



23-14 - HYPOTHESIZED FREEZING IN LOW-LATITUDE LAKES OF THE EARLY PERMIAN: EXAMPLES FROM THE USCLAS FORMATION, GRAISSESSAC-LODEVE BASIN, FRANCE



Tuesday, 10 March 2020



8:30 AM - 5:00 PM



Fort Worth Convention Center - Ballroom B

Booth No. 19

Abstract

The lower Permian Usclas Formation is an interpreted lacustrine deposit in the Graissessac-Lodève Basin, located in the Massif Central, southern France. This basin preserves an Upper Carboniferous-Lower Permian section inferred to have accumulated during orogenic collapse of the equatorial Variscan Mountains in Permian time. The Usclas Formation comprises massive and thinly bedded mudstone to tuffaceous mudstone, and contains features previously interpreted as impressions of either ice crystals (implying ephemeral freezing) or gypsum casts (implying evaporative conditions) in this low-latitude region during the late Paleozoic icehouse. Herein we document the primary morphologies of these features and their stratigraphic context, and posit conditions (water saturation, water chemistry, water depth, temperature) of formation. Features occur either dispersed throughout massive mudstone (Morphology 1, most common) or confined to bedding-plane surfaces in buff-colored mudstone (Morphologies 2-4). Key morphological characteristics of features occurring on bedding planes include: single blades (6-10 mm long) or clumped blades (6-10 mm, parallel) that commonly intersect at various angles (Morphology 2), bundles of fine needles (10-30 mm long) that radiate in a preferred direction with rare curvature (Morphology 3), and bundles of delicate blades (20-40 mm long) that branch or fan outward, forming either semi-radial or "bowtie" shapes, where single blades are dendritic, curved, and/or feather-like (Morphology 4). Results of laboratory simulation of ice growth at -15C in fine (mud-clay) sediment match (in scale and form) each of Morphologies 2-4, corroborating the interpretation that these features represent ice-crystal pseudomorphs that formed by freezing of water-saturated, fine-grained mud. In contrast, Morphology 1 (stubby, 0.5-

2 mm radiating needles that occur distributed throughout beds rather than on bedding planes, and that vary in mineralogy by location) requires further study but likely reflects either devitrification or pseudomorphs of other minerals (e.g. pyrrhotite). Evidence for films of ice in lower Permian lacustrine strata of the Lodève Basin implies ephemeral freezing in equatorial Pangaea, suggesting unexpectedly cold temperatures and/or elevations of deposition.

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