

GEO THERM BENEATH YPACARAI VALLEY  
(Asunción Province --Eastern Paraguay)

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Nephelinitic plugs, flows and dykes dominate the Tertiary magmatism in Eastern Paraguay, near Asunción town (Comin-Chiaramonti et al., 1990). This magmatism is associated with NW-SE rift structures and to gravimetric positive anomalies (DeGraff et al., 1981). Usually the nephelinites contain variable amounts (up to about 15% by volumen) of mantle xenoliths (Comin-Chiaramonti, 1986; Demarchi et al., 1988).

The mantle xenoliths are group I spinel lherzolites, harzburgites and dunites (nomenclature of Tracy and Prinz, 1978) and belong to the Cr-diopside series of Wilshire and Shervais (1975). The dominant texture is protogranular, according to Mercier and Nicolas (1975) and the whole size ranges less than 0.1 up to 45 cm.

The Mg/Fe<sub>total</sub> atomic ratio of the orthopyroxene range from 9.7 to 11.8 and is well correlated with the residual character of the whole peridotitic assemblage (Demarchi et al., 1988); increasing Mg/Fe<sub>total</sub> atomic ratio of the orthopyroxene, Fo content of olivine increases from 89.7 to 91.7, Mg/Fe<sub>total</sub> atomic ratio of clinopyroxene increases from 9.2 to 15.3, Cr/(Cr+Al) atomic ratio of spinel increases from 0.16 to 0.60.

The spinel - peridotite assemblage can yield P-T estimates by a variety of methods (s.e.g. O'Neill, 1981; Nickel et al., 1985 for a discussion). The single-pyroxene (orthopyroxene and clinopyroxene) temperatures and pressures were calculated here following the "empirical Al (px)" model of Mercier (1980), utilizing only high-quality microprobe analyses (i.e. of the cations = 4.000 ± 1) from Demarchi et al., 1988.

The estimated P-T for the mantle xenoliths range from 11 to 24 Kb and from 944 to 1151° C respectively (Table 1).

A spinel to garnet peridotite transition was taken from the data of O'Neill (1981) using Fe/Mg and Cr/Al values equivalent to those of the more depleted mantle xenoliths.

All the samples, in terms of P and T, plot above this transition curve (Fig. 1).

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Obviously the calculated spinel-garnet transition represents an upper limit from which a minimum depth of about 63 Km. is inferred before the entrainment of the xenoliths in the ascending magma.

Although the contact with a hot magma may be effective in producing incipient melting in a short time, the absence of zoning both in ortho- and clinopyroxenes (Demarchi et al., 1988) suggests that a re-equilibration between ortho- and clinopyroxene, during the entrainment in ascending liquids was not significant and therefore the data may represent a "broad" geotherm beneath the Asunción area at Tertiary times.

Finally, if the maximum heat-flow value measured actually in the region (i.e.  $58 \text{ mW/m}^2$ , Hamza, 1984) is assumed for the Asunción rift, this is reflected in aeromagnetic anomalies (Drueker and Gay, 1988) which suggest that the magnetic crust is thin corresponding to a shallow Curie-point depth.

The extrapolation from the empirical geotherm (fig 1) indicates that the magnetic Curie-point (about  $550^\circ\text{C}$ ) is reached at 15 Km or less and it is therefore consistent to aeromagnetic anomalies.