Geophysical Research Abstracts, Vol. 9, 07252, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-07252

Interplay between thrusting and surface processes in the Makran accretionary wedge

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The Makran accretionary wedge, between the Arabian and Eurasian plates, grows seawards by frontal accretion and underplating of trench fill sediments since the mid-Miocene, presently at a rate of about 2 cmy^{-1}. The present-day Makran can be roughly divided in 3 structural domains: 1) the Internal Makran, is characterised by large thrusts and strong internal deformation of thrust units expressed by tight folds and associated axial plane cleavage; 2) the coastal Makran displays large wavelength–small amplitude synclines and tight anticlines; and 3) the frontal, submarine domain where rapidly advancing frontal accretion and continuous underthrusting above a mid-level detachment occurs. The whole wedge is $>$500 km wide. This extreme width in combination with a low cross-sectional taper of ca. 3º and little indication for reactivation of the internal parts suggest low basal friction and, most probably, the presence of one or more weak décollements. Active mud volcanoes may indicate that such décollements take advantage of overpressured shales.

We performed a series of analogue laboratory experiments to test the influence of erosion and deposition on the deformation style of Makran-type wedges. Wedge-shaped models made of sand and silicone putty on an inclined basis represent a brittle wedge with weak décollement levels. During shortening, erosion and sedimentation were mechanically introduced to test the effects of mass-redistribution. The working hypothesis was that weak décollements in combination with syn-tectonic erosion and deposition are key parameters in the development of the Makran. Erosion would have focused thrusting in the emerged internal wedge and prevented frontward propagation. Fast redeposition of the erosional products seaward of the thrust front would locally have increased wedge strength, further preventing frontal propagation. Conversely, the presence of weak décollements in the frontal wedge facilitates frontward propagation

of thrusting, hence allowing the wedge to quickly grow seawards by frontal accretion above the weak mid-level décollement, while underplating causes passive uplift of the internal wedge.