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HIGH TEMPERATURE, LOW PRESSURE GARNET-BEARING PERIDOTITES FROM PRAGAUNIYEU: EVIDENCE FOR PLUME ACTIVITY IN NORTHERN PARAGONIA

by

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Introduction: Garnet-bearing mantle xenoliths in Pali Aike, southernmost Patagonia have been repeatedly reported in the past. We present, chemical and isotopic data and PT estimates for garnet-bearing mantle xenoliths from Praguaniyeu, a new locality close to the Meseta de Somuncura, in northern Patagonia.

Results: Xenoliths occur in tuffs, alkali basalts and basanites and comprise garnet-peridotites, garnet-spinel-peridotites and spinel-peridotites, and garnet-bearing spinel--clinopyroxenites. The majority of the xenoliths have equigranular texture. There is, however, a second suite of xenoliths with foliated textures. Minerals are homogeneous in composition and only the very outer opx and cpx rims have insignificantly lower Al_2O_3 contents than the cores. Also very narrow kelyphite rims around garnet are present. In general, the equigranular garnet–bearing peridotites have higher Al_2O_3 (~ 7 wt.%) and Na_2O (~1.8 wt.%) contents than the foliated (~ 4.5 and 1.0 wt.% respectively) ones. Garnets from both suites have similar mg# around 0.84, but different Cr_2O_3 contents (1.2 and 2.5 wt.% respectively). Similar trends were also obtained for spinel peridotites: equigranular spinel-peridotites have higher Al_2O_3 and Na_2O contents (4.8 and 1.5 wt.% respectively) than the foliated (4.0 and 1.0 wt.% respectively) ones.
The major elements CaO and Al_2O_3 range from 4.5 to 0.80 wt.% and from 4.31 to 1.01 wt.%, respectively. In the CaO vs Al_2O_3 diagram the most depleted samples define a linear trend which is different from the linear trend that define the most fertile samples (Fig. 2). It is therefore evident that Pragauniyeu xenoliths are not residues after different degrees of partial meltings of an initial fertile source. Apparently the most depleted samples represent an older depleted lithosphere and the most fertile a recrystallized one. The REE patterns in a chondrite-normalized diagram are flat (La_N/Yb_N ratios vary from 07 to 3.1) suggesting a moderate cryptic metasomatism (no hydrous phases are present).

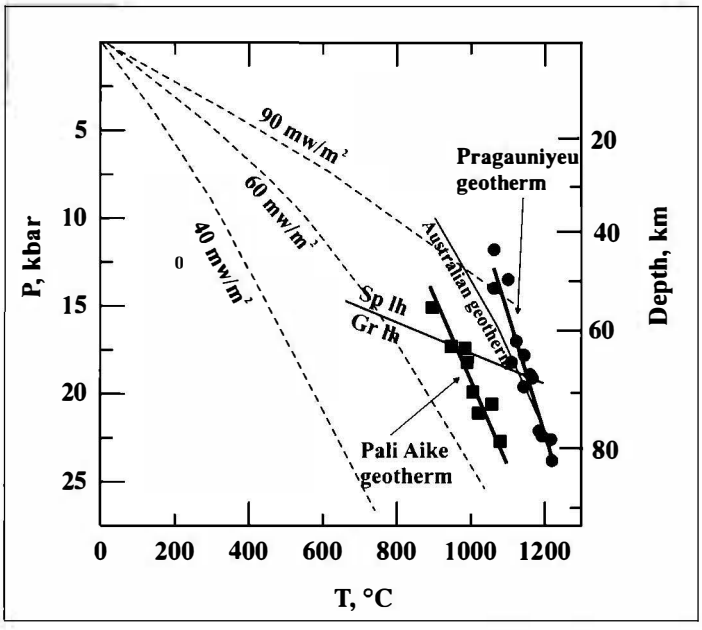

Fig. 1
PT estimates for xenoliths from Pragauniyeu, northern Patagonia. The xenolith geotherm implies very high temperatures at relative shallow depth. Steady state geotherms are from [4], Australian geotherm from [5] and Pali Aike geotherm from [6].

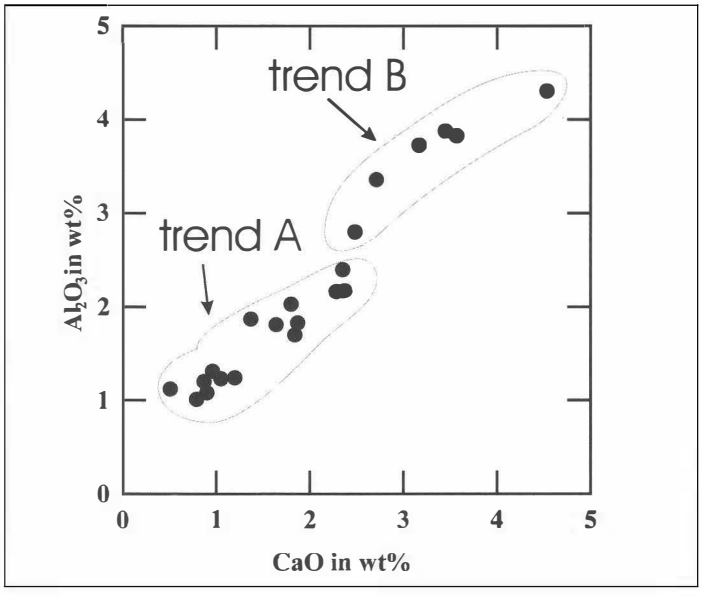

Fig. 2
Plot of CaO vs. MgO for major elements from Pragauniyeu xenoliths. Depleted and fertile xenoliths form different trends (trend A and trend B respectively).

Ion-probe analyses have shown that gt and cpx in the foliated garnet-peridotites are not in equilibrium in respect of REE, since LREE in cpx are strongly depleted, resembling patterns similar to those of garnets. There is a correlation between texture and degree of LREE depletion. The equigranular garnet-bearing peridotites have cpx that are in equilibrium with gt (La ~ 6x chondritic). Conversely, cpx in the moderate foliated samples have La around 2 times chondritic and in the strongly foliated samples the LREE depletion is very high (La ~ 0.2 times chondritic).

Equilibrium P-T estimates are calculated for garnet-bearing samples based on compositions of coexisting gt-cpx-opx and for spinel-bearing samples based on compositions of coexisting ol-cpx-opx. Temperature estimates were made with the two-pyroxene geothermometer of [1]. Pressure estimates were made with Al in opx coexisting with garnet [1] and Ca exchange between coexisting ol-cpx [2]. Tequil are unusual high and range from 1060°C to 1230°C, whereas Pequil are low, ranging from 12 to 24 kbars (Fig. 1).
The age of the equilibrated garnet-lherzolites as inferred from Sm-Nd mineral dating is 29.4 ± 5.7 Ma (garnet-clinopyroxene; $\varepsilon_t = +9.9$).

Conclusions: The preliminary results demonstrate that xenoliths from Pragauniyeu in northern Patagonia lie on elevated geotherms and represent an extreme high temperature, probably related to extensional tectonics due to the uplift of the same source that generated the Meseta de Somoncura tholeiitic basalts. The young age of the subcontinental mantle in this area (29.4 ± 5.7), represents the closing of the Sm-Nd isotopic system between garnet-clinopyroxene after the Somoncura extensive magmatic event (about 40 Ma ago). These features of the subcontiental mantle and the OIB signature of the Somoncura basalts may suggest a rising plume in this area[3].

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