The Journal of
Gemmology

2006 Volume 30 Numbers 1–2

The Usambara effect, colour change with change in path length of light through a material, is found to interact with the alexandrite effect, colour change with change in spectral distribution of light. This article provides insight into the interaction between the Usambara effect and other colour change phenomena. In colour change studies of the past more focus has been placed on the alexandrite effect, but old studies also show awareness of the Usambara effect. This contribution provides a review of previous work and updating of earlier interpretation of this effect in the light of new observations. Epidote and kornerupine are introduced as new colour change minerals, and the Usambara effect is discussed in synthetic alexandrite and chlorophyll.

Non-basalt-related and basalt-related sapphires can be distinguished on the basis of their trace element contents (sometimes called a chemical fingerprint), as determined with energy-dispersive X-ray fluorescence analysis. When using the oxide weight percent ratios of Cr_2O_3/Ga_2O_3 versus Fe_2O_3/TiO_2 these trace elements show two discrete populations. However, for blue sapphires originating from non-basalt-related deposits in the Isalo area of Madagascar, from Ratnapura, Sri Lanka and from Mogok, Myanmar, a nearly complete overlap is observed whereas the overlap for basalt-related sapphires from Bo Phloi, Kanchanaburi, Thailand, New South Wales, Australia, and ChangLe, Shandong, China, is less significant. LA-ICP-MS was applied to obtain ppm and ppb-level data for 'ultra-trace elements' such as Zn, Sn, Ba, Ta and Pb. The results clearly show that they differ for blue sapphires from the sources investigated. The combination of trace element and 'ultra-trace element' contents offers the potential for providing useful criteria in identifying the geographical origins of sapphires and other gemstones.

Recently, a large number of relatively large faceted rubies showing an unusual inclusion pattern have appeared in the gem market. A detailed examination showed that the stones have been treated with a lead-bearing glass of high RI to improve the clarity. Under magnification, flash effects and bubble-like inclusions were visible and enabled straightforward detection of stones with this new type of modification. X-ray images (radiographs) also show evidence of fracture filling and lead can be detected by using X-ray fluorescence analyses. At present the majority of the stones tested have been from an occurrence at Andilamena in north-eastern Madagascar. However, the treatment can be applied to all types of fractured corundums.

This report describes an egg-shaped non-nacreous pearl attached to the interior of a Crassostrea virginica (Gmelin, 1791) (in the position of the adductor scar); the State shell of Connecticut, Mississippi and Virginia, commonly known as the American or Eastern oyster. The pearl is said to have been discovered when the owner opened (shucked) an oyster for eating. The pearl is hollow and together with the shell has a gross weight of 28.204 grams. The pearl measures approximately 13.00 x 10.88 mm. The mollusc, UV/visible and Raman spectra, and microradiography results are described.

The original term 'keshi' describes tiny mantle pearls that developed without a tissue transplant during the production of Akoya cultured pearls. The term is now often used for gonad-grown cultured pearls that have formed from mantle tissue grafts under

conditions where a bead has been rejected. A discussion of the term 'keshi' in its original and recent application is given. The formation of original and recent keshi cultured pearls is explained, with radiographs and cross sections of recent keshis. Current pearl trade use of the term is discussed. An alternative term to keshi – a beadless cultured pearl – is proposed. Recent Chinese freshwater cultured pearls with beads and the potential increase inumbers of beadless cultured pearls are discussed.

A new type of Tairus hydrothermally-grown synthetic emerald, coloured by vanadium and copper
by Dr Karl Schmetzer, Dr Dietmar Schwarz, Dr Heinz-Jürgen Bernhardt and Dr Tobias Häger
pp 59-74

Gemmological, chemical and spectroscopic properties of a new type of hydrothermally-grown synthetic emerald grown commercially by the Tairus company in Novosibirsk, Russia, are described. The results of chemical and spectroscopic examination in the UV-Vis range indicate that the samples are coloured by a combination of vanadium and copper; chromium contents are negligible. Infrared spectra show the presence of different types of water molecules and/or hydroxyl ions. Two major types of isomorphic replacement are present, octahedral substitution of aluminium by vanadium and tetrahedral substitution of silicon by aluminium with charge compensation by lithium on channel sites. Distinction of this new type of synthetic emerald from natural emerald can be made on the basis of distinct growth features visible through the microscope, and chemical and/or spectroscopic features may also be helpful.

The identification value of the 2293 cm^{-1} infrared absorption band in natural and hydrothermal synthetic emeralds
by J.M. Duroc-Danner
pp 75-82

Where ordinary gemmological tests fail to reveal the identity of a gemstone Fourier-Transform Infrared Spectroscopy (FTIR) can often provide the answer. Ways of distinguishing natural from synthetic emeralds of various types have been concentrated in the spectral region between 2240-2400 cm^{-1}, where many more- or less strong absorptions are observed. Amongst these, the presence of a small absorption near 2293 cm^{-1} has been utilised by many authors to indicate a natural emerald since this absorption had not been found in synthetics.
However, now a Russian Tairus hydrothermal synthetic emerald has been found which shows the 2293 cm^{-1} absorption, so this feature can no longer be used to prove a natural origin.

Surface coating of gemstones, especially topaz – a review of recent patent literature
by Dr Karl Schmetzer
pp 83-90

Different methods of surface coating of gem materials are reviewed with respect to various patent documents published recently. In addition to the longer known techniques of simple sputtering and dye-coating, two different types of coating processes are used: first, heat treatment of a faceted gem in contact with a transition metal-bearing powder, and secondly deposition of a coating on the facets of a sample and subsequent heat treatment of the coated stone. The reaction mechanisms, nomenclature and recognition of treated stones are discussed.

Gem minerals from the Saranovskoye chromite deposit, western Urals
by Ernst M. Spiridonov, Maria S. Alferova, Talgat G. Fattykhov
pp 91-102

Gem-quality minerals, including uvarovite, Cr-grossular and Cr-titanite, associated with the Saranovskoye chromite deposit, northern Urals, are described. The geology and mineralogy of the deposit indicates its formation following a well-known cycle of low-grade metamorphic processes and hydrothermal activity.