



Zagros geodynamics, from subduction to collision: the fate of the Neotethys

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The Zagros orogen, which separates the northern active margin of Eurasia and the southern passive margin of Arabia, preserves a unique record of the long-standing convergence history across the Neotethys, from subduction/obduction processes to present-day collision. We herein present a synthesis of the results obtained on several geodynamic issues:

- the location of the oceanic suture zone and the age of oceanic closure and collision,
- the magmatic and geochemical evolution of the upper plate during convergence,
- the P-T-t history of the restricted Zagros blueschists and their relationship to those from nearby Makran and Oman and with the suture zone itself,
- the convergence characteristics across the Neotethys (kinematic velocities, subduction zones, obduction mechanisms, thermomechanical modeling constraints).

Three main periods/regimes can be outlined:

- (1) Long-lasting subduction processes and arc magmatism (>150-35 Ma).

Trace and rare-earth element (REE) systematics on the upper plate Sanandaj-Sirjan and Urumieh-Dokhtar magmatic arcs (SSMA, UDMA, hereafter) show that, despite a marked inward shift (~300 km) from the SSMA to the UDMA at the end of the Tertiary, they originated from similar, subduction-related mantle sources. The inward shift of arc magmatism likely resulted from the amalgamation of the Paleocene-Eocene

intraoceanic arc of Kermanshah (earlier thought to represent a remnant of the Peri-Arabic obduction). Oceanic subduction proper ended by 35-30 Ma and was likely followed by continental subduction (although no HP-UHP continental rocks, unlike for other segments of the Neotethys, have yet been reported).

(2) A distinctive period of perturbation of subduction processes (115-85 Ma).

The sharp rise of convergence velocities (from 2-3 to 6 cm/yr) across the Neotethys at 118-115 Ma, was followed, possibly as a result of plate acceleration, by two regional-scale (i.e., > 3000 km along strike), coeval (~100-80 Ma), short-lived major tectonic phenomena:

- the transient exhumation of oceanic blueschists all along the Neotethyan subduction zone, which testifies to a change in plate-slab coupling,
- the development of intra-oceanic subduction ultimately leading to the obduction of oceanic crust onto Arabia.

(3) Collision and slab tear at depths (~25-0 Ma).

Collision started before ~25-23 Ma (in Lorestan at least) and resulted in 70 km of shortening in the internal zones alone over the last 20-15 My. The suture zone runs along the Main Zagros Thrust, which is deeply rooted, possibly to Moho depths.

Calc-alkaline magmatism resumed in the UDMA after collision, mainly from the Mio-Pliocene onwards. In Central Zagros this syn-collision magmatism shows a distinctive adakitic trend attributable to the melting at depths of mafic material (i.e., the oceanic crust from the slab and/or the obducted ophiolitic material) in response to localized slab breakoff (i.e. 200-300 km along strike), as further supported by tomography. The timing of this event is thus broadly coeval with slab-breakoff below southern Turkey and supports the view that slab tearing propagated in the Neotethyan slab during the period c. 10-5 Ma. This period also significantly coincides with the intensification of collision in Zagros, as witnessed by deformation and progressive unconformities in the Arabian foreland.