Gem-quality Dark Blue Haüyne from Afghanistan

Haüyne is a cubic silicate mineral of the sodalite group with the formula $Na_3Ca(Si_3Al_3)O_{12}(SO_4)$. Most faceted haüyne seen in the gem trade consists of small, bright blue stones that originate from the Eifel Mountains in western Germany (Kiefert & Hänni 2000). Recently, however, some unusual gem-quality haüyne ranging from yellowish green to bluish green has become available from Afghanistan's Badakhshan Province (Renfro *et al*. 2024; Srisataporn *et al*. 2024). This locality is now also producing blue haüyne.

In January 2025, the Swiss Gemmological Data Foundation received a donation of blue cabochons, faceted stones and rough material represented as haüyne (Figure 30, right side). They were reportedly from Ladjuar Medan in the Sar-e-Sang area, Badakhshan, Afghanistan. Although greenish blue haüyne has been known from Badakhshan since at least 2006 (Kondo *et al*. 2008), pure blue material has not been previously described in the literature from this locality. This note characterises blue Afghan haüyne, and compares it to the material from Germany in the GGTL Laboratories Switzerland reference collection.

The identity of the stones as haüyne was confirmed by FTIR spectroscopy, which showed features consistent with those of haüyne from Germany (Figure 31). The RI varied from 1.498 to 1.508, consistent with the documented range for haüyne (Deer *et al*. 1992). However, measurements of hydrostatic SG were slightly lower than expected, with values of 2.42–2.44 (vs 2.44–2.50 usually documented). The reason for the lower SG values is not known. The stones fluoresced faint orange to short-wave (254 nm) UV radiation and bright orange to long-wave (365 nm) UV.

Compared to German haüyne, the material from Afghanistan showed greater colour saturation (again, see Figure 30). In addition, there were significant differences in their UV-Vis-NIR absorption spectra (Figure 32). The Afghan haüyne displayed an absorption band with an apparent maximum at 400 nm, which was considerably more intense than the feature observed around the same wavelength in the German haüyne. This band is attributed to the presence of S_2^- ions, although it appears slightly offset from its position of 380–394 nm in the spectra of the German haüyne (Kiefert & Hänni 2000) or in minerals with analogous structures, such as sodalite (Blumentritt 2021). In addition, an absorption band with an apparent maximum at approximately 600 nm due to S_3^- (Climent-Pascual *et al*. 2009) was stronger in the spectrum of the Afghan haüyne. This band creates a transmission window centred around 480 nm, thereby contributing to the 'ultramarine'-blue colour characteristic of members of the sodalite group (haüyne,

Figure 30: The group of stones on the right consist of haüyne from Ladjuar Medan, Afghanistan, while those on the left are haüyne from the Eifel Mountains in Germany. The largest cabochon weighs 1.50 ct. Photo by F. Blumentritt.

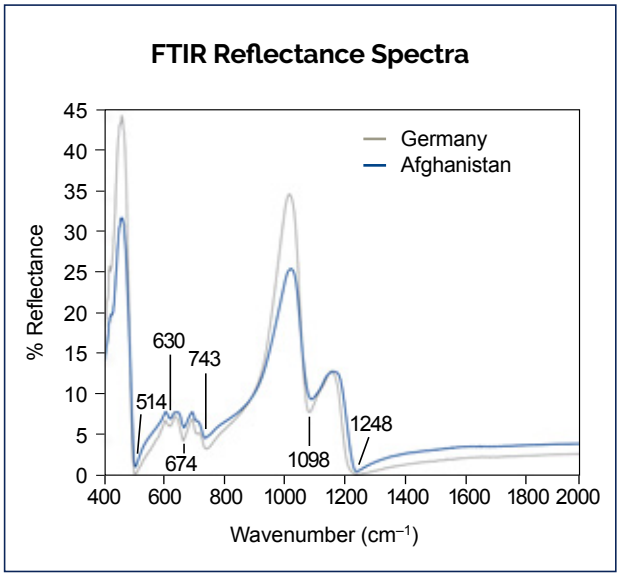

Figure 31: Infrared spectroscopy shows consistent features for haüyne from both Afghanistan and Germany.

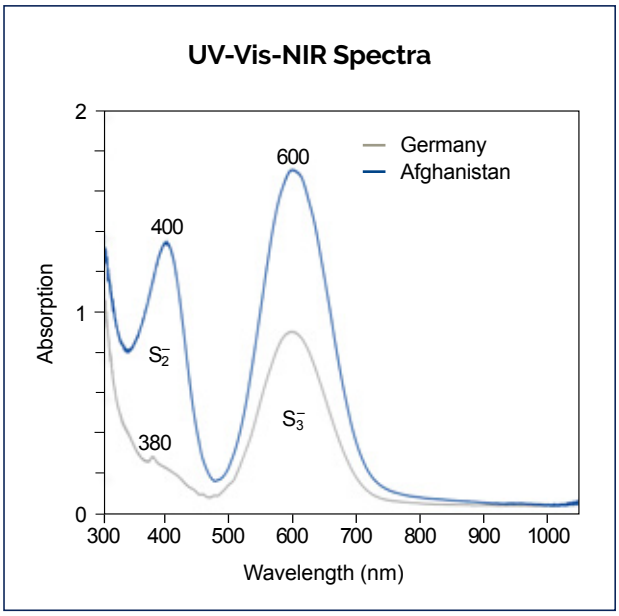

Figure 32: Significant differences are seen in the UV-Vis-NIR absorption spectra of haüyne from Afghanistan and Germany, particularly around 400 nm. The path length of the beam through the samples was about 3.2 mm (Afghanistan) and 1.5 mm (Germany).

sodalite, lazurite, etc.).

Semi-quantitative chemical analyses of the Afghan samples by EDXRF confirmed the identification of the haüyne species within the sodalite group, with mean relative proportions of Na, Ca and K of 70%, 29% and 1%, respectively. In addition, the Afghan haüyne exhibited greater Cu (average 270 ppmw, range 61–610 ppmw) compared to the German samples (average 20 ppmw Cu). Conversely, the Afghan haüyne exhibited lower Fe (average 33 ppmw, range 7.4–114 ppmw) in comparison to an average of 4,410 ppmw for the German haüyne. This is consistent with the enriched Fe content of German haüyne noted by Kiefert and Hänni (2000). Finally, arsenic was systematically detected in the Afghan haüyne samples, but was not found in the German material that we analysed, and likewise has not been reported in haüyne in the literature.

Until recently, gem-quality haüyne has been scarce and extremely expensive, but new production from Afghanistan is increasing the availability of this attractive gem material, including polished samples weighing 4–5 ct and more.

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