MIOCENE ULTRAPOTASSIC VOLCANIC ROCKS FROM SOUTHWESTERN TIBET

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Ultrapotassic volcanic rocks were discovered during a reconnaissance study of the Bongba-Xungba-Jarga igneous province about 70 to 100 km to the N and NE of the Indus Tsangpo Suture Zone and Mt. Kailas. Massive flows up to 20 m thick, pyroclastic rocks and cross-cutting dikes form small volcanic edifices and cinder cones. The volcanic rocks are underlain by shallow marine and terrigenous sediments of the Cretaceous Takena Formation and by rhyolitic volcanic rocks of the Linzizong Formation. The ultrapotassic rock suite has have been dated by the $^{40}Ar/^{39}Ar$ method as early Miocene (16.3–23.8 Ma). In central Asia other post-collisional ultrapotassic volcanic rocks have been reported from the northern Karakorum (POGNANTE, 1990) and from NW Tibet (PEARCE & MEI, 1988).

In general, the eruptive rocks are markedly porphyritic, with phenocrysts of phlogopite, diopsidic clinopyroxene, ± olivine, ± orthopyroxene set in a groundmass assemblage of clinopyroxene, sanidine, ± olivine, ± orthopyroxene, ± phlogopite, apatite, titanomagnetite and residual glass. In addition, in most samples, olivine megacrysts are present. Their deformational features and somewhat higher Mg and Ni contents relative to olivine phenocrysts suggest an origin as mantle xenocrysts.

In order to obtain constraints on the magma source region, attention was restricted to the less evolved samples. These are characterized by elevated SiO_2 contents (53.5–57.4 wt%), high mg numbers (65–75), relatively high Ni (87–358 ppm) and Cr (295–528 ppm), moderate Al_2O_3, low CaO and TiO_2. They are relatively primitive ultrapotassic rocks with major element characteristics that are transitional between groups I (lamproitic) and III (orogenic) according to the definition by FOLEY et al. (1987). All samples are selectively enriched in incompatible trace elements. They have high Ba/La, low Ce/Pb ratios and REE patterns with negative Eu anomalies, consistent with a modification of the magma source region by a crustal-derived component. Their incompatible element distribution patterns (Fig.1) are strikingly similar to those of the phlogopite lamproites from southeast Spain (VENTURELLI et al., 1984). The presence of relative Nb, Ta and Ti depletions may indicate that subduction processes were important in their genesis. An alternative explanation of these anomalies requires a residual Ti-rich phase (e.g. rutile) in the mantle source region. Unfortunately, there is no a priori way to separate the geochemical features that are characteristic of active subduction processes from those of ancient subduction events which have modified the mantle composition.

The ultrapotassic rocks from SW Tibet have highly radiogenic initial $^{87}Sr/^{86}Sr$ ratios (0.7172–0.7220) and unradiogenic initial $^{143}Nd/^{144}Nd$ corresponding to $\varepsilon Nd(CHUR)$

values between -11.8 to -14.4. These isotopic compositions are like those of the lamproites from southeastern Spain (NIXON et al., 1984; NELSON et al., 1986) and the leucite lamproites from the West Kimberley region of Western Australia (McCULLOCH et al., 1983). The initial Pb isotopic compositions are within the range $^{206}Pb/^{204}Pb$ of 18.40 to 18.52, $^{207}Pb/^{204}Pb$ of 15.68 to 15.73 and $^{208}Pb/^{204}Pb$ of 39.42–39.75. A distinctive feature of the Pb compositions is their position to the left of the Stacey Kramers (1975) geochron. These unusual Pb isotopic compositions require a complex multi-stage evolution.

The isotopic compositions indicate that the ultrapotassic volcanic rocks have tapped an EM2 domain that may be located within the subcontinental lithosphere. Partial melting of this source may have been initiated by a number of processes (decompressional melting, resulting from uplift, thermally induced melting following the cessation of subduction, introduction of volatiles), their details, however, are poorly understood.

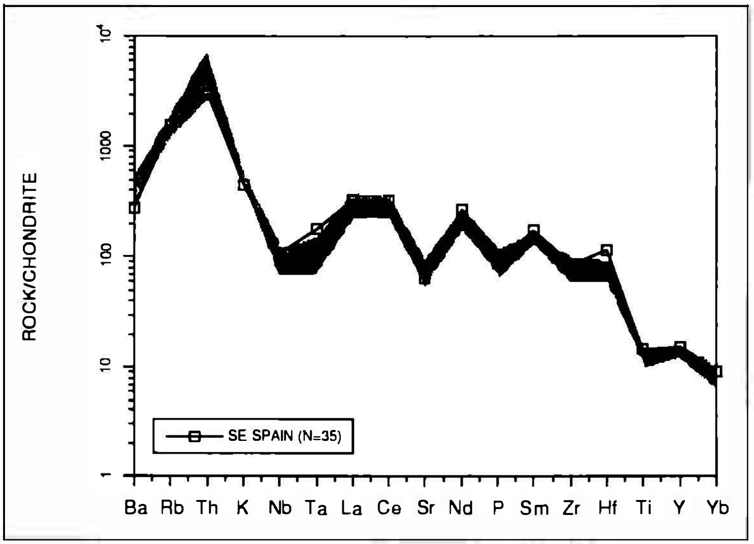

Fig. 1:
Geochemical patterns for Miocene ultrapotassic volcanic rocks from southwest Tibet. The data are normalized to chondritic abundances, except for Rb, K and P which are normalized to primitive mantle values (THOMPSON, 1982). Note the remarkable similarity with lamproites from southeast Spain. Data sources: VENTURELLI et al., 1984, NIXON et al., 1984; NELSON et al., 1986.

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