this diamond would enhance nitrogen aggregation under commonly used HPHT conditions. In addition, irradiation of a type Ib diamond followed by annealing would create a very distinct NV^- absorption, resulting in pink to purple coloration (E. Bienemann-Küespert et al., *Gmelins Handbuch der Anorganischen Chemie*, Verlag Chemie, Weinheim, Germany, 1967, p. 237). Radiation treatment would also leave other traces, such as the 595 nm and the H1a and possibly H1b absorptions, which were not detected in this diamond.

The authors have recently seen the H2 center in a suite of very rare type Ib diamonds containing large concentrations of single-nitrogen that may exceed 400 ppm. These stones showed no deformation-related features and were distinctly different from the stone reported here. In contrast to these high-nitrogen type Ib diamonds, this is the first type Ib "H2 diamond" we have seen that shows a combination of H3, NV^-, and H2 centers with classic strain patterns between crossed polarizers and a very low nitrogen concentration. The properties observed for this diamond are, at this point, difficult to explain. The deformation pattern and color distribution indicate octahedral growth and dynamic post-formation conditions. Besides the strong post-growth deformation and associated defects (dislocations, vacancies, and interstitials), the observed features suggest prolonged natural annealing at a low enough temperature to avoid aggregation of the single nitrogen, but nevertheless resulting in the combination of defects noted.

Thomas Hainschwang (gemlab@adon.li)
Gemlab Gemological Laboratory
Vaduz, Liechtenstein

Franck Notari
GemTechLab Laboratory
Geneva, Switzerland

COLORED STONES AND ORGANIC MATERIALS

Gem amphiboles from Afghanistan, Pakistan, and Myanmar. The amphibole group consists of several common rock-forming minerals, as well as many unusual species. Examples that are best known to gemologists are tremolite and actinolite, which as fine-grained aggregates form nephrite. Like most amphiboles, these are opaque, or translucent at best. In the past few years, however, some unusual transparent amphiboles from three localities in Asia have been faceted. These include light yellow richterite from Afghanistan, green pargasite from Pakistan, and brown pargasite and near-colorless edenite from Myanmar. One of these contributors (DB) has obtained facet-quality examples of all these amphiboles from local dealers in Peshawar (Pakistan) and Mogok (Myanmar), and also recently visited one of the deposits.

The Afghanistan richterite was first seen in the Peshawar mineral market in October 2001. The material was sold with sodalite and hackmanite crystals, often

Figure 4. Beginning in late 2001, facet-quality richterite has been recovered from the vicinity of Afghanistan's lapis lazuli deposits. The crystal shown here is 1.9 cm tall, and the oval brilliant weighs 1.72 ct. Courtesy of Dudley Blauwet Gems; photo © Jeff Scovil.

associated on the same specimen. The source was reported to be in the vicinity (i.e., an approximately six- to eight-hours' walk) of the Sar-e-Sang lapis lazuli deposits, which are located in the Kokcha Valley, Badakhshan Province. During 2002, DB saw at least 5 kg of rough material, including some attractive crystals (figure 4); about 20% was facet grade. However, due to the mineral's perfect cleavage, very few stones have been cut. The largest richterite cut by DB weighed 1.86 ct; attempts to cut larger stones have been unsuccessful.

The Pakistan pargasite appeared on the mineral market in the mid-1990s, typically as broken crystals embedded in a marble matrix. Similar material from China was described in the Spring 2002 Gem News International section (p. 97). Due to its attractive green color (figure 5), the Pakistan pargasite is sometimes referred to as "Hunza emerald" by local dealers. DB visited the mining area in November 2003. It is located about 3 km east of the Karakoram Highway bridge that crosses the Hunza River near Ganesh in the Hunza region. The pargasite is found within marble boulders that contain small seams of phlogopite. In addition to the green pargasite, the area has yielded translucent-to-opaque red, pink, and purple-blue corundum (to 7.5 cm) and "maroon," blue, dark brown, and black spinel (to 2.5 cm). Pargasite crystals up to almost 3 cm have been found, sometimes associated with the

dark brown spinel, but transparent material is very rare, yielding faceted stones of less than 1 ct.

The two transparent amphibole species from Myanmar (figures 6 and 7) were purchased by DB in Mandalay in June 2002. The vendor, a geology student from a university in Yangon, reported that both the pargasite and edenite were mined from the well-known Mogok deposit of Ohn Bin. Only a few pieces were available, although several more samples of both minerals turned up in 2003. The largest pargasite and edenite cut by DB weighed 1.78 ct and 0.29 ct, respectively (again, see figures 6 and 7).

To positively identify the specific amphibole species present, one of us (FCH) analyzed the faceted stones pictured in figures 4–7 by electron microprobe. Also analyzed was one additional sample of brown pargasite from Myanmar. Approximately 10 point analyses were obtained from each sample, and their averages were used to calculate the formulas listed in table 1. The mineralogical classification within the amphibole group of each stone was then established using the conventions published by B. E. Leake et al. ("Nomenclature of amphiboles: Report of the subcommittee on amphiboles of the International Mineralogical Association, Commission on New Minerals and Mineral Names," *Canadian Mineralogist*, Vol. 35, 1997, pp. 219–246). All the amphiboles contained relatively high amounts of fluorine. The analyses also revealed that the green pargasite from Pakistan contains traces of vanadium; up to 1.3 wt.% V_2O_3 was reported in similar material by V. M. F. Hammer et al. ("Neu: Grüner Pargasit aus Pakistan," *Lapis*, Vol. 24, No. 10, 1999, p. 41).

Gemological properties were obtained on the same four samples (by SM and EPQ) using standard testing equipment and a gemological microscope; the data are summarized in table 1. The properties of each stone fell within the ranges reported for these amphibole varieties in mineralogical textbooks (see, e.g., W. D. Nesse, *Introduction to Mineralogy*, Oxford University Press, New York, 1991, pp. 277–290). The relatively low R.I. values of the richterite are consistent with its Mg-rich composition (i.e., lacking iron); its properties may overlap those of colorless tremolite. The properties of the pargasites and the edenite also are consistent with the literature—that is, with values reported for hornblende. Material referred to as "hornblende" also includes other closely related species of the amphibole group; because their physical properties may overlap, conclusive identification of these species requires quantitative chemical analysis.

Dudley Blauwet (mtnmin@attglobal.net)
Dudley Blauwet Gems
Louisville, Colorado

Frank C. Hawthorne
University of Manitoba
Winnipeg, Manitoba, Canada

Sam Muhlmeister and Elizabeth P. Quinn
GIA Gem Laboratory, Carlsbad

Figure 5. This vivid green pargasite from Pakistan is colored by vanadium. The specimen is 2.1 cm tall, and the oval brilliant weighs 0.59 ct. Courtesy of Dudley Blauwet Gems; photo © Jeff Scovil.

Figure 6. Transparent yellowish brown pargasite was recently found in Myanmar. The crystal is 1.5 cm tall, and the faceted stone weighs 1.78 ct. Courtesy of Dudley Blauwet Gems; photo © Jeff Scovil.