LANDSAT AND SPOT INVESTIGATIONS
IN SINAI PENINSULA, EGYPT

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The Sinai Peninsula is an excellent site for the application of satellite remote sensing. It is characterized by a well-exposed but hardly accessible terrain with no vegetation cover, diversity of landscapes and contrasting lithologies, and frequent cloud-free atmospheric conditions. The development of the Peninsula places an ever-increasing demand for renewable and nonrenewable resources, which validate the turn to the use of satellite remote sensing as a powerful information gathering tool for geological investigations.

This paper is a summary of a Ph. D. research that is to be published in several full-sized papers. The objectives were to: (1) provide new geological and geomorphological information on Sinai in general and on carefully selected sites in Southern Sinai in specific, (2) evaluate the capabilities and inherent characteristics of Landsat and SPOT data to solve specific geological problems,(3) provide an assessment of the image processing and enhancement techniques most suitable for Sinai and similar environments, and (4) expose and encourage Egyptian geologists to use remote sensing in implementing geologic research and mapping .

Landsat - MSS hard - copy mosaics were used to capitalize the regional tectonic features and the hierarchy of the gross geomorphic features. TM and SPOT digital data were processed to investigate, in some details, few selected sites in Southern Sinai. The regional synoptic view of the Landsat mosaics suggested the modification of the classically accepted geomorphic zones into six modified ones: the Northern Coastal Zone, the Northern Folded Sedimentary Zone, the Central Sinai plateaus and the associated drainage systems, the Southern Basement Complex, the Western Coastal Zone, and the Coral Reef Belt.

A statistical lineament analysis, based on a 27 - sector gird, was conducted to determine the preferred orientations in Sinai, and to demonstrate the spatial variability as a function of progressive geographic area change associated with lithologic, structure or tectonic variations. The results revealed four major systems: Aqaba, Suez, Cross-Trend and Duwi. The Cross - trend was the most prominent and persistent all over Sinai. The Aqaba system was second. These systems are thought to be inherent fractures that lead the opening of the Gulf of Suez and Gulf of Aqaba. They also imprinted intimate morphological expressions on Sinai, and are important leads in exploration for oil, minerals and water resources .

Landsat and SPOT data revealed a unique repetitive structural pattern associated with known oil fields in south - west Central Sinai. TM-pc 4,2,1 and SPOT 3,1,2 (RGB) emphasized submarine features and oil activities in the area. TM band color combination and IHS 7,4,1 or 2 provided excellent rock discrimination in the Um Bogma manganese mines. It proved to be very useful in mapping the areal extent and areal variation in attitude, sequence, and lithology of the strata exposed in the area. TM - ratio Composite 7/5,5/4,4/2 (RGB) uniquely discriminated the iron - manganese deposits, when color coded BGR, it remarkably distinguished several photo - stratigraphic units including key marker beds .

In Iqna, a younger granite pluton, TM 7,4,1, TM-pc 4,2,1 and SPOT-pc 3,1,2 revealed concentric lithologic zonation which is thought to be reverse zoning. Associated with the lithologic zonation is a Joint and dyke swarm zonation, with higher frequency and concentration in the marginal areas. In katherine pluton, several new features were identified; e.g. an unmapped strike - slip fault. SPOT - pc and - IHS provided a surprising amount of information in the basement rock of Southern Sinai . SPOT data were also a good indicator for vegetation occurrence and consequently water resources. The study also revealed that the areas surrounding Iqna and katherine plutons should be remapped. Shortly, both Landsat and SPOT data provided unique information that complemented each other.

KEY WORDS : Landsat, TM, SPOT, Sinai, Egypt, Geology, Image Processing.