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Contrasting Kimberlites and Lamproites

B.H. SCOTT SMITH, Scott-Smith Petrology, Vancouver, British Columbia

During the last two decades lamproites have joined kimberlites as potential primary sources of economic quantities of diamonds. Previously, for about 100 years, kimberlites were considered to be the only major source of diamond. Differences in the near-surface emplacement, petrography and petrology shows that kimberlite and lamproites are petrogenetically distinct rock types. They must also be considered separately for exploration purposes.

Kimberlite can be defined briefly as being composed of xenocrysts and phenocrysts of olivine set in a matrix composed of several of the following primary minerals: monticellite, phlogopite, diopside, carbonate, serpentine, perovskite, spinel and apatite. *Lamproites* are defined as rocks characterized by one or more of the following primary phenocrystal and/or groundmass constituents: titanian phlogopite and tetraferriphlogopite, iron-rich leucite, titanian potassium richterite, olivine, diopside and iron-rich sanidine. Glass and xenocrystic olivine may be important constituents. Minor phases include priderite, apatite, wadeite, spinel, perovskite, shcherbakovite, armalcolite, jeppeite and ilmenite. Both definitions are augmented by mineral and bulk rock compositions. Both kimberlites and lamproites can be usefully classified using modal abundances. Within kimberlites, two Groups, termed 1 and 2, can be distinguished on the basis of their petrography, distribution, geochemistry and mantle-derived xenocrysts and xenoliths. Group 2 kimberlites are so far confined to South Africa and show some similarities with olivine lamproites in mineralogy, mantle-derived xenocrysts, geochemistry and isotopes. Among the wide modal range of lamproites, two main varieties have been recognized: leucite lamproite and olivine lamproite (sensu lato). Economic quantities of diamond have been found so far in olivine lamproites only. The abundances of diamond and other mantle-derived minerals varies between different mineralogical and textural types of lamproites as well as Groups 1 and 2 kimberlites. The nature of some of the mantle-derived constituents (e.g. diamond, garnet, spinel), however, is similar.

Kimberlites occur as deep (typically <2000 m) carrot-shaped diatremes which grade upwards into shallow craters and down into complex irregular root zones. Lamproites, on the other hand, form asymetric shallow (<300 m) craters infilled predominantly with pyroclastic material which may then be intruded by magmatic lamproite forming a ponded lava lake. Rare lamproite lavas are known. Lamproites do not form diatremes while lavas, lava lakes and scoriaceous juvenile lapilli have not been recognized in kimberlites. The geology of lamproites is thus similar to that of other small alkaline volcanics and existing terminology can be used. Dominant textural types are lapilli tuffs and magmatic lamproite. Kimberlite textures, particularly within the diatreme, are unusual and have necessitated a special classification to be devised. Dominant textural types are unspecified crater-facies material, tuffisitic kimberlite breccia and hypabyssal kimberlite.

The differences between kimberlites and lamproites have important implications for exploration. Apart from those noted above there are also other significant variations such as in mantle-derived constituents or "indicator" minerals used in prospecting. It is also important to distinguish kimberlites and lamproites from other petrographically similar but separate rock types such as alnoites, melilitites and minettes which have not yielded significant quantities of diamond. Discriminating these rock types, however, is not always easy.

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