Ultrapotassic vs. sodic peralkaline syenite and granite

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Peralkaline granites and syenites are defined compositionally by the (Na + K) > Al > Na > K relationship (in number of atoms). Peralkalinity corresponds actually to hypo-aluminous tendency and results generally in large development of albite in addition to mesoperthitic alkali feldspar, a mafic assemblage dominated by sodic species, e.g. richterite-arfvedsonite, aegirine, and HFSE-bearing accessory mineralogy, e.g. pyrochlore, fergusonite, chevkinite, elpidite, aenigmatite. They are commonly emplaced in within-plate either oceanic (e.g. Kerguelen), or post-orogenic and anorogenic continental settings.

In the Proterozoic igneous provinces of north-east Brazil and other areas, a second type of peralkaline syenites and granites can be distinguished by their (Na + K) > Al > K > Na relationship. The liquid line of descent from mesocratic to leucocratic alkali feldspar syenite and granite and related melanocratic cumulates are characterised by the constant [clinopyroxene + alkali feldspar + titanite + apatite] paragenesis. Almost pure K-feldspar coexists with clinopyroxene evolving from diopside to aegirine-augite to aegirine. Extreme K abundances (up to 15 wt% K_2O vs. 1.5 wt% Na_2O) are associated with high LILE amounts, LREE being carried by apatite and HREE by titanite. Ultrapotassic peralkaline syenites and granites remind of lamproitic suites, though the common K > Al relationship and the resulting peralkaline K-bearing [richterite + priderite] association were not observed. The strikingly peralkaline affinity of the ultrapotassic suite could originate in the partial melting of an extremely enriched mantle fertilised by K-products, containing possibly a member of the phlogopite-tetrasilicic mica association.