The Role of Foraminiferal Biofacies as a Paleo-Oxygenation and Paleoenvironmental Proxy of the Lower Silurian Qusaiba Shale, Qasim Region, Saudi Arabia.

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ABSTRACT

ABSTRACT The Qusaiba Shale is a prolific source rock in the Middle East and North Africa, and studies of its sedimentology and biostratigraphy utilizing graptolites, chitinozoa, achritarchs, and microspores were extensively carried out both in outcrop as well as in the subsurface. On the other hand, investigations applying foraminiferal biofacies as a proxy of paleo-oxygenation and paleoenvironment have not been carried out until now. In this study, detailed foraminiferal and geochemical analyses using XRD and XRF were conducted on the Lower Silurian Qusaiba Shale type section near the Old Qusiaba Village. The outcrop is made up of thick shale in the lower part and alternating clay, silt, and sandstone in the upper part. A high diversity of benthic foraminifera, consisting of twenty genera, was recovered from the shale and silty shale samples. The discovery represents primitive agglutinated formainifera, which consist predominantly of monothalamids, simple single chamber forms of Psammosphaera, Thuramminoides, Amphitremoida, as well as tubothalimids; Tolypammina, Ammovertella, Hyperammina, and rare multichambered Ammobaculites and Simobaculites. The stratigraphical distribution of the foraminiferal assemblages exhibits barren to low abundance in the lower part of the succession. This interval characterized by a low detrital influx of the quartz, Ti/Al, high clay content, as well as high V/Al, Co/Al, and P/Ti ratio, may indicate dysoxic to suboxic condition with high paleoproductivity in an offshore environment. On the contrary, in the middle of the section, a high diversity of foraminiferal assemblages comprising monothalimids, tubothalimids with smooth wall texture, and sparse multichambered forms, bloomed and reflect better paleo-oxygenation cconditions. In the uppermost part of the studied section, tubothalimids and globothalimids forms disappeared and were replaced by medium-grain wall textured monothalamid assemblages, indicating oxic conditions with a higher hydrodynamic energy of a lower shoreface paleoenvironment.