**ADVANCES IN SPACE RESEARCH**

**Reconstruction of the subsurface crustal and radiogenic heat models of the Bornu Basin, Nigeria, from multi-geophysical datasets: Implications for hydrocarbon prospecting**

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Abstract This study aims to reconstruct the subsurface crustal and radiogenic heat models from integrated airborne magnetic and gamma-ray spectrometric and satellite gravity methods for implications on hydrocarbon exploration in the Bornu Basin, NE Nigeria. The results revealed the basin’s lithologies and shallow-to-deep structures (faults and lineaments) and their trends, depicting contrasting magnetic intensities, gravity anomalies, and radionuclide concentrations. High magnetic anomalous zones in the southern and southeastern parts of the basin could be associated with the influence of the intrusive body (porphyritic granite) of high magnetization as observed in the 2D magnetic/gravity models. Moderate to low anomalous zones suggested thick sedimentation in the northeastern and central areas. The total horizontal derivatives (THDR) and Rose diagrams of the magnetic and Bouguer anomalies revealed major lineaments/faults in the NE-SW, NNE-SSW, and E-W directions. These structures likely serve as the migratory pathways/traps for the hydrocarbons. The structures delineated on the radioelements ratio, and composite maps also correlate with those identified on the THDR maps, especially the major SE-NW structure created by magmatic intrusion in the southeastern part of the basin. The estimated total radiogenic heat production (RHP) rates for the study area decreased in the order of 740.46 > 674.16 > 665.35 > 462.23 > 415.17, with the maximum obtained from the Yolde Formation (YF) and Pindiga Formation (PF). These are attributable to clay, limestone, shale, and ferruginized sandstone. The Chad Formation (CF), on the other hand, had thicker sediment (6.8 km) and a maximum RHP of 550 qWkg1 , which is relatively low ( 797.87 qWkg1 obtained in the PF and the YF falls within the moderate RHP windows (750–1500 qWkg1 ) for sufficient hydrocarbon maturation and accumulation in the Bornu Basin. 2023 COSPAR. Published by Elsevier B.V. All rights reserved.

Keywords: Subsurface crustal modeling; Magnetic anomaly characterization; Satellite gravity modeling; Gamma-ray spectrometry (GRS); Hydrocarbon prospecting; Chad (Bornu) Basin

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