Fe-hydroxides). Shock effects in olivine are variable across the section, with most grains having mosaic extinction and one or more sets of planar fractures, consistent with a shock stage of S4.
Geochemistry: (M. Hutson and A. Ruzicka, *Cascadia*) Dominated by equilibrated olivine (median $Fa_{18.7}$, N=207) and low-Ca pyroxene (median $Fs_{13.0}$, N=162), but also containing more

magnesian and ferroan olivine ($Fa_{5.4\text{-}37.2}$) and pyroxene ($Fs_{0.0\text{-}37.3}$). Overall average including both equilibrated and more varied compositions in the mixture is olivine ($Fa_{19.0\pm5.4}$, N=207), low-Ca pyroxene ($Fs_{12.0\pm6.1}Wo_{1.2\pm1.1}En_{86.9\pm6.4}$, N= 162).
Classification: H3-6 finely intermixed genomict breccia. Type 5-6 lithology implied by larger feldspar grain sizes and equilibrated olivine and pyroxene; type 3 lithology implied by common presence of magnesian and zoned olivine and pyroxene. Paired with Buck Mountain Wash on the basis of mineralogy, mineral chemistry, and texture.
Specimens: *Cascadia* holds 23.2 g in one piece, in addition to two polished thin sections and a mounted butt.

Yucca 041 34°42.05'N, 114°17.3'W
Arizona, United States
Find: 2005 Sep
Classification: Ordinary chondrite (H3-6)
History: Found by Dennis Asher. Jerry A. Baird donated the entire stone to *Cascadia*.
Physical characteristics: Most of sample has a broken surface covered with weathering patina and dust. Fusion crust occurs on one small area.
Petrography: In thin section composed mostly of an intimate mixture of mineral and chondrule fragments with diverse (type 3-6) characteristics. BSE imaging shows that most of the rock is composed of type 4-6 lithologies, with equilibrated olivine, and plagioclase up to 50 μm and sometimes >100 μm across, but that some zoned or magnesian or ferroan olivine and pyroxene grains characteristic of type 3 are present. This resembles the fragmental (main) lithology of Buck Mountain Wash. Shock effects in olivine are variable (weak undulose extinction to strong mosaicism), with ?25% of the olivine grains showing mosaic extinction with multiple sets of planar fractures indicating a shock stage of S4. Metal and sulfide grains show minor weathering (~5% replacement by Fe-hydroxides). Contains a band of shock melt with zoned olivine crystals set in glass, and silica polymorph.
Geochemistry: (M. Hutson and A. Ruzicka, *Cascadia*) Dominated by equilibrated olivine (median $Fa_{18.5}$, N=127) and low-Ca pyroxene (median $Fs_{12.1}$, N=129), but also containing more magnesian and ferroan olivine ($Fa_{6.5\text{-}30.3}$) and low-Ca pyroxene ($Fs_{0.9\text{-}37.8}$). Overall average including both equilibrated and more varied compositions in the mixture is olivine ($Fa_{16.7\pm6.5}$, N=127), low-Ca pyroxene ($Fs_{11.3\pm7.8}Wo_{1.2\pm1.3}En_{87.6\pm8.4}$, N= 129).
Classification: H3-6 finely intermixed genomict breccia. Type 5-6 lithology implied by larger feldspar grain sizes and equilibrated olivine and pyroxene; type 3 lithology implied by common presence of magnesian and zoned olivine and pyroxene. Paired with Buck Mountain Wash on the basis of mineralogy, mineral chemistry, and texture.
Specimens: *Cascadia* holds 41.4 g in single piece, in addition to two polished thin sections and a mounted butt.

Yucca 042 34°44.055'N, 114°12.397'W
Arizona, United States
Find: 10 Mar 2004
Classification: Ordinary chondrite (H3-6)
Petrography: In thin section, the sample appears to be relatively integrated, grading from material with a texture resembling a type 5 chondrite comprised primarily of chondrule fragments to material resembling a type 4 chondrite comprised of well-defined chondrules

amidst chondrule fragments. Smaller chondrule and mineral fragments occur between chondrules and larger chondrule fragments; lithic clasts are absent. BSE imaging shows that most of the meteorite contains equilibrated silicate, but that there is a substantial (~10 area %) admixture of type 3 material (both magnesian and iron-rich zoned olivine and pyroxene grains). Most of the equilibrated material contains devitrified glass or small (< 50 μm) plagioclase feldspar grains; coarse (>50 μm) plagioclase is also present. Chlorapatite, merrillite, chromite-plagioclase objects, and metallic copper were observed.
Geochemistry: (M. Hutson and A. Ruzicka, *Cascadia*) Representative analyses for fragments and chondrules (both equilibrated and unequilibrated grains): olivine ($Fa_{18.9\pm5.4}$, N=104), low-Ca pyroxene ($Fs_{16.2\pm3.6}Wo_{1.3\pm0.8}$, N= 66), plagioclase feldspar ($Ab_{79.7\pm2.2}Or_{5.8\pm2.7}$, N=17).
Classification: Sample represents an intimate mixture of fragmental material. Type 3 is inferred from presence of zoned magnesian and ferroan olivine grains; type 6 from coarse (>50 μm) plagioclase feldspar grains. Sample is classified as an H3-6 genomict breccia. May be paired with Buck Mountain Wash (Yucca 002).
Specimens: *Cascadia* holds 28.6 g in multiple pieces, in addition to one polished thin section and a mounted butt.

Yucca 043 34°46.043’N, 114°13.350’W
Arizona, United States
Find: 2 March 2004
Classification: Ordinary chondrite (H3-6)
History: Sample was found as 7 nearby pieces that were glued together by finder to form a single stone, but which fell apart during cutting.
Petrography: In thin section, the sample appears to be relatively integrated, with a texture resembling a type 5 chondrite comprised primarily of chondrule fragments. Smaller chondrule and mineral fragments occur between the larger fragments. With the exception of a large (~1.5 mm across) angular feldspathic cryptocrystalline clast, lithic clasts are absent. BSE imaging shows that most of the meteorite contains equilibrated silicate, but that there is a substantial (~10 area %) admixture of type 3 material (both magnesian and iron-rich zoned olivine and pyroxene grains). Most of the equilibrated material contains devitrified glass or small (< 50 μm) plagioclase feldspar grains; coarse (>50 μm) plagioclase is also present. A particularly large (90 × 475 μm) plagioclase feldspar grain was observed adjacent to the cryptocrystalline pocket. Clinoenstatite, silica polymorph, chlor-apatite, merrillite, chromite-plagioclase objects, metallic copper, and an Fe-Ni carbide phase were observed. Notable is one roughly rectangular (100 × 250 μm) chromite-plagioclase intergrowth surrounded by successive bands of chromite, plagioclase feldspar, high-calcium pyroxene, and phosphate. Additionally, one high-Ca pyroxene grain has elevated alumina, similar to aluminous pyroxene grains reported for Buck Mountain Wash.
Geochemistry: (M. Hutson and A. Ruzicka, *Cascadia*) Representative analyses for fragments and chondrule (includes both equilibrated and unequilibrated grains): olivine ($Fa_{18.9\pm4.0}$, N=112), low-Ca pyroxene ($Fs_{17.0\pm4.5}Wo_{1.3\pm0.7}$, N= 98).
Classification: Meteorite represents an intimate mixture of fragmental material. Type 3 is inferred from presence of zoned magnesian and ferroan olivine grains; type 6 from coarse (>50 μm) plagioclase feldspar grains. It is classified as an H3-6 genomict breccia. Paired with Buck Mountain Wash (Yucca 002).

Specimens: *Cascadia* holds 65.8 g in multiple pieces, in addition to one polished thin section and a mounted butt.

Yucca 044 34°43.637'N, 114°14.738'W
Arizona, United States
Find: 14 Feb 2011
Classification: Ordinary chondrite (H4)
History: Two stone pieces that fit together totaling ~3.2 kg were found by Teri Lynn Johnson on Feb 14, 2011. On the same date and nearby, Scott Johnson found an additional 26 g stone that fit between the two larger pieces.
Petrography: Sample is composed of numerous well-defined chondrules and chondrule fragments set in a fine-grained matrix. Feldspathic material consists of a mix of devitrified glass and small (mainly <20 μm across) plagioclase feldspar grains. Numerous chromite-plagioclase assemblages and grains of native copper are present.
Geochemistry: Olivine ($Fa_{19.9\pm1.0}$, N=46); orthopyroxene ($Fs_{17.0\pm1.4}Wo_{1.5\pm0.7}$, N=21)
Classification: Ordinary chondrite (H4)
Specimens: *Cascadia* holds 51.5 g in multiple pieces, in addition to one polished thin section and a mounted butt

2. New Dense Collection Areas (DCA):
Algeria: Tindouf, Kereb es Sefiat.
China: Eboliang, Bayin Gobi.
Egypt: Thamaniyat Ajras.
Iran: Abarkouh, Gandom Beryan, Ravar, Yazd.
Mauriania: Bir Moghrein, Dayet el Aam, Galb Inal, Nouakschott.
Morocco: Hassi Bou Talha, Mdaouer, Oued Chebeika.
Western Sahara / Morocco: La'gad, Nagjir.

3. Listing of institutes and collections
An up-to-date index of collections and approved repositories (next to a green check mark) cited in the Meteorite Bulletin can be found here:
https://www.lpi.usra.edu/meteor/MetBullAddresses.php?grp=country

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Acknowledgments

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