References

Černá I., Černý P. and Ferguson R.B., 1973. The fluorine content and some physical properties of the amblygonite-montebrasite minerals. *American Mineralogist*, **58**, 291–301.

Orris G.J., and Bliss J.D., 2002. *Mines and Mineral Occurrences of Afghanistan*. U.S. Geological Survey Open-File Report 02-110, 95 pp.

Schunk J.E. and Deane N., 1955. Another mineral in gem quality. *Journal of Gemmology*, **5**(3), 154–156, http://doi.org/10.15506/jog.1955.5.3.154.

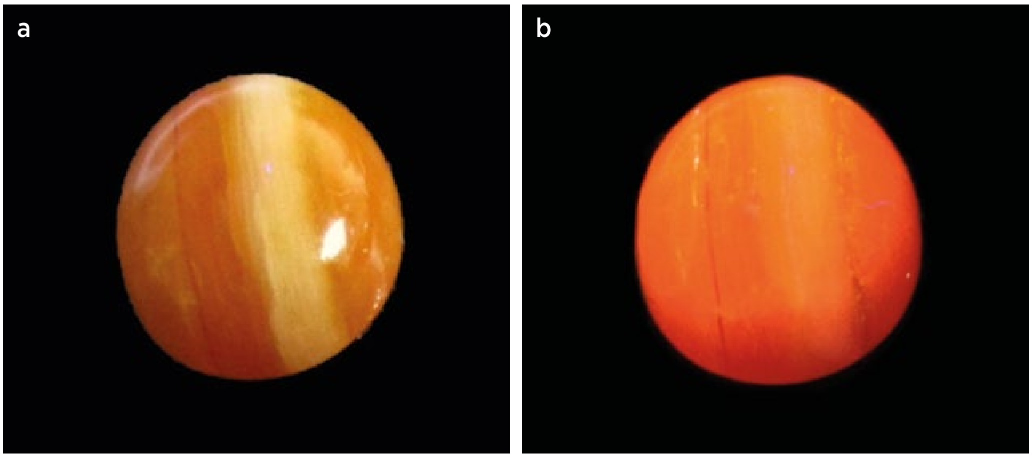

Figure 11: (**a**) This 2.20 ct opal, reportedly from Hokkaido, Japan, displays prominent banding. (**b**) Viewed with long-wave UV radiation, the sample demonstrates a vibrant orange reaction in the orange bands, but the thin transparent colourless areas are inert. Photos by B. Williams.

Orange-Fluorescing Common Opal from Japan

During the June 2018 JCK Las Vegas show in Nevada, USA, gem dealer Dudley Blauwet had some interesting banded orange common opal that was notable for exhibiting strong orange fluorescence to long-wave UV excitation. The opal came from the Shikaribetsu Lake area in Kato District, Tokachi Province, Hokkaido, Japan (Okazaki et al., 2014). This region is covered by Daisetsuzan National Park, and contains numerous volcanos and hot springs. The geochemistry of the opal was characterised by Okazaki et al. (2015) and by Kanai et al. (2016). Both studies were unable to find an unambiguous relationship between chemical composition and fluorescence colour, leading the authors to propose that organic compounds may be involved.

Blauwet had four opal cabochons weighing up to 2.20 ct, and he loaned the largest sample for examination (Figure 11a). The stone was cut as a double cabochon and showed prominent, parallel, colour banding ranging from a translucent strong orange to very pale orange with some thin transparent colourless layers (Figure 12). The latter areas were inert to the UV lamp, but the orange areas fluoresced a vibrant orange (Figure 11b), which was stronger to long-wave than to short-wave UV radiation.

The RI of the stone, approximated by the spot method, was ~1.42. Specific gravity was measured hydrostatically as 2.12. Viewed between crossed polarisers, most of the stone remained light upon rotation (consistent with an amorphous structure), and no strain was visible, but the colourless areas blinked dark with every 90° of rotation. (However, we were unable to find any evidence of the

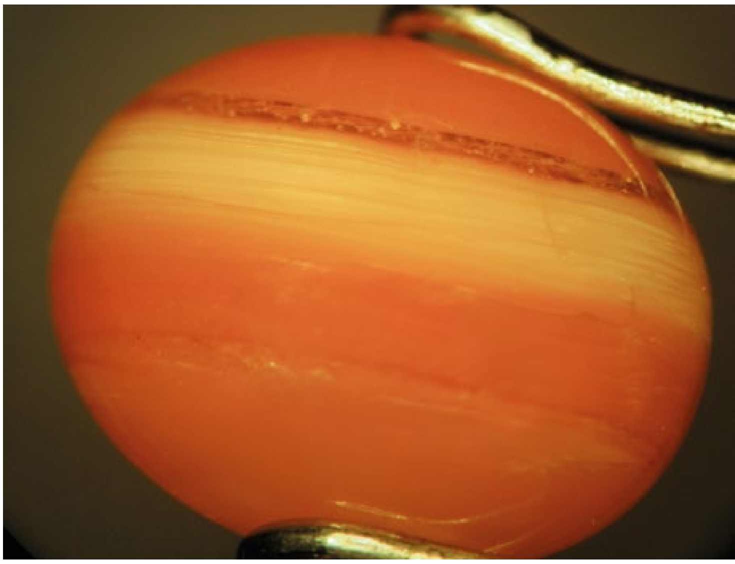

Figure 12: A closer view of the 2.20 ct opal shows the pronounced layered texture. Photo by Dean Brennan, Stone Group Laboratories.

presence of quartz to provide a reason for the blink.) There was no detectable magnetic susceptibility. No discernible results were obtained by Raman spectroscopy on either the coloured or colourless areas, but the 'fingerprint' region of the Fourier-transform infrared (FTIR) spectrum matched that of opal.

Energy-dispersive X-ray fluorescence spectroscopy with an Amptek X123-SDD spectrometer revealed the presence of minor Ca and traces of Fe, the latter being common in many orange opals. Moderate amounts of Mn were present, as were traces of Th. Using a Geiger counter, we detected low radiation emissions, at only about 1.5× background levels.

Strong orange fluorescence in common (pink) opal has been attributed to organic compounds called quinones (Fritsch et al., 2004), and may indicate the presence of organic material during the opal's formation.

Cara Williams FGA and Bear Williams FGA
(info@stonegrouplabs.com)
Stone Group Laboratories
Jefferson City, Missouri, USA

References

Fritsch E., Gaillou E., Ostroumov M., Rondeau B., Devouard B. and Barreau A., 2004. Relationship between nanostructure and optical absorption in fibrous pink opals from Mexico and Peru. *European Journal of Mineralogy*, **16**(5), 743–751, http://doi.org/10.1127/0935-1221/2004/0016-0743.

Kanai Y., Tachibana Y., Aoki M., Okazaki C., Oppata Y., Mita N. and Matsueda H., 2016. Study on chemical composition of fluorescent opal specimens in the Shikaribetsu area, central Hokkaido. *Bulletin of the Geological Survey of Japan*, **67**(4), 101–110, http://doi.org/10.9795/bullgsj.67.101 (in Japanese with English abstract).

Okazaki C., Matsueda H., Aoki M., Kanai Y., Mita N. and Oppata Y., 2014. First report of the fluorescent opal found in the Shikaribetsu volcano area, Hokkaido. *Journal of the Geological Society of Japan*, **120**(11), IX–X, http://doi.org/10.5575/geosoc.2014.0040 (in Japanese).

Okazaki C., Matsueda H., Kanai Y., Mita N., Aoki M. and Oppata Y., 2015. Preliminary report on mineralogy and geochemistry of opals from the Shikaribetsu area, central Hokkaido. *Bulletin of the Geological Survey of Japan*, **66**(7/8), 169–178, https://doi.org/10.9795/bullgsj.66.169 (in Japanese with English abstract).

Two Large Rubies from the Pamir Mountains, Tajikistan

In 2016, a sizeable amount (about 600 g) of facet-grade ruby rough was offered on the New York market that had been collected over multiple mining seasons from the Pamir Mountains of Tajikistan. The material was examined by the author, and subsequent to manufacturing, several stones were submitted to the American Gemological Laboratories (AGL) for gemmological reports.

Rubies and pink sapphires from Tajikistan were first reported in the late 1990s (Smith, 1998). Since that time, little additional information has come forward, with the exception of an excursion to the region in 2006 (see, e.g., www.ruby-sapphire.com/tajikistan_ruby_and_spinel.htm). Since rubies of Tajik origin are not particularly well known or recognised in the gem and jewellery industry, this report provides a refresher of their key identifying features—as seen in the two largest, unheated rubies examined here, which weighed 12.08 and 17.14 ct (Figure 13).

Figure 13: Weighing an impressive 12.08 ct (ring) and 17.14 ct (loose), these two unheated rubies were the best gems cut from a recent production of about 600 g of rough material from the Pamir Mountains of Tajikistan. Photo by Bilal Mahmood, AGL.

The stones showed a highly saturated red colour. Consistent with rubies originating from marble-type deposits, they exhibited a strong red and moderate red reaction when exposed to long- and short-wave UV radiation, respectively. Microscopically, they contained faint, very fine-grained planar clouds that had a whitish or slightly bluish appearance when illuminated with fibre-optic lighting (Figure 14). Concentrations of fine stringers were present, as well as colourless carbonate inclusions (calcite; identified by Raman spectroscopy) that commonly exhibited tiny black inclusions of their own (probably graphite). Partially healed fissures