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Chemostratigraphy and Provenance of the Neoproterozoic and Early Palaeozoic Outcrops in the Hatat Window, Northern Oman

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Abstract

Neoproterozoic and early Palaeozoic sedimentary rocks are important hosts to substantial amounts of hydrocarbons in the subsurface of Oman. Key surface exposures of these units occur both in the Huqf outcrops of central Oman, and in the Hajar Mountains of north Oman.

Neoproterozoic and early Palaeozoic sedimentary rocks deposited in the Saih Hatat area of northern Oman were buried to greenschist facies metamorphic levels during the obduction of the Semail Ophiolite in the Late Cretaceous. These rocks were subsequently exhumed during a phase of E/W-shortening in the Hajar Mountains during the Oligocene. Today, approximately 4.4km of section corresponding to the Sarin, Hiyam and Amdeh formations are exposed within the Hatat tectonic window. The age and tectonic history of these rocks has partly negated detailed examination and correlation using conventional stratigraphic and sedimentological methods. Only Am3 and Am5 of the Amdeh Formation have been dated using biostratigraphy.

Here, we present an inorganic geochemical (chemostratigraphic), mineralogical and detrital zircon geochronological composite framework for the Sarin, Hiyam, Hatat and Amdeh Formations that are exposed in the Hatat Window. The chemostratigraphic framework is based on key elements and element ratios that are linked to changes in lithology, sediment provenance, climate and depositional environment. The inorganic geochemical signatures of the Amdeh Formation presented here are laterally extensive and are correlated with confidence to key formations within the subsurface Haima Supergroup, while the Sarin and Hiyam stratigraphy relates to the Nafun and Ara Groups of the Huqf Supergroup. The results of the zircon geochronological analysis show the emergence of different zircon populations through time. The Omani basement (c. 850 Ma) is a constant source for detrital material throughout and there is a subtle contribution of material from Meso- and Palaeoproterozoic parent rocks during the deposition of the Amdeh Formation. Zircons related to the Angudan Orogeny (c. 540Ma) make their first appearance within the Hiyam Formation and then continue throughout the remainder of the studied section, aiding correlation with other Neoproterozoic units in Oman.