PETROLOGY OF SUPRASUBDUCTIVE MANTLE XENOLITHS FROM ESTANCIA SOL DE MAYO (CENTRAL PATAGONIA, ARGENTINA)

MASSIMILIANO MELCHIORRE
Dipartimento di Scienze della Terra, Università di Ferrara, Via Saragat 1, 44100 Ferrara

A new suite of mantle xenoliths from Estancia Sol de Mayo (ESM, Patagonia) has been studied. They have been sampled at the southwestern corner of the Meseta Lago Buenos Aires (MLBA), one of the five Mesetas comprised in the Triple Junction (TJ) province (Fig. 1) together with the Mesetas to the northeastern (called the “northeastern region”) and the plateaux of de la Muerte (MM), Belgrano (MB) and Central (MC) Meseta. They are entrained in the alkaline post-plateau lavas of the MLBA. These lavas can be subdivided in

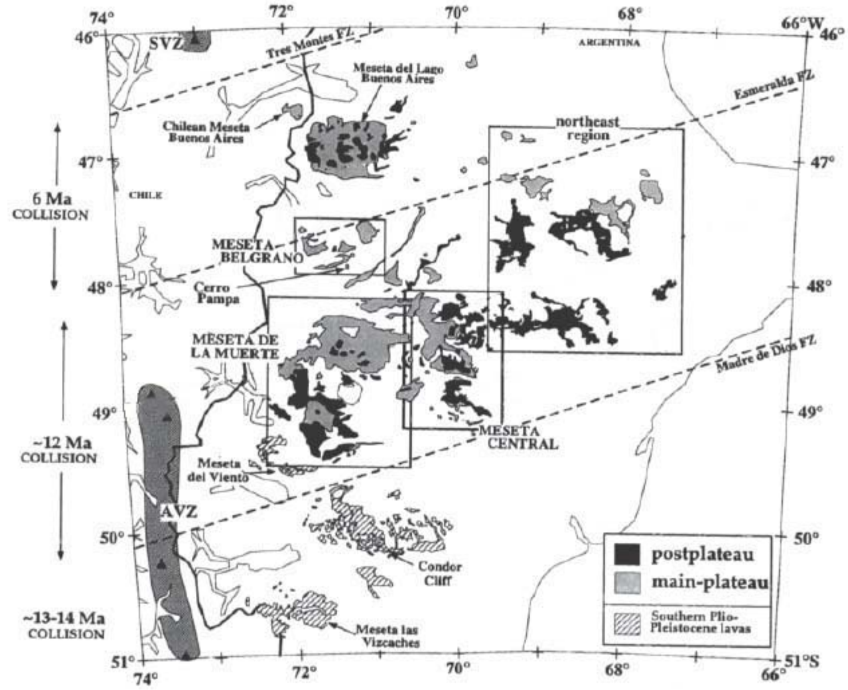

Fig. 1 - Map showing the occurrence of the different plateaux of the Triple Junction Province (from Gorring *et al.*, 1997). In grey and black are represented the main and post-plateau sequences, respectively.

two sequences related to the main and to the post-plateau event, respectively. The $^{40}Ar/^{39}Ar$ radiometric ages from MLBA main plateau lavas range from 10 to 4.5 Ma with the oldest lavas exposed on the southeast edge of the plateau, whereas the post-plateau lavas range from 3.4 to 0.125 Ma, but most are $\leq$ 1.8 Ma in age. Chondrite-normalized trace element patterns of the lavas resemble those of the OIB, as well as those of the main and post-plateau from the TJ province, the latter having a slightly higher incompatible trace element concentrations with respect to those of the main plateau. The OIB signature of the samples is also highlighted by the Ba *vs*. Nb diagram, in which the samples clearly fall in the field of the within-plate composition, together with those of all the other localities belonging to the TJ province.

The xenoliths are represented by anhydrous spinel-bearing harzburgites and dunites, with minor lherzolites and one wehrlite. They are characterized by a coarse grained protogranular texture and they are devoid of modal metasomatic features. They show two texturally different clinopyroxenes. One is protogranular, here defined cpx 1, whereas the second is linked to the spinel (cpx 2). Moreover, three different orthopyroxenes are recognized: the first type is represented by large protogranular crystals with exsolution lamellae (opx 1); the second type occurs as small, clean, and undeformed grains without exsolution lamellae (opx 2); the last type occurs as smaller grains arranged in vein (opx 3).

On the whole, the major element compositions of the clinopyroxenes and orthopyroxenes highlight three different trends. Two of them are shared by cpx and opx: the first is characterized by high Al_2O_3 content at almost constant Mg# (trend 1) and the second by a slight increase of the Al_2O_3 content with the decreasing of the Mg# (trend 3). A third trend (trend 2), which is situated in between the other two, is observed only for the cpx and it comprises the clinopyroxenes of the wehrlites (Fig. 2). The trace element concentrations normalized to those of the Chondrite do not show any difference between cpx 1 and cpx 2 (characterized by prominent to slightly negative Nb, Zr and Ti anomalies and LREE enriched), but discriminate three groups of orthopyroxenes: one is represented by the opx 3 (those arranged in vein) characterized by a prominent positive Zr anomaly, whereas the other two always show prominent to slightly negative Ti and Zr anomalies and they are LREE depleted.

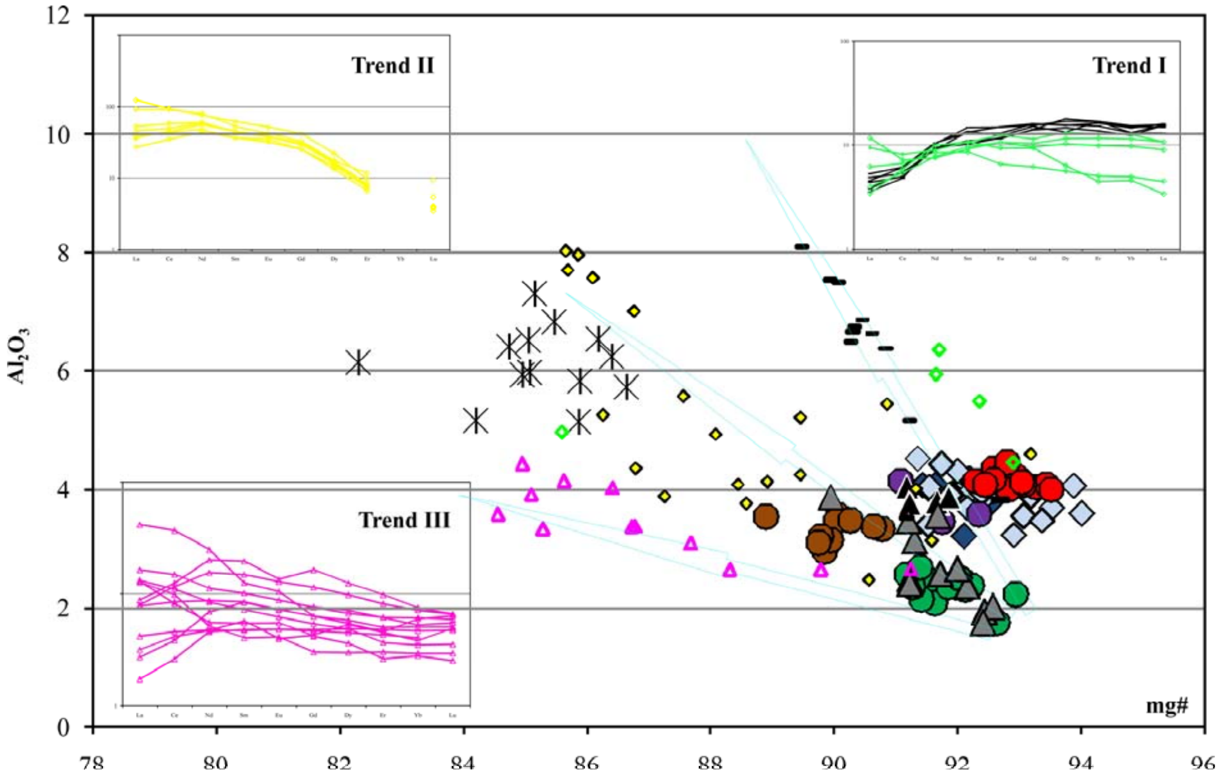

Fig. 2 - Al_2O_3 *vs*. Mg# for ESM clinopyroxenes and REE (insets) compositions of clinopyroxenes of pyroxenites and wehrlites from northern and central Patagonia (Dantas, 2007). Empty pink triangles and black bars are cpx from pyroxenites from northern Patagonia; empty green diamonds are cpx from pyroxenites from central Patagonia; yellow diamonds are from wehrlites from central Patagonia. All the other symbols are cpx from mantle xenoliths from Estancia Sol de Mayo. The arrows indicate the three trends.

The correlation between the incompatible trace elements ($(La/Yb)_N$ and Sr_N) and the Al_2O_3 features of the cpx highlight the presence of a refertilization/metasomatic events affecting the ESM upper mantle, evidenced by the enrichment of the LREE and Sr correlated to a decreasing of the Al_2O_3 content. The melt accounted for the refertilization process has a tholeiitic affinity; this hypothesis is supported by the major element compositions of some clinopyroxenes falling in trend 1 (Fig. 2) and by the occurrence of secondary orthopyroxene arranged in vein that need a SiO_2-saturated (or oversaturated) parental melt to crystallize. Because of the lack on the ESM field of tholeiitic lavas, and taking into account the large amount of melt involved in tholeiitic magmatic activity, the most feasible process which can be envisaged is refertilization, *i.e.* with a melt/rock ratio higher than metasomatism.

A further metasomatic event occurred within the ESM mantle. The interaction affected the trace element compositions of the clinopyroxenes. The metasomatizing agent has a transitional/alkaline affinity and is analogous to the lavas occurring within the various plateaux. This conclusion has been reached by reconstructing the REE pattern of a clinopyroxene in equilibrium with a selected lava from the Somoncura Province that resemble those of the clinopyroxenes from Estancia Sol de Mayo (Fig. 3). This metasomatic event is also evidenced by the isotopic data for some separated ESM cpx that are characterized by high $^{87}Sr/^{86}Sr$ and low $^{143}Nd/^{144}Nd$ ratios, plotting close to the HIMU field.

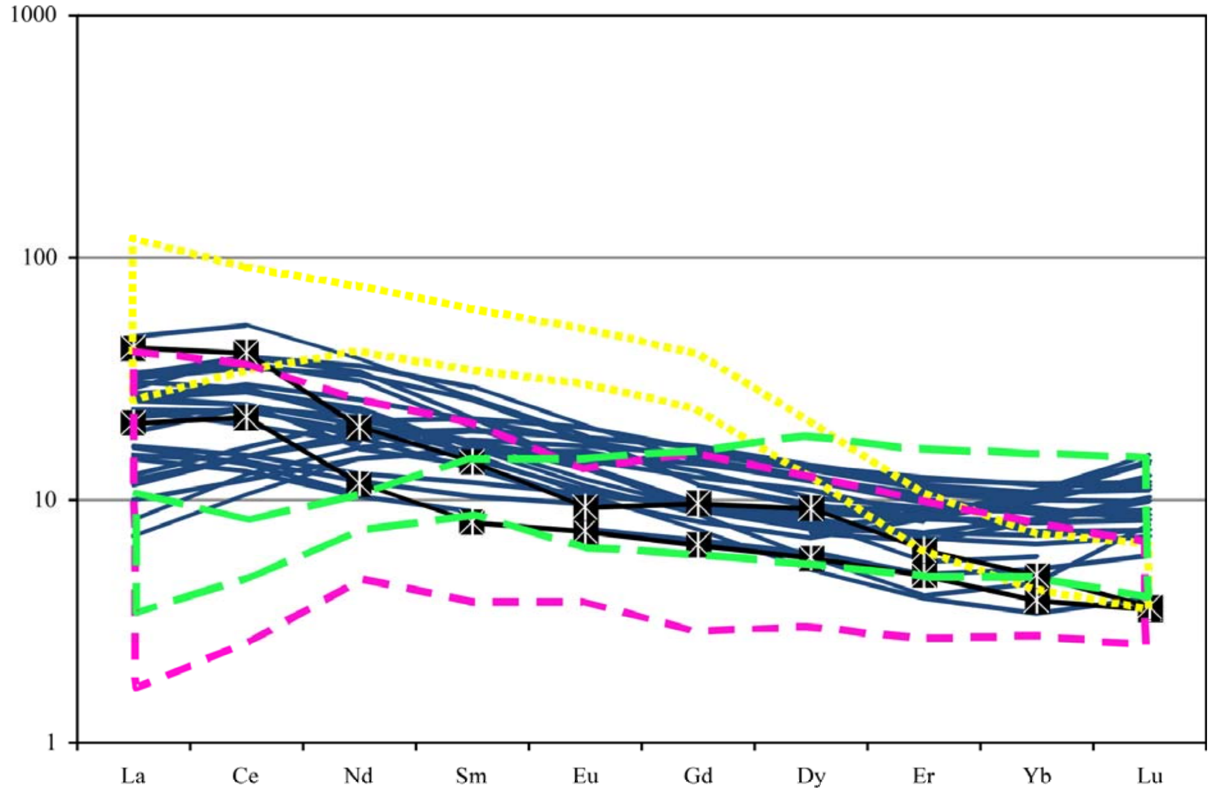

Fig. 3 - Chondrite-normalized REE of calculated clinopyroxenes (white asterisk with black background) in equilibrium with a transitional/alkaline melt. The blue lines are the patterns of the cpx from Estancia Sol de Mayo; the green line identifies trend 1, the yellow line trend 2 and the pink line trend 3.

From the comparison with other already studied localities it is evident that the Al_2O_3 enrichment observed for both the cpx and the opx is common all over Patagonia. Also the cpx from the other Patagonian localities are aligned on the same trends than those defined by the cpx and opx of Estancia Sol de Mayo. Moreover the trace elements features of mantle xenoliths evidence the occurrence in some localities of metasomatic events affecting the upper mantle. The other localities only evidence mantle partial melting events.

Sr-Nd systematic, performed for all the localities, shows a large range of both $^{87}Sr/^{86}Sr$ and $^{143}Nd/^{144}Nd$ isotopic ratios. This large range is also observed in xenoliths from a same locality (*i.e.* Cerro de Los Chenques and Cerro Clark). Because some of the samples fall close to the DMM field and the other are aligned toward the EM II end member, some calculations of isotopic mixing have been performed. It has been possible to asses that, for the most radiogenic samples, up to 9% of an EM II has to be considered in order to account for the samples with the highest Sr and the lowest Nd isotopic ratios (Fig. 4).

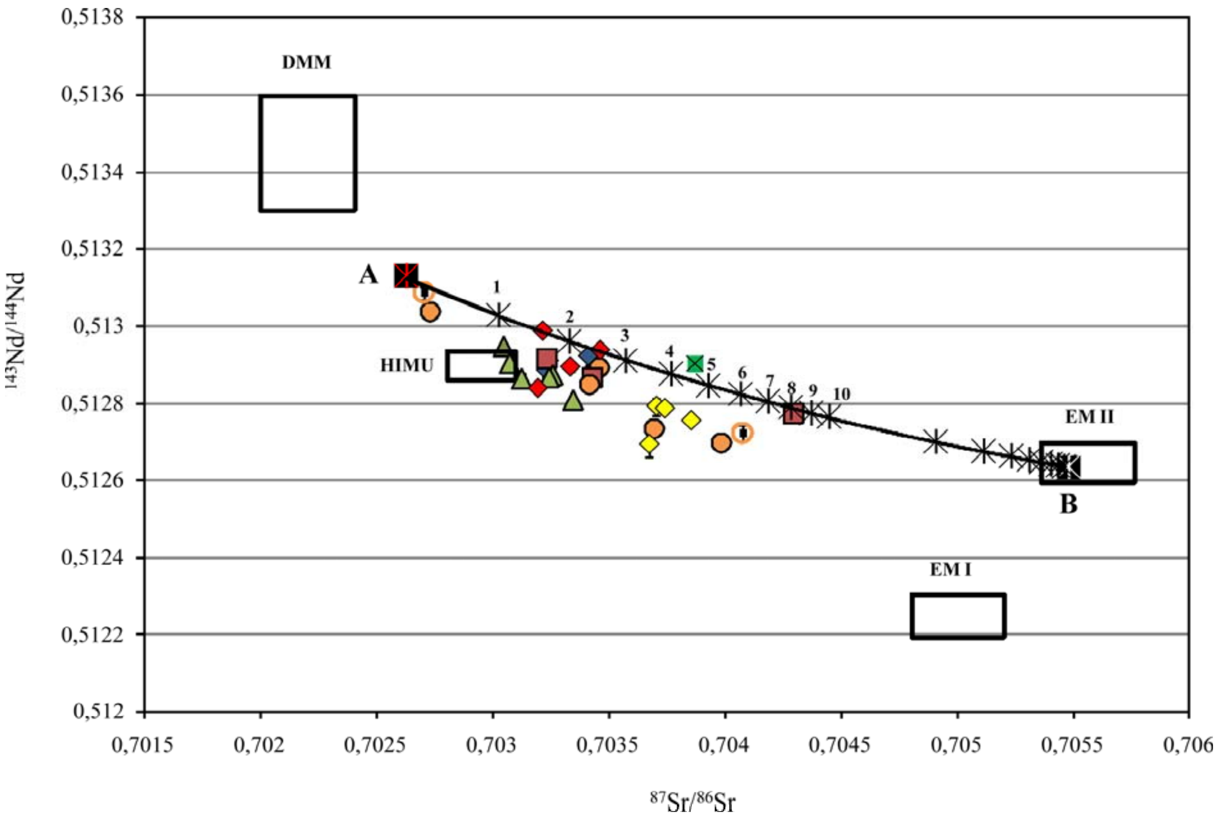

Fig. 4 - $^{143}Nd/^{144}Nd$ *vs*. $^{87}Sr/^{86}Sr$ for the 33 samples analyzed. Fields are from Zindler & Hart (1986). The red (**A**) and white (**B**) asterisks with black background represent the DMM and EM II compositions of the end-members chosen for the mixing. The solid black line represents the mixing hyperbola. Numbers are the percentages of the EM II component in the mixture. Black asterisks represent the different isotopic compositions of the mixtures.

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