Upper Jurassic Morrison Formation Clams On The Half Shell, Central Montana

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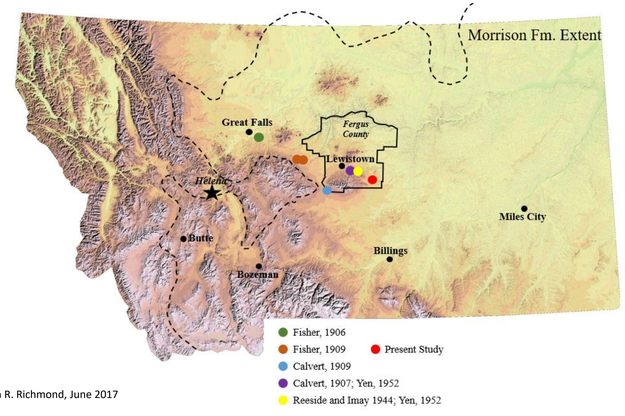
Abstract

A gray-green, illitic mudstone bed containing freshwater bivalves was discovered in the Upper Jurassic Morrison Formation of central Montana. The 20-cm thick bed lies 19 m above the marine Swift Formation. Five bivalve species have been identified from the assemblage-*Unio felchi*, *U. mammillaris*, *U. nucalis*, *U. stewardi*, *Vetulonaia whitei*-plus an unidentified genus. Thick and thin shelled ecophenotypes are represented, indicating lotic and lentic environments. In addition to the bivalves, gastropods (*Viviparus*, *Tropidina*), ostracods (*Alicenula*, *Candona*, *?Cetacella*, *Theriosynoecum*), and charophytes (*Aclistochara*, *Mesochara*, *Porochara*) are represented. Fish bones and piscivorous fish teeth were found. The occurrence of *Viviparus* places the deposit in sediments equivalent to the Brushy Basin Member. The occurrence of the ostracods *C. morrisonenis*, *T. wyomingense* and the charophyte *P. minima* assign the deposit to Morrison Formation Biozone 3.

Paired bivalve specimens are crushed due to post-burial compaction. Unpaired valves are commonly well-preserved with some over 13 cm in length. Unbroken single valves are typically oriented convex; however, some are concave or vertically oriented. Shell fragments are also incorporated in the deposit. Preserved amorphous organic material is abundant and implies rapid burial. The allochthonous assemblage is representative of a crevasse splay flood event. There are no associated fluvial sandstone beds exposed in the outcrop. The formation mudstone/sandstone ratio and morphology of the sandstone beds indicates an anastomosing floodplain environment. Shells are poorly sorted and have no preferred apex orientation. Valve imbrication shows a northwest paleoflow direction. The largest shells were used to approximate an entrainment velocity of 0.65 m/s.

Ten shells were thin-sectioned to observe growth bands. Thin closure lines demarcate various growth bands. Correlation of band widths is observed among the specimens signifying a communal response to environmental disruptions. Thin closure lines indicate short periods of adverse conditions, such as turbidity due to seasonal storms. The varied fauna and flora fossil assemblage is evidence of a salubrious perennial environment that experienced negligible seasonal variation, punctuated by occasional storms.

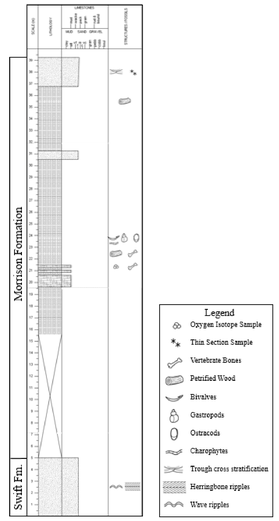
Montana



Prepared by Dean R. Richmond, June 2017

Stratigraphy

The mud splay bed is 19 meters above the underlying marine Swift Formation and 52 meters below the overlying terrestrial Lower Cretaceous Kootenai Formation.



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Geochemistry Weight Percent

Geochemistry indicates the splay bed is an illitic mudstone. There is no Morrison "clay change" present in the formation in central Montana.

Quartz	56.1%
Illite	20.4%
Smectite	8.3%
Calcite	7.3%
Orthoclase	5.3%
Kaolinite	1.7%
Gypsum	0.5%
Geothite	0.4%

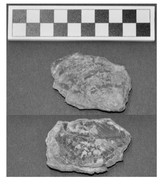
Fossil-Rich Bivalve Splay Bed

Bivalves and Other Invertebrates

Scale bar = 10 cm

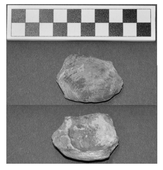
Unio felchi*

Vetulonaia whitei

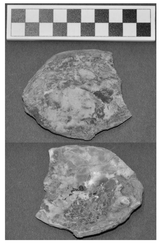


Unio mammillaris

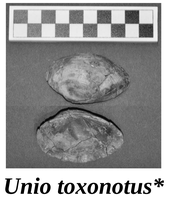
V. mayoworthensis



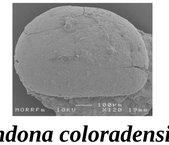
Unio nucalis*



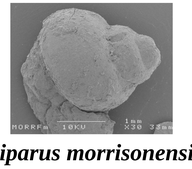
Unio stewardi



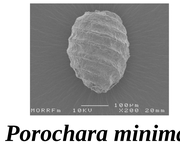
Unio toxonotus*



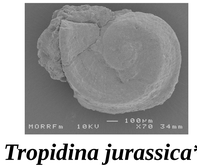
Candona coloradensis (Biozone 3, 4)



Viviparus morrisonensis*



Porochara minima (Biozone 3)

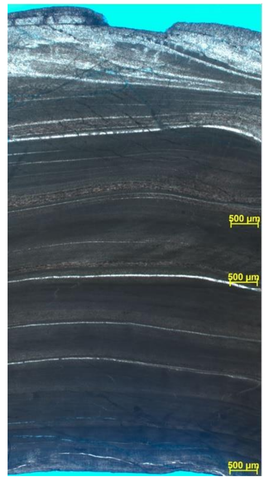


Tropidina jurassica*

* first occurrence in Montana

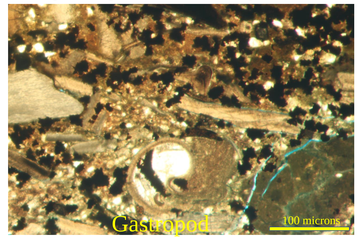
Bivalve Growth Bands

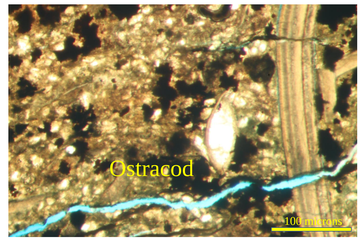
Spliced bivalve thin section images showing growth bands (dark) and closure lines (white).



Mudstone Matrix in Thin Section

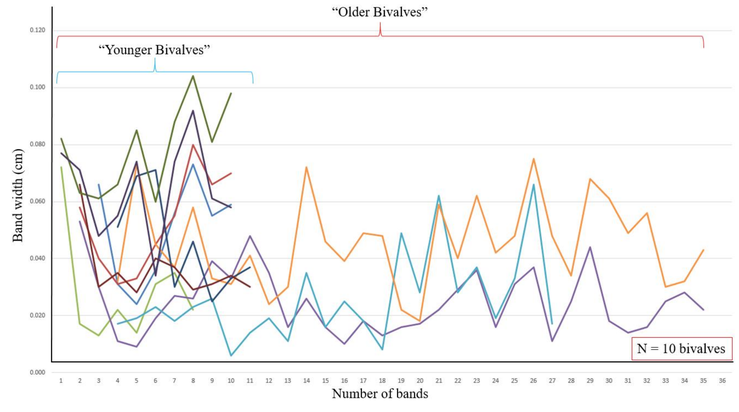
Geopetal matrix preserved under the shells. The matrix contains microfossils, shell fragments, and amorphous organic material (black specks).





Bivalve Growth Band Correlation

Each line represents the variation in growth band width for 10 partial unpaired valves. The graph displays a coarse correlation of growth and shell closure, suggesting the community responded similarly to environmental conditions. Thin shell closure lines suggest closure was due to storm events which resulted in water turbidity.



Next Steps - We plan to continue to excavate this fossiliferous bed summer 2017. In addition to searching for more bivalves, we will be looking for crocodile, turtle, lungfish, fish and mammalian fossils.

Acknowledgements

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