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Crustal asymmetries within the Corinth and North Evia Gulf rifts (Greece): Moho depth variations and structural inheritances

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The Hellenides in Continental Greece is a tertiary alpine belt with complex tectonic units distributed into two major crustal domains: the External Zones and the Internal Zones, whose geological histories diverged mainly during the late Jurassic, when the internal zones got loaded by the emplacement of large ophiolitic nappes. The Frontal Thrust of the Internal Zones, later partly reactivated as the Main Pelagonian Detachment, marks the boundary between these two major tectonic domains. Since the Miocene, the entire Greek territory has been affected by back-arc extension associated with the southward slab roll-back of the Ionian subduction (Africa Plate). This extension has led to the exhumation of core-complexes and by the formation of numerous extensional basins in the Aegean Sea and two major rifts on mainland Greece: the Corinth Rift from about 4 Ma, and the Sperchios – North Evia Gulf Rift considered to open since 3.5 Ma. The first one is located within the External Zones, while the later developed mainly within the Internal Zones. The Corinth Rift has been extensively studied through various techniques and datasets, whereas the Sperchios – Northern Evia Gulf Rift has been less well-investigated.

We present new crustal cross-sections through the Sperchios – North Evia Gulf Rift interpreted from the analysis of recently acquired seismic data and from filed-based tectonic analysis. These sections reveal (1) the location and variability of major normal faults, and associated depocenters, and (2) the presence of a magmatic chamber in the eastern part of the rift. On the basis of existing data and on new data from receiver functions, we propose an improved version of the Moho depth map in this area. This updated map shows significant latitudinal asymmetries within the rifts, along with longitudinal asymmetries across the entire region. We propose two new Moho depth cross-sections to account for these depth variations and asymmetries: one through the western parts of the rifts and another through the eastern portions. In the west, our results show crustal thickening beneath the western domains of both rifts and crustal thinning beneath some particular zones of the Hellenides, particularly beneath the highly elevated Parnassus zone. To the east, the crustal configuration differs, with a shallower Moho beneath the rifts and a slight crustal thickening between them, under the Kifissos Basin. Furthermore, within the Sperchios – North Evia Gulf Rift, depocenters and major faults are not localized along the same rift boundary. To the west,

deformation is largely controlled by faults forming the southern boundary of the rift, whereas in the east, major faults and associated depocenters are located along the northern boundary. We propose that the crustal thickening and thinning observed are related to the presence of deep detachments beneath the Corinth Rift and the western part of the Sperchios – North Evia Gulf Rift, including the Main Pelagonian Detachment that seems particularly important to constrain the present crustal geometries.