



Figure 11: Some green patches of malachite also were present in the shattuckite specimen (left, image width 6.35 mm). The radiating fibrous pattern is typically associated with spherulitic growth (right, image width 5.08 mm). Photomicrographs by G. Choudhary.

Raman spectra in the region 200–2000 cm^{-1} identified the specimen as shattuckite, with characteristic peaks at ~259, 329, 395, 450, 508, 559, 661, 775, 847, 942 and 1069 cm^{-1} (see, e.g., www.ruff.info/doclib/hom/shattuckite.pdf), while the green areas displayed peaks for malachite.

Shattuckite is a hydrous copper silicate, $\text{Cu}_5(\text{SiO}_3)_4(\text{OH})_2$, which occurs as a secondary mineral in oxidized copper deposits and is commonly associated with chrysocolla, ajoite, malachite and quartz (Anthony et al., 1995). It is known from Bisbee (Shattuck mine), Arizona, USA, as well as Namibia, Democratic Republic of Congo (Overlin, 2014), Chile and elsewhere (Anthony et al., 1995).

This specimen was identified as shattuckite on the basis of Raman spectroscopy, and without this technique it could have been mistaken for azurite. The client was not aware of the sample's identity or origin.

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Saguaro Stone, a New Ornamental Material from Arizona (USA)

During the 2014 Tucson gem shows in Arizona, USA, Warren Boyd FGA (Apache Gems, San Carlos, Arizona) donated to Gem-A a 39.60 ct oval cabochon marketed as *Saguaro Stone*. This new gem material had been recently surface-collected by Charles Vargas on the San Carlos Apache Reservation in Arizona. Boyd indicated that so far 700–800 kg of rough have been stockpiled, and that nearly 1,000 cabochons have been cut and polished in China and the USA, ranging from 10 × 8 mm to 20 × 10 mm, as well as a number of free forms. A few pieces have been sold to local designers, and in the

future there are plans to market the material on a larger scale.

For this report, the authors investigated the 39.60 ct oval cabochon (Figure 12) and a few small rough fragments. Viewed with the unaided eye, and particularly with the microscope, it was evident that this new ornamental material consisted of multiple phases that differed in colour and lustre. Standard gemmological testing was inconclusive, so a thin section was cut from one of the rough fragments for detailed mineralogical study. Under the high magnification of a petrographic microscope



Figure 12: This attractive new ornamental material (39.60 ct), called Saguaro Stone and found on Arizona's San Carlos Apache Reservation, consists mainly of brecciated green volcanic glass and veins of calcite. Gift to Gem-A from Apache Gems; photo © M. S. Krzemnicki, SSEF.

and assisted by Raman microspectroscopy, it became evident that this material consisted of a volcanic rock, formed mainly by brecciated masses of green volcanic glass. In places it showed wavy flow structures, and also present were a few primary magmatic inclusions such as plagioclase (up to 1.3 mm) and altered greenish brown biotite platelets (0.5–1.6 mm; Figure 13a). Additionally, small vacuoles in the rock (Figure 13b) were filled with fibrous chalcedony and opal (amorphous), and also some zeolites. The greenish colour of the brecciated masses was possibly due to the secondary formation of submicroscopic chlorite.

The Raman analyses further revealed that the whitish veins between the brecciated volcanic glass masses consisted of calcite. Also present were small transparent grey grains (with a distinctly higher lustre) of alkali feldspar that contained tiny metallic hematite flakes and small orange patches, possibly iron hydroxide. When exposed to short-wave UV radiation, the calcite veins fluoresced weak reddish pink, whereas the volcanic glass remained inert (Figure 14). The entire stone was inert to long-wave UV radiation.

EDXRF chemical analysis (with a spot size of ~3 mm in diameter) revealed major amounts of Si, Ca and Al, minor Fe and Mn, and traces of alkalis and alkaline earths (including Sr and Ba). This composition is consistent with a silica-

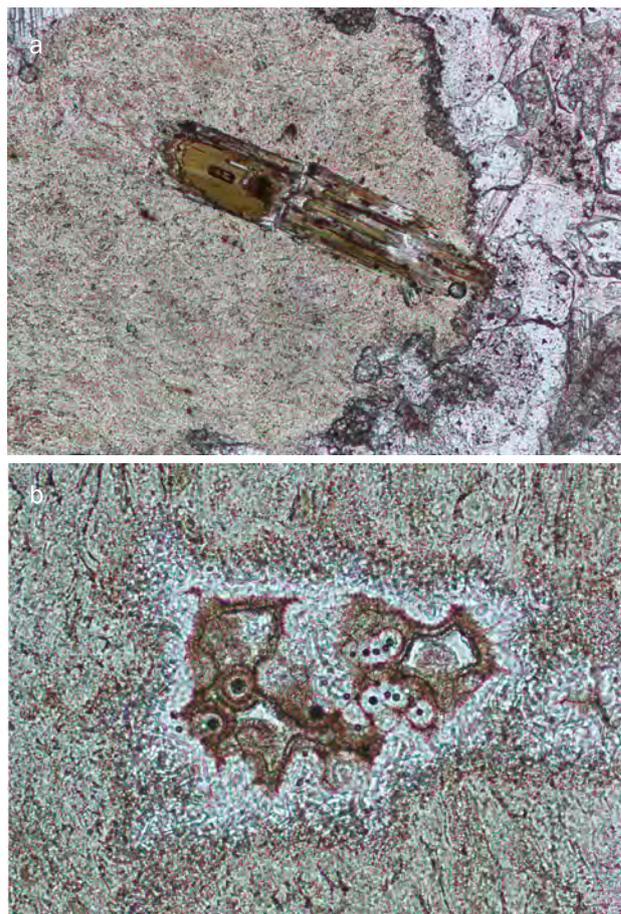
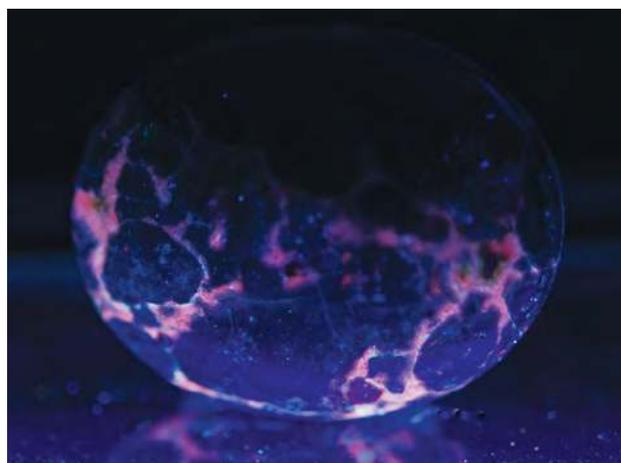


Figure 13: Thin-section examination of the green volcanic rock revealed interesting features. (a) A primary magmatic inclusion of biotite is hosted by a matrix of volcanic glass showing weak flow structures. The colourless grains on the right side correspond to a secondary calcite vein. (b) A small cavity in the rock is filled with acicular chalcedony and amorphous opal. Photos © L. Franz, MPI University of Basel; image width 1.25 mm (a) and 0.56 mm (b).

Figure 14: When the 39.60 ct cabochon is exposed to short-wave UV radiation, the calcite veins in the volcanic rock show a pinkish reaction, whereas the volcanic glass masses remain inert. Photo © M. S. Krzemnicki, SSEF.



rich volcanic glass containing plagioclase and phyllosilicate inclusions, together with secondary calcite veins.

This ornamental rock makes an attractive addition to the gem market, especially as it is relatively tough and hard, and thus shows a high lustre combined with an attractive colourful brecciated texture.

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'Ruby'-red Tourmaline from Nigeria

During the June 2015 JCK show in Las Vegas, Nevada, USA, Bill Barker (Barker & Co., Scottsdale, Arizona, USA) displayed some red tourmaline from a new discovery at the Oyo Valley deposits in Nigeria, which was notable for its ruby-like coloration. He obtained three large pieces of rough in April 2015 from his supplier in Lagos, Nigeria. Although the rough was dark, it was very red. Cutting of a piece that weighed 8.4 kg yielded 3,973 carats of faceted stones (not including melee from the offcuts) ranging from ~1 to 16 ct each. The final yield of 9.5% was far below the typical yield (13–16%) that Barker has obtained in the past from Oyo Valley Nigerian rubellite, and resulted from his choice to cut smaller stones (especially Portuguese-style rounds) so they would not appear overly dark. Also, only clean faceted stones and no cabochons were cut from the rough.

Barker assembled seven jewellery suites from this material (see, e.g., the cover of this issue), and also offered individual cut stones (Figure 15). They displayed an attractive red colour similar to Thai ruby—so much so that he displayed the rubellite next to Thai ruby at the JCK show (e.g. Figure 16). This coloration is rather distinct from the lighter pink to purplish pink hues that are typically shown by Nigerian tourmaline.

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Figure 15: These 'ruby'-red tourmalines from Nigeria weigh 4.25–7.25 ct. Photo by Rich Barker.



Figure 16: The Nigerian rubellite on the left (2.71 ct) shows a similar coloration to the Thai ruby on the right (3.14 ct). Both gems were faceted by the same cutter as Portuguese-style rounds. Photo by Rich Barker.

Tremolite from Mwajanga, Tanzania

During the 2015 Tucson Gem shows, gem dealer Werner Radl of Mawingu Gems (Niederwörresbach, Germany) displayed a prismatic gem-quality crystal (Figure 17) that

he obtained in Tanzania. It was sold to him as tourmaline, and reportedly came from a new find in the Mwajanga area (Manyara region of north-central Tanzania).