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Late Tertiary Vertical motions in the Arabia–Mediterranean Transition Zone: Tectonics versus Counteracting Sedimentary Loading Effects

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Since the Middle Eocene the northwest Arabian Platform has been emerging out of the water and rising to its present day elevation of about 1 km above sea level. In contrast, the adjacent Levant Basin subsided and accumulated more than 5 km of sediments. This study investigates these opposing vertical motions by distinguishing their tectonic component from isostatic adjustments to sedimentary loading and erosional unloading. To reduce large uncertainties involved with such an analysis due to uncertainties in paleo-water-depths, which in pelagic environments may vary from hundreds to thousands of meters, we employed a non-routine two-stage approach. Water depth in the Levant basin before the beginning of the late Tertiary tectonism was estimated by assuming thermal equilibrium and isostatic balance with the adjacent inland crustal column. For later periods, paleo-bathymetry-topography profiles were reconstructed based on analyses of morpho-structural elements such as incised canyons and abrasion surfaces. The reconstructed bathymetry indicates that the Levant Basin, which is only about 1.5 km deep today, was 2-3.5 km deep in the Middle Eocene. Accordingly, backstripping results indicate that the enhanced subsidence of the Levant Basin and its continental margin during the Late Tertiary can be explained by sedimentary loading and filling of a pre-existing deep-water basin and does not require the involvement of a downward tectonic force. On the contrary, the tectonic force in most of the study area was upward. Because of this upward motion, the relatively shallow region of the northwest Arabian platform was uplifted, exposed, and truncated. The continental margin and the Levant basin, on the other hand, subsided due to the large sedimentary load but the magnitude of subsidence was reduced by the contradicting tectonic force. These results imply that the deep tectonic processes that uplifted and exposed the Arabian platform in the Late Tertiary extended far westward beyond the inland region. We discuss two possible mechanisms for this regional uplift: a long wavelength arching of the Arabian Platform as a result of its collision with Eurasia, and/or heating and thinning of the lithosphere.