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Kelyphitic microstructures from orogenic garnet-bearing rocks of the Dinaride ophiolite zone

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The Inner Dinarides, a part of the Alpine-Dinaride mountain chain in south-eastern Europe, comprise ultramafic massifs and related metamorphic rocks that are relics of a partially dismembered ophiolite which originated along the contact of the European plate and the Adria microplate. The Late Jurassic to Early Cretaceous regional geodynamic processes involved intra-oceanic NE-dipping subduction that preceded the final emplacement of the ophiolite at the continental margin. During subduction mafic cumulates and other rocks came in contact to the hot upper mantle (spinel lherzolite) resulting in the formation of high- to medium-grade metamorphic rocks.
Such rocks were sampled mainly representing garnet-bearing amphibolite and metaperidotite varieties. The samples comprise various proportions of amphibole, plagioclase, garnet, corundum, sapphirine, spinel, pyroxenes (diopside and hypersthene), TiO_2 phases and occasionally quartz. Pyrope-almandine garnet typically occurs as large grains either with or without fine-grained radial and fibrous symplectitic mineral intergrowth forming a corona structure (kelyphite). The chemical composition of garnet does not show a significant change from the core to the rim. The kelyphite consists of orthopyroxene and spinel with Ca-amphibole and plagioclase. The bulk composition of the kelyphite differs from the original garnet composition pointing to a reaction between garnet and its surrounding including H_2O possibly from an external source. As such a reaction depends on the physical conditions during kelyphite formation, this, besides reaction kinetics, puts constraints on the exhumation history of the host rocks.
P-T pseudosections were constructed in the MnNCFMASHTO system and contoured by isopleths for the mode and chemical composition of minerals. On this basis combined with conventional cation-exchange geothermo-barometry, a clockwise P-T path with maximum pressure conditions at ca. 20 kbar (ca. 65-70 km depth) with temperatures over 830°C was reconstructed. These conditions were followed by a significant pressure decrease to medium-pressure values at 11 kbar (depth of ca. 35 km) and temperatures of 780°C and a final setting at low-pressure, low-temperature conditions of ca. 4 kbar ($\sim$14 km depth) and 550°C.
A plausible explanation for the observed reaction microstructure is that the kelyphite was formed around garnet during the uplift of deep-seated rocks that were significantly decompressed but without drastic change of temperature supported with hornblende-plagioclase thermometry and the occurrence of orthopyroxene as component of the kelyphite. Such conditions driven by large tectonic movements enable infiltration of hydrous fluid necessary to form amphibole and to trigger the genesis of kelyphitic microstructures. The so far unknown details of the Dinaride geodynamic evolution can be partially unraveled with the aid of this peculiar microstructure inasmuch hot mantle rocks, being part of the ophiolite, were proved to be uplifted for at least 50 km accompanied by fluid infiltration.
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