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Abstracts

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Petrology of the Proterozoic Alkaline Carbonatite Complex of Samalpatti, Tamil Nadu, India: example of the carbonate-silicate liquid immiscibility

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The Precambrian gneissic rocks of the Samalpaatti area are intruded by the Proterozoic carbonatites, alkaline rocks, pyroxenites and minor dunites. Mineralogically carbonatites show wide variation in their compositions but chemically most of them are silicocarbonatites. Alkaline rocks are either syenites or lamprophyres. Syenites vary from quartz syenite to nepheline syenite with appreciable amount of hornblende. Albitite type syenites are also reported which may be the results of fenitization. Lamprophyres are camptonite type containing barkevicite, augite, and plagioclase feldspars as a main phenocrysts. Both carbonatites and alkaline rocks are rich in large-ion lithophile (LIL) and high-field strength elements (HFSE). Carbonatites are enriched in $\delta^{13}C$- and $\delta^{18}O$-values. The Rayleigh fractionation model is best explanation for the C and O isotope enrichments. The carbonatites and alkaline rocks are crystallized from the carbonate and silicate melts separated from carbonated nephelinitic magma by liquid immiscibility at shallow levels. Globules of silicate minerals surrounded by carbonatite matrix strongly support liquid immiscibility origin for the present carbonatites and alkaline rocks besides geochemical evidences.

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Carbonatites and Upper Mantle relationships

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Geochemical characteristics were systematically determined for carbonatite samples from selected outcrops in Eastern Paraguay and Southern Brazil (Paraguay: Rio Apa, Amambay, Sapucai; Southeastern Brazil: Alto Paranaíba, Arco di Ponta Grossa). The occurrences comprise two mainly chronogroups, i.e. 1) Early Cretaceous (Eastern Paraguay and Arco di Ponta Grossa) and 2) Late Cretaceous (Arco di Ponta Grossa and Alto Paranaíba), and two main types of associated alkaline rocks, i.e. A) plagioleucitites l.s. (Eastern Paraguay and Arco di Ponta Grossa) and B) kamafugites l.s. (Alto Paranaíba).

The geochemical data show that all the occurrences have an enriched isotopic signature; moreover the combinated O-Sr systematics indicates that the carbonatites have negligible or absent crustal signature. The interpretation of the origin of a such enriched isotopic signature of the Paraguayan vs South Brazilian carbonatites (subcontinental lithospheric mantle vs asthenosphere) and relationships with the petrogenetic models of the Paraná tholeiitic volcanism (130 Ma) remains controversial.

A petrogenetic and evolutive model (e.g. parent liquids, crustal crystallization, hydrothermal interactions) is described as a function of stable (O-C), radiogenic (Sr-Nd) and incompatible elements with the aim to test the meaning of carbonatitic complexes as a marker of the subcontinental gondwanic lithosphere.

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P-T of the mantle xenoliths in alkali basalts from S. Korea

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Mantle xenoliths in alkali basalt from Boun, Gansung area, and Baegryung island in S. Korea are spinel lherzolite composed of olivine, orthopyroxene, clinopyroxene, and spinel. Xenoliths generally show triple junctions among grains, kink-banding in olivine and pyroxenes, and protogranular and eqigranular textures having no orientation of specific direction. Anhedral brown spinels are disseminated in the intergranular spaces of minerals. Mineral compositions are very homogeneous without compositional zonation from rim to core in grains regardless different localities. Olivine shows Fo. component of 89.0 - 90.2 and low CaO of 0.03 - 0.12wt%, orthopyroxene is enstatite with En component of 89.0 - 90.0 and Al_2O_3 of 4 - 5wt%, and clinopyroxene is diopside having En. component of 47.2 - 49.1 and Al_2O_3 of 7.42 - 7.64wt% from Boun and 4.70 - 4.91wt% from Baegryung showing local variation. Spinel shows the distinctive negative trend with increasing of Al and decreasing of Cr, and Mg value and Cr number are 75.1 - 81.9 and 8.5 - 12.6.

To estimate T and P for these mantle xenoliths pyroxene-geothermometers(Wood & Banno, '73; Wells,'77; Mercier, '80; Sachtleben & Seck, '81; Bertrand & Mercier, '85; Brey & Köhler, '90) and Ca/Al-solubility geobarometer (Mercier, '80; Lane & Ganguly, '80) are used. Temperatures of Mercier(1980) and Sachtleben and Seck(1981) are compatible and equilibrium temperatures of xenoliths, average value of these two , are from 970℃ to 1020℃, and equilibrium pressures derived from Mercier(1980) are in the range of 12 - 19 Kb(42 - 63Km). These temperatures and pressures seem to be reasonble with the consideration of Al-isopleths in MAS system(Lane & Ganguly, '80) and Fe effect on Al-solubility in orthopyroxene(Lee & Ganguly, '88).

Equilibrium of temperatures and pressures of xenoliths in P-T space belongs to ocenanic geothem among the Mercier's mantle geotherms(1980) and is completely different from continental geotherms of S. Africa(Lesotho) and S. India having different geological ages. Mineral compositions and paleogeotherms of upper mantle beneath S. Korea and eastern China are very similar, but chemical compositions of upper mantle could be different from each other since eastern China has various mantle xenoliths including spinel/garnet lherzolites and harzburgite due to different degrees of partial melting.

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Petrology of kimberlites of the Siberian and Easteuropean platforms.

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In the petrochemical and mineralogical composition the kimberlites(breccia) of the Siberian and Easteuropean platforms are exremes among kimberlites of all known diamondiferous provinces on the Earth.

Kimberlites of the Easteuropean platform(Archangelsk region) have max ultrabasicity in chemical composition. The dominant mineral of heavy residue is chrome-spinel(It's ratio to Py and Ilm is 61-92:2-14:14:1. The majority of the inclusion have ultrabasic composition(90-95% spinel apolherzolites and apodunites)). Rombododecahedra are predominant among the large diamonds while ochtahedra dominate among the small size diamonds.

Kimberlites of the Siberian platform are characterized by higher "carbonaticity", i.e. enriches in calciun and carbon dioxide. Chrome-spinel is miserable here. The ratios of CrSp:Py:Ilm are 0,05-2,7:1-20:1. The ultramaric inclusions amount in kimberlites of Nizhne-Olenyok, Malo-Botuba, Dalgun-Alakit and Muna regions average 45%, 75-80%, 80-90%, 90-95% respectively. Pyropes and picroilmenites predominate in the composition of the heavy minerals. Picroilmenites are higher ferrous(contain higher Fe_2O_3) compared with those from kimberlites of the Easteuropean provinces. The latter are significantly high magnesian.

The clean dependences have been established between the typochemism of minerals, between the composition of the ultrabasite inclusions and that of kimberlites, between the chemical composition of kimberlites and its diamondiferous. This is common to kimberlite rocks of the Siberian and Easteuropean platforms.