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Compositional variations of peritectic garnet in peraluminous leucogranite sills from Elba Island (Italy): Implications for crustal melt generation processes

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Recent geochemical and isotopic studies of late Miocene peraluminous granites from Elba Island (Italy), point out the prominent role of entrainment of peritectic phases during the formation of crustal melts in post-collisional orogenic settings (Farina *et al*., 2012; 2014). In spite of the convincing evidence for entrainment, peritectic minerals have never been observed being easily dissolved and assimilated by the melts during the decompressional transfer from source to emplacement level (Clemens *et al*., 2011 and references therein).

In this contribution we describe the first finding of peritectic garnet in peraluminous leucogranites associated with the Monte Capanne plutonic complex (7.4-6.9 Ma; Elba Island, Italy). The presence of garnets in these rocks indicates that they are produced by partial melting of metasediments at depth and not by fractionation of the monzogranitic pluton itself (Dini *et al*., 2002).

The peraluminous garnet-bearing leucogranites associated with Monte Capanne are composed mainly by quartz, K-feldspar, plagioclase and garnet. These rocks are extremely acidic, with silica content reaching 75% and aluminium content of 15% approximately. The garnets present in this leucogranite are rounded, homogeneous in size (of about 200-300 µm), and are charcterised by cores that are rich in inclusions. The inclusions are mainly of quartz, but K-feldspar, plagioclase, biotite and rarer titanite and ilmenite are also present.The garnets are typically almandine-rich (66-75%) with a spessartine component that ranges from 20 to 29 %. The other garnet end-members concentrations are low (below 2%). The content of almandine-spessartine along the crystals shows a patchy zonation, although in some grains there is a weak core-to-rim zonation with rich almandine rims and rich spessartine cores.

The P-T conditions were calculated using data from LA-ICP-MS analyses. The content of heavy REEs in the rims is higher than in the cores.The pressure was determined using the method proposed by Bea *et al*. (1997) using the equation: P = 3.6 + 5.6* Gd/Dy. Three different values were obtained from each garnet grain, two values from the rim and one from the core. The values range from 4.5 to 6.5 kbar, with a mean value of 5.6 kbar (for the cores). Zircon saturation thermometry gives temperature estimates of about 780ºC (Watson and Harrison,1983).

P-T conditions estimates from trace element distribution in the analysed garnets (ca. 4.5-6.5 kbar and 780ºC) suggest that partial melting, dominated by muscovite breakdown, occurred in the lowermost portion of the Tuscan continental crust. The calculated P-T conditions are in agreement with a peritectic origin for the garnets. The garnet crystallization took place probably in a zone not far from the base of the Tuscan continental crust (~23km) due to muscovite dehydration (Fig. 1).

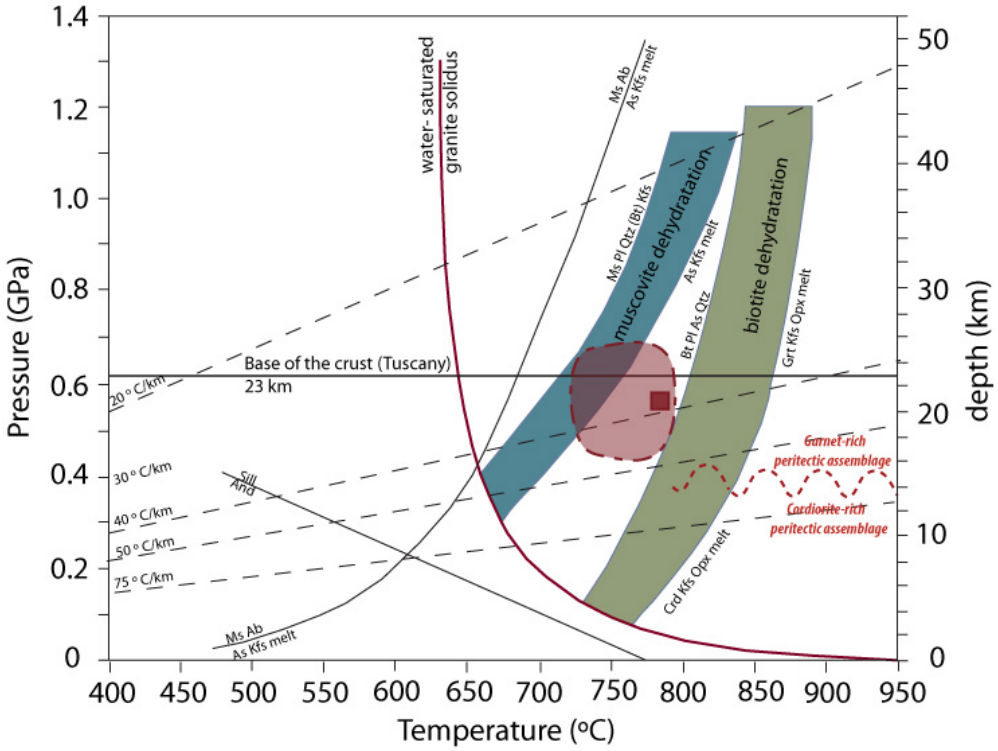

Figure 1. P-T diagram showing conditions for muscovite and biotite dehydration as well as crystallization conditions of the garnet-bearing leucogranite (in red). Modified from Dini *et al.* (2005).

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