A Comprehensive Approach: Remote Sensing and Geochemical Analysis for Mapping the Mafic Intrusion in the Arabian Shield

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The current research uses satellite imagery and Remote Sensing techniques in integration with field, petrographically and geochemical studies to identify the lithologies of Kamal layered mafic intrusion (KLMI) that is exposed in the Yanbu suture zone (YSZ) in northwest Saudi Arabia. This research uses Visible Near Infrared (VNIR) and Short-wave infrared (SWIR) of the ASTER image. To map the KLMI red, green blue (RGB) combination, decorrelation stretch (DCS), band ratios (BR), principal component analysis (PCA), minimum noise fraction (MNF), and spectral angle mapper (SAM) technique were used in integration with geochemical data. The FCC (False Color Composite) and DCS results show the hydrothermally altered zones; the BR differentiated the KLMI in dark red color from all other rocks. The PCA 135 and MNF 135 differentiated among the igneous, sedimentary, and metamorphic lithologies. The SAM results classify the KLMI and Nabat complex into the best correlation with the published map and geochemical results. The geochemical findings reveal a well-defined geological profile of Neoproterozoic rocks, including schists, gneisses, ophiolites, and various intrusive formations. The post-collisional nature of the KLMI is characterized by its un-metamorphosed and un-deformed state. The association of the KLMI with ophiolitic ultramafic rocks provides valuable insights into the geological evolution of the Yanbu suture zone. All the results were correlated with the published maps of the Ministry of Petroleum and Minerals, Saudi Arabia with a scale of 1: 250,000. The obtained data revealed that the overall accuracy is 78%, encouraging remote sensing to identify and map further suture zones. The results will help with local scale maping of the area and, eventually, aid in exploring valuable minerals.