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THE TECTONIC PATTERN OF GABAL MEATIQ AREA, (NORTH EASTERN DESERT OF EGYPT)

G. M. SALLOUM

SUMMARY

The Gabal* Meatiq area was studied geologically and petrographically in detail by several workers. The present study aims at the delineation of the tectonic pattern of this area. Two major tectonic cycles affected the area, these are: *the Early Proterozoic,* characterized by the deposition of pelitic, calcpelitic and arenaceous sediments accompanied by the eruption of some volcanics. These formations were metamorphosed, migmatized and granitized to the amphibolite facies. Such conditions prevailed in the Protoplatforms, relicts of which are now preserved as Median Masses.

The second tectonic cycle predominated during the *Late Proterozoic* during which an euogeosyncline developed. The tectonic evolution of this euogeosyncline included two stages. The Typical Geosyncline stage, which according to the rock types formed and the tectonic movements affecting them can be differentiated into three phases.

The second stage is the Orogenic Epigeosyncline, which again includes two tectonic phases. The orogenic epigeosynclinal stage continued during the lower Palaeozoic as evidenced by the presence of conglomeratic bands unconformably overlying the red-biotite granites of Um Had at Wadi** Umm Hassa. These conglomerates are believed to be Lower Palaeozoic in age.

TECTONIC PATTERN

Gabal Meatiq area was mapped geologically by NOWEIR [1968], DARDIR *et al.*, [1971] and SHAZLY [1971]. The present author, in an attempt to construct the tectonic pattern of this area was able to delineate two major tectonic cycles affecting it: The older cycle is of Early Proterozoic and was represented by the deposition of pelitic, calcpelitic and arenaceous sediments with the eruption of some volcanics. These rock formations were metamorphosed, migmatized and granitized to the amphibolite facies. The domal structure of Gabal Meatiq was formed at that stage. Such structural conditions are specific to the protoplatforms [PAVLOVSKY and MARKOV, 1963]. The second younger cycle predominated during the late Proterozoic times, it is characterised by the development of a geosynclinal system and the deformation of the older Early Proterozoic structures. The tectonic characteristics of this cycle indicate that, it pertains to the euogeosyncline type. The preserved relicts of the Early Proterozoic within the Late Proterozic euogeosyncline are the *Median Masses* [EL RAMLY and SALLOUM, 1974]. The gneisses of Gabal Meatiq and Gabal Umm Had are considered as median masses. During the tectonic development of this euogeosyncline, two stages can be distinguished as follows:

The first stage is a *typical geosyncline* whereas the second is an *orogenic epigeosyncline.* Based on the rock types formed and the activity of the tectonic events, the typical geosynclinal stage can be differentiated into three tectonic phases. During

* Gabal = Mountain.
** Wadi = Valley

the *first tectonic phase,* a differential subsidence took place with the deposition of pelites, marls, silts, sands, grits and conglomerates. Coarse grained sediments predominate near the borders of the Median Masses (along the south western border of Gabal Meatiq Median Mass). Actually the Median Masses represent areas of source materials to the eugeosynclinal troughs from which they are seperated by deep-seated faults. Admittedly, these faults were not so deep in the earth's crust and that is why the magmatic activity which accompanied these faults was of limited extent. During the *second phase,* tensile stresses predominated, resulting in the rejuvenation of the previously formed deep-seated faults and the development of new faults. Accordingly, the area was faulted into a number of blocks which were differentially depressed. The deep-seated faults, also extended to greater depths in earth's crust and probably reached the upper mantle, as indicated by the development of basic, intermediate and acidic volcanics. Basic and intermediate volcanics predominate in Wadi Kariem and Wadi Abu Diwan areas, whereas the acid varieties are best developed in Wadi Atalla and Wadi Asal areas. The section, in general, is composed or intercalations of quartzite, quartz sericite and chlorite schists with few layers of jasper and magnetite-hematite bands. In the area situated to the north of Gabal Meatiq, arenaceous sediments predominate with minor pelites and acidic volcanics. This area might be considered as a shelf and represents the comparatively shallow marine continuation of the Meatiq Median Mass. It was not subjected to intensive depression or faulting and it may occupy and intermediate position between the elevated Median Mass and the highly depressed geosynclinal troughs. At the borders of this intermediate phase, deep-seated faults extended to their maximum depth in the earth's crust as indicated by the intrusion of ultrabasic ophiolitic masses along them. During *the third tectonic phase,* the area was uplifted, thrusted and deformed. The folds formed are of the linear type, asymmetric and usually complicated by faults. The trend of the fold axes is mainly NW, but sometimes they are submeridional, NE or sublatitudinal [EL-RAMLY and SALLOUM, 1974], this producing block faulting. The fold structures located close to the borders of the Median Masses are highly compressed and their limbs dip at angles of about 80°—85°, sometimes the folds are overturned. On the other hand, the fold structures in the geosynclinal troughs have submeridional, sublatitudinal or NE trends and are of the brachy type, their limbs dip at angles ranging between 15° and 50°. The process of folding was accompanied by the metamorphism of the country rocks up to the green schist facies [AKAAD and EL-RAMLY, 1960], then followed the intrusion of gabbros, diorites-granodiorites and granites.

The Orogenic Epigeosynclinal stage, includes two tectonic phases: The first phase began with the uplifting of the area under consideration, accompanied by the rejuvenation of the previously formed deep-seated faults and the formation of the *Intermountaine basins* of Wadi Hammamat, Wadi Karim and El Quei (see the map) The Hammamat basin is the largest in the area. There, the section is composed of shallow water sediments including sands, clays and grits. The presence of minor bands of chemical sediments in some parts of the section may indicate that the palaeogeographic conditions were favourable for their formation. The relief was more or less uniform. Such conditions were prevailing at the base of the section. Tectonic movements resulted in the deepening of the basins and the relief became remarkably contrasted. This resulted in the formation of coarse-grained sediments including a thick section of conglomerates. The field description of the Hammamat section, shows that, it is of the transgressive terrigenous type and that the basin was formed before the relief became contrasted. The area of Wadi Hammamat and the neighbouring areas were uplifted and subjected to partial erosion. In the Eastern part of the

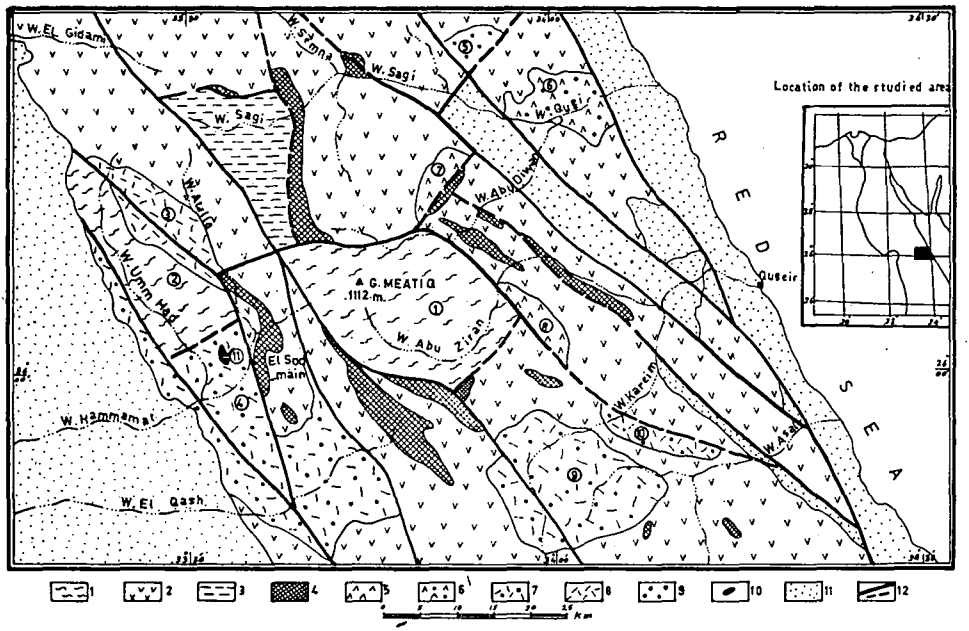

Fig. 1. Tectonic map of Gabal Meatiq area (by G. M. SALLOUM, 1980)

LEGENDS

1 — Median Masses.
2 — Geosynclinal troughs filled with terrigeneous and volcanogenic rocks.
3 — Geosynclinal troughs filled with terrigeneous and volcanogenic-siliceous rocks.
4 — Massives of serpentinized ultrabasic rocks.
5 — Intermountaine basins filled with Dokhan-type effusives.
6 — Intermountaine basins filled with molasse and Dokhan-type effusives.
7 — Intermountaine basins filled with molasse and Atalla-type effusives.
8 — Intermountaine basins filled with Atalla-type effusives.
9 — Intermountaine basins filled with molasses.
10 — Upper Paleozoic (?) sediments.
11 — Meso-Cenezoic sediments.
12 — Main zones of faulting and inferred zones (dotted lines).

Numbers in circles on the tectonic map refer to the name of tectonic zones.

Median Masses

1 — G. Meatiq
2 — G. Umm Had

Intermountaine Basins

3 — Atalla
4 — Hammamat
5 — Sagi
6 — Quei
7 — Abu Diwan
8 — Abu Ziran
9 — Karim I
10 — Karim II
11 — Umm Hassa

area thick volcanic piles were accumulated specially along the zones of deep-seated faults. These volcanic piles are of an intermediate composition at their lower parts, but they become acidic upwards with some thin intercalations of conglomerates, indicating breaks in the volcanic activity. The Wadi Atalla volcanics pertain to the acid types [SCHURMANN, 1953; AKAAD and EL-RAMLY, 1960]. They are most probably equivalent to the acidic volcanics in the Hammamat area, as they are controlled by the same zones of deep seated faults.

In the Atalla Intermountaine basin, the outpouring of molten material took place before the formation of the basin itself, this assumption is based on the fact

that, the Atalla volcanics lie directly on the basement rocks with the absence of the molasse formations. It is believed, that the Abu Diwan and Abu Ziran Intermountaine basins which were filled with the Dokhan volcanics, were formed under similar tectonic conditions.

The section of Wadi Sagi Intermountaine basin, situated in the north-eastern part of the area (see *Fig. 1*), is composed of regressive terrigenous sediments. It began with very coarse grained sediments and ended with fine terrigenous sediments. Accordingly, it is possible to conclude that this basin began its development after the uplifting movement took place. In one way or the other, the sediments of this basin may be compared with those of the Hammamat basin.

Generally speaking, the Intermountaine basins were formed at different ages and were filled with a variety of rocks including molasse sediments, acidic, intermediate volcanics or combinations of such rocks. They are controlled by deep-seated faults, along which tectonic movements took place and magmatic materials were outpoured.

At the end of this phase, differential movements stopped and the intermountaine basins ceased to develop.

The second tectonic phase, began with the deformation of the previously formed sediments within the intermountaine basins. This deformation was accompanied by slow uplifting and the intrusion of granites essentially hornblende-biotite granites, followed by the intrusion of biotite and leucocratic granites. The fold structures formed within the intermountaine basins are always oriented parallel to the general trend of the basin itself. Thus, the folds have different trends as the basins are oriented in different directions. The angles of dip of the limbs of the folds range between 20° and 40°, but, the fold limbs of the structures situated close to the zones of faulting have angles of dip ranging between 70°—86°. Deep-seated faults played an important role during the tectonic development of the Late Proterozoic eugeosynclinal system.

The Orogenic Epigeosyncline system, continued during the Lower Palaeozoic time and its rocks now form part of the platformal structure of the Eastern Desert of Egypt.

In Wadi Umm Hassa, a small exposure of coarse-grained conglomerates unconformably overlies the red-biotite granites, which were intruded during the orogenic stage (probably Late Proterozoic). These conglomerates were formed under uneven rugged paleotopographic conditions. They are most probably, of Lower Palaeozoic age.

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DR. G. M. SALLOUM
17, Ahmed Siddik Str., Flat 9
Sidi Gaber — Alexandria
Egypt