KIMBERLITE EMPLACEMENT MECHANISMS PART 1: A SOUTHERN AFRICAN PERSPECTIVE

[1]FIELD, M. and [2]CLEMENT, C.R. [1]De Beers Consolidated Mines Ltd., P.O. Box 10191, Beaconsfield 8315, South Africa; [2]Monopros Ltd., #1510 - 10 Bay Street, Toronto, Ontario, M5J 2R8, Canada.

Detailed investigation of the deeply eroded kimberlite pipes at Kimberley, South Africa has lead to an understanding of many important aspects of these unique volcanic rocks. These kimberlite pipes are composed of three distinctive zones, namely the crater, the diatreme and the root zones. Each zone contains different textural varieties of kimberlite (Part 4). Genetic interpretations indicate that the emplacement of the pipes occurred in closed systems created by temporary lithological or other barriers or caps through which the kimberlite magmas eventually intruded. The kimberlite magmas were clearly inhibited during ascent, and this resulted in massive and complex subsurface brecciation of the country rock, as well as a build-up of exsolved volatiles, CO_2 in particular. When the gas pressure rose above the confining lithostatic pressure the surface was breached, and sudden and rapid degassing took place. This resulted in fluidisation of the magmas and the excavation of diatremes through previously and contemporaneously brecciated country rock. The fluidisation systems quenched to produce diatreme infilling with textures unique to kimberlites, termed tuffisitic kimberlite breccia (TKB).

At the bi-lobate, Orapa kimberlite pipe in Botswana, the crater zone is preserved. One lobe consists of layered pyroclastic rocks, which grade downwards into monotonous TKB. The magmatic lapilli and matrices of these deposits are identical to that of the TKB. This locality provides further evidence that many kimberlites are emplaced as a result of gas-rich kimberlite magmas being temporarily trapped by competent cap rocks. There is little evidence for phreatomagmatic processes.

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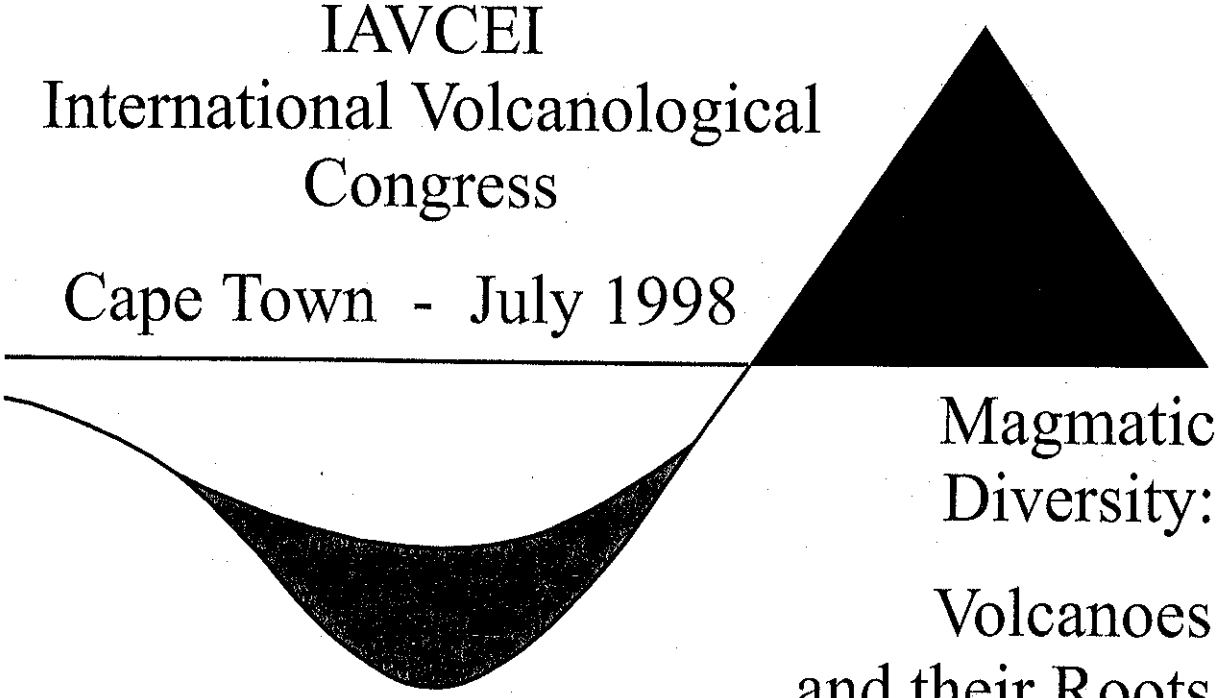

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Abstracts