

Abstract

The Tuscan Magmatic Province (TMP) is a region that generated various types of magmatic products over the past 15 Ma. Compositions range from granitic (as on Elba Island) to calc-alkaline and ultrapotassic. Capraia is a typical example of the latter. This volcanic island, situated in the center of the Tyrrhenian Sea, was the site of two temporally and compositionally distinct magmatic events. The first (Capraia cycle- 7.9 to 7.0 Ma) consists of high calc-alkaline rocks while the second (Zenobito cycle- 4.77 Ma) presents shoshonitic products. Ultrapotassic products such as shoshonites and lamproites are also found in other areas of the TMP and more generally in Italy. Many hypotheses exist on their genesis. A metasomatised mantle is commonly accepted to exist in Italy, and is thought to have a link with the production of ultrapotassic products. The goals of this thesis are to provide complete mineralogical and petrological data on the Zenobito cycle and to compare it at first with shoshonitic products from Radicofani (Tuscany) and lamproitic ones from Sisco (Corsica), Orciatico and Montecatini (Tuscany) and more globally with shoshonites and lamproites from Italy to better characterize their source(s) and verify possible mantle heterogeneities in the TMP.

Our results show that the Zenobito and Radicofani shoshonites share similar mineralogical and major and trace elements characteristics, but are distinct on an isotopical point of view. Sisco and Tuscany lamproites show mineralogical similarities but are geochemically distinct (in terms of major and trace elements as well as radiogenic isotopic ratios).

Monte Carlo simulations reproducing the melting of a veined-mantle suggest that a metasomatised harzburgite close to the one found in Finero (Ivrea Zone) and containing amphibole- and phlogopite-bearing veins can generate both shoshonitic and lamproitic products from the TMP, except Sisco (different source). Veins were probably formed as lithospheric reaction products of melts generated with the involvement of metapelitic sediments. A higher degree of partial melting of the veins was responsible for the transition from ultrapotassic products to shoshonites. This is consistent with the increasing amount of extension suffered by Capraia over about 3 million years of magmatic activity. Orciatico and Montecatini lamproites were probably created during phases of moderate extension.

Finally, trace and isotopic data suggest that on a global scale, heterogeneities in the mantle exist, probably because of different kind of lithospheric veins and/or mantle. Such heterogeneities could be the result of the complex tectonic setting involving the Mediterranean region coupled with the implication in mantle melting of different kind of sediments.