

PROCESSES IN HIGH-LEVEL CARBONATITE MAGMA CHAMBERS: EVIDENCE FROM NOOITGEDACHT, SOUTH AFRICA

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Core sampling at the Mesoproterozoic Nooitgedacht carbonatite, Kaapvaal Craton, South Africa (27°30' 25°30') raises important questions concerning the petrogenesis of dolomitic carbonatite; the relationship between phoscoritic rocks and mixed dolomite-calcite carbonatite associations; and the physical properties of carbonatite magmas in the subvolcanic environment. The Nooitgedacht intrusive sequence consists of plugs of pyroxenite and ijolite; magnetite pyroxenite; 10 cm to 2 m wide cone sheets of phoscorite; cone sheets of magnetite-apatite-calcite carbonatite followed by dolomite and ankerite carbonatite and then intrusion of nepheline syenite. There are also radial dykes of dolomite carbonatite and a newly discovered plug of mixed dolomite-calcite carbonatite. The phoscorite consists of magnetite, apatite and mica and is similar to rocks termed phoscorites elsewhere, including the Kola Alkaline Province. Although the mineral assemblage is consistent with a cumulate, the « phoscorite » is intrusive, and possibly a product of crystal fractionation from a high-level magma chamber. The mixed dolomite-calcite carbonatite plug may even represent the products of delayed nucleation at the top of the same magma chamber. It consists of large, cm-diameter, ferroan dolomite crystals as an original magmatic phase (according to C and O isotope ratios) but, the composition of the calcite matrix suggests that it is secondary. Nevertheless, groundmass textures are preserved and 6 cm-long spinifex-like calcite crystals suggest emplacement of a volatile-rich, liquid magma, rather than a crystal mush, forming a carbonate pegmatite in the magma-chamber cupola. Similar pegmatitic textures have been observed at an Eocene dolomitic carbonatite centre, in southern Namibia.