Gem Notes

COLOURED STONES

Figure 1: Anorthoclase from Antarctica (here, 2.29 and 1.61 ct) has a dark appearance due to the presence of abundant melt inclusions. Photo by Mauro Pantò.

'Black Anorthoclase' from Antarctica

Mount Erebus is an active volcano on Ross Island in Antarctica, and is known as a source of large 'anorthoclase' feldspar crystals (i.e. phenocrysts) that occur in lava flows and volcanic bombs on the mountain's flanks (Dunbar *et al*. 1994). (*Editor's note*: Although mining on Antarctica is prohibited, samples may be collected for scientific research. The mineral name *anorthoclase* has been discredited by the International Mineralogical Association, but the term remains widely used—especially by geologists studying Mount Erebus—and therefore this term will continue to be used here, without quotes for simplicity. It refers to an intermediate member of the solid-solution series constituted by high albite–sanidine alkali feldspar.) The crystals are hosted by phonolite, which is an uncommon volcanic rock of intermediate chemical composition (i.e. between felsic and mafic). The phonolite contains abundant (up to 30% by volume) anorthoclase megacrysts up to 10 cm long, and physical weathering of the lavas and bombs has resulted in lag deposits containing abundant anorthoclase crystals that are locally present on the summit cone of the volcano (Dunbar *et al*. 1994; Kelly *et al*. 2008). The anorthoclase is chemically zoned with a compositional range of $An_{10.3–22.9}Ab_{62.8–68.1}Or_{11.4–27.2}$ (expressed as mol.% anorthite, albite and orthoclase, respectively; Kelly *et al*. 2008). Besides their large size, the anorthoclase crystals are notable for containing abundant melt inclusions that may give them a dark greyish brown to nearly black appearance.

At the 2018 gem shows in Tucson, Arizona, USA, Mauro Pantò (The Beauty in the Rocks, Sassari, Italy) had a few anorthoclase gemstones from Mount Erebus. They were cut from a single piece of rough that was presented to him as a gift from a geologist who had also received it as a gift. The rough piece measured about 30 mm long and 8 mm wide, and yielded six stones ranging from approximately 1 to 3 ct (e.g. Figure 1). Pantò kindly donated one of the stones to Gem-A, and it was characterised by authors CE and PD.

The stone had RIs of 1.531–1.538 (birefringence 0.007) and a hydrostatic SG of 2.66. These values are both somewhat high for anorthoclase, which may be due to the abundant melt inclusions (Figure 2). Chemical analysis with a Thermo Scientific ARL Quant'X energy-dispersive X-ray fluorescence (EDXRF) spectrometer showed major amounts of Si, Al, Na, Ca and K, consistent with

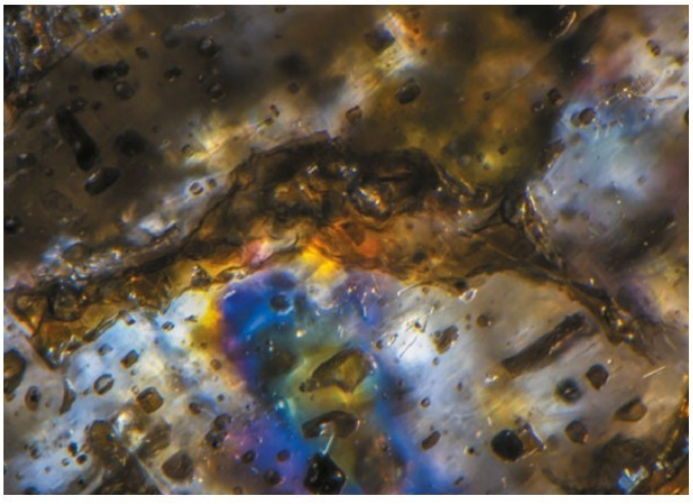

Figure 2: Melt inclusions in the anorthoclase form relatively large irregular masses or smaller rectangular bodies, both of which contain contraction bubbles. Photomicrograph by N. D. Renfro, © GIA; image width 0.96 mm.

anorthoclase. In addition, the analyses showed traces of Fe and Ti (probably due to the melt inclusions), as well as Sr and Ba (which are common impurities in the feldspar).

Microscopic examination of the stone by author NDR showed that two types of melt inclusions were present: those that were large and irregular, and those that were small and rectangular (again, see Figure 2), as previously reported by Dunbar and Kyle (1990). Raman analysis of the inclusions yielded spectra that would be expected for a glass, which is consistent with the presence of contraction bubbles that formed in the melt as it cooled into glass. Also common were iridescent cleavage fractures (Figure 3).

Moussallam *et al.* (2015) determined that the anorthoclase megacrysts at Mount Erebus formed in a vigorously convecting magmatic system involving perhaps 1–3 complete journeys between the magma chamber (at a depth of several kilometres) and the lava lake at the earth's surface, and that a typical crystal of 1 cm across may have formed over a period of at least 14 years. Considering the recent age of some of the lava flows (several years to decades in some cases), these may be the youngest feldspars that have been cut into gemstones.

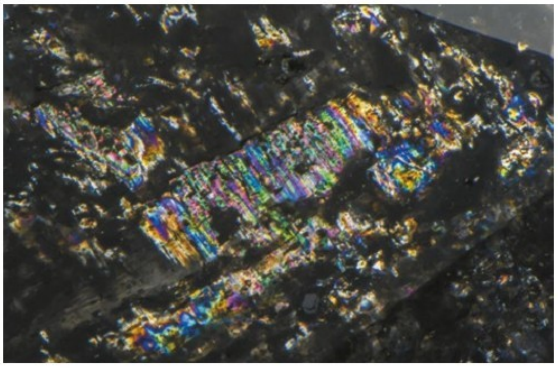

Figure 3: Iridescent cleavages are commonly seen in the anorthoclase. Photomicrograph by N. D. Renfro, © GIA; image width 4.10 mm.

Brendan M. Laurs FGA

Charles Evans FGA DGA and Pat Daly FGA
Gem-A, London

Nathan D. Renfro FGA
Gemological Institute of America (GIA)
Carlsbad, California, USA

References

Dunbar, N.W. & Kyle, P.R. 1990. Volatile contents of melt inclusions in anorthoclase phenocrysts from Mount Erebus: Implications for magmatic crystallization. *Antarctic Journal of the United States*, **25**, 9–11.

Dunbar, N.W., Cashman, K.V. & Dupré, R. 1994. Crystallization processes of anorthoclase phenocrysts in the Mount Erebus magmatic system: Evidence from crystal composition, crystal size distributions, and volatile contents of melt inclusions. *In*: Kyle, P.R. (ed) *Volcanological and Environmental Studies of Mount Erebus, Antarctica*. American Geophysical Union, Washington DC, USA, 129–146, http://doi.org/10.1029/ar066p0129.

Kelly, P.J., Kyle P.R., Dunbar, N.W. & Sims, K.W.W. 2008. Geochemistry and mineralogy of the phonolite lava lake, Erebus volcano, Antarctica: 1972–2004 and comparison with older lavas. *Journal of Volcanology and Geothermal Research*, **177**(3), 589–605, http://doi.org/10.1016/j.jvolgeores.2007.11.025.

Moussallam, Y., Oppenheimer, C., Scaillet, B., Buisman, I., Kimball, C., Dunbar, N., Burgisser, A., Schipper, C.I., Andújar, J. & Kyle, P. 2015. Megacrystals track magma convection between reservoir and surface. *Earth and Planetary Science Letters*, **413**, 1–12, http://doi.org/10.1016/j.epsl.2014.12.022.

Blödite—A Rare Collector's Stone

Blödite is a rare, hydrated Na-Mg sulphate with the chemical formula $Na_2Mg(SO_4)_2 \cdot 4H_2O$. It is monoclinic and typically forms short prismatic crystals with glass-like lustre, or it may occur in granular to massive aggregates; it is usually colourless, pale red or dark grey (Bernard & Hyršl 2004). Blödite was discovered in 1821 in a salt deposit at Ischler Salzberg in Bad Ischl, Gmunden, Austria, and was first described by Johann Friedrich John, who named it in honour of German chemist Karl August Blöde (John 1821). Decades later, Austrian mineralogist Gustav Tschermak named a new mineral *simonyite* (after the geographer Friedrich Simony; Tschermak 1869), but it turned out to be the same mineral as blödite (Groth & Hintze 1871). Today the name *simonyite* is discredited, but sometimes it is used synonymously with blödite.

Blödite is found mainly in marine evaporite deposits (Bernard & Hyršl 2004). The mineral is easily soluble in various liquids, even in cold water (www.mindat.org/min-695.html). It will dehydrate in air, resulting in a white crust forming on its surfaces. Due to these qualities, as well as its low hardness (Mohs 2½–3), blödite is rarely faceted and certainly qualifies as a collector's stone.