The Cryogenian to Ediacaran of Oman - New Age, Geochemical and Sedimentological Constraints on the Saqlah, Fiq and Hadash Formations

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Abstract

The Neoproterozoic is an increasingly studied period in earth's geological history. Yet, despite lots of previous work on the geology of this time, our understanding of the earth system at this time is far from complete. The Cryogenian Period lies in the middle of the Neoproterozoic and is known as having two global-scale glaciations interrupted by a significant interglacial period. The subsequent Ediacaran Period saw continuing climate fluctuations and considerable changes in the biosphere, including the first evidence for animals. However, like much of the Precambrian earth, the Cryogenian and Ediacaran remain highly ambiguous. North Oman is host to some of the best-preserved sequences of these ages accessible to geologists today. Our study has focussed on upper Cryogenian and lower Ediacaran lithologies of North Oman, the Saqlah, Fiq and Hadash Formations, interpreted to represent rocks formed in the intra-Cryogenian inter-glacial, the second 'Marinoan' glaciation, and the immediate aftermath, respectively. We use the preceding interglacial sedimentological observations, geochemical analyses, and emerging geochronological techniques to better understand the timing of, and environmental conditions accompanying, the Cryogenian and earliest Ediacaran.

The earliest Ediacaran Hadash Formation 'cap' carbonate is one of many similar carbonates that overlie Cryogenian glacial sedimentary rocks on multiple continents. We present new carbon isotope data from multiple sections to constrain any diachroneity in deposition and attempt to reproduce published palaeomagnetic reversals from the formation to address the rapidity of deposition. In addition to dating these carbonates, we present new LA-ICP-Ms/Ms Rb–Sr dating of authigenic clays within shales of the Fiq formation and volcanics of the Saqlah Formation. These age data are combined with sedimentological interpretation and water chemistry proxies, and organic carbon isotope data from the Fiq shales to better understand the nature and evolution of the Cryogenian to Ediacaran of Oman.