

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

Les lamproïtes se présentent en pipes de diamètre réduit (~ 1 km) et exceptionnellement comme des laves. Essentiellement, elles sont constituées par de l'olivine ($\text{Fo}_{92}\text{-Fo}_{78}$), de la phlogopite, du clinopyroxène ($\text{En}_{51}\text{Fs}_{44}\text{Wo}_{45}\text{-En}_{46}\text{Fs}_{13}\text{Wo}_{41}$) et des proportions variables, selon le degré de cristallinité, de la richterite potassique, de la sanidine et du verre; dans quelques types, des orthopyroxènes ($\text{En}_{85}\text{Fs}_{12}\text{Wo}_3\text{-En}_{72}\text{Fs}_{25}\text{Wo}_3$) et de la leucite peuvent apparaître. Sur la base des compositions normatives, on peut distinguer quatre types de lamproïtes: jumillites (avec ol et lc normatives), cancalites (avec ol normative), forunités (avec $<5\%$ de ol ou q normatives) et verites (avec >5 de q normative). Tous ces types montrent une haute relation $\text{Mg}/(\text{Mg}+\text{Fe}^{2+})$ (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 à 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 sont favorables au mélange des magmas de différente composition. Les calculs effectués à ce sujet avec les éléments majeurs, indiquent que les quatre types de lamproïtes 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 re-investigated mainly on the basis of new geochemical and mineralogical data. The rocks are characterized by phlogopite, olivine, sanidine, \pm biotite, \pm clinopyroxene, \pm orthopyroxene, \pm K-rich amphibole, \pm 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 $(\text{Na}+\text{K})/\text{Al}(\text{atoms})$ 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 difficult 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, leucitic and tephritic leucitic 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 (4.8-61 ppm), Rb (47-540 ppm), Sr (1090-2700 ppm), Th (36-130 ppm) 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 spine l 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 multiple 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 common type is pseudoleucite, rutile-, \pm 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

of SiO_2 , TiO_2 , Al_2O_3 , Na_2O , K_2O , P_2O_5 and incompatible trace elements.

The geochemical evolution have been investigated by molecular ratio diagrams with Zr as the ratio element in order to eliminate deformation of the data by the closure effect.

The kimberlites and lamproites have differing trends, and one rock type cannot have evolved from the other. The geochemical variation of the lamproites modelled with congruent melting of known mantle phases give rich/phl/cpx/ap/ru = 30/45/20/3/2. This solution yields too high (Fe,Mg)O values and too low alkali content. A model is proposed where incongruent melting of phlogopite to a melt of sanidine-ilmenite composition leaves a residue of olivine. This model gives rich/phl/cpx/san/ap/ilm = 38/27/11/16/3/5. The kimberlite variation can be explained by melting of ol/phl/cc/cpx/spi/ap = 65/17/9/5/3/1.

REE distributions of both rock types indicates that the mantle source was heavily enriched in REE and especially the LREE.

C14

PETROGRAPHY, GEOCHEMISTRY AND Sr ISOTOPIC COMPOSITION OF THE MBUJI-MAYI AND KUNDULUNGU KIMBERLITES (ZAÏRE).

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At Mbuji-Mayi the diamond-rich kimberlite breccia, of late Cretaceous age, contains nodules of "primary kimberlite". Phenocryst phases are Cr-chlorite (often rimmed or replaced by phlogopite) and two generations of olivine completely pseudomorphosed to phlogopite and calcite. The very fine-grained matrix consists of Cr-chlorite, hydromica and calcite with minor amounts of apatite, magnetite and rutile. The phenocryst assemblage and mineral transformations are rather peculiar. Given the absence of phlogopite phenocrysts, one cannot rule out the possibility that these kimberlites were originally of basaltic type.

Except for a higher carbonate content, they are chemically similar to South-African kimberlites. The $^{87}\text{Sr}/^{86}\text{Sr}$ initial ratios are low (0.7040-0.7045) which point to a mantle origin without crustal contamination. The isotopic ratio in rare carbonate inclusions is equally low suggesting that they are genetically linked to the kimberlites. REE patterns are the same as those observed in South-African kimberlites: $(\text{La}/\text{Yb})_{\text{N}} \approx 100$; $\text{La}_{\text{N}} = 100-600$; no Eu anomaly. Cr-rich diopside megacryst have lower $^{87}\text{Sr}/^{86}\text{Sr}$ ratios (ca. 0.7030) implying a xenolithic character. The pronounced HREE depletion seems to indicate that they formed in equilibrium with garnet.

The Kundulungu kimberlites are of the basaltic type (fresh olivine phenocrysts, fine-grained chloritic matrix, absence of phlogopite phenocrysts). They are much lower in carbonates but, in terms of trace element and Sr isotopic geochemistry they are very similar to the Mbuji-Mayi and other kimberlites.

C15

Nd AND Sr ISOTOPIC COMPOSITIONS AND REE GEOCHEMISTRY OF ALKALI BASALTS FROM THE MASSIF CENTRAL, FRANCE.

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Cenozoic volcanic rocks of alkali basalt family are widespread in the Massif Central. They are underlain by the Hercynian granitic basement. The compositions of basalts range from hawaiitic to basanitic, but basanites dominate the rock types. Results show that the basalts from the Cantal, the Aubrac and the Mont Dore ($T < 10$ m.y.) have $^{143}\text{Nd}/^{144}\text{Nd} = 0.51283$ to 0.51299 or $\epsilon_{\text{Nd}} = +3.7$ to $+6.7$, and $^{87}\text{Sr}/^{86}\text{Sr} = 0.70338$ to 0.70435 . Quaternary basalts from the Chaîne des Puys yield $^{87}\text{Sr}/^{86}\text{Sr} = 0.70366$ to 0.70458 . In a Nd-Sr isotopic correlation diagram, these data fall within the correlation band. The positive ϵ_{Nd} values suggest that their magma sources have had a time-integrated LREE depletion, similar to that observed for the MORB sources.

The REE data show typical LREE enrichment of alkali basalts, with $\text{La}_{\text{N}} = 80-250 \text{ X}$, $\text{Lu}_{\text{N}} = 7-13 \text{ X}$, $(\text{La}/\text{Yb})_{\text{N}} = 10-20$, and practically no Eu anomalies. Geochemical arguments do not favor any significant crustal contamination for the derivation of these basalts studied. Theoretical considerations call for a recent mantle metasomatism in which a LREE depleted source region was enriched in LREE and other LIL elements before partial melting events. Since the positive ϵ_{Nd} values and enriched LREE abundances are so common to most alkali basalts and related rocks, it appears that mantle metasomatism is precursory to the generation of alkali basalts and that the influx of metasomatic fluids have localized the melting events.

C16

Sr, Nd ISOTOPES AND TRACE ELEMENT GEOCHEMISTRY OF MELILITES FROM WESTERN EUROPE

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Melilitite bearing nephelinites (melilitites) are commonly found in provinces where evidence of melting at deep levels in the mantle (kimberlites, carbonatites) exists. They are actually among the most mafic basaltic rocks and their high content in REE and Sr together with a fairly rapid eruption mode would suggest little contribution of high level contamination in their genesis.

Twenty cenozoic melilitites from Europe (Spain, France, W. Germany and Czechoslovakia) have been analysed for Sr, Nd isotopic composition and trace element (REE + transition elements) contents. $^{87}\text{Sr}/^{86}\text{Sr}$ and $^{143}\text{Nd}/^{144}\text{Nd}$ ratios plot mostly within and partly below the oceanic trend with no obvious regional variation. The average $^{87}\text{Sr}/^{86}\text{Sr}$ ratio is 0.703776 (range $0.70322-0.70446$), the average $^{143}\text{Nd}/^{144}\text{Nd}$ ratio of 0.512832 ($0.51269-0.51300$). Leaching experiments show isotopic inhomogeneities and suggest the presence of a high $^{87}\text{Sr}/^{86}\text{Sr}$ component interpreted as being of crustal origin. The origin of melilitite could be found in an ordinary (oceanic type) upper mantle of which the melting products experienced contamination at high level during upward migration of the magma in the crust. The Sr/Nd ratio of the contaminant is tentatively estimated to fall in the range 3 to 15 which could fit upper crustal rocks such as shales or granites.

REE elements present the usual pattern of alkali-rocks with high concentration level, high Ce/Yb ratios (58 to 130) and no Eu anomaly.

Beside additions evidence for crustal contamination, REE and tran-