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The oldest sediments of Greece revealed by detrital zircon LA-ICP-MS U-Pb dating: Cambro-Ordovician sandstones from northern Gondwana in the External Hellenides – implications on the evolution of the eastern Mediterranean

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Detrital zircon U-Pb ages of a quartzite from the Feneos locality of Peloponnesus, S. Greece, were determined by LA-ICPMS. The rock classifies as a mature quartz arenite and belongs to an original shale-sandstone succession now metamorphosed into a phyllite-quartzite unit. The latter chiefly represents the External Blueschist Belt of the Hellenides widely known as the Arna or Phyllite – Quartzite (PQ) Unit. Zircon age clusters at 0.5-0.75, 0.85, 0.95-1.1, 1.75-2 and 2.4-3 Ga point at the Saharan Metacraton and the Transgondwanan Supermountain as contributing sources; the youngest concordant grain is 522 Ma old.

Based on great similarities in lithology, zircon age-distribution patterns and depositional setting between the Feneos quartzite and intact Cambro-Ordovician sandstone-shale sequences of Libya (Murzuq and Kufrah basins) we propose that the protolith of the former was deposited in an epeiric sea north of Libya during the Cambro-Ordovician. Feneos, as part of the Cimmerian block, had become detached from the NE Gondwanan margin during Late Carboniferous – Early Permian times and drifted northward. In central Crete, similar-looking sequences (Galinos beds) were originally deposited in an accretionary/fore-arc complex outboard of the south Laurussian active margin (Pelagonia) between ∼297-230 Ma. The southern Pelagonian margin eventually collided (mild docking) with the northward drifting Cimmerian block signaling the closure of Palaeotethys by early Late Triassic. The Gondwanan affinity of the Feneos quartzite strongly contrasts the European one of the Galinos beds; the suture of Palaeotethys can thus be traced in S. Greece within the pre-Triassic sedimentary sequences of Peloponnesus and Crete.

In the eastern Mediterranean realm, rocks with similar age clusters crop out in Greece (Peloponnesus, this study; eastern Crete, Sfaka locality; north-central Macedonia, Vertiskos terrane), NW Turkey (central Sakarya terrane), Libya (Murzuq and Kufrah basins), Israel (Elat locality) and Jordan (El-Quweira locality). Their zircon age spectra plotted with respect to sediment depositional age indicate a collisional margin setting for all. Evaluating the depositional setting of the arguably similar sedimentary sequences above we demonstrate their common provenance from the Gondwana Super-fan System which draped the northern Gondwanan periphery from ∼525 to 460 Ma (Lower Cambrian – Middle Ordovician). Using as anchoring points the non-metamorphosed Early Palaeozoic outcrops of Libya and the Middle East that remained intact at their original deposition sites we have traced, in space and time, the path of the remainder time- and facies-equivalent rocks presently cropping out in the Hellenic and Turkish mountain belts. The fate of the northern Gondwanan margin was multiple rifting and travelling of the fragments thereof throughout the Palaeozoic before their final incorporation into younger orogenic belts.