

PHOTOGEOLOGIC STUDY OF THE SOUTHERN GALALA PLATEAU

GULF OF SUEZ - A. R. E.

BY

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NOTE

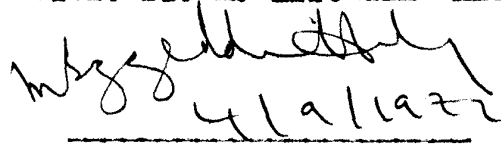
The present thesis is submitted to the Ain Shams University in partial fulfilment of the requirements for the Degree of Master of Science in Geology.

Beside the research work materialized in this thesis, the candidate has attended three graduate courses for one year in the following topics:

1. Advanced structural geology and geotectonics.
2. Field geology and surveying.
3. Advanced stratigraphy.

He has successfully passed the final examinations of these courses. Also, and in fulfilment of the language requirement of the Degree, he has passed the final examination of a course in the German language.

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A B S T R A C T

The photogeology, airphoto lineation and drainage lineations, analysis of joints and minor structures, and drainage basin analysis of the Southern Galala Plateau and vicinity are involved in the present study. The total area covered is approximately 22,450 sq km located in the northeastern part of Egypt between Lat. $27^{\circ} 00'$ to $29^{\circ} 30'$ and Long. $31^{\circ} 40'$ to $33^{\circ} 00'$ and traversed by the well known Wadi Araba.

To build up the regional pattern of airphoto lineations of the southern Galala Plateau a multi-stage analytical technique was applied using airphoto indexes (scale 1:100,000) as a base. A set of seven indexes were analyzed; designated: North Galala, Zafarana, South Galala, Saint-Paul, Sikket El-Agel, Wadi Mahariq, and Wadi El-Asyuti. A total of 29,536 linear features were identified, recorded, and their lengths and directions (azimuth) annotated and plotted in 126 azimuth-frequency (rose) diagrams and 126 frequency curves.

Three topographic maps (scale 1:100,000) designated: North Galala, Zafarana, and Saint-Paul were involved in the drainage and drainage lineation analysis carried out for an area about 8000 sq km in size. A total of 8431 drainage linears were recorded annotated and plotted in different types of diagrams. Approximately 1000 joint readings from 15 different stations were analyzed. Photogeological-field mapping at a scale of 1:40,000 was carried out for the major part of the Southern Galala Plateau and the Rod El-Hamal area. The minor structures for 22 selected field stations are also reported. Horton analysis of 23 drainage basins in the Gulf of Suez area was carried out. The relationships between stream length and stream number to stream order are thus established.

The regional airphoto lineation pattern is characterized by a strong degree of preferred orientation in the directions NE and/or NW and less significantly in the directions ENE, NNE, NNW, N, E, and WNW. Maximum concentration of lineation was noticed in the Eocene limestones and least concentration in the unconsolidated wadi and coastal deposits and the "Nubia" sandstones. Local linearly concentrated lineation belts are noted delimiting the courses of significant fault zones.

Joint analysis shows a variable degree of preferred orientation with prominent concentrations in NNW, ENE, NE, ENE, or WNW directions.

The change in trends is directly related to the orientation of the faults present. Genetically, most of these joints are of the tensional type, being secondary echoes of faulting. Minor structures reported are mainly small tensional faults. Subsidiary to these are: minor folds, compressional (reverse) faults, and diapiric features. Contacts between the base of competent sandstones and limestones and the top of incompetent shales are sensitive for the start and development of such structures.

Drainage pattern in the area is well-integrated but of variable density, stream length, furcation, and/or uniformity. Parts are dendritic, others are trellis to subtrellis, and still others are parallel to subparallel. Lithology, structures, and relief affect the pattern and are, singularly or in any combinations in between, the cause of its local variability. Drainage lineations show higher degree of scattering than the airphoto lineations of corresponding areas. Drainage basin analysis shows significant results for the basins analyzed both on 1:500,000 and 1:100,000 scales. On the first scale, the average weighted mean bifurcation ratio (Wrb) of the 23 basins analyzed is 3.02, average drainage density (Dd) 0.65, and average stream frequency (Fs) is 0.09. On scale 1:100,000, the corresponding values are 3.86 (Wrb), 1.7 (Dd), and 0.86 (Fs) respectively.

Structures particularly faults affect the multivariable aspects of the geology of the region. The Wadi Araba Structure is looked at as a faulted plunging anticline or a system of dragged and/or tilted fault blocks and scarps. The writer subscribes to the second alternative. The major lineation trends reported in the present study are believed to have been produced mechanically by a north-south stress. The minor trends present may be a result of a change in the stress direction (little bit to the west; i.e. 10° or 15°) or being second or third order echoes of the major trends. The writer believes that the pattern is very old and has its roots in the Precambrian times. But, its trends were differentially activated or subdued at different times since then particularly in Tertiary times related to the rift tectonics of the Red Sea.

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