Geophysical Research Abstracts
Vol. 14, EGU2012-1251, 2012
EGU General Assembly 2012

Geochemistry, geochronolgy and tectonic significance of high-temperature meta-ophiolitic rocks: possible relation to Eocene South-Neotethyan arc magmatism (Malatya area, SE Anatolia)

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A meta-ophiolitic body ("Berit meta-ophiolite") is exposed within a belt of regional-scale thrusts that make up the southeast Anatolian orogenic belt. To the south (southeast of Doğanşehir town) the outcrop is tectonically bounded by the Eocene Maden complex or the Pütürge metamorphic massif, whereas the Malatya metamorphic unit is exposed to the north. The meta-ophiolitic rocks exhibit polyphase deformation including folding and thrust imbrication. Both the meta-ophiolitic rocks and the Malatya metamorphic unit are intruded by an Eocene (48-43 My) granitoid body. The metaophiolite body is characterized by pyroxene-granulite, garnet-amphibolite, amphibolite, amphibole-metagabbro, pyroxene-hornblendite, epidote-amphibole schist, plagioclase-amphibole schist, quartz-plagioclase-amphibole schist, muscovite-epidote-plagioclase-amphibole schist and epidote-plagioclase-amphibole schist. The major and trace element chemistry are consistent with an ophiolitic origin. The highest metamorphic grade is represented by pyroxene-granulite facies rocks that are enveloped by amphibolitic facies rocks, probably as a result of exhumation-related retrograde metamorphism. The pyroxene-granulite facies mineral paragenesis is characterized by garnet+pyroxene+amhibole+ plagioclase+kyanite$\pm$corundum$\pm$zoisite. In contrast, the garnet amphibolite facies paragenesis is: garnet+pyroxene+amphibole+plagioclase+quartz+rutile$\pm$zoisite. The main mineral phases in both facies lack compositional zoning. A Sm-Nd (pyroxene-garnet-whole rock) isochron age of 50.6$\pm$3.1 Ma was obtained from the granulite facies rock, which is interpreted as the time of peak granulite facies metamorphism. Pressure-temperature of the granulite facies rocks is estimated as 13.2–17.5 kbar and 690°C–941°C, equivalent to granulite-eclogite facies boundary metamorphic conditions.
In addition, two sub-parallel, NE-SW-trending belts of unmetamorphosed Upper Cretaceous ophiolitic rocks are present within the SE Anatolian orogenic belt. The more northerly belt between the Malatya-Keban metamorphics and the Bitlis-Pütürge metamorphics includes the North Berit ($\sim$Göksun), South Berit ($\sim$Berit Meta-ophiolite), İspendere, Kömürhan, Guleman and Killan ophiolites. The southern belt that is located between the Bitlis-Pütürge metamorphics and the Arabian platform includes the Baer-Bassit, Kızıldağ (Hatay) and Koçali ophiolites. Tectono-stratigraphic restoration suggests that an ocean basin existed between the Malatya-Keban platform to the north and the Bitlis-Pütürge continental unit(s) to the south. Upper Cretaceous ophiolites and an incipient volcanic arc are interpreted to have formed above a north-dipping subduction zone within this ocean. The northern edge of the oceanic slab was thrust beneath the continental Malatya-Keban platform and intruded by granitic rocks in response to continuing northward subduction. Further south the subduction trench is inferred to have collided with the Bitlis-Pütürge continental unit(s) giving rise to HP-LT metamorphism in the Bitlis massif, followed by pre-Middle Eocene exhumation. Continuing northward oblique (?) subduction of remaining southern Neotethyan oceanic crust gave rise to Eocene calc-alkaline arc volcanism (Helete). In the regional context the granulite facies meta-ophiolitic rocks are suggested to have formed near the base of an inferred regional-scale Eocene magmatic arc. A possible heat source was South Neotethyan ridge subduction although other models may be considered. Exhumation of the Berit meta-ophiolite could have been achieved by rifting of the Eocene Maden back-arc basin, coupled with later-stage out-of-sequence southward thrusting.