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Tethys Related Continental Collision Imaged by Magnetic and Gravity Modelling

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Subduction of the PaleoThetys and NeoThetys oceans and related collisions led to the formation of magmatic arcs and sedimentary basins within the Himalayan-Alpine belt. The related structures are mostly separated by thrust faults, including suture zones, which are highlighted by Thetys related magmatic arcs and ophiolite belts. However, their identification is impeded by sediment cover and overprint of Triassic-Quaternary magmatism.
Our new map of average magnetic susceptibility in the Iranian Plateau, calculated by the radially averaged power spectrum method, shows high values at known Magmatic-Ophiolite Arcs (MOA) and low values at known sedimentary basins. Based on susceptibility, we identify hitherto unknown sedimentary basins and hidden MOAs in eastern Iran and the SE part of the Urmia Dokhtar Magmatic Arc (UDMA). They indicate steep (>60º dip) paleo-subduction zones, in contrast to shallow subduction (<20º dip) of NeoTethys in the NW part of UDMA and the Sabzevar-Kavir MOA.
Our new 2D crustal-scale model across the major tectonic provinces of the NW Iranian plateau is based on gravity-magnetic modeling constrained by receiver functions along a 500 km long SW-NE trending seismic profile. Our model shows significant variation in sedimentary thickness, Moho depth and the depth and extent of intra-crustal interfaces. The Main Recent Fault (crustal suture) between the Arabian crust and the overriding Central Iran crust dips at $\sim$13° angle towards the NE to a depth of $\sim$40 km, and its geometry suggests $\sim$150 km underthrusting of the Arabian plate beneath Central Iran. Our model includes a high-density lower-crustal layer beneath Zagros.
We identify a new crustal-scale suture beneath the Tarom valley between the South Caspian Basin and the Alborz. It is associated with sharp variations in Moho depth, topography and magnetic anomalies and the presence of a 20 km thick high-density crustal root at 35-55 km depth to the north of the suture. The high density lower crust in Alborz and Zagros may be related to partial eclogitization of a crustal root. Our crustal density model does not support Airy isostasy along the profile in particular around the Tarom valley. Our model does not support an oceanic origin of the southern South Caspian Basin (SCB), but rather a highly extended continental crust along our profile.