Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.36440

Geochemistry and Cyclostratigraphy of the mid-Cambrian Marjum Formation

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Environmental conditions played an important role in the evolutionary rise of animals, both in terms of marine habitat availability and their preservation in the fossil record. However, the precise nature of these roles remains uncertain. My research aims to clarify them via a refined characterization of the depositional context of soft-bodied fossil-bearing strata from the middle Cambrian of western Utah. Despite their paleontological significance, environmental proxies are rarely applied to such remarkable sedimentary deposits; when they are, they almost exclusively target outcrop samples.

We recovered a unique set of shallow drill cores intersecting siliciclastic-rich materials from the Drumian Marjum Formation in the House Range. The House Range is renowned worldwide for yielding no fewer than three Cambrian Burgess Shale-type faunas. We drilled thirteen meters of core through the soft-bodied fossil-bearing interval of the Marjum Formation that is under active paleontological investigation. A large suite of centimeter scale XRF geochemical data through all three cores permit analysis of orbital cyclicity. Preliminary data identify short eccentricity, obliquity, climate precession, and half-precession bands as well as sub-Milankovich periods.

In the coming months, we will continue to analyze these cyclicity data and supplement them with local- and global-scale paleoredox proxy data. Local-scale redox information gleaned from sedimentary Fe speciation and redox-sensitive element distributions will provide insights into the variation of seafloor habitability through time and the geochemical conditions that facilitated exceptional preservation. Global-scale redox information derived from stable thallium isotopes will illuminate whether and how marine oxygenation contributed to the spread of marine animal life. Our detailed dataset will provide new insights into Cambrian orbital cyclicity, and the roles some environmental processes played in the rapid diversification of Cambrian animal life and its unique preservation in the fossil record.