



Deep crustal structure of the northeastern margin of the Arabian plate from seismic and gravity data

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The United Arab Emirates-Oman mountains constitute a 700 km long, 50 km wide compressional orogenic belt that developed during the Cainozoic on an underlying extensional Tethyan rifted margin. It contains the world's largest and best-exposed thrust sheet of oceanic crust and upper mantle (Semail Ophiolite), which was obducted onto the Arabian rifted continental margin during the Late Cretaceous. Although the shallow structure of the UAE-Oman mountain belt is reasonably well known through the exploitation of a diverse range of techniques, information on deeper structure remains little. Moreover, the mechanisms by which dense oceanic crustal and mantle rocks are emplaced onto less dense and more buoyant continental crust are still controversial and remain poorly understood.

The focus here is on an active-source seismic and gravity E-W transect extending from the UAE-mountain belt to the offshore. Seismic refraction data were acquired using the survey ship M/V Hawk Explorer, which was equipped with a large-volume airgun array (7060 cubic inches, 116 liters). About 400 air gun shots at 50-second time interval were recorded on land by eight broadband seismometers. In addition, reflection data were acquired at 20 seconds interval and recorded by a 5-km-long multichannel streamer. Results presented here include an approximately 85 km long (stretching about 35 km onshore and 50 km offshore) P-wave velocity crustal profile derived by a combination of forward modelling and inversion of both diving and reflected wave traveltimes using RAYINV software. We employ a new robust algorithm based on a Monte Carlo approach (VMONTECARLO) to address the velocity model uncertainties. We find ophiolite seismic velocities of about 5.5 km/s and a thick sedimentary package in the offshore. Furthermore, the velocity model reveals a highly stretched crust with the Moho discontinuity lying at about 20 km. A prestack depth-migrated profile (about 50 km long) coincident with the offshore part of the refraction profile shows a thick sequence (up to about 10 km) of seaward dipping sediments that are offset by a number of listric (normal) faults, some of which intersect the seabed and so reflect recent tectonic activity. The trend of the Bouguer anomaly provides further constraints on the deeper structure of the margin and appears to confirm the presence of a stretched crust.