# KIMBERLITES OF YAKUTIA AND SOUTH AFRICA. ASPECTS OF COMPARATIVE STUDY

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Study of individual kimberlite pipes in Yakutia and extrapolation of data obtained by comparing kimberlites from areas with different erosion levels has revealed definite differences in the structure and distribution of kimberlite rocks of various types and varieties in Yakutia and South Africa.

In the Yakutian province, the average size of kimberlite pipes decreases from south to north. Larger pipes, often of complicated configuration with pinches and blows, in the southern fields of the province (Malo-Botuobinsk, Alakit, Daldyn, Upper-Muna) give way northwards to smaller, simpler in configuration, conjugate bodies or groups of adjacent bodies. Also, the structure of kimberlite pipes becomes simpler in this direction.

For the southern part of the province, exploration and mining data indicate that kimberlite pipes consist of two parts in vertical section: a funnel and a columnar channel that tapers downwards.The funnel and the columnar part are filled with kimberlite breccias with variable amounts of wallrock and mantle xenoliths. Wallrock xenoliths are abundant in kimberlite breccias in near-contact and upper zones of pipes, especially low-angle contact areas, as well as in near-contact zones of columns of major emplacement phases and in zones around sedimentary reefs. With depth and towards the center of a pipe or an ore column, xenoliths regularly decrease in amount. Found not infrequently around sedimentary reefs and in low-angle contact areas in the funnel are specific layered rocks of debatable origin. Some researchers (Lipatova et al., 1979) refer them to crater deposits, whereas others (Zolnikov, Egorov, 1070; Zolnikov et al., 1979) argue that the banded and layered textures have resulted from either an interaction of kimberlite melt with sedimentary reefs or liquid flow in the pipe body during infilling. Both the funnel and the columnar part are filled with kimberlite breccias of two textural varieties: autolithic kimberlite breccia (KBA) and kimberlite breccia with a massive-textured groundmass (KBM). There are no other differences between kimberlite breccias of the two parts of the pipes, except lower density and fracturing of the rocks in the upper horizons and some change in composition (decrease in the amount of serpentinization with depth). Within each textural variety, there are differences which reflect repeated emplacement of kimberlite material. The structure of the pipes is complicated by pre-pipe veins and intra-pipe kimberlite injections.

The proportions of KBA and KBM differ within different diatremes.In the southern fields of the province, KBA and KBM occur in nearly equal amounts. In the northern fields, starting from the Kuranakh one, the proportion of the pipes filled with KBM gradually decreases to become quite low in the Ary-Mastakh, Starorechensk, Dyuken and Kuoika fields. In the latter fields where the erosion level is 1.5-2 km (Brakhfogel, Kovalsky, 1970, 1975), the type KBA is predominating. However, it is often associated with rocks that are thought to be related to the intrusive facies of kimberlite magmatism (Kovalsky, 1963; Kornilova et al., 1983; Nikishov, 1984) and are referred to as "kimberlite", as well as to rocks that are analogous to alnoites (monticellite- and melilite-bearing, finely porphyritic, massive rocks) and compose the adjacent dikes and stocks. Rb-Sr and K-Ar ages of the rocks (Brakhfogel, 1983) indicate that they are contemporaneous with the pipes. In the southern fields, such rocks are found as fragments in breccias and as intra-pipe injections.

From the above it follows that in Yakutian kimberlite pipes diatreme and hypabyssal intra-pipe facies do not differ in rock type or texture as has been found for South African kimberlite pipes (Mitchell, 1986; Clement and Skinner, 1989) KBA and KBM (kimberlites, kimberlite breccias and tuffisitic kimberlites and tuffisitic kimberlite breccias in Clement and Skinner's, 1985, terminology) can be found both in the diatreme and hypabyssal zones. Moreover, pipes of the northern part of the province with deeper erosion levels suggest that the proportion of autolithic (tuffisitic) kimberlite breccias increases in hypabyssal parts of the pipes. The presence of crater-facies epiclastic and pyroclastic kimberlites has not been documented in the Yakutian province.

Therefore, our proposed model of the structure of the kimberlite system of Yakutia is as follows. Like in the model for kimberlite magmatism of South Africa (Hawthorne, 1975; Mitchell, 1986), there are morphological elements such as pre- and post-pipe veins and dikes, sills, stocks and pipes. Each element is an independent formation related to a particular stage of emplacement of a kimberlite melt. In the sedimentary cover, kimberlite bodies have a zone distribution: kimberlite and alnoite dikes and stocks are restricted to the lower horizons of the cover, whereas kimberlite veins and pipes occur throughout the cover up to the paleosurface (Nikishov, 1984). Kimberlite pipes are filled with kimberlite breccias of any of the two textural varieties, irrespective of depth. However, study of the deeply eroded pipes of the northern part of the province indicates that tuffisitic (autolithic) kimberlite breccias are a predominant rock type with depth. The rocks which compose dikes and stocks and are related to the intrusive facies of kimberlite magmatism differ in composition from similar kimberlite rocks that fill root zones of the pipes and are related to the subexplosive facies of kimberlite magmatism. There are also some compositional differences between intrusive rocks of pre-pipe and post-pipe stages. Analysis of all the facies of kimberlite magmatism indicates that kimberlite melt evolved with time, with initial portions being richer in titanium, aluminium, iron and alcalies relative to subsequent ones.

No division into Groups 1 and 2, like in South Africa, can be made. Yakutian kimberlites are characterized by wide variations of geochemical and chemical compositions, with no distinct grouping. Initial Sr87/Sr86 ratio of Yakutian kimberlites varies within 0.7034 and 0.7127, being the highest in micaceous-carbonate kimberlites and kimberlite breccias with both high and low TiO2 concentrations.

Yakutian kimberlites also differ from South African ones in some compositional characteristics, prevailing morphologies and diamond grade.

These distinctions are due to a number of objective and subjective factors that call for joint studies of kimberlite magmatism on a global scale.


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