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Structure and mineralization potential of the southwestern part of Sokoto Basin in Nigeria

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This study investigates the lithological boundaries, structural features, and mineralization potential in the southwestern part of the Sokoto Basin, Nigeria, using an integrated approach involving high-resolution aeromagnetic, radiometric, and Landsat 8 multispectral data. The aeromagnetic data were enhanced using tilt derivative, analytical signal, and first vertical derivative filters to delineate subsurface lithological units and structural trends. Depth-to-source estimations were carried out using Euler deconvolution and Source Parameter Imaging (SPI), while radiometric data were analyzed to map potassium concentrations indicative of hydrothermal alteration zones. Landsat 8 imagery supported lithological and structural mapping through band ratios and false-color composites. The results revealed three major magnetic zones, high (53.3–120.2 nT), intermediate (27.0–53.2 nT), and low (-50.8–22.3 nT) corresponding to different rock units. Depth models highlighted complex basement topography with favorable zones for subsurface mineralization. Structural interpretation identified faults and NE-SE trending fractures that control fluid flow. Potassium anomaly zones were associated with metamorphosed rocks such as amphibolites and quartz mica schists, indicating gold-related hydrothermal alteration aligned with major structural features. The integration of geophysical and remote sensing methods provides a more detailed and spatially extensive understanding of the subsurface geology compared to traditional field-based mapping, offering valuable insights for future mineral exploration and a refined geological interpretation of the Sokoto Basin.

KEYWORDS

lithologic boundaries, structural trends, mineralization potential, hydrothermal alteration, geological structures

1 Introduction

The study area is located in the southwestern part of the Sokoto Basin, at the boundary between the sedimentary and basement complex regions in northwestern Nigeria. The Neoproterozoic schist belts, running from southwest to northwest across Nigeria,