Geochemistry, Provenance, Tectonic Setting, Paleo-Oxygenation Conditions of Ediacaran and Cambrian Shales from the Tighardine Area (Western High Atlas, Morocco)

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Résumé

Clastic sediments from the Ediacaran and Cambrian periods within the Tighardine Formation of the Western High Atlas have been investigated to determine their provenance, tectonic setting, and paleo-oxygenation conditions. Geochemical data indicate that the Cambrian clastic sediments are predominantly shales, while the Ediacaran deposits consist mainly of shales with minor wackes. The Cambrian shales (Ca-S) exhibit a relatively uniform composition, with SiO contents ranging from 52.35 to 60.60 wt.%, AlO from 18.37 to 24.81 wt.%, FeO from 5.65 to 9.93 wt.%, and TiO from 0.8 to 1.07 wt.%. In contrast, the Ediacaran shales (Ed-S) show greater geochemical variability, with SiO ranging from 33.52 to 77.90 wt.%, AlO from 11.12 to 26.12 wt.%, FeO from 0.74 to 13.34 wt.%, and TiO from 0.58 to 5.10 wt.%. The higher AlO concentrations in the Cambrian shales are associated with increased mica content, corroborated by petrographic analyses. Variations in AlO/TiO and TiO/Zr ratios point to a felsic source for the Cambrian shales, while the Ediacaran shales are interpreted to have originated from an intermediate source with contributions from both mafic and felsic lithologies. Both shale groups yield Th/Sc ratios greater than 1, indicating a continental, silicic provenance. Tectonic discrimination diagrams place the Cambrian shales between active and passive continental margin fields, whereas the Ediacaran shales plot within the active continental margin field. These results are consistent with the regional tectonic setting and associated volcanic activity. Redox-sensitive proxies, such as V/Cr ratios, indicate that the Cambrian shales were deposited under oxic conditions, whereas the Ediacaran shales formed in an anoxic environment, as evidenced by the presence of a graphitized zone within the Ediacaran strata of the study area.

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Mots-Clés: High Atlas, Tighardine region, shales, silicic rocks, Cambrian, Ediacaran