consistent with a Jurassic age of diatreme emplacement.

C7

CARBONATE TUFF FROM MELKFONTEIN, EAST GRIQUALAND, SOUTH AFRICA

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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 (Mg/Mg + Fe^{+2} 0.40 - 0.54, TiO_2 0.04 - 0.2 wt %, Cr_2O_3 0.01 - 0.07 wt%). Clinopyroxene (Mg/Mg + Fe^{+2} 0.45 - 0.68, Ca/Ca + 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 (Mg/Mg + Fe^{+2} 0.51 - 0.62) and contains 1.5 to 2.4 wt % TiO_2. Plagioclase occurs as discrete xenocrysts of albite ($Ab_{98.1}An_{0.9}Or_{1.0}$) or as crystals of andesine ($Ab_{70.2}An_{27.5}Or_{2.3}$) 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.

C8

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

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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 occuring in the groundmass ilmenites. Both varieties of ilmenite display reverse zonation with rims more magnesium than cores.

C9

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

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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 lherzolite 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.

C10

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

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Dans la région volcanique néogene du Sud-Est de l'Espagne, se trouvent associées espatial et temporellement des roches calco-alcalines, shoshonitiques et ultrapotassiques.

Les lamproites se présentent en pipes de diametre reduit (~1 km) et excéptionellement comme des laves. Essentiellement, elles sont constituées par de l'olivine (Fo_{92}-Fo_{78}), de la phlogopite, du clinopyroxene ($En_{51}Fs_4Wo_{45}$-$En_{46}Fs_{13}Wo_{41}$) et des proportions variables, selon le degré de cristallinité, de la richterite potassique, de la sanidine et du verre; dans quelques types, des orthopyroxenes ($En_{85}Fs_{12}Wo_3$-$En_{72}Fs_{25}Wo_3$) et de la leucite peuvent apparaître. Sur la base des compositions normatives, on peut distinguer quatre types de lamproites: jumillites (avec ol et lc normatives), cancalites (avec ol normative), fortunites (avec < 5% de ol ou q normatives) et verites (avec > 5 de q normative). Tous ces types montrent une haute relation $Mg/Mg+Fe^{2+}$ (0,82-0,72), des hauts contenus en Ni,Cr,K_2O,P_2O_5,Ba,Sr,Th et Zr, et un bas teneur en Al_2O_3 et CaO.

Les particularités de ces roches ne peuvent--pas s'expliquer par des simples processus de cristallisation fractionnée a partir d'un magma commun, et non-plus par la variable fusion partielle d'un manteau péridotitique standard. Par contre, quelques données mineralogiques et chimiques son favorables au mélange des magmas de differente composition. Les calculs effectués à ce sujet avec les élements majeurs, indiquent que les quatre types de lamproites du Sud-Est de l'Espagne pourraient avoir été originés par le mélange, dans des proportions variables, d'un magma shoshonitique et d'un autre de type kimberlitique.

C11

THE ULTRAPOTASSIC ROCKS OF THE BETIC CORDILLERA, SPAIN

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The ultrapotassic rocks of SE Spain are reinvestigated mainly on the basis of new geochemical and mineralogical data. The rocks are characterized by phlogopite, olivine, sanidine, ±biotite, ±clinopyroxene, ±orthopyroxene, ± K-rich amphibole, ±glass. Phlogopite is present both as phenocrysts and as microcrysts (Ph1 and Ph2): Ph2 has Ti and Fe/Mg higher than Ph1. Only in some case the chemistry of phlogopite is related to the degree of fractional crystallization. Four different kinds of biotite have been found. lowTi-biotite associated with crustal xenoliths unstable biotite (B1), phenocrysts (B2), microcrysts (B3). Sometimes Ph and B coexist together. The rocks have low - moderate Al_2O_3 (8.9-12.8), low Fe/mg ratio, Nb/Y =1, high contents of Zr, P, Th, Ce, Ba, Ni, Cr, and low Sc and Y values. Many rocks exhibit (Na+K)/Al (atoms) major than unit. Frequently the investigated outcrops are geochemically well identified. Nevertheless, chemical variations between the different outcrops are gradual. The petrogenesis of these rocks is really difficul to explain. The magmas generated in the mantle, but crustal contamination or magma mixing largely influenced the rock chemistry. The fluids too possibly played an important role during the petrogenesis and produced selective enrichment of several elements.

C12

TRACE ELEMENT GEOCHEMISTRY OF K-RICH LAVAS FROM ALBAN HILLS, ROMAN COMAGMATIC PROVINCE (Italy)

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Quaternary K-rich volcanics are widespread in the Roman-Neapolitan area. Based on major and trace element abundances a potassium series (KS) and a high-potassium series (HKS) have been distinguished. KS rocks are represented by alkali basalts, trachybasalts, latites and trachytes which have lower enrichment in K and other incompatible elements with respect to leucitites, leucite-tephrites and leucite-phonolites which make up the HKS. At Alban Hills together with predominant pyroclastics, leucititic and tephritic leucititic lava flows occur. On 22 selected Alban lava samples major element, Cs, Rb, Sr, Hf, Ta, Th, Sc, Cr, Co, Ni and REE contents have been determined. SiO_2 ranges between 40-49%, K_2O= 5-10% ca, Mg_v=37-69. Cs(4.8-61ppm), Rb(47-540ppm), Sr (1090-2700ppm), Th(36-130ppm) and LREE display all high values. REE patterns are strongly fractionated for both light and heavy REE with a significant negative Eu anomaly. The ferromagnesian elements are variable and, except for Co, positively correlated with Mg_v. The obtained data indicate that the K-rich volcanism of Alban Hills is the product of low degree of melting of a LILE-enriched garnet-peridotitic mantle. The observed elemental variations have been produced by low-pressure fractionation with separation of cpx, leucite and spinel as main phases. The distribution patterns of Alban Hills lavas normalized against a primordial mantle composition are similar to those observed in leucite-bearing volcanics from Aeolian arc, where these rocks are associated with shoshonitic volcanics and both follow calc-alkaline magmatism. This supports the view that the K-rich magmatism of Roman comagmatic province represents the latest stage of a subduction-related volcanic cycle.

C13

KIMBERLITE AND LAMPROITE DYKES, WEST GREENLAND. IMPLICATIONS FOR MELTING OF RICHTERITE, PHLOGOPITE AND CLINOPYROXENE IN A LIL ENRICHED MANTLE.

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Thin kimberlite and lamproite dykes are exposed in the Precambrian rocks of the Sissimiut area, central West Greenland. The dykes are remarkable fresh and show evidence of multible intrusions. The kimberlites are characterised by olivine megacrysts with groundmass perovskite and spinel, and contains olivine-phlogopite-ilmenite nodules. Two types of lamproites have been distinguished. The most commen type is pseudoleucite, rutile-, +/- olivine-bearing. The second is a MARID type with richterite, rutile, Mn-ilmenite, and megacrysts of clinopyroxene.

Geochemically the kimberlites are distinguished from the lamproites by higher MgO, FeO, CaO, CO_2, Cr, Ni, Co and Cu contents, and lower amounts