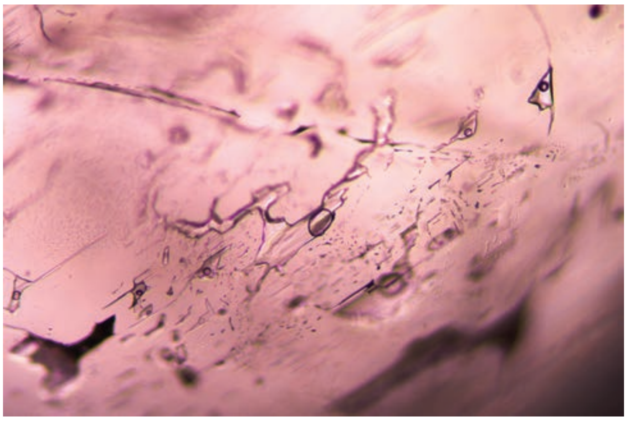

Figure 24: Partially healed fissures containing two-phase inclusions are prominent features in the cat's-eye väyrynenite. Photomicrograph by J. C. Zwaan; image width 1.4 mm.

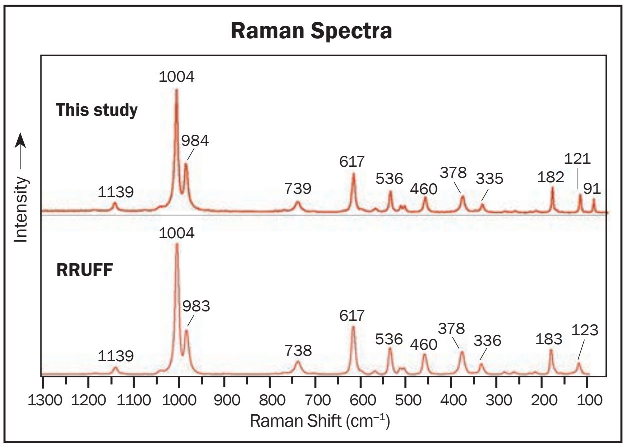


Figure 25: The Raman spectrum of the cat's-eye stone provides a good match to väyrynenite in the RRUFF database that is from Shengus in northern Pakistan.

northern Pakistan (Figure 25). The main peak at 1004 $cm^{-1}$ and the strong band at 984 $cm^{-1}$ are attributed to the $PO_4^{3-}$ $\nu_1$ symmetric stretching mode, while peaks between 800 and 300 $cm^{-1}$ are due to $PO_4^{3-}$ bending modes and vibrations of POH units (Frost et al., 2014). Additionally, in the 3800–2600 $cm^{-1}$ region (not shown in Figure 25), a strong band was present at 3219 $cm^{-1}$ that is assigned to the OH stretching vibration (Frost et al., 2014). Note that Raman spectra of väyrynenite from different localities (e.g. from Finland and Pakistan) may show significant differences, and these appear to be related to variations in chemical composition (Frost et al., 2014).

EDXRF analyses were performed with an EDAX Orbis Micro-XRF Analyzer, using a spot size of 300 µm. As expected, the main elements Mn and P were found (Be cannot be detected with this technique). Minor Fe and traces of Ca also were present, and these are consistent with electron microprobe analyses of väyrynenite reportedly from Gilgit, Pakistan (Falster et al., 2012).

This cat's-eye väyrynenite is extremely rare, and is the only example of this stone that Blauwet has seen after decades of dealing in gem material from Pakistan and Afghanistan.

*Dr J. C. (Hanco) Zwaan*

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## SIMULANTS

### Quartzite and Calcite Bangles, Resembling Jadeite

Recently submitted by an appraiser for identification were five bangle bracelets that were all represented as jade when sold to their client. Among them were obvious examples of agate and typical B-jade (bleached and polymer impregnated), but also some unexpected imitations.

One bangle appeared near-colourless but was actually very pale yellowish green (seen

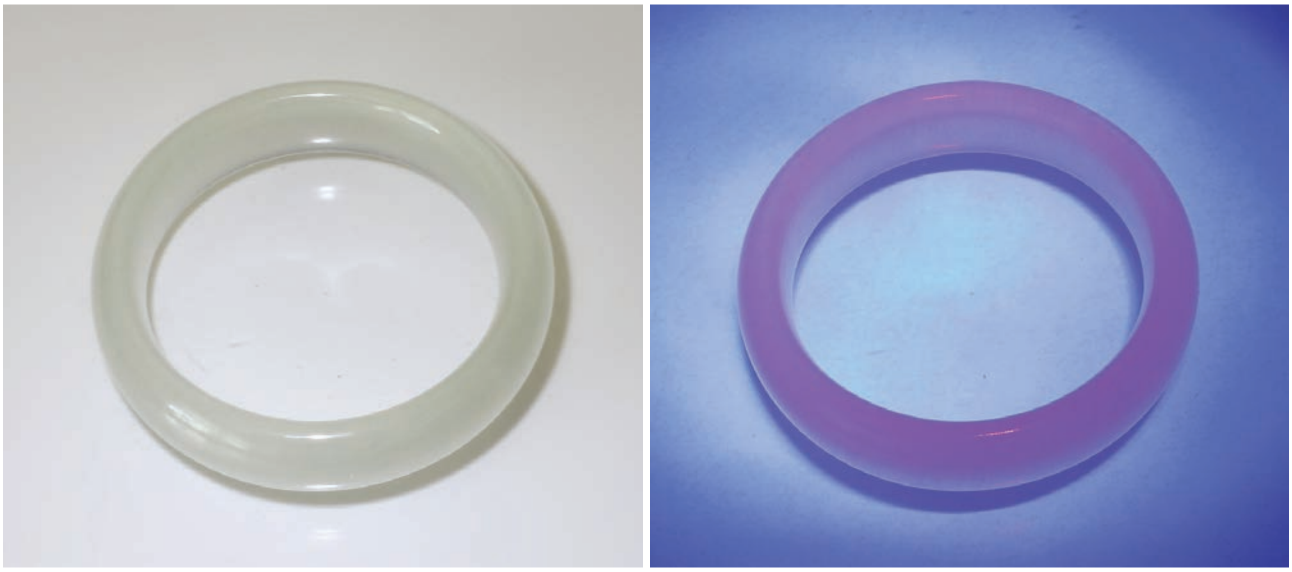

*Figure 26: This 16.5-mm-diameter bangle resembling 'ice jade' proved to consist of calcite (left). It displays pink fluorescence to long-wave UV radiation (right). Photos by B. Williams.*

only when placed on a white background). It exhibited the watery translucency typical of finer 'ice jade' (Figure 26, left), but Raman analysis with a GemmoRaman-532SG instrument identified it as calcite. Weighing 63.79 g, it was 16.5 mm in diameter and had an average thickness of 9.1 mm—which was somewhat thicker than a typical stone bangle. Close examination with a 10× loupe revealed an even pattern of colourless parallel banding throughout the piece, which created a weak, billowy cat's-eye effect along the entire circumference of the bangle. Viewed with the microscope, the banding was resolved as lamellar twinning together with numerous microscopic incipient cleavage cracks. Due to the twinning, the polariscope showed no 'blink' (i.e. the bangle remained light when it was rotated between crossed polarizers). No polymers or dyes were detected, either by microscopic observation or by FTIR spectroscopy with a PerkinElmer Spectrum100 unit. EDXRF chemical analysis with an Amptek X123-SDD spectrometer revealed a relatively high Mn content, and the bangle showed a uniform moderate pink fluorescence to long-wave UV radiation (Figure 26, right).

Another bangle appeared to be an imitation of 'moss-on-snow' jadeite (Figure 27, left), a variety that exhibits small areas of vivid green coloration in a white base. The bangle weighed 66.27 g and was 16.9 mm in diameter with an average thickness of 8.6 mm. It was highly trans-

*Figure 27: Although appearing like 'moss-on-snow' jadeite, this 16.9-mm-diameter bangle consists of dyed quartzite (left). The green areas of the bangle exhibit strong green fluorescence to long-wave UV radiation (right). Photos by B. Williams.*

lucent and mostly milky white, with three areas that were mottled in deep bluish green. Microscopic observation revealed the typical translucent graininess of quartzite, and the coloured areas showed green dye concentrations along grain boundaries. Raman analysis identified the bangle as quartz, confirming that it was quartzite. FTIR spectroscopy revealed the presence of a polymer in the coloured areas, which is the presumed method of delivering the dye. The green areas fluoresced a strong green under long-wave UV radiation (Figure 27, right).

While B-jade continues to be prevalent in the market, gemmologists should also be wary of other convincing jadeite imitations such as these.

*Cara Williams FGA and Bear Williams FGA*

## TREATMENTS

### Large Pink Sapphire with Diffusion-Induced Star

In August 2016, a large, semi-transparent to translucent, oval pink star cabochon mounted in a white metal ring with several diamonds was submitted for testing to the American Gemological Laboratories in New York (Figure 28). The client indicated that the cabochon weighed 56.47 ct before it was set in the ring. Measuring approximately 25.10 × 22.07 × 9.68 mm, the stone was quite impressive for its size, and visible-range spectroscopy using an S.I. Photonics CCD (charged coupled device)-array UV-Vis spectrophotometer showed that its attractive pink colour was caused by $Cr^{3+}$.

*Figure 28: Measuring approximately 25 × 22 mm, the oval pink cabochon in this ring proved to be a heat-treated pink sapphire with a Ti-diffusion-induced star. Photo by Kelly Kramer.*

Mid-infrared spectroscopy of the cabochon using a Thermo Nicolet 6700 FTIR spectrometer identified it as a sapphire. It also showed extremely weak lines at 3309 and 3232 $cm^{-1}$, which are part of a series of absorptions (3309, 3232 and 3185 $cm^{-1}$) that are indicative of heat treatment in metamorphic-related sapphires (Smith, 2010). Microscopic examination revealed numerous thermally-altered 'fingerprints' (partially healed fissures) that had a melted and drippy appearance. Coupled with sheets of heating residues that also were prevalent in the stone, heat treatment was evident. Fibre-optic lighting revealed an extremely shallow, sub-surface milky sheen/layer all over the stone (Figure 29). At 60× magnification, extremely minute needles could be discerned in this layer. In the absence of

*Figure 29: The thin, sub-surface milky sheen/layer seen in the sapphire using fibre-optic lighting is an indication that the star is the result of a diffusion process. As shown here at 60× magnification, minute needles can be discerned. A thermally altered partially-healed fissure with a melted/drippy appearance can be seen at the lower left. The three prominent straight lines are parting planes. Photomicrograph by Christopher P. Smith.*