

## Abstracts Written for *Gems & Gemology*

Elise A. Skalwold, FGA GG

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**Some observations on the composition and origin of opals from Java.** H.C. Einfalt [hcv.einfalt@gmx.de], *Journal of Gemmology*, Vol. 30, No. 7/8, 2007, pp 383-398.

The gemological properties, composition and geological environment of precious and non-precious opals from Rangkasbitung, Banten Province in West Java are described, including water, black and brown “tea” opals. These are characterized by restricted occurrence as isolated nodules in a decomposed tuff layer as a component of the paragenesis montmorillonite – zeolite (clinoptilolite) - opal formed in an open fresh water system at low temperatures. Internal features consist of flow texture, microcrystalline granular quartz/chalcedony, and inclusions of zeolites. Several samples show indications of stress: hidden latent micro-fractures in brown and black opals; play-of-color fields exhibiting bent color lamellae, crosscutting micro-fractures through several color fields with a displacement of fragments against each other in a coherent opal mass and a sub-parallel arrangement of elongated color fields interpreted as the result of shearing or squeezing. These are discussed as a possible reason for the poor stability of some Indonesian opals which often develop fractures during polishing and wear.

Observations include pseudo-birefringence in all but one the opals studied and an unusual “inverse” hydrophane opal which loses its play-of-color when immersed in water. Along with the red, orange and green play-of-color commonly observed in Indonesian opals, subordinate patches of deep blue were also observed. The comparatively large size of the spheres in the Indonesian samples explains the dominance of red to green colours in these opals. Detailed discussion of XRD data and SEM examination, richly illustrated by SEM micrographs of hydrofluoric acid etched samples, divide the opals into three structurally different types having different nanostructures: opal-A, opal-CT and opal-C.

**Thortveitite – new gemstone.** R. Chapman [ross@gemsofaus.com.au], I.F. Mercer, A.H. Rankin and J. Spratt, *Journal of Gemmology*, Vol. 31, No. 1/2, 2008, pp 1-6.

An attractive purple, strongly pleochroic, biaxial specimen of unknown origin, was acquired in Bangkok in 2004 as a relatively large water-worn pebble from which a faceted stone was cut. Analysis revealed a previously unknown gem form of the mineral thortveitite; a scandium yttrium silicate.

Standard gemological and advanced laboratory test results are presented in charts and discussed in detail. WDX electron microprobe analysis revealed significantly higher concentrations of scandium and lower concentrations of yttrium than previously reported in literature pertaining to non-gem thortveitite, which unlike this specimen is normally opaque to translucent and only found in very small crystals. The unusual chemistry indicates a possible synthetic origin; however, a natural origin is also suggested by the presence of three-phase inclusions in a planar array. These inclusions differ in nature

from quenched flux or melt inclusions in that they are characterized as hydrothermal-type with a gas-bubble, brine and probable cubic halite daughter crystal. They also show signs of heating, either natural or by man. Laser Raman microspectroscopy confirmed the results for thortveitite and discrepancies in known literature are pointed out.

The authors discuss the argument for and against synthetic or natural origin. If synthetic, the size and quality of this specimen may indicate the possibility of material having entered the market already. However, the results of recent geological fieldwork indicate scandium minerals are more widespread than previously thought which, along with the appearance of the inclusions and known thortveitite synthesis, supports the possibility of natural occurrence. The results of this investigation form a data base to aid in identifying other specimens which are suspected to be circulating in the market place.

(The full article can be accessed from the Gem-A website <http://www.gem-a.com/publications/journal-of-gemmology/samples.aspx> or specifically at <http://www.docs.i-version.com/?id=QLSMQFB7> )

**Afghan beryl varieties.** L. Natkaniec-Nowak [natkan@uci.agh.edu.pl], *Journal of Gemmology*, Vol. 31, No. 1/2, 2008, pp 31-39.

Using three specimens of each of three color varieties, the author presents in-depth characterization Afghan beryl varieties from pegmatites at Ghursalak in Konar Province (aquamarine, morganite) and from the Panjshir Valley (emerald). Description includes a locality map and details the occurrence these beryls which crystallized within granitic, beryl-muscovite pegmatites under conditions typical of pneumatolytic and hydrothermal conditions. The investigation describes mineralogical and gemological properties, including INAA, XRD, ICP-AES and IR spectroscopic analysis, with results summarized in accompanying charts. IR spectroscopy of the aquamarine and emerald indicated presence of organic matter, probably bituminous within structural channels. The author notes that while Afghanistan has not been a major gem-mineral producer for the world market, many important gemstones have been known from the region since Egyptian, Greek and Roman times. Production is growing and examples of fine material are now appearing in markets world-wide.

*[Two papers by Darko Sturman which are related to each other and follow his 2005 paper: Use of the polarizing filter on the refractometer. Journal of Gemmology, Vol. 29, 5/6, pp. 341-348.]*

**Clarification of measurement of the RIs of biaxial gemstones on the refractometer.** B.D. Sturman [darkos@rogers.com], *Journal of Gemmology*, Vol. 30, No. 7/8, 2007, pp 434-442.

Three simple rules are outlined for making refractometer observations, which if followed correctly, allow one to determine optic character and sign solely by recognizing observed

patterns without the need to construct graphs. Discussion details all four possible biaxial patterns and includes diagrams illustrating the behavior of these materials on the refractometer based on calculated movements of shadow edges for different orientations of the optical elements and the facet under test. An appendix is included detailing the calculation methods used to generate the graphs. The author notes that though one pattern is quite common and requires use of a polarizing filter to determine true beta, the other three are rare and may only show up at all because gem cutters sometimes use a large crystal face as the gem table.

**Determination of the optic axial angle in biaxial gemstones and its use in gemmology.** B.D. Sturman [darkos@rogers.com], *Journal of Gemmology*, Vol. 30, No. 7/8, 2007, pp 443-452.

Of the many optical mineralogy concepts adapted for use in gemology, one which is little known is that of utilizing optic axial angle in identification of biaxial gemstones. This is especially useful for differentiating between biaxial gemstones with similar or overlapping RIs (peridot vs sinhalite) and for distinguishing between a uniaxial and a biaxial stone in an orientation which produces one variable and one constant shadow edge (tourmaline vs actinolite). Along with background explanation, the author gives detailed examples using the method to solve several variations of both situations and includes diagrams illustrating patterns seen. Determination of the optic axial angle requires the same data as determination of the optic sign, but it is a much more discriminatory constant for use in identification of biaxial gemstones. Appendix 1 describes the construction of the optic axial angle diagram and Appendix 2 describes the role of a possible error in RIs.

**'Paraiba' tourmaline and similar looking materials.** C. Choudhary and C. Golecha, *Gems & Jewellery*, Vol. 17, No. 1, 2008, pp 16-18.

The authors point out the increase of Paraiba tourmaline simulants sold in the marketplace and being submitted to the laboratory. Apatite and glass, which have been seen for several years, are now joined by cubic zirconia and hydrothermal beryl; production of the latter two has recently been launched on a commercial scale. Short descriptions of each are presented and the comparative gemological properties are summarized in a chart. The authors point out a glass simulant with swirled color zoning which, at first glance, mimics pleochroism reminiscent of that in tourmaline. All four simulants are easily separated from tourmaline with standard gemological testing.

**Surface treatment of gemstones, especially topaz – an update of recent patent literature.** K. Schmetzer [SchmetzerKarl@hotmail.com], *Journal of Gemmology*, Vol. 31, No. 1/2, 2008, pp 7-13.

The author stresses that detailed knowledge of possible treatment processes is essential for the recognition of treated gemstones in the laboratory. Though it is not known which if any of the reported technologies have already been implemented, it is warned that it is probable that at least some will be applied in the future. Following up on the previous

2006 JOG paper on the same subject covering the period from 1996-2005, the author updates and adds to the list describing patents pertaining to surface treatment of gem materials.

A detailed table summarizes patents which are specifically related to and applied for the enhancements of gem materials. Different treatment types are identified and discussed: (A) deposition of coating without specific heat treatment, including 1. deposition of a coating including a wear-resistant material; 2. depositions of a coating causing optical phenomenon; 3. deposition of a coating and formation of a diffractive optical element; and (B) deposition of a coating with specific heat treatment, including 1. contact heat treatment with transition and metal-bearing solids; 2. deposition of a coating to the faceted stone and subsequent heat treatment.

**Ornamental variscite: A new gemstone resource from Western Australia.** M. Willing [margotwilling@iinet.net.au], S. Stöcklmayer and M. Wells, *Journal of Gemmology*, Vol. 31, No. 3/4, 2008, pp 111-124.

An in-depth characterization of variscite mined from a new location on Woodlands Station, Western Australia; including its geological occurrence and associated minerals. Analysis of data obtained from standard gemological methods, petrographic thin sections, SEM, XRD, XRF and Vis-NIR reflectance spectroscopy is summarized in numerous figures and tables augmenting the text.

Along with an overview of occurrences and mining worldwide, also included is a detailed look at archeological finds of variscite from the Neolithic Age and Roman Era. In reference to an image of well-polished, intensely colored variscite ornaments from 4500-4000 BC, it is noted that the terms *callais* and *callainite* have been used to describe these items, as well as variscite and turquoise in other archeological studies and early mineral reference works. The authors point out that though variscite mining has a long history, there are few sources of ornamental quality material and much of that on the market is from stockpiled material. The Woodlands Station deposit represents an important new source and one whose textural characteristics make sculptural *objets d'art* attractive and recognizably different to variscite from elsewhere.

Hosted in siltstone, two habits occur: fibrous and equigranular. Numerous color images illustrate the varying appearance of material found at this location. It is shown to owe its bluish-green color to trivalent chromium and X-ray diffraction analysis confirms the variscite to be the 'Meßbach-type' in association with metavariscite, a dimorph of variscite. Co-genetic inclusions of elemental gold form a rare and unique feature of the variscite, appearing as discrete platelets or granules most easily visible in dark green material. Matrix material was shown to consist of iron oxides, quartz, crandallite and alunite.

**Visually distinguishing A-jadeite from B-jadeite.** Li Jianjun, [geoli@vip.sina.com], Liu Xiaowei, Zhang Zhiguo, Luo Yueping, Cheng Youfa and Liu Huafeng, *Journal of Gemmology*, Vol. 31, No. 3/4, 2008, pp 125-131.

After first discussing the distinctions between A-jadeite and B-jadeite in the context of the Chinese gem trade, the authors proceed to describe visual skills which can aid in the separation of these two types. A-jadeite is defined as that which has been carved and polished, with minimal application of wax to finalize luster development. Application of mild acid as a bleaching agent with no damage to the jadeite's structure is acceptable, as is heating to develop red coloration in iron containing material. B-jadeite is defined as that which has been processed with strong acid and the resulting pores filled with wax or polymer resin. An overview of the production of each type is given as background information pertinent to understanding the separation method. C-jadeite (dyed) is not addressed.

Visual distinctions are described, illustrated with color photographs and discussed in terms of (1) surface luster or comparative reflectance differences; (2) distribution of coloration on the surface; (3) nature of internal inclusion patterns; (4) internal reflection of light resembling the adularescence of moonstone; (5) presence of micro-fractures; (6) size of item and the quality and intricacy of the carving. For example, the appearance of an internal yellow glow found in A-jadeite distinguishes it from B-jadeite which exhibits a white-blue reflection. The underlying reasons for this effect, as well as for other observations listed above, are discussed in detail. Careful attention to all of these features in concert is required for an accurate determination, though caution is advised, warning that a margin of error still exists which may necessitate confirmation with advanced laboratory equipment.

**A colour-changing titanite from Afghanistan.** T. Hainschwang  
[thomas.hainschwang@gemlab.net], *Gems & Jewellery*, Vol. 17, No. 4, 2008, pp 6-7.

A gem reportedly mined in Badakhshan province in northeast Afghanistan and which is not commonly associated with colour-change was submitted to the Gemlab Laboratory and subsequently identified by FTIR spectroscopy as titanite (sphene). The 3.95 ct stone appears orangey yellow under incandescent light and brownish yellowish green under natural daylight. Its UV-Vis-NIR absorption spectra was compared with non-colour-changing titanite from Madagascar and was found to have a more intense broad absorption band centered near 600 nm which was shifted approximately 15 nm closer to the shorter wavelengths. A description of absorption and transmission spectra results is included along with graphs comparing intensity under different light sources versus wavelength and normalized absorption versus wavelength.

**Journal gains a greater presence and accessibility.** Jack Ogden, *Gems & Jewellery*, Vol. 17, No. 4, 2008, p. 13.

The *Journal of Gemmology*, primary academic publication of the Gem-A, will go on-line as of 2009 and be accessible with full search capabilities to members through the organization's website. Peer reviewed papers with abstracts will be uploaded as they become ready and will be summarized in *Gems & Jewellery* as brief articles. At the end of 2009, a single issue hard-copy of that year's papers will be available at no cost to subscribers, but in following years subscriptions will only be for on-line access and the

hard-copy will be available for an extra fee at year's end. The Gem-A's publications began with *The Gemmologist* in 1931, *Gemmological News* in 1935 and finally the *Journal of Gemmology* in 1945.

**Trade Alert: Flux grown synthetic red spinels again on the market.** M. Krzemnicki [gemlab@ssef.ch], *Gem Market News*, Vol. 27, Issue 6, 2008, pp 7-9.

This report was originally published in the SSEF Newsletter October 2008 after the lab encountered several red flux grown spinels at the September Hong Kong Jewellery Fair. These have been offered for sale in Bangkok recently as well. While not new, they are appearing more often as red spinel becomes increasingly popular. The material resembles fine quality natural spinel and is very difficult or impossible to separate using standard gemological tests. Flux grown crystals resemble natural crystals, including growth marks, and could fool buyers if mixed in with packets of natural crystals. The author warns that cobalt colored blue flux grown spinels have not been seen at this time, but may appear again.

Microscopic observations revealed only a few small jagged **or** tubular cavities filled with black to orange brown flux residues with gas bubbles; one had a single metallic flake and tiny parallel hollow channels. Natural red spinels can contain brownish iron-hydroxide in cavities which should not be confused with flux residues. Advanced testing indicates a low concentration of zinc which distinguishes it from that of natural whose level exceeds this by a factor of ten or more. Ramen spectra show a distinctly broader peak shape for the flux grown synthetic similar to that found in Verneuil. Strong photoluminescence produced by green laser excitation indicated emission peaks due to chromium in both natural and flux grown red spinel, but in the latter the peak was less structured, offering another possible separation technique.

**A classification of gem corundum deposits aimed towards gem exploration.** C. Simonet, E. Fritsch [Emmanuel.Fritsch@cnsr-immn.fr], B. Lasnier, *Ore Geology Review*, vol. 34, 2008, pp. 127-133.

This study proposes a classification of gem corundum (ruby and sapphire) deposits which is aimed at being practical and useful in the field; particularly for prospecting purposes by emphasizing promising geological environments. Additionally, it also lends important scientific support to gemologist's efforts in determination of geographical origin by helping them to better understand the inclusion suites seen in gem corundum.

Though mostly based on a very extensive review of available literature, it also draws on significant information gathered during fieldwork, both published and unpublished by the lead author.

This presentation differs from previous investigations in that the authors - while not concentrating on exact geological processes of corundum growth, but rather on globally favorable geological conditions - propose a grouping of gem deposits according to common characteristics and general mechanisms of formation. Petrographic data and the

mode of genesis of the deposits are taken into consideration. Deposits are classified into primary and secondary ones which are then further subdivided and extensively described in the bulk of the paper.

The authors point out the importance of the relationships between different gem deposits and help link them to some particular geological environments, an important aid in prospecting and mining. A caveat is made regarding the drawing of conclusions about a given deposit in relation to similar deposits as each is unique despite general groupings. Also, geologically different types of deposits may co-exist in close geographical proximity. The authors close by pointing out that many unknowns remain, as for example, the influence of metasomatism on ruby-bearing marbles and the geological controls of gem-quality (transparency). Their classification system seeks to provide a useful base for future work on the geology of gem corundum deposits, a subject which in their opinion deserves more involvement from economic geologists, petrologists, and mineralogists.