Remote sensing based lithological/stratigraphic mapping and mineral exploration in Salt Range, Pakistan

Muhammad Shafique; Muhammad Hanif and Irfan U. Jan
National Center of Excellence in Geology, University of Peshawar, Peshawar
shafique08@yahoo.com

Abstract

The southern border of hydrocarbon-bearing Potwar Basin is known as the Salt Range Thrust (SRT). The Salt- and Trans-Indus ranges have got wealth of mineral potential and mining has been going on for ages. Coal mines, salt, gypsum, limestone, fireclay, silica sands, uranium and fossil fuel are very economic occurrences among others. The Salt Range has a unique lithology, stratigraphy and wealth of minerals deposits; however, due to its large spatial extent, rough terrain and remote location, most of it has remained under-unexplored. The current advancement in the satellite based remote sensing and geospatial techniques and its uses in the remote areas, especially rough terrain and at regional scale have shown that these techniques have proved very successful in unraveling the geology and mineral resources. Satellite remote sensing images are frequently and efficiently used for mapping different minerals of economic importance and rock units with varying lithology and stratigraphy. The aim of this study is to use these innovative technologies of SRS and GIS and state-of-the-art techniques to map lithological/stratigraphic units and detect mineralized zones.

The Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) satellite sensor launched by NASA-USA presents unprecedented opportunities for lithological mapping and mineral exploration. We used the Short Wavelength Infrared (SWIR) bands of ASTER images to map lithological/stratigraphic and mineralized zones in salt range. The spectral reflectance of known minerals, stratigraphic/lithological units are used to classify the ASTER images using Principal Component Analysis, Spectral Angle Mapper, Decorrelation Stretching and Band Rationing to discover the unknown minerals and produce seamless and more detailed lithological, stratigraphic map for the region. The remote sensing derived Digital Elevation Model (DEM) providing the topographic information of the region and DEM derived drainage network were used in integration with ASTER images to classify the lithological and stratigraphic units. The mapped mineralized zones using remote sensing can attract the government and private sector for further investigation for minerals exploration and might lead to the discovery of minerals deposits. Similarly the seamless and more detailed information on lithology/stratigraphy and of the region shall assist the hydrocarbon industry in the country and abroad to explore and understand the tectonics and petroleum system in the region.