Geophysical Research Abstracts
Vol. 12, EGU2010-3562, 2010
EGU General Assembly 2010

Early Cretaceous amphibolite dehydratation melting preserved within the Tertiary Sabzevar ophiolitic suture (NE Iran): significance for the closure of the Alpine Tethyan oceans in central Iran

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The tectono-metamorphic signature of the oceanic-derived units marking orogenic suture zones provides key elements to decipher modes and regimes of oceanic subduction and continental accretion, and to constrain tectonic reconstructions at paleo-convergent margins. The remnants of the Tethyan oceanic realm form the most remarkable of these suture zones, running from the Mediterranean through East Europe, Middle East to Asia. These ophiolitic rocks record a polyphase and prolonged history of oceanic construction (the Paleozoic-Early Mesozoic Paleo-Tethys and the Mesozoic-Tertiary Neo-Tethys oceanic realms) and consumption during a sequence of Late Paleozoic to Cenozoic subduction/obduction/collision stages localized along the Eurasian active plate margin (e.g. Stampfli and Borel, 2002). The Iranian ophiolites are an integrant part of this evolving scenario, with the Neotethyan remnants distributed to mark diachronous closures of various oceanic branches during the Alpine-Himalayan convergence history. Despite these peculiar characteristics, few modern studies have addressed the characterization of the tectono-metamorphic evolution of the Neotethyan Iranian ophiolites. Furthermore, most of these studies focused on the Zagros orogen (e.g. Agard et al., 2006), and the ophiolitic mélanges surrounding the Central East Iranian Microcontinent are still lacking of a full petrological and geochronological characterisation.
The ophiolitic mélange exposed in the Sabzevar Range of NE Iran is a remnant of one of the Neo-Tethyan oceanic branches of Central Iran, closed during the Paleocene-Eocene Arabia-Eurasia convergence. In this study, we document occurrence of km-scale, variably retrogressed mafic high-pressure granulitic (Am + Grt + Cpx + Pl + Qtz) slices embedded within this suture zone. Granulites record an episode of amphibole-dehydratation melting and felsic (tonalite/throndhjemite) melt segregation at 1.1 $\pm$ 0.1 GPa and 810 $\pm$ 80 °C. In situ U(-Th)-Pb geochronology of zircon and titanite grains hosted in melt segregations points to an Early Cretaceous (Albian) age for the metamorphic climax. This provides evidence for an unknown episode of high-grade subduction zone metamorphism in the region and argues for juxtaposition of an older ophiolitic suture along the Paleocene-Eocene Sabzevar orogen. When combined with the existing reconstructions, these new data (i) impose reconsideration of the current paleotectonic models of the Eurasia convergent margin during the Early Cretaceous, and (ii) argue that punctuated events of subduction of short-lived back-arc oceanic basins accompanied the long-lasting history of the Neotethyan subduction in the region.

Agard P., P. Monié, W. Gerber, J. Omrani, M. Molinaro, L. Labrousse, B. Vrielynck, B. Meyer, L. Jolivet and P. Yamato (2006): J. Geophys. Res., 111, doi: 10.1029/2005JB004103.
Stampfli, G. M. and G. D. Borel (2002): Earth Planet. Sci. Lett., 196, 17–33.