A Tale of Two Fishes: An Analysis of Differentiation in Compositional Characteristics of Two Distinct Fossil Butte Member Localities

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The Green River Formation is one of the world's most productive fossil sites, with its Fossil Butte Member (FBM) immaculately preserving millions of individual freshwater fish from the Eocene epoch. Two localities, the 18-inch layer and the split-fish layer, contribute most of the formation's specimens; the latter represents near-shore deposits, while the former preserves strata from the center of the lake. Materials from the two localities can be distinguished by color, texture, and matrix composition; this experiment sought to observe the exact compositional differences responsible for the two groups' dissimilarities. 18-inch layer fossil matter was hypothesized to contain elevated levels of organic and calcareous compounds, while split-fish layer strata was hypothesized to display higher concentrations of non-calcareous inorganics. Experimental groups representing 18-inch layer (18L) and split-fish layer (SFL) materials were further divided into subgroups of fossil (F) and matrix (M) material. Material was gathered from three samples from each locality, totaling twelve samples overall. Samples were tested by way of x-ray diffractometry (XRD), infrared spectroscopy (IR), and energy-dispersive x-ray spectroscopy (EDS) to determine crystalline content profile, organic molecule profile in fossil materials, and elemental content and distribution, respectively. Analysis of data yielded the following observations: 1. XRD patterns showed no discernible differences in trends between 18L and SFL-group materials, though showed low homogeneity within group 18L-F. 2. EDS indicated heightened carbon and trace element presence and lowered iron in 18L fossil matter as compared to SFL matter. 3. IR spectroscopy indicated elevated presence of saturated hydrocarbons in 18L-F materials.