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Multi-decollement levels in the Corinth Rift region, a new model of continental extension

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The Gulf of Corinth is a type-example of an intracontinental rift set on a previously thickened crust. A debate exists on the possible role played by intracrustal horizontal decollements in the kinematics of extension. One potential decollement is located at or near the brittle-ductile transition where a zone of microseismicity is recorded (Rigo et al. 1996). Another potential decollement is more shallow and reaches the surface south of the Gulf near Mt Kelmos (Sorel, 2000). The two decollements have been described in the western part of the Gulf. Extension in the eastern part seems to be more localized along a few steeply dipping normal faults inducing a regional uplift (Armijo et al., 1996). The simple observation of a geological map of the area shows a drastic difference between the two regions as noticed by Ghizetti and Vezzani (2005), with a much thicker and wider onshore syn-rift basin in the east. This difference can be attributed either to two different styles of extension due to different rheological stratifications in the eastern and western part, or to a more advanced extension in the east closer to the Aegean Sea. Interestingly, the influence of such crustal rheological heterogeneity was recently tested by introducing a weak level corresponding to the Phyllite-Quartzite nappe (Le Pourhiet et al., 2004).

We have investigated the tectonic history of the Phyllite-Quartzite (PQ) high-pressure and low-temperature nappe from Crete to the northern Peloponnese and we reach the following conclusions. The exhumation of the PQ nappe in the early Miocene involved significant intracrustal extension at the top of the Hellenic accretionary complex. This

extension was progressively less and less efficient from Crete to the Peloponnese and this is reflected in the finite structure observed in tectonic patterns and in the P-T history of the PQ nappe (warmer conditions toward the north-west). The syn-orogenic Cretan detachment responsible for the exhumation is present immediately south of the Corinth Rift in the Zaroukla-Feneos tectonic window below the detachement postulated by Sorel (2000). Locally in the northern part of the window an additional detachment (Zaroukla detachment) follows the base of the Gavrovo-Tripolitza nappe. This second detachment is also locally offset by some of the syn-rift normal faults. The kinematics of the Zaroukla detachment itself indicates N-S extension whereas the syn-orogenic extension is associated with NE-SW stretching. Using these observations and the distribution of microearthquakes below the Rift, we describe a model involving several decollement levels active at the same time following several rheological discontinuities from the superficial Zaroukla detachment to the deep brittle-ductile transition. We also propose a progressive evolution model accounting for the difference between the eastern and western parts of the rift.