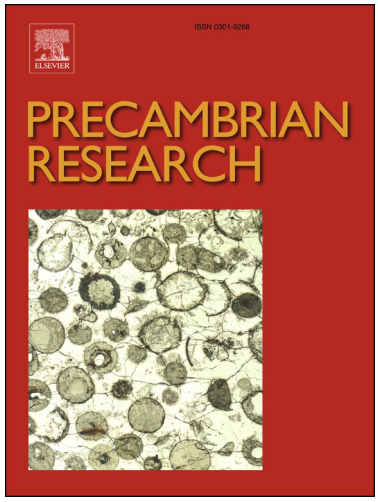

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Cryogenian iron formations in the glaciogenic Kingston Peak Formation, California

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ABSTRACT

The Kingston Peak Formation records glacial sedimentation during the Cryogenian in Death Valley, California, and contains iron formation horizons. These iron formations are part of a thick sedimentary succession containing glaciogenic diamictites, together with mass flow breccias, conglomerates, sandstones and siltstones. The Kingston Peak iron formations are mineralogically and sedimentologically simple, consisting of finely laminated hematitic siltstones that contain up to 50 wt% Fe. These iron formations have been the subject of controversy as they have previously been described as being either absent, or the product of volcanism, diagenesis, hydrothermalism or weathering. Here we present a detailed case study of the sedimentology, stratigraphy, geochemistry and iron isotope composition of the Kingston Peak iron formations. Unequivocal textural evidence indicates a synsedimentary origin for these iron formations. The iron isotopic signature ($0.2 < \delta^{56}Fe < 1.65$) is indicative of partial oxidation of a ferrous iron reservoir. Therefore the Kingston Peak iron formations are interpreted to be primary chemical sediments deposited by the mixing of oxygenated glaciogenic fluids with ferruginous seawater. Pulses of oxidants led to the precipitation of iron oxides, which became enriched under periods of sediment starvation in a basin influenced by episodic mass flows and glacial input. Sedimentological evidence implicates deposition in a range of glaciomarine environments, from ice-distal to relatively ice-proximal, at multiple stages throughout the glacial succession and well before the end of the glacial period. These iron formations have geochemical and sedimentological similarities to other glacially-associated Neoproterozoic iron formations that occur globally and have important implications for our understanding of ocean chemistry and glaciation in the Cryogenian.

Keywords:
Iron formation
Glaciation
Neoproterozoic
Ocean chemistry
Oxygenation

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