

consistent with a Jurassic age of diatreme emplacement.

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CARBONATE TUFF FROM MELKFONTEIN, EAST GRIQUALAND, SOUTH AFRICA

N.Z. BOCTOR, F.R. BOYD, P.H. NIXON

Geophysical Laboratory, 2801 Upton St. NW, Washington, DC 20008

The Melkfontein carbonate tuff overlies the southern slopes of a ridge of Beaufort sandstone that is cut by Karro dolerite intrusions. The tuff is considered a remnant of a volcano and is believed to have erupted at a relatively recent age (63 M.Y.), in comparison to the nearby kimberlitic intrusions.

The carbonate tuff is composed of calcite that encloses numerous xenocrysts of garnet, clinopyroxene, amphibole, mica, and plagioclase together with "cognate" magnetite, apatite, and zircon crystals. Garnet is iron-rich ($\text{Mg}/\text{Mg} + \text{Fe}^{+2}$ 0.40 - 0.54, TiO_2 0.04 - 0.2 wt %, Cr_2O_3 0.01 - 0.07 wt %). Clinopyroxene ($\text{Mg}/\text{Mg} + \text{Fe}^{+2}$ 0.45 - 0.68, $\text{Ca}/\text{Ca} + \text{Mg}$ 0.54 - 0.57) is sodic, containing 3.0 to 6.5 wt % Na_2O . Alkali amphibole (Na_2O 4.0 - 4.5, K_2O 1.2 - 1.4, TiO_2 1.2 - 1.7 wt %) occurs as discrete xenocrysts or as rims on clinopyroxene. Biotite is iron-rich ($\text{Mg}/\text{Mg} + \text{Fe}^{+2}$ 0.51 - 0.62) and contains 1.5 to 2.4 wt % TiO_2 . Plagioclase occurs as discrete xenocrysts of albite ($\text{Ab}_{98.1}\text{An}_{0.9}\text{Or}_{1.0}$) or as crystals of andesine ($\text{Ab}_{70.2}\text{An}_{27.5}\text{Or}_{2.3}$) attached to large garnet xenocrysts. The mineral chemistry of clinopyroxene, garnet, amphibole, and mica in the Melkfontein tuff is different from that reported for these minerals in carbonatites (or kimberlites). It is similar, however, to the mineral chemistry reported for these minerals in garnet granulite xenoliths from Lesotho kimberlites (Griffin et al., 1979). Such similarity suggests that they are derived by disaggregation of garnet granulite xenoliths from the lower crust at Melkfontein. The occurrence of "cognate" magnetite (1.7 - 8.6 wt % MgO , 1.4 - 7.8 wt % TiO_2 , <0.01 wt % Cr_2O_3), apatite, and zircon in the Melkfontein tuff suggests some similarity to carbonatites.

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THE OPAQUE OXIDES OF THE WESSELTON MINE KIMBERLITE, KIMBERLEY, SOUTH AFRICA.

S.R. SHEE

Department of Geochemistry, University of Cape Town, Private Bag, Rondebosch, Cape, Republic of South Africa.

The Wesselton Mine is one of four operating diamond mines in Kimberley, South Africa. It yields approximately 330000 carats of diamonds a year. The Wesselton kimberlite pipe has had a complex geological history and excluding minor dykes and sills, 9 or possibly 10 different kimberlite intrusions have been recognised between the 435 and 1020 metre levels. In addition two major areas of contact breccias occur below the 660 metre level (Clement pers. comm.).

The kimberlites have been examined petrographically with particular emphasis on the opaque minerals in the groundmass. These minerals are spinels, ilmenite, perovskite and rutile. Representative microprobe analyses of these minerals have been obtained.

Subhedral to euhedral groundmass spinels in the Wesselton mine kimberlites range in size from 0,002mm to 0,1mm but are usually 0,04mm. They exhibit a normal magmatic trend and evolve from low TiO_2 , high Cr_2O_3 cores (picrochromites) to low Cr_2O_3 , high TiO_2 and Fe_2O_3 rims (titanomagnetite). Despite some chemical overlap, spinels from different kimberlite intrusions can be distinguished from one another. The Wesselton spinels do not show a zonation trend from titanomagnetite cores to magnesium pleonaste rims similar to that described for the De Beers kimberlite by Pasteris (1980).

Ilmenite xenocrysts and primary groundmass ilmenites in the Wesselton kimberlites are characterised by high MgO and Cr_2O_3 contents, the highest MgO contents occurring in the groundmass ilmenites. Both varieties of ilmenite display reverse zonation with rims more magnesium than cores.

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MAGMA MIXING IN THE EVOLUTION OF KIMBERLITE: COMPOSITIONALLY DISTINCT MEGACRYST SUITES FROM S.W. PENNSYLVANIA, USA.

ROBERT H. HUNTER AND LAWRENCE A. TAYLOR Department of Geological Sciences, University of Tennessee, Knoxville, TN 37996. USA

Megacryst populations recording a fractionation interval within kimberlitic melts have been documented from many occurrences; a locality in Pennsylvania records a magma-mixing event involving a fractionated melt and a less evolved, perhaps parental, melt. Furthermore, there is complete documentation of the subsequent evolution of the hybrid melt to its final crystallization.

Two compositionally distinct populations of megacrysts and phenocrysts occur: (1) a primitive suite composed of Cr-garnet and olivine (Fo 92-90), the latter containing inclusions of Cr-garnet, Cr-diopside, enstatite, and immiscible sulphide blebs; and (2) a more evolved suite consisting of Cr-poor garnet, olivine (Fo 85-83), and megacrysts and inclusions of picroilmenite. The two populations are compositionally similar to different stages of the fractionation sequence of kimberlites possessing a continuum of megacryst compositions (e.g., the Monastery kimberlite), particularly with regard to the compositions of co-precipitating Cr-poor garnet and picroilmenite. Reverse Mg-zonation in ilmenite megacryst rims and zonation in all olivine rims to an equilibrium composition of Fo 88 provide tangible evidence for mixing of the two populations and their host melts. Ilmenite, identical in composition to that in the re-equilibrated megacryst rims, was a liquidus phase in the hybrid melt, followed paragenetically by Cr-spinel, then Ti-magnetite; Cr-, Ti-phlogopite, zoned to Ti-phlogopite is the dominant mafic silicate phase.

P-T calculations on garnet ilmenite xenoliths indicate formation of the kimberlitic melt at 53-55 kb and 1320-1350°C; values from the megacrysts indicate that the mixing took place at lower temperatures (1170-1200°C).

Mixing calculations verify the mineral evolutions observed and have allowed an assessment of the relative proportions of the melts involved in the mixing.

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LES ROCHES ULTRAPOTASSIQUES (LAMPROITES) DE LA REGION VOLCANIQUE NEOGENE DU SUD-EST DE L'ESPAGNE

J. LOPEZ RUIZ, E. RODRIGUEZ BADIOLA Instituto de Geología (C.S.I.C.), Madrid, España.