European Mineralogical Conference
Vol. 1, EMC2012-338, 2012
European Mineralogical Conference 2012

Fluid and melt inclusion study of enclaves from La Galite Archipelago (Tunisia): insights on partial melting processes in the buried basement of Central Mediterranean Sea

S. Ferrero (1), R. Braga (2), M. Berkesi (3), B. Cesare (1), N.L. Ouazaa (4), A. Cavallo (5), and S. Kassaa (4)

(1) Universita' di Padova, Dipartimento di Geoscienze, Italy (silv.ferrero@gmail.com), (2) Università di Bologna, Dipartimento di Scienze della Terra e Geologico-Ambientali, Italy (r.braga@unibo.it), (3) Eötvös University, Department of Petrology and Geochemistry, Hungary, (4) Université Tunis El Manar, Département de Géologie, Tunisie, (5) Istituto Nazionale di Geofisica e Vulcanologia, Roma, Italy

At La Galite Archipelago peraluminous granitoids, cutting through the sedimentary succession, contain abundant entrained material [1,2]. Enclaves of sedimentary, magmatic and metamorphic origin and xenocrysts of cordierite and garnet were identified. The plutons are related to Miocene anatexis of the crystalline basement buried beneath the Maghrebian Chain [3].
Two types of enclaves, garnet-bearing tonalites and garnetites (garnet $\geq$90 % modal) have been investigated. A microstructural study showed the occurrence of primary fluid, melt and mixed inclusions at the core of garnet porphyroblasts. The coexisting mineral inclusions assemblage consists of Ti-rich ($\sim$6 wt%) biotite, plagioclase, quartz, ilmenite and minor K-feldspar. Phase assemblage and mineral composition support the hypotheses of garnet as a peritectic product of biotite-dehydration melting. Therefore, observed fluid (FI) and melt (MI) inclusions were trapped during the anatectic event, i.e. when the garnet grew, under melt-fluid immiscibility conditions. Since they do not show evidence of post-entrapment modifications, FI and MI study will provide data on the anatexis products.
Fluid inclusions ($\leq$20 μm in size) are one phase at room temperature, dark in colour and rounded-to-tubular in shape. Microthermometric experiments show a CO_2-dominated fluid, but the lowering of the melting temperature (Tmelting = -70/-60 °C) suggests the presence of other miscible components. Homogenization to liquid (L+V$\rightarrow$L) was observed in the range -14°C - +11°C. Raman investigation at different temperatures (25-400 °C) showed that FI contain a complex fluid system consisting of CO_2 (70.1-77.5 mol%), H_2O (11.2-14.4 mol%), N2 (8.8-11.1 mol%) and CH4 (2.5-4.0 mol%) plus siderite and OH-bearing phase. Since these solid phases systematically occur in all measured inclusion, they can be unlikely considered as accessory phases, but rather are probably the products of a post entrapment fluid-host reaction.
MI vary from glassy inclusions to nanogranites [4], with abundant partially crystallized inclusions, and generally show a negative crystal shape. In the first case, their size is generally $\leq$5 μm, and they always contain a shrinkage bubble. Nanogranites are $\geq$5 μm in size, and consist of plagioclase, K-feldspar, quartz and biotite, along with minor accessory phases (e.g. zircons, apatite). The average melt composition measured on glassy and mixed inclusions is metaluminous (aver. ASI=1) and leucogranitic, with SiO_2= 73.9 wt%, K2O= 5.9 wt%, Na2O= 3.4 wt% and fluid content $\sim$2.3 wt% (equal to the deficiency from 100% from chemical analysis). This is the first finding of a metaluminous leucogranitic melt within peritectic garnet, while usually they had a peraluminous composition [5,6].

References

[1] Laridhi Ouazaa, N, 1994: These d'Etat en Geologie: Université de Tunis
[2] Belayouni, H. et al., 2010. JAES, 56, 15–28
[3] Fourcade, S. et al., 2001. Lithos 57, 187–216.
[4] Cesare, B. et al., 2009. Geology 37, 627–630.
[5] Acosta-Vigil, A. et al. 2007. Chem. Geol. 235, 450–465
[6] Ferrero, S. et al., 2012. JMG 30, 303–322.