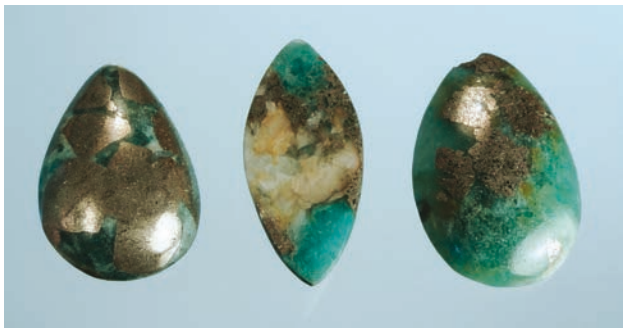
## An Unusual Emerald and Pyrite Mixture from Colombia

Emeralds from Colombia are commonly associated with pyrite (for information on the geology of the deposits see, e.g., Pignatelli et al., 2015), and sometimes pyrite is found also as inclusions in the emeralds. In 2015, a new find of emerald from an undisclosed locality in Colombia produced intergrowths of pyrite, emerald and dolomite. Cabochons cut from this material are quite distinctive, and four of them were studied for this report (e.g. Figure 8).

The ratio of pyrite, emerald and dolomite in the samples was highly variable. In two of them, pyrite clearly crystallized first, forming euhedral cubic crystals up to 10 mm. In the other two cabochons, pyrite was present as irregular corroded masses surrounding small grains of emerald (e.g. Figure 9). The green areas of the stones were typically formed by a granular mixture of emerald and dolomite (again, see Figure 9)—except for the marquise-shaped cabochon, in which both minerals occurred separately. (The presence of emerald and dolomite in the cabochons was confirmed by Raman spectroscopy; pyrite does not produce a Raman spectrum with this author's unit.)

*Figure 8: These cabochons from Colombia consist of intergrowths of pyrite, emerald and dolomite. The centre stone is 36 mm long. Photo by J. Hyršl.*



Overall, the polish lustre of the cabochons was mediocre due to the different hardness of the three minerals (Mohs 7½–8 for beryl, 6–6½ for pyrite, 3½ for dolomite). Within the mixed emerald-dolomite areas, the softer grains of dolomite could be easily distinguished with a loupe from the harder emerald by differences in their lustre.

Pyrite is a relatively unstable mineral, especially in humid conditions, and it is very fragile. For this reason, the studied cabochons are not suitable for jewellery use, but they represent interesting collector's objects.

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### Reference

Pignatelli I., Giuliani G., Ohnenstetter D., Agrosì G., Mathieu S., Morlot C. and Branquet Y., 2015. Colombian trapiche emeralds: Recent advances in understanding their formation. *Gems & Gemology*, **51**(3), 222–259, http://dx.doi.org/10.5741/gems.51.3.222.

*Figure 9: The texture of the various minerals is visible on the base of this cabochon (35 mm long), which shows irregular corroded masses of pyrite and granular intergrowths of emerald and dolomite. Photo by J. Hyršl.*

## Garnet from Mahenge, Tanzania

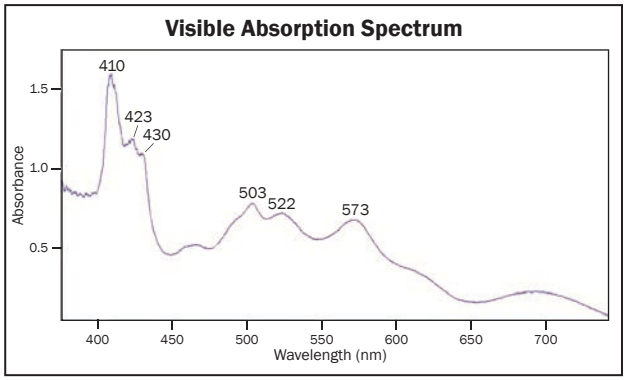
The Mahenge area in the Morogoro region of south-central Tanzania is a well-known source of several gem varieties, particularly spinel and ruby. During the 2016 Tucson gem shows, Steve Ulatowski (New Era Gems, Grass Valley, California, USA) had some pink to orangey pink garnets from a new find in this area that he sold as 'Mahenge Malaya'. He obtained the rough material in mid-December 2015 in Arusha, Tanzania. Consisting of clean alluvial pebbles, the garnet ranged from pinkish orange to a saturated 'hot' pink. Most of the production was rather

*Figure 10: Weighing 6.79 and 6.84 ct, these faceted garnets from Mahenge, Tanzania, are unusually large for this new find. Courtesy of Evan Caplan; photo by Jeff Scovil.*

small sized, although Ulatowski encountered ~1 kg of material consisting of >0.5 g stones, with the largest pieces weighing >3 g. Faceting of two of the largest pieces yielded attractive pink and pinkish orange gemstones weighing 6.79 and 6.84 ct (Figure 10).

Ulatowski loaned a 3.22 ct triangular preform for examination, and the table facet was kindly polished during the show by Todd Wacks (Tucson Todd's Gems, Tucson, Arizona). Its colour was 'fleshy' pink with a faint brown tint (World of Color 2.5R5/6, Brownish Red) under daylight-equivalent lighting. Viewed with incandescent lighting, the brown tint was not evident and the stone appeared slightly more reddish pink (World of Color 2.5R5/10, Moderate Red). This colour behaviour is typical of many so-called Malaya or colour-shift garnets from East Africa. The stone had an RI of 1.751 and a hydrostatic SG of 3.82. Anomalous extinction was observed between crossed polarizers, and the garnet was inert to both long- and short-wave UV excitation. Magnetic susceptibility was not insignificant, with it being picked up by a 9-mm-diameter N-52 REE magnet, and easily dragged by smaller N-52 magnets. The stone appeared eye clean, but microscopic observation revealed several small, scattered, whitish, breadcrumb-like inclusions as well as what appeared to be fine strings of partially dissolved needles.

*Figure 11: The visible-range spectrum of a 'fleshy' pink sample of Mahenge garnet showed absorptions related to both almandine and spessartine.*




Pink is one of the rarer colours of garnet, and is typically seen in either the hydrogrossular or pyrope-dominant varieties. EDXRF chemical analyses with an Amptek X123-SDD spectrometer revealed major amounts of Mn and Fe, minor Ca, and traces of Cr. Although Mg was below accurate detection levels for this instrument, electron microprobe analysis of five samples of this garnet by John Attard (Attard's Minerals, San Diego, California, USA) revealed major amounts of Mg in all of them. They consisted mainly of pyrope with variable spessartine and almandine, and a very minor grossular component.

Visible-range spectroscopy using an Ocean Optics USB4000 spectrometer with a 7-inch integrating sphere showed weak almandine absorptions at 503, 522 and 573 nm, as well as spessartine absorptions at 410, 423 and 430 nm (Figure 11). Infrared spectroscopy with a PerkinElmer Spectrum100 Fourier-transform infrared (FTIR) instrument revealed a significant water content. The various water-related peaks between 3560 and 3675 $cm^{-1}$ were consistent with OH absorption (Ogasawara et al., 2013).

This attractively coloured garnet is a welcome addition to the gem marketplace.

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Ogasawara Y., Sakamaki K. and Sato Y., 2013. Water contents of garnets from the Garnet Ridge, northern Arizona: $H_2O$ behavior underneath the Colorado Plateau. American Geophysical Union, Fall Meeting, abstract #V23A-2754, http://adsabs.harvard.edu/abs/2013AGUFM.V23A2754O.

## New Production of Grandidierite from Madagascar

Grandidierite, $(Mg, Fe^{2+})(AlFe^{3+})_3(SiO_4)(BO_3)O_2$, is an extremely rare collector's stone that is known in gem quality mainly from Madagascar, and less commonly from Sri Lanka. The material from Madagascar typically lacks transparency: Ostwald (1964) noted that "only massive [rough] material was available for study", and Mitchell (1977) stated that the small number of faceted stones and cabochons that he examined were "semitransparent, due to fissures and inclusions". Schmetzer et al. (2003) documented the first transparent faceted grandidierite (0.29 ct); it was also the first time this gem was reported from Sri Lanka.

During the 2016 Tucson gem shows, Frédéric Gautier (Little Big Stone, Antananarivo, Madagascar) had several pieces of transparent faceted grandidierite from new finds in the Androy region, Tuléar Province, southern Madagascar. The initial production occurred in late 2014, when some low-quality material was found. Better-quality stones were found during early- to mid-2015: approximately 300 kg were produced, with a very small percentage that was transparent. Most of the gem material consisted of small pieces, with some larger fractured pieces weighing 5–10 g. The colour ranged from pale to moderately saturated greenish blue to bluish green, in medium to dark tones. Gautier faceted 40 clean stones weighing 0.10–1.78 ct (e.g. Figure 12). Gemmological properties of a recently produced Malagasy grandidierite were described by Vertreist et al. (2015).

This new production from Madagascar marks the first time that a significant number of clean faceted grandidierites have become available, and also the largest pieces of transparent material ever to be cut. Hand mining of the deposit continues, and it is possible that more gem-quality rough will be produced. Nevertheless, grandidierite remains a very rare gem material.

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Ostwald J., 1964. Some rare blue gemstones. *Journal of Gemmology*, **9**(5), 182–184, http://dx.doi.org/10.15506/jog.1964.9.5.182.

*Figure 12: Weighing 1.78 ct (left) and 1.08 ct (right), these grandidierites from Madagascar are exceedingly large and transparent for this rare gem material. Photos by Jeff Scovil.*