

## **Possible Solutions to Depositional Dilemmas and Formational Nomenclature by Comparing Fossil Assemblages Using a Morphometric Approach: Frontier/Turner Depositional System Potential**

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### **Abstract**

Geologists use everything in their arsenal to define and distinguish a formation from the surrounding strata. Just some of this arsenal includes analyzing sediment characteristics, mineralogy, and fossil content. Even when a formation is considered well-defined, determining its depositional history can turn out to be just as difficult. Similarities between formations are sometimes so great that the job of distinguishing these sedimentary packages becomes quite difficult. The fossil species within a formation can often define the formation itself and provide clues to its depositional history, which makes studying fossil content fundamental to understanding the overall formation. I postulate that it is not the comparison of different species that demarcate formations but the slight differences within individuals of the same species that truly define a formation. Quantitative studies, like morphometrics, can analyze these slight variations between individuals of the same species to determine whether assemblages from formations are statistically comparable or not. This method is especially applicable to formations that look similar in age, physical characteristics, and depositional environment but may have distinct depositional histories. The Frontier/Turner system in the Powder River Basin is an ideal target to test this theory. The Frontier and Turner formations are both of similar depositional environments and ages but were described at different times by different people so are considered unique formations by most geologists. Individuals have done extensive research on these formations and have various conclusions as to the similarities and differences between the Frontier and Turner. Some promote the theory that the Frontier and Turner are the same system just different in their proximity to the delta source with the Turner being the more distal portion of the delta. Others argue that the Frontier has a western source for its sediment supply while the Turner gets its sediments from an eastern source making these two formations completely separate in their depositional history. I suggest a morphometric analysis of the ammonite species between these two formations would answer this long-debated question. I would argue if a comparison of character traits of specimens of the same species of ammonite between the Frontier and Turner formations shows a statistically significant similarity, then the Frontier and Turner are part of the same depositional system. Likewise, if the same species show a statistically significant difference between the two formations, then one could argue that these ammonites were living separately from each other and therefore not part of the same depositional system. This type of quantitative analysis could then be applied to any set of formations (if there is a large enough fossil assemblage) that are difficult to distinguish by other means.