Switch-on, switch-off: Plio-Quaternary evolution of the Megalopolis Basin (Southern Greece), through structural overprinting, interaction and fault migration

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We present an updated tectono-stratigraphic development model of the Megalopolis Basin (MB), which is an intra-montane basin, located in the actively extending domain of the Hellenic Arc, based on re-interpretation of borehole data, field mapping and stratigraphic – sedimentological reconnaissance. The Megalopolis basin develops on the hanging-wall of the W. Mainalo Fault System, which accommodates the deformation associated with the exhumation of the PQ metamorphics in the window of Assea, east of the MB. During the early stages of basin development, NNW-SSE normal faults controlled its eastern margin. These interacted with and gradually dismembered the ENE-WSW ones that were related to pre-Pliocene extension.

The establishment of ENE-WSW Quaternary extension in the southern Peloponnese is associated with major, range-bounding NNW-SSE faults, such as the Sparta F. that controls the eastern margin of the Taygetos horst. Fault growth and consequent uplift of the Taygetos horst affected the southern reaches of the Megalopolis Basin, through the development of an intra-basinal high (Leontari horst) that split the southern portion of the MB in two sub-basins, while the activity on the faults on the eastern margin of the MB ceases. The switching-off of the eastern margin was taken over by the faults that control the western margin of the MB, such as the prominent NNW-SSE, east-throwing Ellinitsa Fault and the Lykaion Fault System; the latter is a rather elusive structure, owing to the nature of the affected formations (erodible Pindos clastics) and dense forest cover that obscure fault exposures.

The successive stages of fault evolution are reflected in, and largely control, the sedimentation type(s) in the MB. The initial Pliocene lacustrine conditions were gradually replaced by extensive fluviatile sedimentation (Megalopolis Fm), which interfingers with more focused, lacustrine deposits in the basin centre (Marathousa Fm.), when the Pleistocene Megalopolis Lake developed.
The subsequent deposition of the (mainly) fluvial Apiditsa and Ellinitza formations, follows the gradual starvation of sediment feeding from the E-ESE, (which fed the Megalopolis Fm) and marks the onset of fault activity in the southern and western parts of the MB. The establishment of the modern Alfeios drainage, initially deposited floodplain sediments, subsequently to cut into them and form terraces, following episodic (?) drops of its base-level, owing to alternating climatic conditions and/or surges of fault activity. Finally, the breaching of the basement salient in the NNW (Karytaina gorge), led to the establishment of the present-day base level, with Alfeios cutting into its more recent deposits.

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