The Rosario do Sul Kimberlitic Province, Rio Grande do Sul State, Southern Brazil.

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Introduction

The Rosario do Sul kimberlites are situated in the vicinity of the town of Rosario do Sul in the Rio Grande do Sul State of Southern Brazil and are the first to be reported from this area. None of the kimberlites are diamondiferous. The bodies are distributed along a NW-SE trend between 30°S and 31°S and 54°30'W and 55°30'W and intrude the Triassic Rosario do Sul Formation, which forms part of the intracratonic Parana Basin situated on the Archaean Rio De La Plata Craton (Figure 1). The rocks of the Rosario do Sul Formation comprise a 5000m thick sequence of reddish-coloured sandstones covering an area of approximately 1,000,000km^2 over Brazil, Paraguay, Uruguay and Argentina (Schobbenhaus - Filho *et al.*, 1975).

Petrography

Twenty bodies comprising pipes, dykes and sills ranging from 1-20ha in size have been identified. Magmatic and fragmental (tuffisitic and clastic) textures were observed in samples from most of the occurrences. The mineral composition of the rocks is that of Group-1 kimberlites with coarse-grained olivine phenocrysts set in finer-grained monticellite, phlogopite, perovskite and minor apatite. Accessory groundmass phases include opaque minerals (spinel and ilmenite). Garnet xenocrysts are common. Olivine macrocrysts are, however, rare. Most samples contain abundant olivine phenocrysts, occurring as isolated grains and clusters or aggregates. These phenocrysts are also characterised by unusual shapes that are atypical of kimberlites, but are common in the melilitite clan (i.e. melnoites - Scott Smith, 1995). However, the Rosario rocks cannot be effectively classified as melnoites because they do not contain the appropriate mineralogy (e.g. melilite and clinopyroxene). Instead, the rocks display a transitional character between Group-1 kimberlites and melnoites and are therefore classified as marginal kimberlites.

Mantle indicator mineral-chemistry

The Rosario kimberlites contain abundant garnets, spinels and ilmenite. No clinopyroxenes were recovered from the concentrate. The **garnets** are predominantly low-TiO_2 (<0.6wt%), moderate-Cr_2O_3 (0-4.4wt%) and CaO-saturated (4.5-6.0wt%) varieties (Figure 2). Using the classification of Gurney *et al.* (1993) peridotitic (lherzolitic-G9) varieties, as well as possible megacrysts (Cr_2O_3< ≈2wt%) and eclogitic garnets (Cr_2O_3<2wt%) can be distinguished. Trace element data were obtained for 34 garnets representing possible conductive peridotitic-mantle parageneses with low-TiO_2 (<0.4wt%) and high-Cr_2O_3 (>2wt%). Temperatures and pressures of equilibration were determined using the techniques of Ryan *et al.* (1996). The highest pressure (P_{Cr}) calculated is ≈33kbar, which in turn defines a maximum geotherm of ≈43mW/m^2 (Figure 3). The intersection with the graphite-diamond transition along this geotherm is measured at a temperature of ≈1100°C and indicates that no sampling occurred in the diamond stability field. Only about five of the 34 garnet grains analysed display depleted incompatible element compositions (Griffin and Ryan, 1995) (Figures 4 and 5). The remaining garnets are enriched in incompatible-elements, which is consistent with a high geothermal regime and/or a fertile mantle source. The grains do not appear to be affected by melt or hydrous metasomatism. The **spinels** are predominantly high-MgO (>11wt%) kimberlitic types with lesser, low-MgO, non-kimberlitic varieties (Figure 6). All the spinels have low-Cr_2O_3 (<56wt%) contents and therefore none plot inside the diamond-inclusion/intergrowth field defined by Fipke *et al.* (1995). Kimberlitic and non-kimberlitic **ilmenites** are present and display a broad range of MgO concentrations between 0 and 11wt% (Figure 7). The Cr_2O_3 contents of the ilmenites range between 0 and 2.4wt%. Two populations, respectively displaying lower-chrome concentration (megacrysts) and higher-chrome concentrations (metasomatised megacrysts), are defined (e.g. Schulze *et al.*, 1995). Overall, the low-MgO contents of the ilmenites suggest unfavourable conditions for diamond preservation (Fipke *et al.*, 1995).

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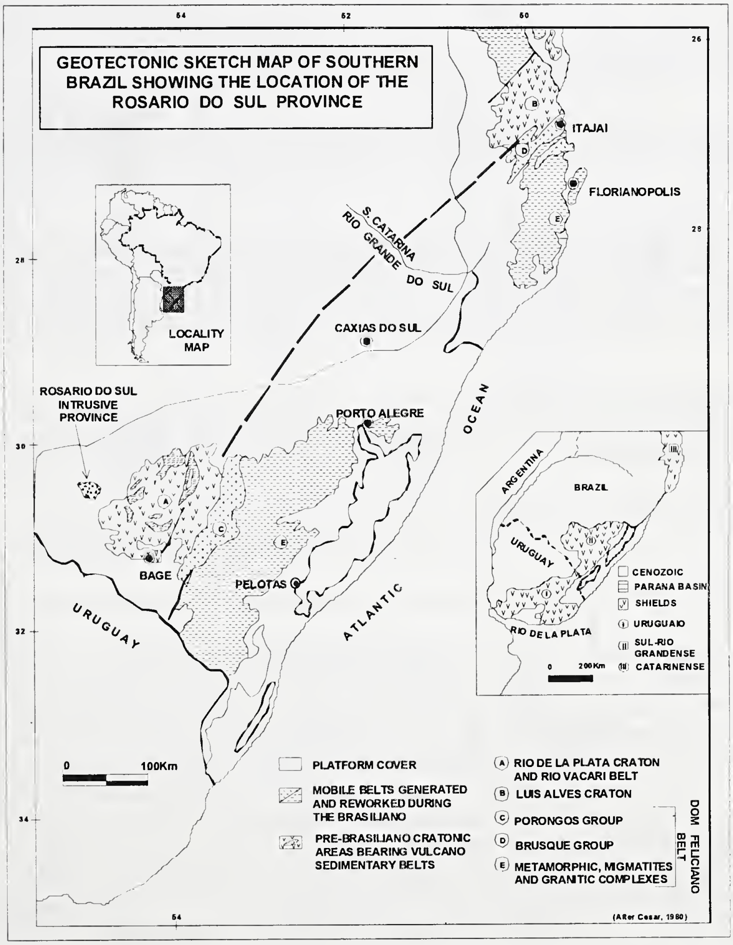


Figure 1

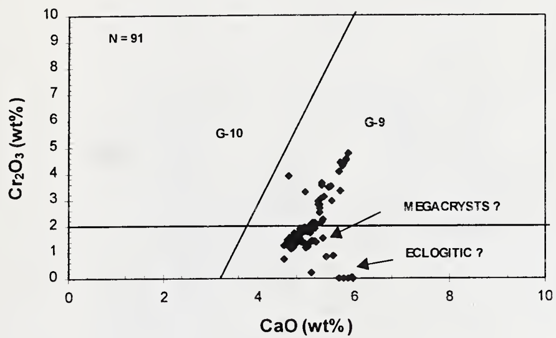


Figure 2

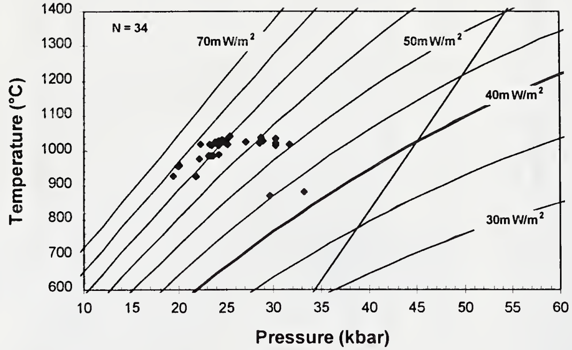
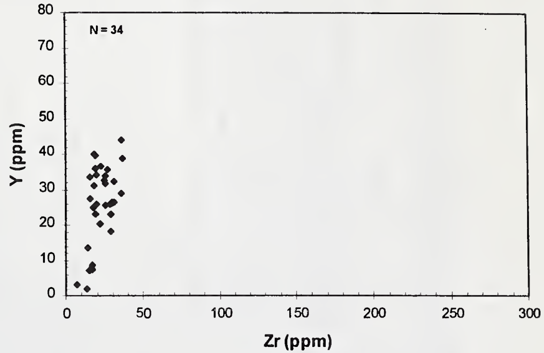


Figure 3



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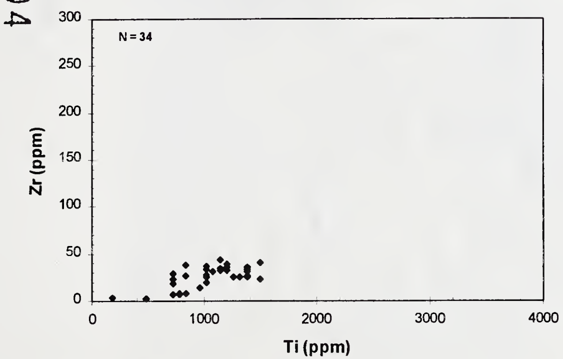

Figure 5

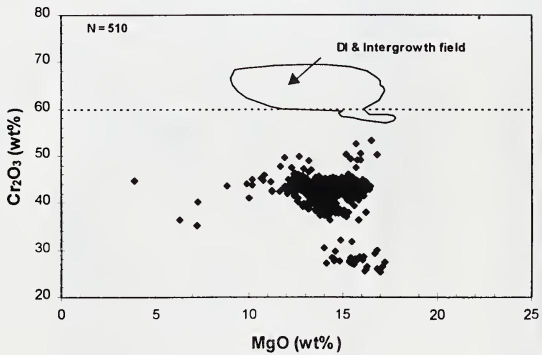

Figure 6

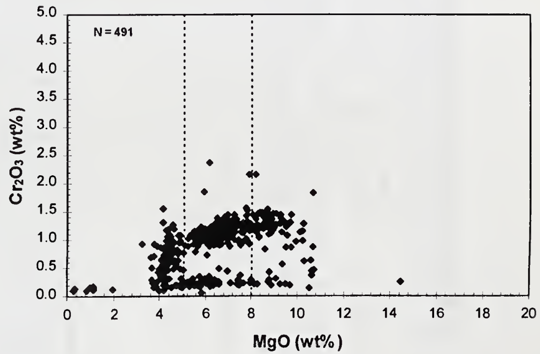

Figure 7