Stratigraphic Relationship of the Exposed Wajid, Saq and Qasim Formations in Western Saudi Arabia: A Geochemical and Statistical Approach

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An extended Neoproterozoic orogenic cycle (Pan-African Orogeny) related to the assembly of the Gondwana resulted in the deposition of a massive volume of siliciclastics on the northeastern margin of the Gondwana including the Arabian Peninsula. The exposed sections of the lower Paleozoic Wajid Formation of the southwestern Saudi Arabia and the Saq and Qasim formations of the northwestern Saudi Arabia appear to have been deposited during this time. However, since these formations are physically separated by hundreds of miles around the eastern edge of the Arabian Shield, the exact stratigraphic relationship among these formations is not clear. Based on the elemental (major, minor, trace and rare earth elements) chemistry, this study made an attempt to determine the relationship among these formations and found that while the Wajid, Saq and Qasim formations do contain some common elements, there are differences in the bulk elemental chemistry. The bulk elemental chemistry revealed more similarities between the Wajid and Saq formations than that of the Qasim with either one of these formations. Multivariate cluster and factor analyses confirm the findings. Ternary plots of the factored bulk elemental data while showing distinctive compositional differences among these formations also show a distinct trend of transition between the Wajid and Saq formations. No such trend was observed between the Wajid and Qasim formations. Ternary plots of selected trace and rare earth elements (REE) including La-Th-Sc, Th-Sc-Zr/10, and Th-Co-Zr/10 suggest several different tectonic settings for the deposition of these formations including the oceanic island to continental island arc, passive and active continental margins.