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The North Evia Gulf rift system in Central Greece: structural development and crustal inheritances from onshore fault analysis and offshore Sparker seismic data (WATER project)

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The Sperchios - North Evia Gulf rift system is WNW-ESE directed and participates to the widespread crustal extension induced by the respectively southward and south-westward Nubian and Ionian slabs retreat, and by the extrusion of the Anatolia-Aegean microplate. This crustal stretching, active at least since the early Pliocene, is partly coeval with the North Anatolian Fault (NAF) propagation through the Marmara Sea and the North Aegean domain. At the western termination of the NAF, in the studied area, the domain is widely heterogeneous as it has been previously deformed by successive tectonic events during Hellenic orogeny, from Middle Jurassic to Paleogene times. The low elevation of the Internal Zones in respect to the External Zones of Hellenides suggest that the Frontal Thrust of the Internal Zones, that crosscut the Sperchios Rift, plays a major role in the distribution of rift systems within that area. The Sperchios-North Evia Gulf rift developed over the internal Zones and was driven by at least two major extensional episodes. The first one is characterised by a NNE-SSW extensional direction while the second, still active, is NNW-SSE to N-S. This change in direction can be associated to a modification of the tectonic setting within the Aegean Plate or can be a consequence of clockwise rotation of the whole western Aegean domain.

The WATER survey (Western Aegean Tectonic Evolution and Reactivations), conducted in July-August 2017 onboard the R/V "Téthys II", allowed to acquire more than 1300 km of very high resolution seismic reflection profiles (Sparker 50-300 Joules) around North Evia Island (North Evia Gulf, Oreoi Channel and Skopelos Basin). The new dataset issued from this survey illustrates structural patterns that can be correlated with onland fault systems.

The interpretation of this new seismic data allowed us to precise the main trends of the North Evia Gulf rift deformation. For example, the rift bordering faults show rapid longitudinal changes in

terms of offsets and of their main tilting polarity. Our structural analysis results, together with the kinematic analysis of onshore fault zones, give detailed constraints on the rift structural organisation as well as on the relative chronology of tectonic episodes.

Furthermore, these results provide important data in order to discuss the relations of some major rift structures with other crustal structures inherited from earlier deformation in the Hellenides, and also to consider the deformation patterns in the south-western prolongation of the North Anatolian Fault system during Pliocene to Quaternary times. We discuss the relations between various generations of crustal-scale structures and propose that the variations in the rift asymmetry were triggered, during its initial development, by the presence of older crustal heterogeneities.