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Interference of lithospheric folding in Central Asia by simultaneous Indian and Arabian plate indentation

J.H.W. Smit (1), S.A.P.L. Cloetingh (2), E. Burov (1), D. Sokoutis (2), M. Kaban (3), M. Tesauro (3), and J.-P. Burg (4)

(1) Univ. P&M Curie, Institut des Sciences de la Terre de Paris, Paris, France, (jeroen.smit@upmc.fr), (2) Utrecht University, Faculty of GeoSciences, Netherlands, (3) GeoForschungsZentrum Potsdam, potsdam, Germany, (4) ETH Zurich, Institute of Geology, Zurich, Switzerland

Although large-scale folding of the crust and the lithosphere in Central Asia as a result of the indentation of India has been extensively documented, the impact of continental collision between Arabia and Eurasia has been largely overlooked. The resulting Neogene shortening and uplift of the Zagros, Albors, Kopet Dagh and Kaukasus mountain belts in Iran and surrounding areas is characterised by a simultaneous onset of major topography growth at ca. 5 Ma. At the same time, the adjacent Caspian, Turan and Amu Darya basins underwent an acceleration in subsidence.

It is common knowledge that waves with different orientations will interfere with each other. Folding, by its nature similar to a standing wave, is not likely to be an exception. We demonstrate that collision of the Eurasian plate with the Arabian and Indian plates generates folding of the Eurasian lithosphere in two different directions and that interaction between both generates characteristic interference patterns that can be recognised from the regional gravity signal.

We present evidence for interference of lithospheric folding patterns induced by Arabian and Indian collision with Eurasia. Wavelengths (from 50 to 250 km) and spatial patterns are inferred from satellite-derived topography and gravity models and attest for rheologically stratified lithosphere with relatively strong mantle rheology (thickness of strong mechanical core on the order of 40-50 km) and less competent crust (thickness of the mechanical core on the order of 10-15 km). The observations are compared with inferences from numerical and analogue tectonic experiments for a quantitative assessment of factors such as lithosphere rheology and stratification, lateral variations in lithosphere strength, thermo-mechanical age and distance to the plate boundary on the activity of folding as a mechanism of intra-plate deformation in this area. The observed interference of the patterns of folding appears to be primarily the result of spatial orientation of the two indenters, differences in their convergence velocities and the thermo-mechanical structure of the lithosphere west and east of the Kugitang-Tunka line.