Magnetotelluric (MT) profiling of Oman deep crustal structure as a test for geodynamic models

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A new 130 km long magnetotelluric (MT) resistivity profile across the Oman Mountains near Muscat suggests that the crustal scale architecture of this part of the former Arabian margin is dominated by a SW-dipping to sub-vertical shear system transitional into a zone of deformed mantle recording passage of a craton- or SW-directed, descending subducted oceanic slab and/or ascending high-P metamorphosed microcontinental fragment. Characteristics of this resistivity anomaly match those shown by descending slabs of modern subduction systems, suggesting that the lithosphere-athenosphere beneath the Oman Mountains preserves a memory of craton-directed subduction. The MT image is dominated by a broad, gently (~10°), SW-dipping conductive zone that steepens to subvertical at Moho depth (~40 km), appearing to extend for another 80 km into the mantle but becoming less conductive with depth. At shallow levels the most conductive part (> 15 ohm.m) coincides with strongly deformed schistose rocks (Hatat Schist) in the core of the Saih Hatat fold-nappe, intensely deformed rocks of the upper plate-lower plate (UP-LP) shear zone, and strongly to intensely deformed, schistose rocks of the Hul'w lower plate window. There is no compelling evidence in the resistivity data for any NE-dipping shear system, as required by popular Oman-type supra-subduction models involving subduction of the margin beneath Neotethys followed by overthrusting (obduction) of the oceanic lithosphere. The presence of such a major conductive landwards-dipping structure beneath the Samail Ophiolite suggests that major underthrusting of the continental margin has to be part of the geodynamics of the Samail ophiolite obduction.