The Zagros Suture Amphibolites Record the Cretaceous Thermal Evolution of the Closing Tethyan Realm

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A Cretaceous paleo-accretionary wedge (the Ashin Complex) now exposed along the Zagros suture zone in southern Iran exhibits mafic and metapelitic lithologies. Field, geochemical and petrological observations point to a high-temperature event that gave rise to the formation of peritectic (trondhjemitic) melts associated with restitic garnet-bearing amphibolites in the structurally highest sliver of the Ashin Complex. SHRIMP U-Pb zircon dating of grains crystallized in trondhjemitic leucosomes yields a $^{206}\text{Pb}/^{238}\text{U}$ weighted mean age of 104 ±1 Ma, interpreted as the peak temperature event, which occurred in the amphibolite facies (c. 640-650°C at 1.1-1.3 GPa), based on thermodynamic modeling. Rutile crystals from several leucosomes yield Zr-in-rutile temperatures between 580-640°C and LA-ICP-MS U/Pb ages of 87-94 Ma. This rutile generation may be related to the observed static formation of Na-clinopyroxene and Si-rich phengite rims, as well as the growth of lawsonite in late fractures. The latter paragenetic sequence has been previously interpreted as reflecting a long-term isobaric cooling that occurred at least until the end of the Cretaceous (ages in Angiboust et al., 2016).

While the latter observations point to a long-term cooling of the Zagros subduction thermal gradient down to 7°C/km during late Cretaceous times, this first report of an earlier melting event in the Zagros paleo-accretionary wedge indicates an unusually high thermal gradient of 17-20°C/km. GPLATES paleogeographic reconstructions of the Tethyan realm evolution during Cretaceous times reveal the presence of a spreading ridge jump followed by the subduction of the formerly active ridge-segment between 105-115 Ma, which possibly left an imprint marked by the unusually hot gradient seen in Ashin amphibolites. The model further predicts the subduction of progressively aging oceanic lithosphere, possibly explaining the observed cooling of the subduction thermal regime.