UNUSUAL ARAGONITE PRECIPITATES IN THE NEOPROTERZOIC
RAINSTORM MEMBER OF THE JOHNNIE FORMATION

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ABSTRACT

The Rainstorm Member of the Neoproterozoic Johnnie Formation contains limestone beds with cm scale seafloor-precipitated crystal fans. The crystal fans are between 0.5 cm and 1 cm tall, and are composed of crystals that radiate from a point or limited surface of initiation. The individual crystals display blocky termination in vertical cross section and pseudohexagonal habit in plan view, and are now composed of a mosaic of equant calcite crystals. This morphology is consistent with crystals precipitated originally as aragonite and later inverted to calcite. Seafloor precipitates were most prevalent in the Archean and Paleoproterozoic and are rare in subsequent time periods. Thus, the Rainstorm Member crystal fan occurrence in Neoproterozoic time is somewhat unusual and implies anomalous ocean chemistry that may be linked to global processes.

INTRODUCTION

The purpose of this research was to understand the paleoenvironmental significance of crystal precipitates found in the Rainstorm Member of the Neoproterozoic Johnnie Formation, Death Valley region, eastern California. An investigation into the original mineralogy of the crystals was accomplished through a field and thin-section study, and the crystal-bearing limestone beds were put into a stratigraphic framework to better understand the environmental conditions that were conducive to their formation. While sea floor precipitates are common to Archean and Paleoproterozoic strata, they are rare thereafter, and thus indicate the presence of anomalous oceanic conditions conducive to the formation of sea floor precipitates. Sea floor precipitates of Neoproterozoic age are most common in the carbonates that cap enigmatic low latitude glacial deposits worldwide; their presence has been interpreted to represent alkaline oceanic conditions (Kaufman et al., 1997; Kennedy et al., 1998, 2001; Hoffman et al., 1998). However, the mechanism that produces this elevated alkalinity is still debated.

GEOLOGICAL BACKGROUND

Tectonic setting

The Neoproterozoic rocks deposited in the Death Valley region of the western United States were most likely deposited during the transition from continental rifting to passive-margin development (Stewart, 1970, 1991). Problems with age constraints affect the whole of the Neoproterozoic sequence in the western United States. The best-constrained dates in the Death Valley region are the diabase sills of the Archean and Paleoproterozoic and are rare in subsequent time periods. Thus, the Rainstorm Member crystal fan occurrence in Neoproterozoic time is somewhat unusual and implies anomalous ocean chemistry that may be linked to global processes.