

Inorganic Geochemical Characterization of the Cretaceous Marine and Continental Sediments in the Keana Area of the Middle-Benue Trough, North-Central Nigeria: Its Implication in Tectonic Setting, Provenance and Depositional Environment

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Abstract

Sandstone, shale, and limestone constitute the lithological units occurring in the southern part of the Middle-Benue Trough of Nigeria. The geochemistry of major, trace, and rare earth element (Na_2O , K_2O , and Ba; Cu, Zn, Co, Sc, Ni, Cr, V, Th, U, Nb, Rb, Sr, Zr, and Y) of the Cretaceous marine and continental sediments belonging to the Asu-River Group, Awe, Keana, Ezeaku, and Agwu formations was carried out to determine the provenance, tectonic setting, and depositional environment of the sediments.

Aims and Objectives:

- To determine the lithostratigraphy of the area through field geological mapping.
- To carry out petrographic analysis.
- To carry out major, trace, and rare earth element geochemical analysis of the sediments.
- To classify the rocks, deduce their tectonic setting, and source rock potential based on field, petrographic, and geochemical criteria.

Procedures:

Thirteen shale and limestone samples and three samples of nodules from the study area were pulverized in the Department of Geology and Mining. They were analyzed for major, trace, and rare earth elements at the ACME laboratories limited (code: VAN1204168), Vancouver Canada. The analytical technique employed is the ultra-trace analytical package which uses the ICP mass spectrometry method of geochemical samples: samples were subjected to high temperature dissociate into atoms which in the process cause significant amount of collision excitation and ionization of sample atoms. Results of the analysis were used in interpreting to deduce their Tectonic Setting, Provenance, and Depositional Environment.

Results:

Chemical analysis show that the sediments are depleted in Na_2O which may be due to intense chemical weathering at the source rock area during fluvial transportation of detrital materials.

$\text{Al}_2\text{O}_3/\text{TiO}_3$ ratio (8-21%), La/Sc, Th/Sc, La/Co ratios, Cr, Th values points to an intermediate- felsic provenance under different tectonic environments. $\text{Na}_2\text{O}/\text{K}_2\text{O}$ ratio of less than 1 indicates matured sediments while the Ni/Co ratio (<5), V/V+Ni ratio (<9) and low value Cu/Zn ratio indicates an oxic environment of deposition and the Th/U ratio (<7) strongly suggest a dominantly marine environment.

Conclusion:

The oxic marine environment provided a conducive environment for organisms that could have destroyed the hydrocarbon producing materials to thrive, thus making the environment unfavorable for the production of hydrocarbon especially the light crude.