



# 2010 GEMOLOGICAL ABSTRACTS

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## COLORED STONES AND ORGANIC MATERIALS

**A description and history of one of the largest nacreous pearls in the world.** J. C. Zwaan [zwaanj@naturalis.nl] and H. A. Domnisse, *Journal of Gemmology*, Vol. 31, No. 5–8, 2009, pp. 196–202.

A large and uniquely shaped baroque pearl was investigated to help establish its historical significance. The pearl was mounted in gold with ruby, sapphire, and emerald beads on a jeweled lapis base to create a stylized lotus flower *objet d'art*. Because the pearl was tightly mounted on a gold peg, it was impossible to weigh loose, so its weight was calculated at 2,385 grains (119.25 grams). It exhibited good luster and orient over much of its surface, and X-radiography confirmed a natural origin.

Unlike other historical pearls, this specimen was thought to be of freshwater origin. Its size, color, and physical properties suggested a *Hyriopsis cumingi*, *Cristaria plicata*, or *Hyriopsis schlegeli* mollusk from China or Japan; historical references also point to Asia as the source.

The first record of the pearl is a 1778 print, prepared the year of its first sale, which was discovered in the Amsterdam city archives in 2009. The pearl was offered several times to respected jewel houses (including Fabergé) for sale to European royal families during the 19th and 20th centuries, and was eventually sold in 1979 to an Amsterdam art collector. In 1992, Antwerp goldsmith Jean Lemmens mounted the pearl in its present form.

It had been suggested that this pearl was actually the Arco Valley Pearl, offered at auction in Abu Dhabi in 2007, but the recently discovered 1778 print refutes this notion.

JEC

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**Jaspilite—The gemstone of Ukraine.** P. Baranov [baranov\_pn@bk.ru], S. Shevchenko, W. Heflik, L. Natkaniiec-Nowak, and M. Dumanska-Slowik, *Journal of Gemmology*, Vol. 31, No. 5–8, 2009, pp. 163–169.

Jaspilite is an iron- and silica-rich metamorphic rock of sedimentary or volcanic origin; it is also a general term for material geologists call banded iron formation. Decorative pieces of jaspilite are used for architectural facing stones, as well as for vases, cameos, and the like, while some are fine enough for jewelry use. Jaspilite has a wide range of banded colors, mainly red with areas ranging from bright red to deep brown, yellow, orange, blue, and gray with a metallic luster. Yellow-banded tiger's-eye and blue-banded falcon's-eye specimens are known; these optical effects are produced by fibrous and lamellar aggregates of amphibole. The textures include parallel-striated, wavy-striated, intensely folded (plicated), breccia-like, and "landscape" varieties. The geologic setting and mineralogical complexities of the different varieties are discussed. Principles of shaping jaspilite gems are illustrated, along with guides on optimizing the textures and colors of the rough.

Jaspilite is sold in the monthly World of Gemstones exhibition in Dnepropetrovsk. With considerable reserves available, there is potential to expand into global markets.

ERB

**Role of polyenes in the coloration of cultured freshwater pearls.** S. Karampelas [stefanos.karampelas@cnrsmn.fr], E. Fritsch, J.-Y. Mevellec, S. Sklavounos, and T. Soldatos, *European Journal of Mineralogy*, Vol. 21, No. 1, 2009, pp. 85–97.

The authors analyzed 21 untreated freshwater cultured pearls from the *Hyriopsis* genus by diffuse-reflectance UV-Vis-NIR and Raman spectroscopy, at high resolution. All showed the two major Raman resonance features of unmethylated (unsubstituted) polyenes, rather than carotenoids. Their general formulas are  $R-(CH=CH)_N-R'$ , with  $N = 6-14$ . Each color is due to a mixture of pigments rather than a single one, and each pigment can be related to a specific absorption with apparent maxima in the 405–568 nm range, thus absorbing in the violet to yellow-green region. Recognizing the spectroscopic signatures of pigments in untreated cultured pearls can help separate them from their treated counterparts.

RAH

**A signature for nephrite jade using its strontium isotopic composition: Some Pacific Rim examples.** C. J. Adams [argon@gns.cri.nz] and R. J. Beck, *Journal of Gemmology*, Vol. 31, No. 5–8, 2009, pp. 153–162.

Because nephrite jade historically has been mined and traded in so many localities worldwide, there is great interest in determining its geologic provenance. Current chemical and mineralogical identification characteristics, while

useful, may not be definitive in determining origin. This article presents a technique using radiogenic isotopic ratio patterns. Nephrite's age of formation can be determined by identifying the ratio of the  $^{87}\text{Sr}/^{86}\text{Sr}$  isotopes, a composition inherited during formation from either serpentinite or sedimentary protoliths. The authors tested nephrite from Pacific Rim sources such as New Zealand, New Caledonia, Taiwan, Canada, and Russia. Nephrite from New Zealand—the principal source analyzed—demonstrated a strong association of age and isotopic history with its host rock. Data from other regions, while also promising, were not as conclusive and require further investigation.

AB

**The study of various beads used for cultured pearls.** A. Abduriyim, H. Kitawaki, and S. Akamatsu [ahmadjan@gaj-zenhokyo.co.jp], *Gemmology*, Vol. 40, No. 482, 2009, pp. 22–27 [in Japanese with English supplement].

Since the early 1900s, numerous materials have been employed as beads for culturing pearls. Because of CITES and other regulations designed to protect endangered species, disclosure mandates, and new market considerations, the gem trade needs a means of identifying cultured pearl bead materials. To that end, 70 bead samples were subjected to standard gemological tests (visual examination, magnification, UV fluorescence, and specific gravity), spectroscopy (UV-visible and IR), and chemical analysis (EDXRF and LA-ICP-MS). In particular, LA-ICP-MS was used to analyze a nacre-covered bead by continuous laser ablation. The bead samples comprised shell (from freshwater mussels, marine oysters, and a marine snail), treated beads (exposed to "fluorescent bleach" and "Rongalite," and a composite material), and other materials such as ceramics and Bironite. Although the authors noted several differences in the properties of the various beads, none of the tests would be useful for nondestructively identifying a bead inside a cultured pearl.

ERB

**Zur die Flammenstruktur bei einigen porzellanartigen Perlen [Explaining the flame structure of some non-nacreous pearls].** H. A. Hänni [h.a.haenni@gmail.com], *Gemmologie: Zeitschrift der Deutschen Gemmologischen Gesellschaft*, Vol. 58, No. 1–2, 2009, pp. 47–52 [in German].

Non-nacreous pearls may show alternating areas of bright and dark lines, and some also display spotted patterns. This is due to a crosswise array of bundles of aragonite laths or fibers. Small areas of these bundles alternate in their orientations; light striking the length of the bundles is reflected, while light perpendicular to the bundles is absorbed. The result is observed as a flame structure.

GL

## DIAMONDS

**Diamonds from placers in western and central Africa: A problem of primary sources.** T. V. Posukhova [tposukhova@mail.ru] and F. N. Kolome, *Moscow University Geology Bulletin*, Vol. 64, No. 3, 2009, pp. 177–186.

This study examined alluvial diamonds and associated heavy minerals from placer deposits along the Bafit-Ngoku River in Sierra Leone and along the Kasai and Lubembe Rivers in the southern portion of the Democratic Republic of Congo to determine their properties and geologic origin. Minerals recovered from these placers exhibited little or no evidence of abrasion, which suggests transport over short distances from their primary sources. Characterization of diamonds from these placers by visual, luminescence, and spectroscopic methods revealed features that are distinct from those of known primary deposits in Africa or Siberia. The chemical compositions of the accessory garnet, ilmenite, and zircon differed from those of known kimberlite origin. This suggests that the primary source rocks could be lamproites, though the overall crystal morphology of the diamonds corresponded more closely to kimberlitic material. The occurrence of coated diamond crystals, and those with brown or yellow coloration, is comparable to some Canadian kimberlites. The diamonds in these placers are of mantle origin, but they have no direct analogues with known kimberlite or lamproite pipes in Africa. JES

**The genesis of low-N diamonds.** A. I. Chepurov [chepurov@uiggm.nsc.ru], E. I. Zhimulev, A. P. Eliseev, V. M. Sonin, and I. I. Fedorov, *Geochemistry International*, Vol. 47, No. 5, 2009, pp. 522–525.

The rarity in nature of low-nitrogen type IIa diamonds suggests that they crystallized under unusual geologic conditions in the mantle. The authors of this article have extensive experience with diamond synthesis by the HPHT temperature-gradient method, where metallic elements such as titanium are used to bond with nitrogen in the growth system so it does not become incorporated into the growing crystal. In this study, synthetic diamonds grown in an Fe-Co-C system containing titanium oxide were yellow, whereas those grown in a similar system containing titanium metal were colorless. Based on their experiments, the authors conclude that type IIa diamonds grew in the mantle in the presence of “nitrogen getters” such as titanium. When these elements are present as oxides, nitrogen-containing type Ib diamonds form. However, under the unusual strongly reducing conditions where the titanium occurs as a metal, colorless type IIa diamonds crystallize. JES

**Large Brazilian diamonds.** D. B. Hoover [dbhoover@aol.com] and J. Karfunkel, *Australian Gemmologist*, Vol. 23, No. 10, 2009, pp. 440–446.

A brief history is presented of diamond production in the relatively small region of Alto Paranaíba, Minas Gerais, Brazil. In addition to 65 documented stones weighing >50 ct (details are listed for 40 of them), many more large diamonds are suspected to have been found by itinerant miners (*garimpeiros*) and smuggled out of the country. The area is also known for producing fine pink and red diamonds. RAH

**Magnetic susceptibility of natural diamonds.** A. P. Yelissev, V. P. Afanasiev, and V. N. Ikorsky, *Doklady Earth Sciences*, Vol. 425, No. 2, 2009, pp. 330–333.

Magnetic susceptibility is a measure of the intensity of magnetization of a body that has been placed in a uniform magnetic field of unit strength. Diamagnetic materials have a very weak magnetic susceptibility; they are repulsed by a magnet and do not retain their magnetic properties when the external field is removed. Ferromagnetic materials have a strong magnetic susceptibility, which means that they are strongly attracted to a magnet and can retain their magnetic properties when the field is removed.

Pure diamond is a diamagnetic material. HPHT-grown synthetic diamonds, and occasionally natural diamonds, may appear ferromagnetic due to the presence of iron-containing inclusions. The authors measured the magnetization of 20 high-quality—and seven low-quality—natural diamond crystals, all of Siberian origin, and found a small range of diamagnetic behavior over a temperature range of 5–300 K. They suggest that careful magnetic measurements are useful for separating natural and HPHT-grown synthetic diamonds, and perhaps for determining the nature of iron-containing mineral inclusions in natural diamonds. JES

**Structural defects in natural plastically deformed diamonds: Evidence from EPR spectroscopy.** R. M. Mineeva, S. V. Titkov [titkov@igem.ru], and A. V. Speransky, *Geology of Ore Deposits*, Vol. 51, No. 3, 2009, pp. 233–242.

When geologic stresses are applied, diamond crystals may undergo plastic deformation (i.e., permanent changes in their shape or structure without fracturing). This process can occur in the mantle or during transport by kimberlite volcanism. Two deformation mechanisms have been proposed: dislocation gliding and mechanical microtwinning. Plastic deformation can create a variety of defect centers in the atomic lattice, and these can often be detected by electron paramagnetic resonance (EPR) spectroscopy. In this study, type Ia diamonds of various colors (brown, pink-brown, black-brown, pink-purple, and gray) from Yakutia and the Ural region of Russia were studied, and several different nitrogen-containing defect centers were identified using EPR. Certain

defect centers seem to be associated with particular deformation-induced diamond colors. The wide variety of defect centers suggests that a range of deformation conditions can affect diamonds in the earth. The authors note that defect creation and destruction during HPHT annealing has been extensively studied, while diamond defects caused by plastic deformation have been largely overlooked. JES

**Type II diamonds: Flamboyant megacrysts?** A. E. Moore [andy.moore@info.bw], *South African Journal of Geology*, Vol. 112, No. 1, 2009, pp. 23–38.

Despite their high value as gems, low-nitrogen type IIa diamonds have not been well documented in the scientific literature. Important sources are the Premier (Cullinan) and Jagersfontein mines in South Africa, Orapa and Jwaneng in Botswana, and Letseng in Lesotho. These diamonds typically display irregular or distorted crystal morphology, planar cleavage, little or no UV fluorescence, and high clarity (they may contain graphite as opposed to other mineral inclusions). They are typically colorless or display various colors (i.e., brown, pink), and form a relatively large proportion of giant diamonds. Considering their light carbon isotope-enriched composition, the author suggests that type II diamonds have a websteritic mantle paragenesis that differs from either eclogitic or peridotitic origins. The formation of these large diamond megacrysts is thought to have occurred from chemically evolved and fractionated, relatively low-temperature, residual pegmatitic magmas that are genetically related to kimberlitic magmas. JES

## GEM LOCALITIES

**Age and genesis of the Myanmar jadeite: Constraints from U-Pb ages and Hf isotopes of zircon inclusions.** Z. L. Qiu, F. Y. Wu [wufuyuan@mail.igcas.as.cn], S. F. Yang, M. Zhu, J. F. Sun, and P. Yang, *Chinese Science Bulletin*, Vol. 54, No. 4, 2009, pp. 658–668.

The Hpakan area of north-central Myanmar has long been an important source of jadeite. Here, the material occurs as veins in serpentinized peridotites associated with various high-pressure metamorphic rocks. Complex topography, adverse weather, and other factors have limited the geologic field study of these deposits, and different theories as to their mode of formation and age have been proposed.

In this study, a yellowish green jadeite sample understood to be from the Hpakan area, and unusual for its abundant euhedral zircon inclusions, was analyzed by LA-ICP-MS and cathodoluminescence. *In-situ* analyses of 16 zircon grains yielded U-Pb ages of  $158 \pm 2$  million years. The luminescence patterns in these crystals revealed an internal structure that was less regular than typical for magmatic zircons. The zircon grains also had lower concentrations of the heavy rare-earth elements. The authors

conclude that the jadeite deposits are not genetically associated with magmatism or other geologic events that took place during the Cenozoic collision between the Indian and Asian continental plates. Rather, the deposits are believed to be the result of fluid-induced metasomatism of preexisting rocks during the Late Jurassic, with the fluids originating from the dehydration of subducted oceanic crust. JES

**Colored gemstones from Canada.** B. S. Wilson [brad@alpinegems.ca], *Rocks & Minerals*, Vol. 85, No. 1, 2010, pp. 24–42.

This article reviews Canadian production of colored gemstones and their localities. All major gem species with the exception of tanzanite and alexandrite have been discovered in Canada, and they occur in a variety of geologic environments. One of the best-known gems is hessonite, found in the Jeffrey mine in Quebec (one of Canada's most important mineral localities). While some gem species such as corundum and beryl have been discovered during mining for base metals, exploration for colored stones is new to Canada. A few historic localities have been known for centuries, but the majority were discovered much more recently, within the past 10–20 years. However only a limited number of Canadian mines are currently producing gem rough.

The relatively recent discovery of vast diamond deposits in Canada suggests a viable future in colored gemstone mining, and has stimulated interest among smaller mining companies. MK

**Demantoid from a new source.** K. Schmetzer [schmetzerkarl@hotmail.com] and S. Karamelas, *Gems & Jewellery*, Vol. 18, No. 4, 2009, pp. 10–12.

An illustrated description is given of crystals of green to yellowish green demantoid (6–7 mm in diameter) from Antetetzambato, near Ambanja in northern Madagascar. Growth zoning revealed a combination of dodecahedral {110} and trapezohedral {211} forms. Most samples showed anomalous double refraction. Chemical analyses yielded 0.05–0.07 wt.% Cr<sub>2</sub>O<sub>3</sub>. UV-Vis-NIR spectra over the 280–1000 nm range showed strong absorption bands at 440, 590, and 860 nm, indicating that these andradites are colored by chromium and iron. RAH

**Echte Edelsteine? Vulkanische Gläser aus der Eifel [Are volcanic glasses from the Eifel Mountains true gemstones?].** H. Locker, *Lapis*, Vol. 34, No. 9, 2009, pp. 13–19 [in German].

Rare volcanic glass found in the Eifel Mountains of Germany is comparable to aquamarine and tourmaline in color and transparency. The glass is thought to form when sandstone or pieces of quartz become fluidized after being trapped in an initially silicate-poor volcanic melt. If

the magma becomes a thick fluid, poor in gases but with sufficient silicate content, then a fluid-glass mixture develops. The viscosity of the melted material increases as the temperature of the lava rapidly decreases, resulting in the formation of volcanic glass. If Fe<sup>2+</sup> dominates at high temperatures and reducing conditions, a green color is created; if Fe<sup>3+</sup> dominates (oxidizing conditions) the glass will be yellowish brown. Blue and turquoise-like colors are caused by the presence of Cu<sup>2+</sup>, while Mn<sup>3+</sup> produces a violet color, with the latter showing a higher saturation with increasing alkali content (Na and K). Mn<sup>2+</sup> is responsible for a weak yellow-brown color. The glass has a Mohs hardness of 5½–6 and an RI value ranging from 1.498 to 1.516. GL

**Oxygen isotopes [sic] composition of sapphires from the French Massif Central: Implications for the origin of gem corundum in basaltic fields.** G. Giuliani [giuliani@crpg.crns-nancy.fr], A. Fallick, D. Ohnenstetter, and G. Pegere, *Mineralium Deposita*, Vol. 44, 2009, pp. 221–231.

Oxygen isotope values for sapphires (alluvial, colluvial, and within xenoliths) from alkali basaltic rocks of the French Massif Central are presented. Two major sapphire groups were interpreted to represent distinct genetic origins. The first group (71% of the samples) was restricted to an isotopic range of 4.4–6.8‰, within the established range of sapphires from magmatic sources (predominantly basalts and syenites). The second group ranged from 7.6 to 13.9‰, implying a metamorphic origin such as biotite schist in gneisses or skarns. Some areas within the French Massif Central (i.e., Le Mont Coupet) contained sapphires of both ranges, suggesting a complex geologic history; models are presented. After comparing these results with oxygen isotope values for corundum worldwide, the authors conclude that these basalt-transported sapphires formed in either granulite-facies metamorphic rocks or magmas from the crust-mantle transition.

KAM

**Precious opal from Java: Gemmological properties, micro- and nano-structures.** T. T. Sun [fegemlab@singnet.com.sg], P. C. Mok, S. L. Paul, M. Paramita, C. E. S. Arps, W. Atichat, E. Fritsch, W. W. Kang, and K. Wijaya, *Australian Gemmologist*, Vol. 23, No. 11, 2009, pp. 513–528.

The mining of play-of-color opal (locally called *kalimaya*) on the Indonesian island of Java started in 1970. This study documents opals from near the village of Cilayang (~6°55' S, 106°25' E). White, brown, dark brown, and “jelly” opals are produced; black opal is mined elsewhere in the area. The samples showed all the characteristics of volcanic opal-CT. Both SEM and atomic force microscopy (AFM) imaging showed that the silica lepispheres may be arranged in an orderly or a disorderly manner; a well-ordered stacking provides the best play-of-color. Raman

spectroscopy identified some of these opals as hydrophane, with a band at 965 cm<sup>-1</sup> attributable to OH and another at 3200 cm<sup>-1</sup> due to molecular water.

RAH

**A study on the characteristics of some C- and CT-opals from Brazil.** F. Caucia [caucia@crystal.unipv.it], C. Ghisoli, and I. Adamo, *Neues Jahrbuch für Mineralogie, Abhandlungen*, Vol. 185, No. 3, 2009, pp. 289–296.

The physical properties of blue and “fire” opals from Piauí State, Brazil, were determined by optical analyses, specific gravity measurements, X-ray diffraction (XRD), and IR spectroscopy; chemical compositions were measured with LA-ICP-MS and SEM-EDS. The samples had SG values of 1.98–2.28 and RIs ranging from 1.430 to 1.461. The presence of cristobalite was confirmed with XRD and IR spectroscopy. A “coralloid islands” structure, built of microspherules of amorphous silica, was observed with the SEM, and could explain the iridescence shown by some blue specimens. LA-ICP-MS analyses confirmed the presence of Fe as the principal cause of color in the fire opals (perhaps present as an Fe-oxyhydroxide); Mn was significant in only the darkest specimens.

RAH

**Utah Ammolite.** G. Musick, *Rock & Gem*, Vol. 38, No. 8, 2008, pp. 34–38.

The author, an amateur lapidary, describes his discovery of fossilized shell material near Clawson, Utah, that resembles Ammolite from Alberta, Canada. A general description of the location and material are provided. Samples were collected at the surface from an area of <2 acres. Gemmological tests were not conducted, and identification of the material as Ammolite was based on its visual appearance and association with marine (likely Cretaceous-aged) fossils. Some simple assembled gems were prepared (polished fossil shell attached to quartz caps using epoxy). Photos of the material suggest that its color range is similar to lower-quality Canadian Ammolite; the predominant colors noted are reds, greens, and red-browns.

The author attempted to stake a mineral claim on the site but was refused by the Bureau of Land Management, as current regulations recognize Ammolite as a fossil rather than a gemstone.

[Abstractor's Note: Until proper testing is conducted, this abstractor cautions against labeling the material as “Ammolite” and suggests calling it “fossil shell.”]

KAM

**Zirkone von Tansania: “Malaya-Zirkon” [Zircons from Tanzania: “Malaya zircon”].** U. Henn [ulihenn@dgemg.com], *Gemmologie: Zeitschrift der Deutschen Gemmologischen Gesellschaft*, Vol. 58, No. 1–2, 2009, pp. 67–72 [in German].

Attractive gem-quality zircon showing brown, yellow, and

red coloration is found in the Tanga Province of northern Tanzania. The color similarity of some of these stones to Malaya garnet has given rise to the trade name "Malaya zircon." The zircon has an SG range of 4.67–4.72 and RI values (measured with a reflectometer) from 1.957 to 1.962, both consistent with high-property zircon. It has a typical absorption spectrum; the strongest lines (due to U<sup>4+</sup>) are at 510, 538, 562, 589, 615, 620, 653, 682, and 690 nm. Inclusions are uncommon. Growth zoning parallel to the tetragonal prism faces and cracks with disk-like patterns were occasionally observed.

GL

## INSTRUMENTS AND TECHNIQUES

**Identification of black opaque gemstones.** M. Okano and H. Kitawaki [ahmadjan@gaa-jzenhokyo.co.jp], *Gemmology*, Vol. 40, No. 480, 2009, pp. 12–15 [in Japanese with English supplement].

Black simulants and treated black gemstones pose special identification challenges and are often found mixed with natural black gems in jewelry. Black diamond, CZ, and synthetic moissanite all have RIs over the limit of the standard gemological refractometer, and their dark color makes it difficult to discern inclusions and growth patterns. This illustrated article shows several techniques for separating black opaque stones using common gemological tests, as well as the limitations of these methods. Among laboratory techniques, Raman spectroscopy is the most practical and effective, particularly for melee-set jewelry.

ERB

**Traitement Zachery des turquoises: méthode d'identification simple fondée sur la microchimie [Zachery-treated turquoise: A simple identification technique using chemicals].** B. Mocquet [blanca.mocquet@free.fr], Y. Lulzac, E. Fritsch, and B. Rondeau, *Revue de Gemmologie*, No. 168, 2009, pp. 8–11 [in French].

While Zachery-treated turquoise cannot be detected through classic gemological methods, the material can be identified by its relatively high potassium content. This article describes a microchemical technique for detecting differences in potassium content without using sophisticated analytical methods such as EDXRF spectroscopy. Most fashioned turquoise undergoes surface treatment (e.g., with waxes, oils, or plastics), which must be removed prior to the test; a droplet of dilute nitric acid (30% by volume in water) is sufficient. Then, a drop of picric acid solution is placed on the unprotected surface of the turquoise. If long yellow needles form as the drop dries, the stone is Zachery treated. Untreated turquoise shows no reaction.

GL

## SYNTHETICS AND SIMULANTS

**Aquamarine—Natural or synthetic?** A. Hodgkinson, *Australian Gemmologist*, Vol. 23, No. 11, 2009, pp. 495–499.

Synthetic aquamarine has been available since the late 1980s, and a considerable amount of it appeared at the Tucson gem shows in the late 1990s. This product requires close scrutiny to distinguish it from natural aquamarine. Synthetic aquamarine is seen in a range of color tones and saturations but often is darker than natural material. Commercial production of synthetic aquamarine generally employs seed plates that are cut parallel to a pyramidal face, and the crystal overgrowth exaggerates this feature. A pattern of characteristic growth lines is also diagnostic of the synthetic.

DAZ

**The genetic approach for identification of varieties of crystalline and amorphous silica.** V. S. Balitsky [balvlad@iem.ac.ru] and O. V. Balitskaya, *Australian Gemmologist*, Vol. 23, No. 11, 2009, pp. 500–508.

Correlations between certain gemological characteristics and growth conditions of natural and synthetic varieties of quartz and of play-of-color opal led the authors to outline a testing and identification approach described as "genetic gemology." Recognizing characteristic features exclusive to either natural or synthetic growth allows a gem material's origin to be determined unambiguously. Illustrated examples are given of color distribution in natural and synthetic quartz.

RAH

**Kinetics of diamond single crystal growth in Fe-Co solvents doped with titanium and zirconium.** V. V. Lysakovskii and S. A. Ivakhnenko, *Journal of Superhard Materials*, Vol. 31, No. 1, 2009, pp. 7–11.

The authors grew synthetic diamonds by the HPHT temperature-gradient method using Fe-Co alloy solvents with Ti and Zr as nitrogen getters to control their N content. Growth temperatures of 1380–1680°C and pressures of 5.5–6.1 GPa were used for these experiments. Lower amounts (~1 at.%) of Ti and Zr resulted in type Ib diamonds, whereas higher amounts (~6 at.%) resulted in type IIa crystals with slower growth rates (~3 mg/h vs. ~6 mg/h). Raising the growth temperatures changed the crystal morphology from cuboctahedral to octahedral. The results of these experiments allowed the authors to define the pressure-temperature conditions under which synthetic diamonds could be produced with particular colors, crystal morphologies, and probable inclusion phases.

JES

**Synthetic sapphires with "natural-like" sheen.** G. Choudhary [gtl@gjepcindia.com], *Gems & Jewellery*, Vol. 18, No. 3, July 2009, pp. 6–9.

A new type of synthetic sapphire displays sheen effects similar to those seen in some natural sapphires. Sheen is a kind of surface luster caused by the scattering of light from evenly distributed minute inclusions. Traditionally, the presence of such inclusions has provided a reliable indication of a natural stone. However, synthetic corundum is now being produced with inclusions that can create sheen. The samples tested were yellow, green, and greenish blue, but other colors such as red and blue are available.

A number of gemological properties distinguished these samples as synthetic. Microscopic examination revealed curved zones or clouds consisting of fine whitish pinpoints (possibly gas bubbles or unmelted feed powder); this indicated flame-fusion or Verneuil synthesis. Scattered spherical gas bubbles were present in all samples. In addition to these features, which are typical of synthetic corundum, a number of uncommon inclusions were present, and one of the gems appeared transparent to short-wave UV radiation (indicating a synthetic). Although routine gem testing was sufficient to identify these samples as synthetics, the lighter-colored gems could pose identification problems if they are not carefully examined.

DAZ

## TREATMENTS

**Gemological modification of local natural gemstones by ion beams.** S. Intarasiri, D. Bootkul, L. D. Yu [yuld@fnrf.science.cmu.ac.th], T. Kamwanna, S. Singkarat, and T. Vilaithong, *Surface & Coatings Technology*, Vol. 203, No. 17/18, 2009, pp. 2788–2792.

Rough and polished corundum from Thailand and Myanmar were treated by implanting either low- or medium-energy oxygen or nitrogen ions to change their color. Implantation conditions included energies of 20, 60, and 120 keV, beam currents of 0.1 to a few milliamps, and fluences of  $10^{18}$  to  $10^{19}$  ions/cm<sup>2</sup>. The target gemstones reached temperatures of 200–600°C during the treatment. According to the authors, the samples' clarity, color distribution, luster, and brilliance improved following ion implantation. They suggest that the color alterations result from changes in the oxidation state of the transition metals (such as iron), or the creation of charge-transfer mechanisms or defect color centers within the samples. However, no data about the depth of ion implantation in the samples is provided. The process does not induce any residual radioactivity, and it is much faster than traditional heat treatment.

JES

## MISCELLANEOUS

**Building peace with conflict diamonds? Merging security and development in Sierra Leone.** P. Le Billion and

E. Levin, *Development and Change*, Vol. 40, No. 4, 2009, pp. 693–715.

In developing nations with diamond resources, there is significant debate over which delivers the most social benefit while keeping the diamonds within legitimate trading channels: corporate mining or artisanal digging. This paper describes the diamond areas around Kono, recounts the brutal history of the 1990s civil war, and explores the potential benefits and problems of both mining policies. The authors conclude that the positive effects of artisanal mining have been largely overlooked.

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**Diamonds, governance and “local” development in post-conflict Sierra Leone: Lessons for artisanal and small-scale mining in sub-Saharan Africa?** R. Maconachie [roy.maconachie@manchester.ac.uk], *Resources Policy*, Vol. 34, 2009, pp. 71–79.

The complex problems facing post-civil war Sierra Leone create significant challenges in forming diamond-mining policies that can truly benefit the different communities rather than encourage corruption. Several development initiatives have been launched to equitably distribute proceeds from local alluvial diamond diggings. While these initiatives achieved some success, in some communities the majority of the proceeds went to a handful of “local elites.” In addition, alluvial diamonds are easily extracted and their deposits are scattered over wide areas, which makes them susceptible to illegal mining and theft. At the same time, the government has not been effective at monitoring diamond exports. Meanwhile, long-entrenched dealers who have profited from illegal mining activities have a strong interest in maintaining the status quo. The author argues that it will take considerable time to develop good governance practices and the necessary accountability to make such programs work effectively.

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**Tanzanite as a conflict gem: Certifying a secure commodity chain in Tanzania.** R. A. Schroeder [rschroed@rci.rutgers.edu], *Geoforum*, Vol. 41, No. 1, 2010, pp. 56–65.

Shortly after the September 11 terror attacks, reports in the American press claimed that some tanzanite dealers were actively funding terrorist activities. While a subsequent U.S. State Department investigation debunked the connection to terror, later articles focused on the hazardous working conditions of independent tanzanite miners and the allegedly harsh methods employed by TanzaniteOne, the one large mining operation, in protecting its concession from poachers. TanzaniteOne dealt with these public relations challenges by implementing an unbroken supply chain to the market that complies with the USA PATRIOT Act, though it has experienced ongoing difficulties maintaining this chain in an area with a large, informal economy.

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