THE LATE MIOCENE CORNACYA SHOSHONITIC ANDESITES: REMNANTS OF THE FIRST STAGE OF THE SOUTHERN TYRRHENIAN OPENING

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Abstract

Discovered on the Sardinian margin of the Tyrrhenian sea, the Cornacya shoshonitic lavas, dated at 12.6 Ma, could represent post-collisonnal suites emplaced during the first stage of the southern Tyrrhenian opening.

KeyWords : Tyrrhenian Basin, Basin formation, Back Arcs

The Sardinia Channel is located on the 400 km long submerged segment of the Apenninic-Maghrebides Alpine collisional Chain, at the junction of the Algero-Provençal and Tyrrhenian oceanic basins. The Cornacya submerged volcano is located at the northeastern end of the Sardinia Channel and on the western margin of the Cornaglia basin. It was discovered during dives with the Cyana submersible. This volcano consists of andesites which include amphibole and mica bearing lamprophyric xenoliths. Clots of plagioclase and biotite phenocrysts are ubiquitous in the andesites. The lamprophyric xenoliths are formed of olivine pseudomorphs, euhedral zoned amphibole and mica phenocrysts caught in a fine grained groundmass containing the same minerals and anhedral plagioclase. In the andesites, plagioclase shows intense normal zoning with Ca-rich cores and oligoclase to albite rims. In the lamprophyric inclusion, cores and rims of the phenocrysts are labradorite while the microlites are andesine and/or sanidine. Amphibole in the andesite and lamprophyre is a Fe-rich or not pargasite. Mica composition in the andesite depends heavily of its vicinity with the lamprophyric inclusion. Located far from the inclusion, the mica is a biotite whereas when the host rock and inclusion are in close contact, the mica is a phlogopite.

Cornacya andesites were dated at 12.6 ± 0.3 Ma using $^{39}Ar/^{40}Ar$ method with a laser microprobe on single mica grains.

Cornacya lavas are TiO_2-poor ($<$ 0.8 %) and Al_2O_3-rich (17 $< Al_2O_3\% <$ 22). The Cornacya lavas plot in the shoshonitic field of the Ce/Yb and Th/Yb versus Ta/Yb diagrams. These lavas are enriched in LREE relative to HREE [18.6 $< (La/Yb)_N <$ 37.10] and have a marked Eu negative anomaly (0.62 $\leq$ Eu/Eu* $\leq$ 0.73) which is absent in the andesite with the lamprophyric xenolith (Fig. 1). The mantle normalized multi-element plots (Fig. 1) have overall similarities with shoshonitic rocks developed in continental arc settings.

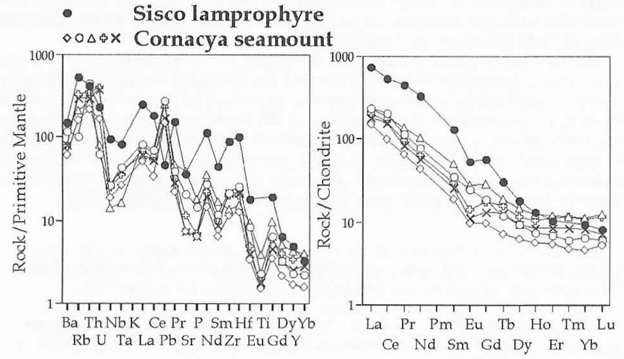

Figure 1.

The $\varepsilon Nd_{(i = 12\ Ma)}$ ratios of the Cornacya lavas are low and range from +0.39 to −10.71. The andesite with the lamprophyric xenolith has the highest ratio (+0.39) which is close to the Bulk Silica Earth composition (Fig. 2). All the these volcanic rocks have very homogeneous and high isotopic Pb ratios [18.791 $< (^{206}Pb/^{204}Pb)_i <$ 18.839, 15.660 $< (^{207}Pb/^{204}Pb)_i <$ 15.676; 38.941 $< ^{208}Pb/^{204}Pb)_i <$ 958]. The Nd and Pb isotopic compositions suggest that all these rocks show crustal affinities and likely derive from the melting of a mantle source which suffered contamination and/or assimilation of continental crust.

The age of the Cornacya shoshonitic suite is similar to that of the Sisco lamprophyre from Corsica which similarly is located on the western margin of the Tyrrhenian sea. The Cornacya K-rich andesites and their lamprophyric inclusions share with the Sisco lamprophyre similar geochemical features. However, new geochemical data show that the Sisco lamprophyre differs from the Cornacya andesites by a higher LREE enrichment and a signifcantly lower εNd (-11.2; Fig. 2).

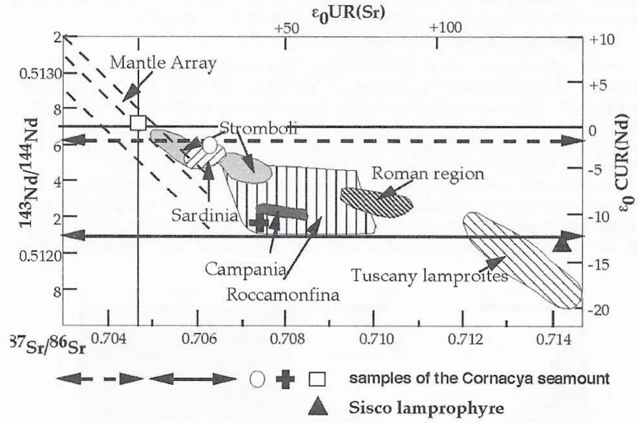

Figure 2.

The geochemical characteristics of this lamprophyre-shoshonitic suite are similar to those of K-rich and Ti-poor magmatic rocks emplaced in post-collisionnel settings.

Both igneous suites are 500 km apart but have similar structural location on the Western Tyrrhenian margin. They emplaced during the post-collisional lithospheric extension of the Corsica-Sardinia block, just after its rotation and before the Tyrrhenian sea opening. This means that lithospheric thinning began in northern and southern Tyrrhenian at the same time, during the Serravallian. The differences between the geodynamic evolution of northern and southern Tyrrhenian basins occurred later due to the southward retreat of the Tyrrhenian subduction.