



Dispersal pathways in the early Messinian Adriatic foreland and provenance of the Laga Formation (Central Apennines, Italy)

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The early Messinian Laga Formation represents a turbidite complex deposited in the Late Neogene foreland basin system of the growing Apenninic chain. While the stratigraphy and physiography of the Laga Basin are well known, the source of its sediments is contentiously claimed to be either recycled Apenninic or primary Alpine. Furthermore, a shift in paleocurrent was proposed as a marker of provenance change around 6 Ma. This study combines double-dating of detrital zircons (fission-track and U-Pb dating) with compositional analyses to address the sedimentary provenance of the lower Laga arenites. Their petrographic composition implies a major metamorphic source combined with an additional dolomite and carbonate source. No compositional difference spanning the shift in paleocurrents is observed, which therefore likely reflects the evolving topography of the foreland due to syn-sedimentary tectonics. Detrital zircon fission-track data reveal youngest age populations at ~16–17 Ma and lag times in the range of 9 to 11 Ma that can be related to modern fission-track ages observed in the Central Alps. The two major $^{238}\text{U}/^{206}\text{Pb}$ age populations, centred at 277.5 and 37.5 Ma, represent (post-)Variscan events and the Paleogene magmatic activity in the Central Alps, specifically the Adamello complex. The Central and Southern Alps are thus inferred as the major source for the early Messinian Laga arenites. The pathways of the sediments from the Alps to the Laga Basin was probably direct along the Apenninic depozones. They crossed the Alps-Apennines foreland and passed on the outer Apenninic wedge-top along elongated and tectonically controlled basins and channels that entered the basin from the north and northwest. Additionally, late Tortonian sediments from the Alps might have been temporarily stored on top of the Apenninic wedge, e.g. in the Marnoso-arenacea Basin, and then seamlessly cannibalized into the Laga Basin in the early Messinian.