UTAH GEOLOGICAL SURVEY
a division of the
UTAH DEPARTMENT OF NATURAL RESOURCES
in cooperation with the
NATIONAL PARKS SERVICE

Plate 1
Utah Geological Survey Open-File Report 396
Interim Geologic Map of the Temple of Sinawava Quadrangle

1:24,000

1 0.5 0 1 Miles

Interim Geologic Map of the Temple of Sinawava Quadrangle, Washington and Kane Counties, Utah

by
Hellmut H. Doelling,
Utah Geological Survey

Interim Geologic Map of the Temple of Sinawava Quadrangle, Washington County, Utah

by
Hellmut H. Doelling

OPEN-FILE REPORT 396 **July 2002**
UTAH GEOLOGICAL SURVEY
a division of
UTAH DEPARTMENT OF NATURAL RESOURCES
in cooperation with
National Park Service
Division of Geologic Resources

Interim Geologic Map of the Temple of Sinawava Quadrangle, Washington County, Utah

by

Hellmut H. Doelling

Utah Geological Survey

2002

Utah Geological Survey
a division of
Utah Department of Natural Resources
in cooperation with
National Park Service
Division of Geologic Resources

Digital and GIS cartography by:
Kent D. Brown

Utah Geological Survey
Open-File Report 396

The views and conclusions contained in this document are those of the authors, and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

This open-file release makes information available to the public during the lengthy review and production period necessary for a formal UGS publication. It is in the review process and may not conform to UGS standards, therefore it may be premature for an individual or group to take actions based on its contents.

6/24/02

Temple of Sinawava Quadrangle
Description of Map Units

QUATERNARY

Alluvial Deposits

Qal1, Qat2

Low-level alluvial deposits of the Virgin River (upper Holocene) – Moderately to well-sorted gravel, sand, silt, and clay in lenses and thin layers deposited by fluvial processes in larger, well-graded river valleys; generally reddish brown to pale brown; clasts are subrounded to well-rounded, mostly exotic (derived from sources many miles upstream) with some locally derived (from within quadrangle area), and are mostly quartzite, basalt, limestone, chert, and sandstone; most clasts are pebble to boulder sized; a few locally derived clasts are more than 3 feet (1 m) in diameter; differs from alluvial deposits in small side canyons in that clasts are significantly better sorted and a large percentage are exotic; Qal1 deposits form river channels and terraces up to about 10 feet (3 m) above modern channel; Qat2 deposits form low terraces up to 25 feet (0-8 m) above the modern river level; 0 to 30 feet (0-9 m) thick.

Qat3

High-level alluvial terrace deposits (middle Holocene to upper Pleistocene) – Moderately to well sorted, pale-gray to pale-brownish-gray cobble gravel with sand, silt, and clay in lenses and matrix; clasts are mostly exotic and consist of quartzite, basalt, sandstone, limestone, and chert; form terrace remnants that cap hills and bluffs along the Virgin River; show moderate soil development; locally partially mantled by windblown sand, colluvium, and talus; as mapped, locally includes a thin apron of colluvium that sloughed downslope from the terraces; between 30 and 90 feet (9-27m) above the active channel; 0 to 20 feet (0-6 m) thick.

The age of river-terrace and other deposits that are graded to the Virgin River can be estimated using calculated long-term incision rates, combined with amount of soil development and lithification. Present height of remnants of well-dated basaltic lava that flowed into the ancestral river channel downstream near the town of Virgin indicates about 1,300 feet (400 m) of incision in the last one million years, or 1.3 feet (0.4 m) per thousand years. Using this rate, Qat3 deposits are calculated between about 20,000 and 70,000 years old; however, these calculations do not take into account fluctuations in incision rates during this time, which could shift these age estimated significantly; in addition, low-level deposits show incision of 25 feet (8 m) or more in just the last few hundred years, though this type of variation probably reflects short-term cyclicity more than long-term incision rates; thus, Qat3 deposits, which would be most affected by short-term cyclicity, may be as young as middle Holocene.

Qa1 **Level 1 alluvial stream deposits (upper Holocene) –** Stratified, fine- to coarse-grained, pale-orange to yellowish-brown sand with varying amounts of clay, silt, and poorly to moderately sorted, subangular to subrounded pebble to small boulder gravel with sandstone, limestone, and basalt clasts; mapped along larger tributaries of the Virgin River; up to about 10 feet (3 m) above the active channel; differs from Qal1 and Qat2 deposits in that is less well sorted and does not include exotic clasts; generally less than 10 feet (3 m) thick.

Qa2 **Level 2 alluvial stream deposits (Holocene) –** Same as Qa1deposits except forms incised terraces 10 to 30 feet (3-9 m) above the active channel and locally covered by windblown silt and fine-grained sand; as much as 20 feet (6 m) thick.

Mixed Alluvial, Colluvial, and Eolian Deposits

Qafc **Young alluvial-fan and colluvial deposits (Holocene to upper Pleistocene) –** Reddish-brown, poorly stratified, poorly sorted, coarse- to fine-grained sand and pebble to cobble gravel with silt and scattered boulders; clasts are angular to subangular and locally derived; deposited by debris flows and sheet wash at decrease in slopes and at mouths of small ephemeral channels that flow into Zion Canyon and major tributaries; mostly graded to and partially mantle Qat2 and Qat3 alluvial deposits, and commonly includes small secondary fan (not mapped separately) inset into main deposit that is graded to the active or modern channel; commonly interfingers with and covers alluvial stream deposits; in many areas debris flows have been deposited on these surfaces in historical times, sometimes causing considerable damage to buildings and roads; 0 to 30 feet (0-9 m) thick.

Qac **Mixed alluvium and colluvium (Holocene to upper Pleistocene) –** Poorly to moderately sorted, poorly stratified sand, silt, and clay with scattered subangular to angular boulders, cobbles, and pebbles; brown to gray; deposited in minor drainages and topographic depressions primarily by ephemeral streams, slope wash, and creep processes; includes mix of alluvial materials carried down drainages and colluvial materials derived from adjacent slopes; may be dissected up to about 20 feet (6 m) by modern ephemeral stream channels; less than 30 feet (9 m) thick.

Qaco **Older mixed alluvium and colluvium (lower Holocene to upper Pleistocene) –** Similar to mixed alluvium and colluvium (Qac) described above, but deeply dissected by ephemeral stream channels.

Qaes **Mixed alluvial and eolian sand deposits (Holocene to upper Pleistocene) –** Primarily pale-yellowish- to pale-reddish-gray, well-sorted sand deposited or reworked by ephemeral streams, with minor intermixed alluvial sand and pebble gravel deposits, rock-fall debris, and colluvium; deposited in stream channels and deep slot canyons cut into Navajo Sandstone; deposits in slot canyons commonly include windblown and talus sand; 0 to 20 feet (0-6 m) thick.

Qces **Colluvial and eolian sand (Holocene to Pleistocene) –** Moderately well-sorted sand with varying amounts of angular blocks of sandstone deposited on moderate slopes and in deep slot canyons; commonly includes eolian sand; generally present in areas with weathered Navajo Sandstone; 0 to 20 feet (0-6 m) thick.

Eolian and Residual Deposits

Qer **Mixed eolian and residual deposits (Holocene to upper Pleistocene) –** Pale-reddish-orange, windblown, well-sorted, mostly fine-grained sand with scattered to common angular to subrounded, residual sandstone blocks derived from the Navajo Sandstone; locally includes minor alluvial sand; occurs as sheets, mounds, and poorly formed dunes in shallow topographic depressions and on gently sloping surfaces mostly on Navajo Sandstone; 0 to 20 feet (0-6 m) thick.

Qre **Mixed fine-grained residual and eolian deposits (Holocene to upper Pleistocene) –** Reddish-brown to pale-yellowish-gray, residual silt, clay, and fine sand with scattered subangular gravel deposited on flat surfaces eroded mostly on lower part of Co-op Creek Limestone Member of the Carmel Formation; partly reworked by eolian processes; 0- to 10-foot-thick (0-3m).

Colluvial, Mass-Movement, and Related Deposits

Qc **Colluvium (Holocene to upper Pleistocene) –** Poorly sorted, nonstratified sand and silt with subangular to angular, mostly sandstone blocks; color and clast composition vary with parent material; deposited primarily by creep and slope wash on moderate slopes; locally includes talus and alluvial deposits; generally less than 20 feet (6 m) thick.

Qmt **Talus (Holocene to upper Pleistocene) –** Primarily very poorly sorted, coarse, angular blocks on steep slopes; fine-grained interstitial component varies from abundant to absent; composed of blocks derived from immediately upslope ledges and cliffs; locally contains small landslide and slump masses and boulders with diameters exceeding 30 feet (9 m); mantles steep slopes beneath cliffs and ledges; locally includes undifferentiated colluvium and landslide deposits; commonly grades downslope into, and locally includes, colluvial and alluvial deposits; generally 15 feet thick (4.5 m) or less, locally exceeds 30 feet (9 m) thick.

Qmts **Talus sand (Holocene to upper Pleistocene) –** Cone-shaped deposits of sand commonly mantling talus, colluvium, and other slope-forming units; locally contains small landslide and slump masses and rock-fall blocks and boulders with diameters exceeding 30 feet (9 m); sand was mostly derived from eroding bare sandstone exposed upslope; locally concentrated by wind; up to 20 feet (6 m) thick.

Qmsy **Younger undifferentiated mass-movement slide and slump deposits (Holocene to upper Pleistocene) –** Masses of rock and unconsolidated material that have undergone translational and/or rotational downslope movement; bedrock strata within the blocks are commonly tilted and shattered; individual blocks may be as much as several hundred feet long; slip surfaces commonly develop in the clays of the Carmel and Cedar Mountain Formations; locally includes deposits with historical movement; probably formed mostly during wet climatic regimes in the Pleistocene, but continue to move near springs and other wet areas, and where undercut or oversteepened by stream erosion or human activity; vary greatly in thickness, but most are probably less than 50 feet (15 m) thick.

Qmso **Older undifferentiated mass-movement slide and slump deposits (lower Holocene to middle Pleistocene) –** Similar to Qmsy deposits but forms isolated mounds and erosional remnants of once larger landslide masses; locally may be more than 30 feet (9 m) thick.

Lacustrine and Basin-Fill Deposits

Qls **Lacustrine and basin-fill deposits of Sentinel Landslide (Holocene) –** Well-sorted, pale-gray, pale-yellowish-brown, to pale-reddish-brown, thin-bedded to laminated, planar-bedded clay, silt, sand, and marl; locally with soft-sediment slump features; form remnants draped across older alluvial, mass-movement, and bedrock deposits; locally as much as 150 feet (45 m) thick; deposits are mapped near canyon floor in Emerald Pools area; organic debris from clayey lake deposits from drill hole just south of the quadrangle (NE1/4NE1/4SE1/4 section 10, T. 41 S., R. 10 W.) yielded ^{14}C ages of 7,150"810 and 6,800"580 yr B.P. (Doelling and others, 2002); sample from near top of deposits near Birch Creek yielded age of 3,600"400 yr B.P. (Hamilton, 1984); lake was created by massive wall of Navajo Sandstone that collapsed, plugging Zion Canyon, and forming a dam that apparently lasted up to a few thousand years; even today the Virgin River has not fully incised the dam deposits as the drill hole penetrated about 30 feet (9 m) of lake deposits below the level of the river.

CRETACEOUS

Kd **Dakota Formation –** Interbedded, slope-forming claystone, siltstone, shale, and ledge-forming sandstone; claystone is gray to brown, locally smectitic; siltstone is dark brown to black, typically with abundant organic debris; shale is gray to dark gray, locally bentonitic or carbonaceous; sandstone is light brown to gray, resistant, locally trough cross-bedded; coal occurs within two laterally persistent zones at the top and base of the unit, respectively; unit is poorly exposed and involved in widespread landsliding; only basal few tens of feet preserved capping one hill in southeast part of quadrangle.

Cedar Mountain Formation

Kcm **Upper member –** Gray to variegated mudstone; mudstone is smectitic and locally contains white carbonate nodules; overlies basal conglomeratic member; 80 to 120 feet (24-36 m) thick.

Kcmc **Conglomerate member –** Typically cliff-forming pebble conglomerate to conglomeratic sandstone with well-rounded clasts of quartzite, chert, and limestone, as well as petrified wood; locally has silicified logs and uranium mineralization; 15 to 30 feet (5-10 m) thick.

JURASSIC

Carmel Formation

Jcw **Winsor Member –** Slope-forming, mostly reddish-brown, fine-grained sandstone, siltstone, and minor shale; upper part of member is pale-yellow, friable, fine-grained silty sandstone; thickness 180 to 280 feet (55-85 m).

Jcp **Paria River Member –** Slope-forming, light-gray to yellowish-gray, thin-bedded, platy limestone underlain by shaly limestone and sandstone, in turn underlain by cliff-forming, white alabaster gypsum bed; thickness 60 to 100 feet (18-30 m).

Jcx **Crystal Creek Member –** Slope-forming, thin to medium-bedded, "banded" reddish-brown and light-gray, fine-grained sandstone and siltstone; local gypsum in veinlets and thin beds; thickness 160 to 220 feet (49-67 m).

Co-op Creek Limestone Member – Interbedded light-bluish-gray to yellowish-gray, resistant, very thin- to medium-bedded, blocky weathering limestone and slope-forming calcareous shale; overall, forms steep ledgy slopes or a bench on top of the Temple Cap Formation; limestone is mostly micritic, but some beds are oolitic and sandy; has minor thin-bedded dolomite and sandstone; has locally abundant fossils, including pelecypods, gastropods, and crinoid columnals; *Pentacrinus asteriscus,* a Middle Jurassic crinoid, is common in some of the limestone beds; deposited in a marine (shallow sea) environment; uppermost part not preserved in quadrangle; complete member is 250 to 280 feet (76-85 m) thick.

Jccu **Upper unit –** Thin- to medium-bedded, pale-yellowish-gray-weathering, micritic limestone; forms sparsely vegetated slopes and cliffs; about 100 to 110 feet (30-33 m) thick.

Jccl **Lower unit –** Mostly thinly laminated to thin-bedded, pale-yellowish-gray weathering, calcareous shale and platy limestone; local rip-up clast conglomerate at the base; forms steep, vegetated to partially barren slopes; contact with upper unit gradational and corresponds to a subtle break in slope and vegetation patterns; 150 to 170 feet (46-52 m) thick.

J-2 unconformity

Temple Cap Formation

Jtw **White Throne Member –** Very light-gray to pale-orange, cliff-forming sandstone resembling the white Navajo Sandstone; consists of fine-grained, well-sorted, cross-bedded sandstone; has high-angle tabular-planar or wedge-planar cross-beds in sets as much as 20 feet (6 m) thick; deposited in an eolian environment; thickness varies due to unconformity at top; upper contact is sharp and marked by a reddish zone at the base of the Co-op Creek Limestone Member of the Carmel Formation; 60 to 165 feet (18-50 m) thick; thins westward.

Jts **Sinawava Member –** Interbedded, fine-grained sandstone, silty sandstone, and mudstone; generally forms prominent reddish-brown to dark-red vegetated bench or ledgy slope; locally forms recessed cliff between the White Throne Member and the white Navajo Sandstone; red color locally streaks the white Navajo cliffs below; interfingers with the White Throne Member at the top; deposited in coastal sabkha and tidal-flat environments; 80 to 140 feet (24-42 m) thick; thins eastward.

J-1 unconformity

Jn **Navajo Sandstone –** (undivided on cross section only) Massive, cliff-forming, cross-bedded, locally highly jointed sandstone; forms spectacular sheer cliffs, deep canyons, and impressive spires, promontories, and monoliths; consists mostly of well-sorted, fine- to medium-grained, quartzose sandstone; bedding consists of high-angle, large-scale cross-bedding in tabular-planar, wedge-planar, or trough-shaped sets 10 to 45 feet or more (3-14+ m) thick; ironstone bands and concretions locally common (white friable sandstone contains about 0.1% Fe_2O_3; densest ironstone samples contain up to 21% Fe_2O_3 [Doelling and others, 2002); deposited in a vast eolian coastal to inland erg (dune field) environment with prevailing winds principally from the north; lower 200 to 400 feet (60-120 m) consists of a transitional interval with planar bedding, evaporite mineral casts, crinkly or wavy bedding, load structures (typically a few inches in amplitude), and bioturbation indicative of a coastal sabkha environment; upper contact is an unconformity that makes a sharp break below the slope of the red Sinawava Member; surface of unconformity is imperceptibly broadly rolling, but across the quadrangle results in a nearly imperceptible thickness difference of the Navajo of a few hundred feet; divided into three generalized non-stratigraphic units based on color and weathering habit; 1,800 to 2,200 feet (550-670 m) thick.

Jnw **White Navajo –** Upper part of Navajo Sandstone; very light gray or white because of alteration, remobilization, and bleaching of limonitic and hematitic (iron-bearing) cement; generally forms a massive vertical to rounded cliff; forms upper 400 to 800 feet (120-240 m) of the formation.

Jnp **Pink Navajo –** Middle part of Navajo Sandstone; generally less resistant than the white Navajo above and brown Navajo below; forms benches, steep slopes, and cliffs; pale-reddish-brown color is more uniform than in units above and below due to more uniformly dispersed hematitic (iron-bearing) cement; locally contains dark green cement (possibly celadonite - an iron-bearing micaceous mineral), and ironstone bands, concretions, and cement; 400 to 1,000 feet (120-300 m) thick.

Jnb **Brown Navajo –** Lower part of the Navajo Sandstone; upper contact is at the top of a dark-brown, irregular and undulating band overlain by a broad light-colored band; generally forms a massive vertical cliff; roughly correlative with the lower transitional beds of the Navajo; 400 to 600 feet (120-180 m) thick.

Jk **Kayenta Formation (entire formation in areas where Lamb Point Tongue of Navajo Sandstone not mapped, and in cross section; lower part (main body) in areas where Lamb Point and Tenney Canyon Tongues are mapped separately) –** Moderate to dark reddish-brown siltstone and sandstone similar to that described for the Tenney Canyon Tongue; contains 20 to 30 percent sandstone ledges in the Zion National Park area; forms steep ledgy slope; upper contact gradational over a few feet but placed at top of steep slope- or ledgy cliff-forming, thin- to medium-bedded sandstone with siltstone partings, and at base of laterally continuous, thick- to massive-bedded, cliff-forming sandstone; deposited in an area of little relief near a terrestrial-marine transition zone alternating between mudflats and fluvial environments; locally has thin to medium ledgy sandstone beds; entire formation is between 550 and 700 feet (170-210 m) thick; lower part below the Lamb Point Tongue is about 290 to 400 feet (88-120 m) thick.

Jkt **Tenney Canyon Tongue of Kayenta Formation –** Upper part of Kayenta Formation in areas where Lamp Point Tongue is present; lenticular beds of pale-reddish-brown to moderate reddish-orange siltstone and very fine-grained sandstone; minor claystone and limestone; forms a steep slope; 140 to 315 feet (43-96 m) thick where separated from the main body.

Jnl **Lamb Point Tongue of Navajo Sandstone –** Mostly reddish-brown, fine to very fine-grained, well-sorted, quartzose sandstone; prominently jointed; forms a vertical ledge in the upper one-third of the Kayenta Formation; strongly cross-bedded; contains scattered thin lenses of flat-bedded, pale-reddish-brown siltstone and claystone similar to Kayenta Formation beds; upper contact placed at top of thick, laterally consistent ledge interval; locally contains a 1-foot-thick (30 cm) bed of limestone near the top; deposited in an eolian erg and sabkha environment; thins and pinches out to west in the quadrangle; 0 to 120 feet (0-37 m) thick.

Jm **Moenave Formation, undivided –** Shown on cross section only; about 400 feet (120 m) thick.

J-0 unconformity

TRIASSIC

TRc **Chinle Formation, undivided –** Shown on cross section only; about 500 feet (150 m) thick.

TR-3 unconformity

TRm **Moenkopi Formation, undivided –** Shown on cross section only; about 1,700 feet (520 m) thick.

Unconformity

PERMIAN

P **Permian formations, undivided–** Shown on cross section only.

REFERENCES

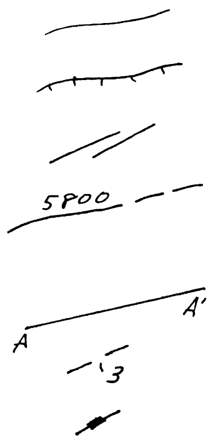
Doelling, H.H., Willis, G.C., Solomon, B.J., Sable, E.G., Hamilton, W.L., and Naylor, L.P., 2002, Interim geologic map of the Springdale East quadrangle, Washington County, Utah: Utah Geological Survey Open-File Report 393, 1:24,000.

Hamilton, W.L., 1995, The Sculpturing of Zion: Zion Natural History Association, 132 p.

Caption for plate 2 index map:

Zion National Park area. Available 1:24,000 scale, 7.5' quadrangle geologic maps are: Open-file report (black and white) geologic maps: Kolob Arch quadrangle - Biek, 2002, Utah Geological Survey Open-File Report 386; Kolob Reservoir quadrangle - Biek, 2002, Utah Geological Survey Open-File Report 387; Cogswell Point quadrangle, Biek and Hylland, 2002, Utah Geological Survey Open-File Report 388; The Guardian Angels quadrangle - Willis and Hylland, 2002, Utah Geological Survey Open-File Report 395; Temple of Sinawava quadrangle - Doelling, 2002, Utah Geological Survey Open-File Report 396; Clear Creek Mountain quadrangle, Hylland, 2001, Utah Geological Survey Open-File Report 371; Springdale West quadrangle - Willis and others, 2002, Utah Geological Survey Open-File Report 394; Springdale East quadrangle - Doelling and others, 2002, Utah Geological Survey Open-File Report 393. Published (color) geologic maps: The Barracks quadrangle - Sable and Doelling, 1993, Utah Geological Survey Map 147; Smithsonian Butte quadrangle - Moore and Sable, 2001, Utah Geological Survey Miscellaneous Publication 01-1; Hildale quadrangle - Sable, 1995, Utah Geological Survey Map 167.

Explanation of Map Symbols
Temple of Sinawava Quadrangle



Contact

Landslide or slump scarp

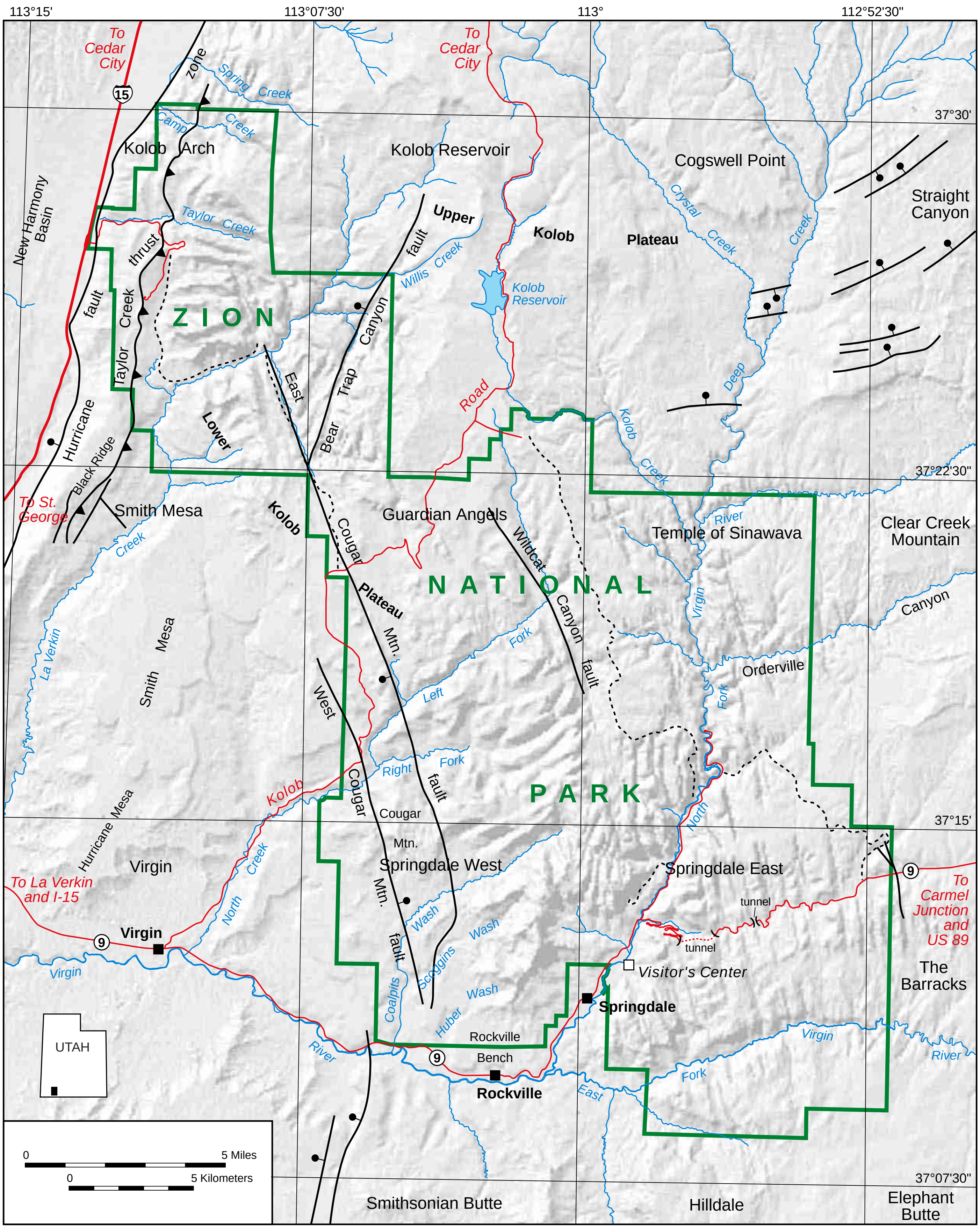
Major joint - near vertical, only small percentage mapped individually

Structural contour - drawn on top of Navajo Sandstone; dashed where projected above ground surface; contour interval 100 feet (30 m)

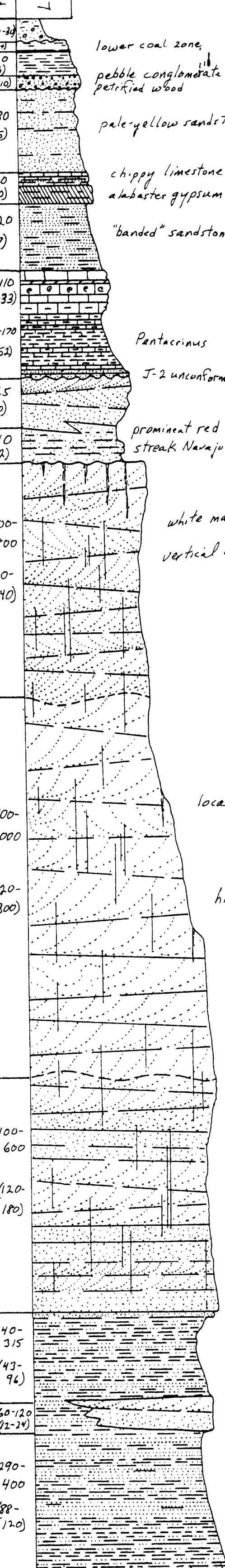
Cross section line

Strike and dip of bedding - measured photogrammetrically

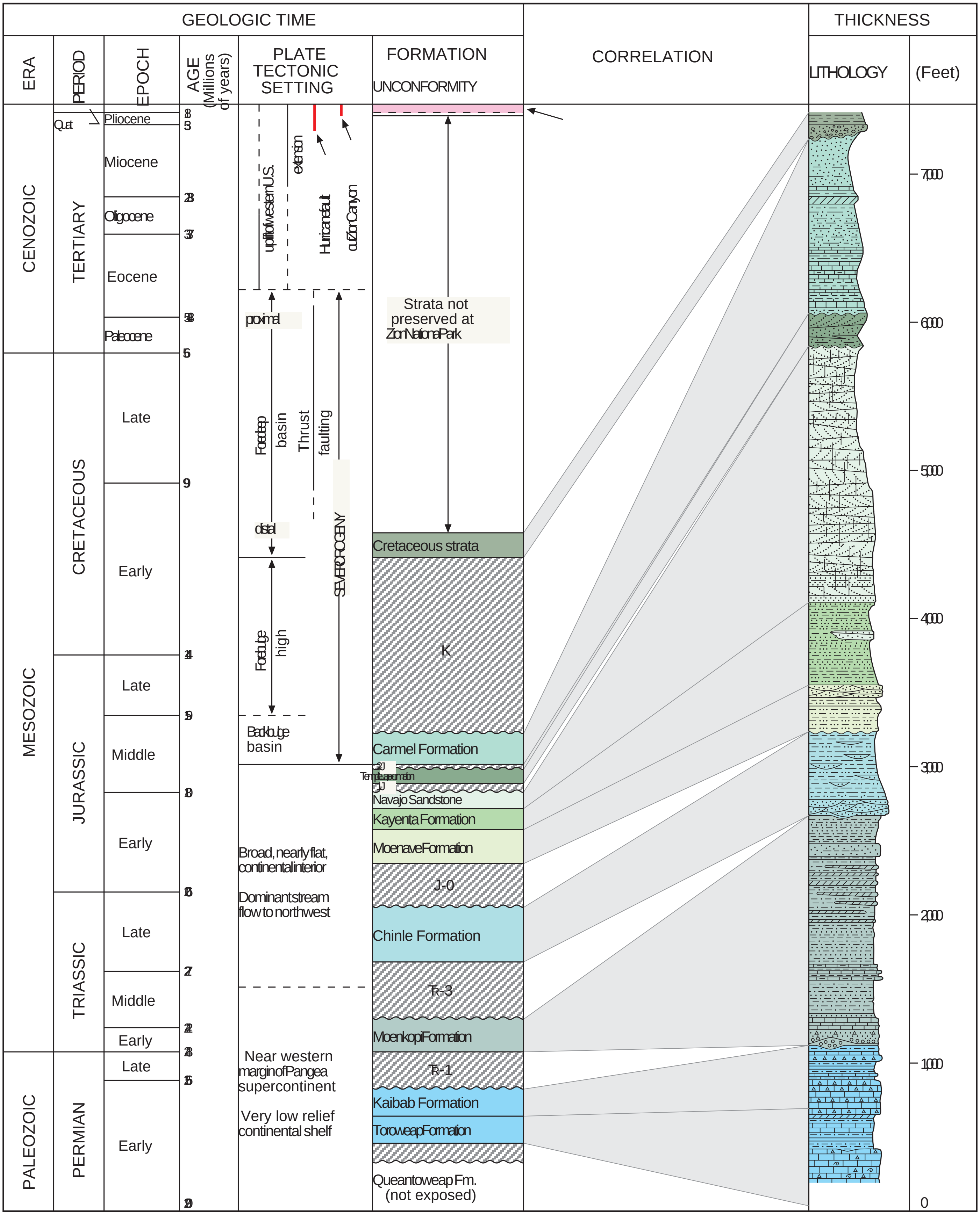
Strike of near-vertical joint


113°15'
113°07'30'
113°
112°52'30"
37°30'
37°22'30"
37°15'
37°07'30"
To Cedar City
To Cedar City
15
zone
Spring Creek
Camp Creek
Kolob Arch
Kolob Reservoir
Cogswell Point
Straight Canyon
New Harmony Basin
Taylor Creek
thrust
Upper
fault
Willis Creek
Kolob
Plateau
Crystal Creek
Creek
Kolob Reservoir
fault
Creek
Taylor
ZION
Canyon
Trap
Bear
East
Road
Deep
Kolob Creek
Hurricane
Black Ridge
Lower
Kolob
To St. George
Smith Mesa
Creek
Guardian Angels
Temple of Sinawava
River
Clear Creek Mountain
Cougar
Wildcat
NATIONAL
Plateau
Canyon
fault
Virgin
Canyon
La Verkin
Smith Mesa
Mtn.
Fork
Left
Orderville
Fork
West
Right
Fork
Cougar
fault
PARK
Kolob
Cougar
Mtn.
Hurricane Mesa
Creek
North
Virgin
Springdale West
Mtn.
Springdale East
To La Verkin and I-15
North
Wash
Wash
tunnel
tunnel
To Carmel Junction and US 89
9
9
Virgin
Virgin
fault
Scoggins
Visitor's Center
The Barracks
Coalpits
Wash
Springdale
Huber
Rockville
River
9
Bench
Virgin
River
Fork
UTAH
Rockville
East
0
5 Miles
0
5 Kilometers
Smithsonian Butte
Hilldale
Elephant Butte

System	Series	Formation	Member / Unit	Symbol	Thickness feet (meters)	Lithology
Q.		surficial deposits		Q–	0-100 (0-30)	
Cret.	Lower / U	Dakota Formation			10+ (3+)	lower coal zone
	Lower	Cedar Mtn Form.	upper member	Kcm	80-120 (24-36)	pebble conglomerate
			conglomerate member	Kcmc	15-30 (5-10)	petrified wood
Jurassic	Middle	Carmel Formation	Winsor Member	Jcw	180-280 (55-85)	pale-yellow sandstone
			Paria River Member	Jcp	60-100 (18-30)	chippy limestone, alabaster gypsum
			Crystal Creek Member	Jcx	160-220 (49-67)	"banded" sandstone
			Co-op Creek Limestone Member: upper unit	Jccu	100-110 (30-33); 250-280 (76-85)	
			Co-op Creek Limestone Member: lower unit	Jccl	150-170 (46-52)	Pentacrinus; J-2 unconformity
		Temple Cap Formation	White Throne Member	Jtw	60-165 (18-50)	prominent red slope
			Sinawava Member	Jts	80-140 (24-42)	streak Navajo cliffs below
	Lower	Navajo Sandstone	white Navajo	Jnw	400-800 (120-240); 1800-2,200 (550-670)	white massive vertical cliffs
			pink Navajo	Jnp	400-1,000 (120-300)	local ironstone; high-angle eolian cross-beds
			brown Navajo	Jnb	400-600 (120-180)	vertical cliffs; horizontal bedding; sabkha environment
		Kayenta Formation	Tenney Canyon Member	Jkt	140-315 (43-96); 550-700 (170-210)	red slope
			Lamp Point Tong. of Navajo Ss	Jnl	60-120 (12-24)	sandstone ledge
			main body	Jk	290-400 (88-120)	red slope

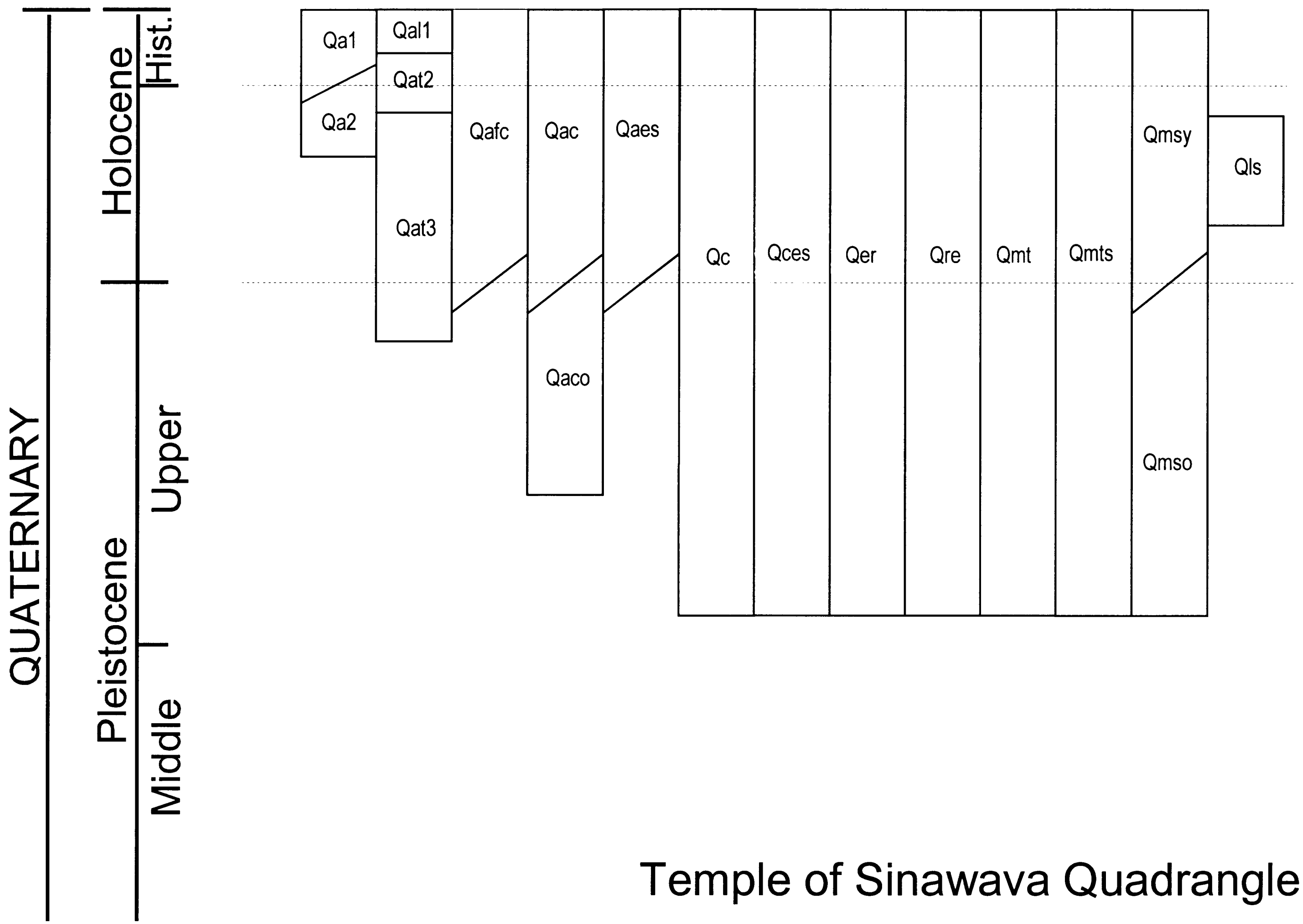


Temple of Sinawava 6/02

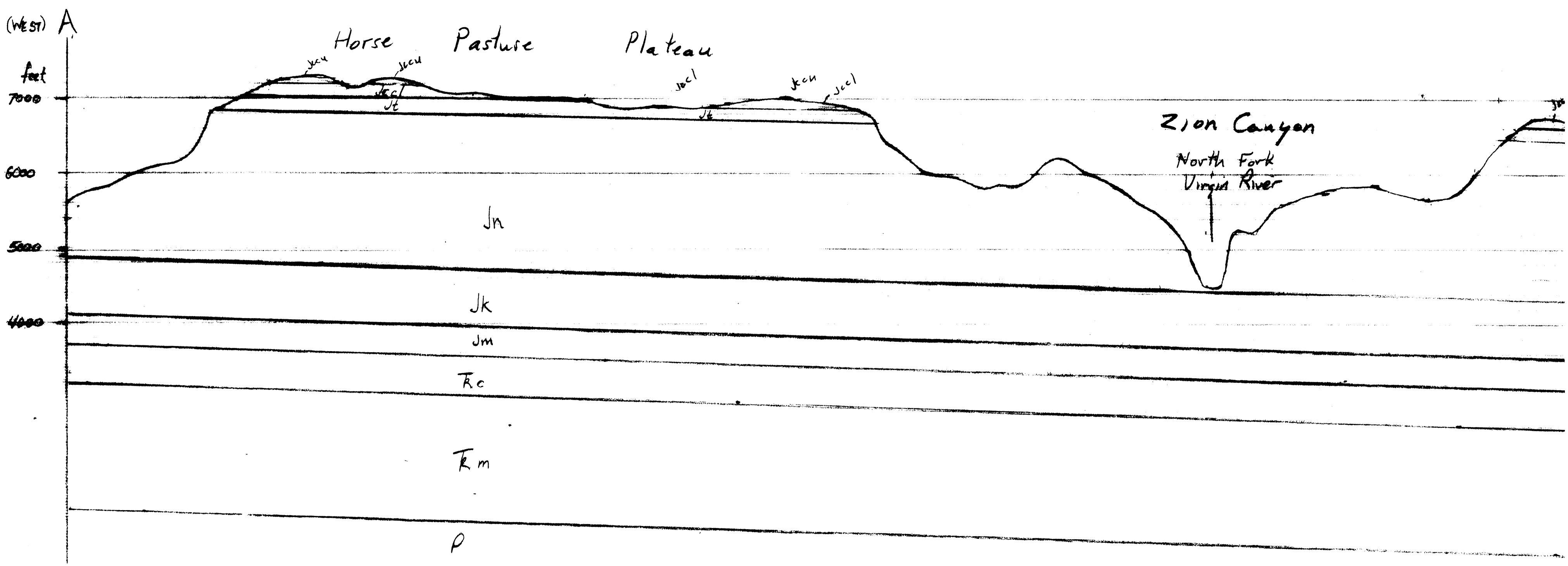


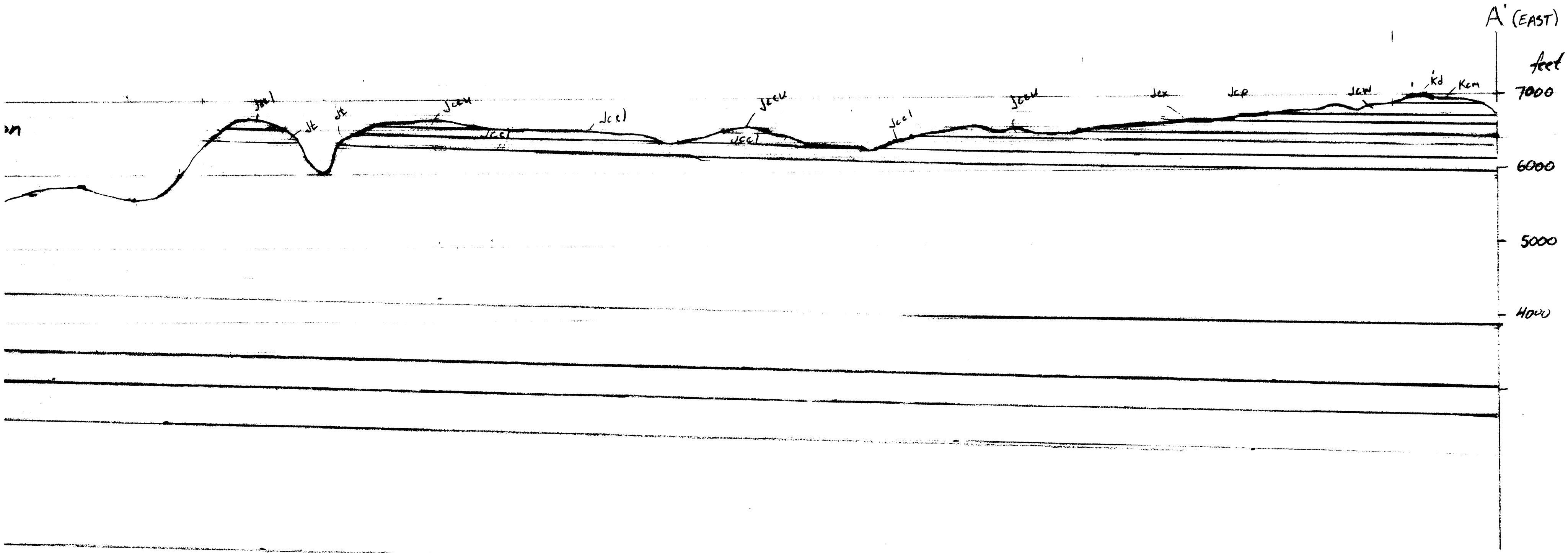
Relationship between age and thickness of rocks exposed in Zion National Park.

Correlation of Surficial Map Units



Temple of Sinawava Quadrangle


(WEST) A
feet
7000
6000
5000
4000
Horse Pasture Plateau
Jccu
Jccl
Jt
Jn
Jk
Jm
Ʀc
Ʀm
P
Zion Canyon
North Fork
Virgin River



Temple of Sinawava quadrangle 7/02 Quat... deposits omitted o