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Unlocking Gold Potential: Remote Sensing Insights and Applied Analysis of the Qena-Safaga Area in Egypt's Eastern Desert

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The eastern desert of Egypt has undergone prolonged deformation as a result of the cratonization of the juvenile crust known as the Arabian Nubian Shield (ANS). This geological phenomenon has raised prospects for potential gold discoveries associated with the corresponding tectonic events. Within this context, the Qena-Safaga zone, located on the border of Egypt's Northern and Central Eastern Deserts, stands out for its metavolcanic rocks, which have been subjected to significant twisting due to the movement along the Qena-Safaga Shear Zone (QSSZ) relative to the Barud magmatic body.

In our recent study, we conducted a thorough examination of numerous deformed post-orogenic granitic intrusions and felsite dikes within the Qena-Safaga area. Our investigation aimed to identify promising mineralization sites, with a particular focus on orogenic gold deposits. Applying a combined approach involving detailed field surveys, advanced analysis of remote sensing data—including band combinations from ASTER and Sentinel 2—and interpretation of aeromagnetic enhanced maps, we systematically distinguished various rock types, structural features, and hydrothermal alterations across the study area.

By integrating insights from multi-sorce data, including the development of remote sensing band combinations and aeromagnetic maps, we were able to validate previously hypothesized mineralized zones within the Qena and Safaga areas, while identifying additional areas with similar mineralization potential. Notably, our analysis, which included sophisticated methods such as the utilization of ASTER and Sentinel 2 data alongside hydrothermal alteration and orientation entropy heat maps, revealed a strong correlation between mineral-rich regions and major structures associated with late-stage deformation of the QSSZ.

Our study stands out for its applied analysis, which provided valuable insights into the geological processes at the Egyptian eastern desert. By elucidating the spatial distribution of mineralization and its relationship with structural features through advanced analytical techniques, our findings offer important guidance for future exploration efforts in this promising area.