Gem Notes

COLOURED STONES

Antigorite Serpentine from North-West Pakistan

During the 2015 Tucson gem shows in Arizona, USA, one of the authors (BML) was informed about some recently produced translucent green gem materials from north-west Pakistan by two different dealers. Syed Iftikhar Hussain (Syed Trading Co., Peshawar, Pakistan) donated to Gem-A a weakly chatoyant cabochon (16.77 ct) and a piece of rough material that were thought to be actinolite, as well as a cobble that was sold to him as nephrite, while Anzor Douman (Arzawa Mineralogical Inc., Winchester, Virginia, USA) had a sample of chatoyant material that resembled nephrite upon initial inspection. Later, during the following year's Tucson gem shows, Sir Ahmad (Farooq) Hashmi of Intimate Gems (Glen Cove, New York, USA) loaned one faceted stone (3.71 ct) and three oval cabochons (6.29–8.59 ct) consisting of an unidentified green material that was reportedly mined from north-west Pakistan. The overall appearance of all the samples (i.e. the semi-transparent to translucent diaphaneity and the 'olive' green colour; e.g. Figure 1) were typical of some nephrite showing good transparency.

Figure 1: These green gems (3.71–16.77 ct), reportedly from a relatively new deposit in Pakistan, proved to be antigorite serpentine. The largest stone shows a faint cat's-eye effect. Photo by B. Williams.

The 'actinolite' samples from Hussain and the 'unknowns' from Hashmi were examined by authors CW and BW, and analysis with a GemmoRaman-532SG spectrometer identified all of them as antigorite serpentine, $Mg_3(Si_2O_5)(OH)_4$. Fourier-transform infrared (FTIR) spectroscopy with a PerkinElmer Spectrum100 unit revealed the expected high amounts of OH and H_2O associated with serpentine minerals, and none of the samples showed any indications of polymer-type treatment.

Further testing of the polished stones revealed spot RI values of approximately 1.56, and hydrostatic SG measurements ranged from 2.59 to 2.60, typical of serpentine. The lustre of the gems ranged from sub-vitreous to silky, which is consistent with the variable low Mohs hardness of antigorite (2½–4, rarely up to 6; Gaines et al., 1997). The samples were inert to long- and short-wave UV radiation, and visible-to-near-infrared (Vis-NIR) spectra with an Ocean Optics USB4000 spectrometer showed a strong absorption peak at 460 nm, a weak 493 nm feature and a broad band centred at 715 nm that extended from the red region into the infrared. Energy-dispersive X-ray fluorescence (EDXRF) spectroscopy showed a chemical composition that was consistent with antigorite for the elements detectable by our Amptek X123-SDD instrument (i.e. Si), as well as significant Ni, minor Cr and Mn, and traces of V and Zn. All samples contained numerous parallel, near-colourless linear features (e.g. Figure 2) that showed a fibrous, feathery effect in some cases. The weak chatoyancy exhibited by the 16.77 ct cabochon was caused by a relatively large amount of these inclusions. Also present in some samples were opaque black dendritic and crumb-like masses (Figure 3).

The antigorite described in this report shows some similarities to a cat's-eye serpentine from an unspecified origin documented by Choudhary (2009), except that stone fluoresced weak yellow

Figure 2: Abundant parallel linear inclusions are present in this 6.29 ct antigorite cabochon. Photo by C. Williams.

to long-wave UV radiation, and the desk-model spectroscope recorded only weak bands in the green and blue regions of the spectrum. Also, it contained fewer trace elements (Cr, Fe and Ni) than the material described here. Although this antigorite may be offered in the market as actinolite or nephrite, it can easily be identified by its lower RI and SG values. It also has a lower hardness, and the parallel linear features present in the samples examined for this report are not seen in nephrite, although antigorite does not always contain such inclusions.

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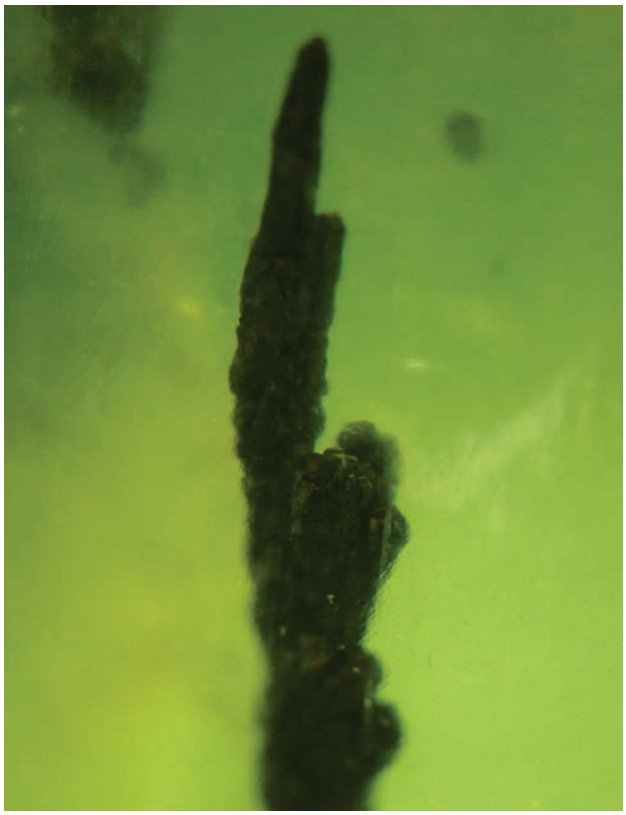

Figure 3: Some of the antigorite samples contained opaque black dendritic inclusions, such as those seen here. Photomicrograph by C. Williams; magnified 30×.

References

Choudhary G., 2009. Gem News International: Serpentine cat's-eye. *Gems & Gemology*, **45**(2), 151–152.

Gaines R.V., Skinner H.C.W., Foord E.E., Mason B. and Rosenzweig A., 1997. *Dana's New Mineralogy*, 8th edn. John Wiley & Sons, New York, New York, USA, 1872 pp. (see pp. 1415–1417).

'Black' Axinite

Axinite is a rather unusual gem material that is most commonly encountered as the species axinite-(Fe), $Ca_2Fe^{2+}Al_2BSi_4O_{15}OH$, which typically shows an overall dark purplish brown coloration. However, at the February 2015 Tucson gem shows, some faceted examples of 'black' axinite were displayed by Mauro Pantò (The Beauty in the Rocks, Sassari, Italy). Pantò cut approximately 10 stones from a single large axinite crystal of unknown origin that his supplier suspected to be from Russia. The dark colour and translucent diaphaneity of the gems both appeared to be caused by abundant inclusions (Figure 4). Pantò mentioned that

Figure 4: These samples of 'black' axinite (5.04–12.87 ct) are coloured by abundant clinochlore inclusions. Photo by Mauro Pantò.