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Undocumented uplifted Holocene shorelines at the western termination of the Corinth Gulf Rift: a record of coseismic uplift episodes?

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The westernmost part of the Gulf of Corinth Rift (Greece) is an area of very fast extension (ca. 15 mm/yr), active normal faulting and high seismicity. To the W of 21.985 degrees E (longitude), because a) the presently active faults are coastal (mostly offshore, close to the coast) and b) due to extensive man-made modification at the coastal zone, there is very limited (if any) potential for on-fault earthquake-geological / paleoseismological studies. Information of paleoseismological value and also estimates of fault footwall uplift rates, can be obtained though from studies of primary, off-fault geomorphic evidence, namely, previously undocumented uplifted Late Holocene shorelines. We present geomorphic evidence of uplifted shorelines at the footwall of the Lambiri coastal fault zone, a major structure that we identify on the basis of geomorphic and geological evidence on the coast. Limited evidence is discussed also for the neighbouring Psathopyrgos f.z. Emerged marine fauna, narrow shore platforms (benches) and marine (tidal) notches occur mainly on emerged indurated conglomerates of Holocene fan-delta foresets and paleo-beaches, as well as on few coastal outcrops of Mesozoic limestones and related underwater-deposited fault-slope scree. The heterogeneous and polygenetic nature of the fan-delta conglomerates and the fact that they are frequently broken up into blocks that have been displaced (subsided, collapsed, or rotated) in various amounts, generally complicates the identification of paleoshorelines, which is still possible though, at several locations along the coast. The cases of erosional benches that we consider as convincing indicators of past sea-levels,

are sub-horizontal features either formed in relatively homogeneous conglomerates or clearly discordant to bedding, and in several cases persist laterally for several metres. The (few) notches that we considered to be diagnostic are features that clearly do not follow bedding and have a convincing relation to well-defined neighbouring benches, i.e. their base coincides with inner edges of benches. Preliminary results indicate at least 4 (possibly 5) successive emerged paleo-shorelines, at 0.5-0.7(?), 1-1.2, 1.5-1.6, 2-2.2, and 3-3.2 m a.m.s.l. at the footwall of the Lambiri f.z. One available radiocarbon dating of a Lithophaga shell at 3 m a.m.s.l. suggests that the above paleoshorelines formed most probably after 1728 (preferred) or 2298 Cal. BP, depending on the marine reservoir correction used in the calibration of the measured radiocarbon age (2430 +/-40 BP). Applying 0.75 m of correction for paleo-sealevel plus 0.25 m as a conservative minimum for the depth below paleo-sea-level of the Lithofaga (which could not be correlated to the ca. 3 m paleoshoreline in specific), the obtained ages suggest a minimum of 2.31 (pref.) or 1.74 mm/yr of average coastal uplift rate for the respective period. Dating of the highest remains of marine fauna that we found on limestone bedrock at 7.1 m a.m.s.l. (probable higher remains have been destroyed by a railway line), are expected to provide a representative average uplift rate for the Middle-Late Holocene. Following examples in the relevant literature, the preservation of uplifted notches and platform remains (benches) can be considered a probable indication of episodic uplift, i.e. coseismic uplift of the Lambiri coastal fault footwall. The number of possible paleoearthquakes inferred by such features can be a minimum because 1) small events may have not uplifted erosional features above the inter-tidal zone (thus, not allowing their preservation), 2) events spaced close in time may have not allowed for the formation of distinct erosional features, 3) solution features that form above the high-tide level may have obscured smaller benches between those that we could identify. We also note that, the possibility that some of the paleoshorelines may correspond to higher-than-present sea levels during the last 2300 yrs cannot be excluded and will be considered further when more observations are available. Keeping the above considerations in mind, in a first approach we may propose 4 or 5 probable events of coseismic uplift since 1728 (preferred) or 2298 Cal. BP. Whether these probable events were associated to ca. 0.5 m uplifts (or more) -as suggested by the shoreline elevations- is difficult to assess, because their total uplift may include a non-seismic component that is unknown.