HISTORY OF THE PHANEROZOIC SEDIMENTARY COVER OF THE
LEVANT REGION: MAIN FEATURES AND IMPLICATIONS FOR
GEODYNAMIC PROCESSES

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The Phanerozoic sedimentary cover of the Levant and adjacent regions records a ca. 500 Ma long history of sedimentary basins on a continental platform and on its margins. This sedimentary cover was shaped during several phases of deposition and erosion, each controlled by a distinct tectonic regime and pattern of vertical motions. Its features reflect the cumulative effect of the successive tectonic movements and their interaction with fluctuations of the sea level and thus provide insights into the geodynamic process that shape continental platforms and control their vertical motions.

The first major stage in the development of the sedimentary cover of the area, after consolidation of the crust during the Pan African orogeny, spanned most of the Paleozoic. During this period the area was part of the northern periphery of Gondwanaland (present-day coordinates), but was situated some distance inland of the continental margin. Sedimentation extended well over 1500 km inland of the margin. Sediment thicknesses that reach several kilometers were controlled by undulations of the basements that produced several swells (uplifts) and depressions (basins), 500-1000 km across. The pattern of these mega-structures changed in the Late Devonian-earliest Carboniferous times, in a period in which much erosion took place; another change, also in a period of erosion, occurred sometime in the Permian and/or somewhat earlier. The structures were accentuated during the periods of change and probably also while sedimentation took place. The presence of blocks of Gandwanian origin within the Caledonian and Variscan orogenic edifices of Central Europe and other areas implies that they were rifted away, perhaps in several events, from the northern Gondwanaland margin. Though reconstructions are still uncertain, this strongly suggests that in the Paleozoic the margin of Gondwana in our area was shaped by rifting events followed by periods of passive margin history.

It is noteworthy that formation of the Paleozoic mega-structures persisted for 200-300 Ma and their formation was accompanied by very little deformation of the upper crustal levels. Therefore it is unlikely that their formation was entirely controlled by transient processes such as heating of the lithosphere or dynamic forces resulting from flow in the asthenosphere. Rather, it seems that the deeper levels of the lithosphere/crust system were somehow permanently modified, which allowed long-term preservation of ancient swells and basins.

The second major stage in the building of the sedimentary cover of our region began in the Permian and lasted into mid-Cretaceous times. The characteristic feature is the tendency of the sediments on the platform to thicken towards the continental margin, though in places thicknesses were modified by syn-sedimentary Permian-early Mesozoic faulting. The margin of North Africa and Arabia was shaped by rifting accompanied by igneous activity, probably in several phases, that led to detachment of continental blocks from the periphery of Gondwanaland. In particular, the Tauride block seems to have been detached from the present site of the Eastern Mediterranean basin, but other blocks whose provenance needs to be better constrained were most likely also detached. The resulting margins have somewhat different features. The eastern Arabian margin and the adjacent deep water basin
were shaped by Permian and Triassic tectonism. Triassic sediments and associated igneous rocks in southern Turkey and farther west are interpreted to indicate that the continental margin and adjacent deep basin existed already along the northern edge of Arabia and in the area of the Eastern Mediterranean. The Levant margin and adjacent basin were affected also by rifting in the first half of the Jurassic, and appear to have formed as a distinct structure by extension at a large angle to this margin (not strike-slip motion parallel to it). The Permian-Cretaceous sedimentary wedge inland of the Levant margin is up to 300-400 km wide, contrasting with the about twice as wide coeval sediment wedge along the eastern side of Arabia, though maximum sediment thicknesses are comparable. The NE African margin is different in that it does not display a good record of early Mesozoic rifting. There Permian, Triassic, and early Jurassic sediments are hardly developed or absent, while along the Levant margin they reach a thickness of >3km. Thus while the different segments of the NE African-Arabian margin probably all formed by rifting since the latest Paleozoic, their detailed histories and the impact on the adjacent platform were different.

The architecture of the Levant and nearby areas was further modified in several event since the Cretaceous. Sedimentation was interrupted in the end-Jurassic and early Cretaceous times, when widespread igneous activity and erosion took place. In the Negev and adjacent areas up to 1 km of erosion truncated a > 200 km wide swell. In places faulting also took place. This is interpreted as caused by a hot spot that migrated to the SSW, leaving an array of volcanics that extends to the Darfur region.

Since the later part of the Cretaceous the Levant region and nearby areas, including the Levant basin, were deformed to produce structures 10-100 km across. These include a series of fold – the Syrian arc – which in at least many cases formed over early Mesozoic normal faults that were rejuvenated as reverse faults; in addition compressional and shearing deformation occurred along E-W faults. Several grabens, nearly perpendicular to the fold trends, were also active. At the same time depressions and uplifts ca. 100 km across also formed, while the overall tilting toward the continental margin became indistinct. This activity was syn-sedimentary until that major regional mid-Cenozoic regression, but it continued also later. This modification of the periphery of the African-Arabian plate was most likely related to the coeval plate convergence farther north (at first consuming oceanic areas, and then passing to continental collision).

The region was further modified by continental breakup since mid-Cenozoic times, which further changed the pattern of vertical motions – causing extensive uplifting – and was accompanied by widespread igneous activity, whereas the deformation mentioned above tended to die out.

Thus the Phanerozoic sedimentation, erosion and topography of the Levant and surrounding regions were controlled by a succession of distinct patterns of vertical motions and tectonic regimes that produced a variety of structures differing in size (wavelength), rate of growth, and the amount and character of deformation of the upper crust were. As much of these features developed coevally with deposition, the study of the sedimentary cover can help identify, distinguish between, and understand the various geodynamic processes that controlled the evolution of the region.