DISTRIBUTION OF KIMBERLITES AND ASSOCIATED ROCKS IN SPACE AND TIME: RELATIONSHIP TO TECTONIC PROCESSES

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In this review kimberlites are those low-volume, ultrabasic, ultrapotassic rocks that conform to the definition by Clement et al. (1984). Stricter definitions on both petrographic and chemical criteria (Rock, 1986) has enabled some occurrences of rocks previously referred to as 'kimberlitic' to be reclassified as 'ultrabasic lamprophyres'. Included within the review are occurrences of lamproite (i) because olivine lamproite from the U.S.A. (the Praire Creek 'kimberlite') and olivine- and leucite-lamproites in N.W. Australia contain diamonds, and hence originate in the same depth-zone in the upper mantle as kimberlites; and (ii) because both kimberlites and lamproites belong to a geochemically unique group of rocks characterised by high-alkali, high-potassic, high LILE values combine with high Mg, Ni and Cr contents, together with low Al. The overlap is particularly marked between Group II kimberlites and olivine lamproites (Dawson, in press).

A new kimberlite province is now known in N.E. China, and new individual kimberlites have been reported from the U.S.A. (Lake Ellen), Brazil and southern Africa; all these occurrences confirm previous observations that kimberlites are mainly confined to the old, stable cratons. The intrusion of diamond-bearing lamproites of Precambrian and late-Tertiary age on the Kimberley Craton of N.W. Australia, again substantiates earlier observations that the older cratons are prone to repeated intrusion of material from the deeper parts of the upper mantle (Dawson, 1980).

Occurrences previously held to be kimberlite but now discredited include several from eastern Canada and the eastern U.S.A.; the only occurrence in Argentina; the occurrences in eastern Sweden at Kalix and Alno; and on the Taimyr peninsula of the USSR.

The distribution of lamproites (Bergman, in press) is likewise confined mainly to cratonic areas, although others (e.g. E. Australia, S.E. Spain) are not. Significantly, coeval lamproites occur within a swarm of Group II kimberlite dykes at Swartruggens, S. Africa (Skinner & Scott Smith, 1979) reinforcing an earlier observation of a similar relationship between kimberlites and fitzroyites in the Seguela area of the Ivory Coast.

Kimberlite magmatism took place in W. Africa, S. Africa (Premier Mine) and in India in the Precambrian; and the presence of diamonds in Precambrian sediments (of both Archaean and Proterozoic age) and in Phanerozoic basal conglomerates overlying Precambrian terranes is perhaps indicative of the presence of more Precambrian kimberlites that have been either removed by later erosion or blanketed by later sedimentary cover. Cambrian kimberlites are known in W. Greenland, and others occur in the Silurian (USSR), the Devonian (USSR, U.S.A.), Upper Triassic (Swaziland), the Permian (eastern U.S.A.), Upper Jurassic (USSR; S. Africa), in the Cretaceous (S. Africa, Angola, W. Africa and Brazil), and the Eocene (Tanzania). Even accounting for enhanced possibility of recognition of relatively young activity compared with older magmatism (due to decreased chance of subsequent sediment burial), the Upper Jurassic/Cretaceous activity was the major epoch of kimberlite intrusion.

Most phases of kimberlite activity were accompanied by coeval igneous activity of a very limited nature. Coeval rock-types vary from locality to locality but include lamprophyres, lamproites, nepheline syenites and carbonatites.

Known lamproites range in age from Proterozoic (Chelima, India; W. Greenland; Argyle W. Australia), Palaeozoic, Mesozoic (Kansas, U.S.A.; S. Africa), but most are Tertiary (e.g. N.W. Australia, Highwood Mountains, U.S.A.) and Gaussberg (Antarctica) is of Recent age (Bergman, in press).

Various hypotheses have been proposed to place kimberlite activity in its contemporary tectonic framework. Much current work tends to associate kimberlite magmatism with crustal thinning linked with major plate movements; certainly, the Mesozoic activity in Liberia, Angola, S. Africa and Brazil is contemporaneous with the opening of the S. Atlantic. Evidence for linking it with hot spot activity is less obvious.

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