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Geochemistry and Sm–Nd Isotope Composition of the lower Ediacaran shales and sandstones of the Saghro Group, Eastern Anti-Atlas (Morocco)

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Petrographic, geochemical, and isotopic characteristics of the Saghro Group sandstones and shales from the Imiter Mine were studied to constrain their provenance, tectonic setting, paleoclimate, redox conditions, and weathering. Mineralogical, geochemical, and isotopic data indicate that the detrital material was mainly derived from felsic and intermediate igneous rocks (granites and granodiorites), with a subordinate contribution from sedimentary sources. Tectonic discrimination diagrams based on major and trace element data suggest deposition on an active continental margin. Major oxide compositions, chemical weathering indices (CIA, ICV, PIA), and mineralogical evidence point to weak chemical weathering under warm climatic conditions. Redox-sensitive element ratios (V, Ni, Cr, MoEF and UEF) indicate deposition primarily under oxic to dysoxic conditions within a shallow continental or marine environment with low salinity or brackich. Geochemical proxies (Th/Sc >1, Zr/Sc >10, and La/Th vs. Hf plot) reveal a felsic source and moderate chemical weathering (CIA <75). Sm–Nd isotopic data, negative Nd(t) values and TDM model ages, ranging from -8.50 to -6.21 and 1.58–2.09 Ga, indicate that the sediments were predominantly derived from a Paleoproterozoic basement (ca. 2.2–2.0 Ga Eburnian Orogen) of the West African Craton, with a dominant felsic crustal signature. The studied shales are characterized by low total organic carbon content (0.1 to 0.3 wt.%) and homogeneous δ^{13}Corg signature (−27.7 to −25.6‰ VPDB).

Overall, the lower Ediacaran deposits at the Imiter Inlier record deposition of sediments derived from moderately chemically weathered Precambrian felsic and intermediate igneous and metamorphic rocks along the active continental margin of a northern unstable continental shelf within the Gondwana supercontinent. These results underscore interplay of tectonic, climatic, and geological processes controlling sedimentation and strongly support sediment derivation from the ancient Anti-Atlas basement consistent with adjacent inliers (e.g., Kerdous, Bas Draa, Zenaga) rather than a juvenile oceanic crust.