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Stratigraphic and Sedimentologic Analysis of the Bear Gulch Limestone (Mississippian-Pennsylvanian) near Grass Range, Montana

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The Bear Gulch is a dolomitic limestone unit of Mississippian/ Pennsylvanian age (~320 Ma) occurring in the Big Snowy Trough, an east/west-trending structure north of the Little Belt Mountains in central Montana. The Bear Gulch crops out near Grass Range, Montana, and is an informal unit within the Fergus Group.

Objectives

Hydrocarbon source rocks similar in age and composition to the Bear Gulch Limestone have been developed throughout the region. Despite the suspected economic potential and previously documented fossils of the Bear Gulch, there has been minimal research published exploring these subjects. The goal of this study is to provide the basis for assessing the source rock potential of the Bear Gulch and to understand its relationship to other mapped units within the Big Snowy Tough.

Methods

Six weeks were spent in the field collecting and cataloging rock samples and measuring laminated sections of the Bear Gulch. This was followed by laboratory analysis of the samples. Thirteen of the 75 samples collected were made into thin sections and analyzed with a petrographic microscope. Mineralogical composition and carbon content were determined through X-Ray Diffraction and Elemental Analysis.

Discussion

A stratigraphic column was constructed from outcrop data collected in the field. As can be seen in the figures to the left, grain characteristics, sedimentary structures, fossils, color, and lithology were identified using a petrographic microscope. The pie charts show the mineral percentages of each sample found through X-Ray Diffraction. Using Elemental Analysis, the organic carbon in each sample was quantified and is presented in the chart below. Using these combined data sets, sedimentary facies were defined.

Implications and Further Research

Analysis of the facies defined through this research can help determine the depositional history of the Bear Gulch. This in turn will help us better understand its capacity for extensive fossil preservation and its potential as a hydrocarbon source rock. The information from this field location will be compared to gamma ray logs from nearby oil wells and a cross-section through the Big Snowy Trough will be constructed in order to explore the lateral variations within Bear Gulch strata. The results of this study will be useful in identifying potential source rock characteristics in similar depositional basins around the world.