

USING POORLY PRESERVED HELL CREEK FORMATION MUSSELS TO INTERPRET PALEOENVIRONMENTS

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The uppermost Cretaceous Hell Creek Formation in its type area in Montana is well known for exceptionally preserved freshwater mollusks, with original calcium carbonate and organic material. In contrast, the Hell Creek molluscan record to the east in southwestern North Dakota produces poorly preserved fossils, without original shell material, and with remains only as internal and external molds. The question is, Why? North Dakota Hell Creek molluscan fossils are variable in diagenetic color, ranging from a dark yellowish orange-moderate brown (10YR 6/6-10YR 4/4) to dusky brown (5YR 2/2) and are relatively fragile and easily crushed. The preservational composition of these mollusks has generally been accepted by researchers to be iron carbonate, due to the reddish staining and the numerous siderite concretions found within the Hell Creek. In contrast, pyrite and iron oxide concretions are relatively rare within the formation. Replacement of the shell material is hypothesized to be penecontemporaneous with shell deposition and associated with the hydrologic and geochemical conditions created by changes in river gradient. The geochemical conditions necessary to precipitate and stabilize siderite are relatively restrictive, allowing for a detailed description of the environment necessary to produce fossils of siderite composition.

X-ray diffraction (XRD) is used to determine the mineral composition of the fossils. Preliminary results indicate that the selected Hell Creek mussels are currently composed of goethite (FeOOH), a mineral that often forms from the oxidation of other iron minerals, such as pyrite or siderite. Continued XRD studies and thin section analyses of the crystalline structures should help to determine the original preservational composition of the freshwater molluscan fossils. With this information, the hydrologic properties pervasive in what is now the greater eastern Williston Basin, light may be shed on the differing paleoenvironments between eastern Montana and western North Dakota.

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