MINERALS OF THE DIAMOND-BEARING KIMBERLITES OF COLORADO AND WYOMING

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 Kimberlite, the igneous rock from the Earth's mantle that hosts most diamond deposits worldwide, was recognized in 1964 to be present in northern Colorado and adjacent Wyoming. Diamonds were first reported from one of the pipes in 1975, and diamonds are now known to occur in most of the —35 kimberlite pipes and dikes in the State Line district of Larimer County, Colorado, and Albany County, Wyoming. Additional kimberlites, which however are not known to be diamond-bearing, occur to the north in the Laramie Mountains of Wyoming (Iron Mountain and other areas), and to the south near Estes Park, Rocky Mountain National Park (Isolation Peak and Hayden Gorge kimberlites), and Boulder, Colorado (Green Mountain kimberlite pipe). The State Line kimberlites include pipes (circular, elliptical, or elongate intrusions), dikes, and diatremes (pipes which have a very fragmental texture, indicating eruption as a "blowout" to the surface). The State Line kimberlites intrude 1.4 and 1.7 Ma Proterozoic granite, and most have been found to be of Early Devonian age, about 390 Ma, but some are reported to be older, of latest Proterozoic age (-600 Ma).

A related rock type, lamproite, occurs in the Leucite Hills of southwest Wyoming. Lamproites host diamond deposits elsewhere in the world, including Western Australia and Prairie Creek (Crater of Diamonds), Arkansas. The igneous rocks of the Leucite Hills are not diamond bearing, but a few diamonds have been reported from not far to the southwest at Cedar Mountain and vicinity in the Green River basin, Wyoming. Igneous rocks with some affinities to kimberlite and lamproite are also known from several other localities in Colorado, Utah, Arizona, New Mexico, and adjacent states, but none are known to be diamond bearing.

The Sloan kimberlite in Colorado was mined on a trial basis in 1994, and some 9,034 diamonds weighing a total of 342 carats were recovered from 3,300 tons of rock excavated from a 614-ft adit. The largest diamond recovered from the Sloan kimberlite was 5.14 carats and was of partial gem quality. A full-scale open pit diamond mine was operated from 1996-1998 at the Kelsey Lake kimberlite group, on the Colorado—Wyoming border. During this mining, two large diamonds were found, and by coincidence both were 28.18 and 28.3 carats, yellow, and cut into 16.8 and 5.39 carat faceted stones. The 16.8-carat stone is currently the largest faceted diamond in existence from North America. Other diamonds found at Kelsey Lake have included stones of 16.9, 14.2 (a colorless, gem-quality octahedron), 11.8, 10.48, 9.4, and 6.2 carats, and many of 1 carat or more in weight. Mining has been inactive at Kelsey Lake for the last several years but is expected to resume.

In addition to diamond itself, classic kimberlite "indicator minerals" are found at all pipes in the State Line district: emerald-green chromian diopside ("chrome diopside"), pyrope garnet (typically red but ranging in color from orange to purple), and metallic-black magnesian ilmenite. Since these minerals (along with diamond) were plucked out of the mantle host rocks from which the kimberlites were derived, and did not crystallize from the kimberlite magma itself, the crystals are termed "megacrysts" (large crystals) or "xenocrysts" (foreign crystals); most have been rounded by abrasion or solution in the kimberlite pipes. A pyrope megacryst exceeding 2 lb in weight has been reported from the Schaffer kimberlite, Colorado, but most of the indicator minerals range from a few millimeters to a few centimeters in size. Some pyrope from the Sloan kimberlite exhibits an alexandrite-like color change from red to green, but only when observed in small thin fragments. Chrome diopside megacrysts as large as 9 cm have been observed in the Sloan kimberlite. Flakes of brown phlogopite (magnesium-rich mica) are common.

Xenoliths ("foreign rocks") found in the kimberlites, typically as rounded nodules from several centimeters to a foot or more in size, include rocks from the mantle (garnet, peridotite, and eclogite) and the crust (granite, gneiss, schist, granulite, limestone, and sandstone). Olivine is a common mineral in the State Line kimberlites, but most grains are rounded and have been altered to serpentine minerals. A wide variety of other minerals have been reported from the kimberlites, including megacrysts of other pyroxene group minerals, and various layer silicates, carbonates, and oxides as constituents of the groundmass of the kimberlites. Reported minerals include: antigorite, apatite, aragonite, barite, biotite, calcite, chlorite, chromite, diopside, dolomite, enstatite, graphite, hematite, ilmenite, iron, lizardite, magnetite, nickel, omphacite, perovskite, pyrite, rutile, sandine, spinel, talc, xenotime, and zircon. Many of these minerals, as well as coesite, corundum, pyrrhotite, pentlandite, periclase, acmite, richterite, hornblende, titanite, and wollastonite, have been reported as inclusions in diamonds.
References:


pp. 10-11

22nd Annual New Mexico Mineral Symposium
November 10-11, 2001, Socorro, NM