Ageing of the Thetyan crust documented by xenoliths from Hyblaean diatremes (Sicily): Implication for crustal assimilation during magma emplacement

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Previous study on xenoliths from Miocenic diatremes from Hyblaean area (Sicily) suggested that the local Meso-Cenozoic sedimentary and volcanic sequence rests upon a fossil oceanic core-complex belonging to the Ionian Thetys lithospheric domain. Hyblaean xenoliths have also suggested that the postulated core-complex hosted long living hydrothermal systems which have produced diverse geochemical and mineralogical modification to the host ultramafic and gabbroic rocks (e.g. hydration, alkalization, sulfidization, carbonation) through time, as well the deposition of hydrothermal brines at different crustal levels. The Upper Miocene volcanic rocks cropping out in the Central-Eastern section of the area were erupted after a 50 Ma non-magmatic period (the Eocene hiatus). The interaction between ascending magmas and the fossil hydrothermal system produced dehydration of the serpentinite wall rock with formation of fluidized eruptive systems (i.e. diatremes). The basalt magma assimilated some hydrous peralkaline anatectit melts thereby attaining a silica-undersaturated, sodic (nephelinitic) character. Magmas that fed the Pleistocene volcanism in the northern margin of the Plateau intersected a section of the fossil hydrothermal system, which was particularly rich in hydrothermal evaporites as testified by the high contents in S, Cl, F, H_2O, Ca, Na, Sr, Ba, relatively high Zr/Hf and occurrence of sodalite series phenocrysts. More in general, we put forward the idea that selective assimilation of hydrothermally altered wall rocks may explain the geochemical paradox of the Hyblaean basaltic lavas, which display Nd-Sr isotope ratios distinctive of MORB-type magmas and distribution of some trace elements more typical of alkaline-series magmas.

Evidence of intergranular melt pools and melt films in lower crustal granite: Products of fluxing by water derived from deformation of nominally anhydrous minerals

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Water in nominally anhydrous minerals in lower crustal granitoids may move from structural sites and fluid inclusions in nominally anhydrous minerals to grain boundaries during deformation. Along grain boundaries, this water can lower the solidus, facilitating the production of small amounts of partial melt. Outcrops of the 2.6 Ga Stevenson granite, a lower crustal granite in the Athabasca granulite terrane, Saskatchewan, range from K-feldspar megacrystic granite to ribbon mylonite. With increasing deformation, water concentration in quartz and feldspar crystals decreases, and very fine-grained (2-10 micron) brown colored grain boundary films and intergranular pools are progressively developed. The fine-grained multi-phase material on grain boundaries and at grain triple junctions has been interpreted as former melt films and melt pools, respectively. The interpreted melt films have a distinctive pocked texture and a multiphase assemblage with quartz, 2 feldspars and fine (1-2 microns) Fe oxides. Melt films on the grain boundaries of plagioclase, potassium feldspar and quartz are approximately 20 microns wide. Melt pools are up to 100^+ microns in diameter. In some zones of the rock, melt pools are nearly interconnected, possibly beginning to mobilize, approaching a situation in which a melt conduit would be established. Water in nominally anhydrous minerals has the potential to lower the solidus significantly enough to initiate partial melting in lower crustal granitoids at high ambient temperatures. 3000 ppm water in quartz and feldspars that make up large volumes of lower crustal granitoids would lower the dry solidus of granite by 96ºC at 1 GPa, facilitating the production of small volumes of partial melt that wet the grain boundaries along which it is produced.

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