GEOLOGY OF THE SOUTHERN HEBRON MOUNTAINS

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Introduction

The geology of the southern part of the Hebron Mountains with surrounding foothills has been covered during the mapping of the Eshtemoa and Har Hazzon, 1:50,000 sheets (15–I; 15–2; Gilat, 1977, Gilat, in preparation). The area extends from the southern outskirts of Hebron in the north, to the northern foothills of the Negev in the south, and from the Shefela foothills in the west to the Judean Desert in the east.

The mountains are drained mainly by the Hebron, Eshtemoa, and Einim valleys, flowing from NE to SW into the Beer Sheba Basin. The main structural feature is the Hebron anticline which exposes Cenomanian-Turonian strata, surrounded in the west, south and east by Turonian-Neogene rocks.

Previous geological mapping was carried out at a scale of 1:250,000 by Bentor *et al* (1965) and Bender (1968). The NE part of the Eshtemoa Sheet in the Ziqlag area was mapped by Golick (1959) at 1:20,000. Sherman (1963) published a geological and a structural map at 1:10,000 and 1:20,000 of the Tsiah area. Aizin (1965) mapped the southern part at 1:20,000 and Kolton (1972) mapped the area north of the Har Hazzon Sheet at 1:20,000.

STRATIGRAPHY

The Judea Group (Fig. 1)

Albian

The upper part of the Albian sequence is exposed in Wadi Hirase in the NW part of the area. It is represented by the upper Kessalon Formation which appears as a cliff, and is built of 26.5 m of very hard, massive, sublithographic limestone, fossiliferous and dolomitic in places. Quartzolite lenses are present.

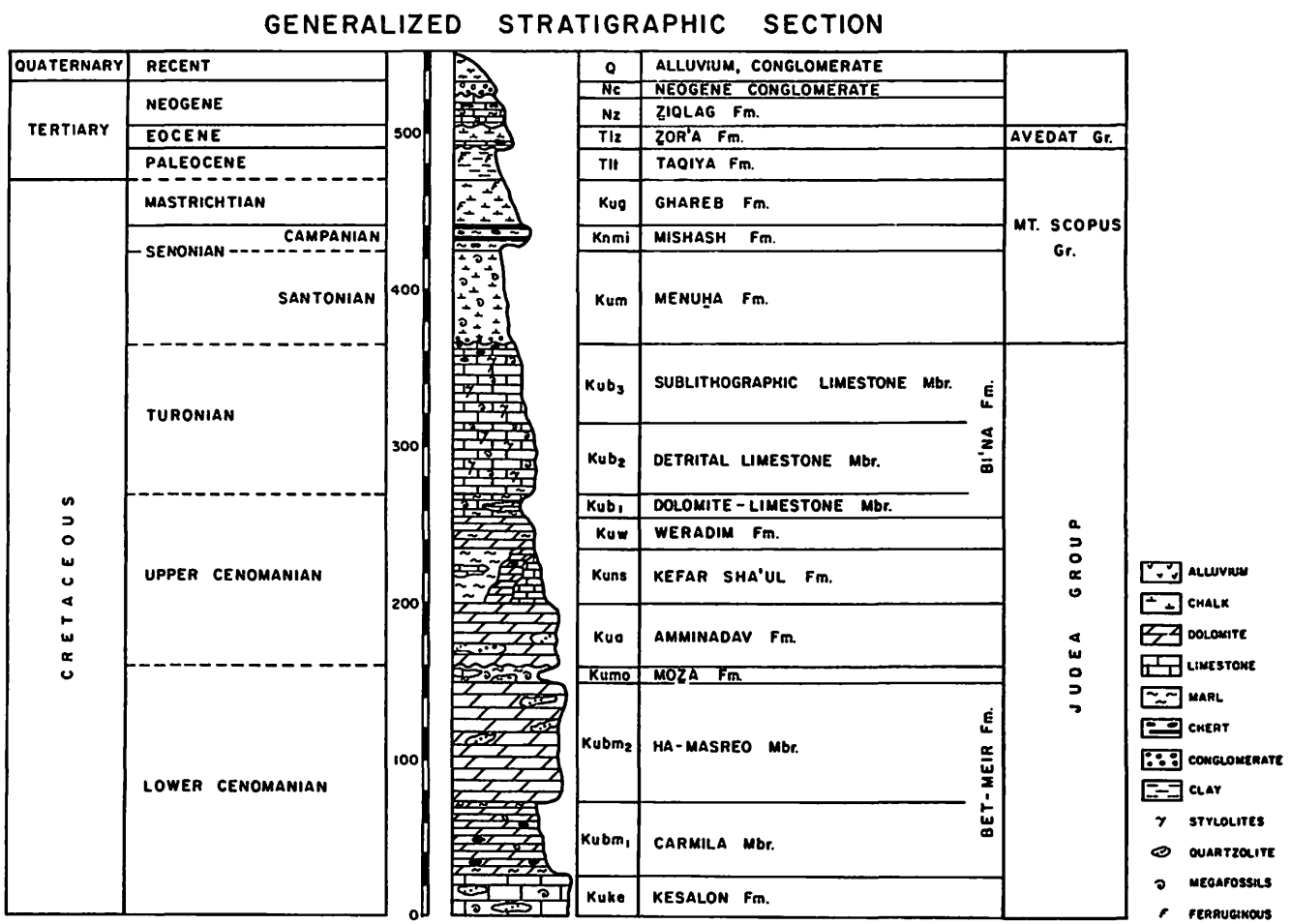

Fig. 1. Generalized stratigraphic section of the southern Hebron Mountains.

Cenomanian

The Lower Cenomanian Beit Meir Formation is exposed near Al Madjid and Al Fawar in the NW of the area, and a small "window" is exposed in Wadi Arabza in the S. The formation is well divided into a lower, marly Carmilla Member, which consists of 47.5 m of white, calcitic dolomite with interbedded marl, concretions of chert and quartz druzes, and the cliff-forming Hamasreq Member consisting of 76.5 m of very hard, uniform clastic limestone, in places dolomitic, porous, and with lenses of quartzolite.

The microfossils (determined by H. Frenkel), appear to be equivalent to those of biozones MG-1 to MG-4 (Arkin and Hamaoui, 1967) of the Negev.

This rock sequence is topped by 6.5-13.5 m of marl, with some interbeds of fossiliferous limestone and clay, of the Moza Formation. It is an important aquiclude in the subsurface, and at the surface, it is often followed by a spring line.

The Upper Cenomanian is the 35-46 m thick dolomite of the Aminadav Formation, which unconformably overlies Moza marl, and is conformably overlain by a limestone-soft dolomite sequence of the Kfar Shaul and Weradim formations. These vary considerably in thickness and are accompanied by facies changes over short distances. Karst, microkarst and nari are well developed. Their total thickness is generally less than 50 m.

Cenomanian-Turonian

The overlying Bina Formation is widely distributed over the south Hebron Mountains and is covered by younger sediments only in outlying areas. It consists of a marly, cave-forming lower member, and sublithographic limestone upper members. It reaches 120-140 m in thickness in the anticline and ranges from 40-80 m on the flanks.

The thickness of the exposed Judea Group is 300-360 m, a dramatic reduction from the 750 m very common in the monocline to the north of Hebron. The rocks are generally more limy than their dolomitic equivalents of the Jerusalem area.

Mount Scopus – 'Avedat – Saqiye Groups

Senonian

The Senonian sequence envelopes the main structure to the west, south and east, and is represented by white chalk (10-80 m) of the Menuha Formation; massive chert with some beds of marl with chert concretions, but almost no phosphorite (7-20 m total thickness) of the Mishash Formation; and to the west and south by less than 50 m of iron-stained argillaceous chalk of the Ghareb Formation (partly metamorphosed in the Beer Sheba basin and the Judean Desert by the "Hatrurim event").

Paleocene

The Paleocene, mostly Danian sediments of the Taqiye Formation consists of 27 m of greenish-grey gypsiferous clay with scattered limonite concretions. It is also partly metamorphosed with the Ghareb Formation.

Eocene

The Zohar Formation, mainly of Middle Eocene age, is exposed only in the NW corner of the area and consists of 160 m of chalk, in part opalized, with chert concretions and some sublithographic limestone beds. A well developed micro-landscape of caves, as well as thick nari-calcrete crust, is typical of these rocks.

Neogene

Marine limestone and conglomerate, cemented by intrabiomicrudite, very rich in Miocene fossils, is exposed in the NW of the area. The maximum measured thickness is 50 m, where it dips 18°NW, overlying the Bina Formation which dips 30°NW.

Abundant conglomerates of Neogene age (Beit Nir and Yattir formations) are found to the west, south and east of the anticline at elevations ranging from 400 to 650 m on the western flank of the monocline, from 390 to 650 m on the southern plunge, and from 550 to 650 m on the eastern flank. In the area of Har Aristobolija, these conglomerates reach an elevation of 850 m.

Quaternary

Quaternary sediments including eluvial, eolian, proluvium-deluvium, coluvial, and alluvial deposits are found throughout the mapped area. Their differentian is based on genetic-lithological considerations without reference to age. These sediments are found in appreciable quantities in valleys and on the northern extention of the Beer Sheba Basin.

Structural Geology

The dominant structure is the southern plunge of the Hebron Anticlinorium which stikes 20°NE. It is surrounded by the Lakhish syncline to the west, the Beer Sheba syncline to the south, and by a very large structural terrace of the Judean Desert to the east.

The southern plunge of the anticlinorium is nearly a symmetrical superstructure, with very steep monoclinal flexures to the WNW and ESE (up to 25-50°). It consists of three major anticlines (Hebron, Bani Naim, and Har Einim); their axes trend NNE-SSW and structural elevation reaches 930-1030 m. Two promi-

nent synclines (Beit Amra and Eshtamoa) have similar trends with dips of 3-8°, and seperate the anticlines.

Three main directions of faulting are recognized in the area (Gilat, 1977, Gilat, in preparation):

1. Faults trending NNE-SSW, two of which follow the flanks of the main structure, are 5-7 km long with a displacement of 20-40 m, and one very large lineament (~70 km long), that passes through Mizpe Shalem, Wadi Al-Var, Nahal Einim, and dissapears under the young sediments of the Negev. This lineament is difficult to recognize in the field, but is easily traceable on satelite images. It is accompanied by numerous tension gashes with a N-S trend, and by very large scale dolomitization of the Upper Cretaceous country rocks.
2. Faults trending N-S with displacements of 20-50 m and 3-6 km long.
3. Faults trending NNW-SSE, 3-7 km long, with displacements of 20-50 m.

The Hebron monocline is part or the Syrian arc system formed by an uplifted block of the basement, and its throw is probably comparable to the uplift of the monocline (Reches *et al*, 1980). The tectonic deformation was initiated in Triassic-Jurassic times, but was mainly shaped during two phases, Senonian to Eocene, and Late Miocene to Recent. The tilting and timing of the last phase is indicated by the structural unconformity (Ziqlag-Bina formations) on the flank of the main structure (Gilat, 1978).

Raw Material Potential

The mineral potential in the area is at present restricted to underground water supply and to raw materials for the building industry.

Confined and perched aquifers in the southern Hebron Mountains are known within the Lower Cretaceous Kurnub Group (thickness 400-700 m) and within the overlying Upper Cretaceous Judea Group (thickness 530-630 m). The Judean aquifer is considered to be the main aquifer in the area. Its exploitation to date is approximately 1.3 x $10^6 m^3$. The annual replenishment is, however, between 30 and 60 x $10^6 m^3$ (Gilat and Arkin, 1978). Its waters belong to the bicarbonate group.

Present exploitation of building raw materials may be seen in the quarrying of sublithographic limestone and of dolomite for aggregates on an extensive scale. Reserves of the limestone a very large in the vicinity of the villages Jaffa, Eshtamoa, and to the south, and could form the basis of a "marble" industry. Very extensive reserves of hard grey dolomite (dolomitized Bina Formation) are located near Har Amasa and several kilometers to the NE, as well as in the Wadi Al-Var area. Various rock types have potential for use in the cement industry.

During the past year, metallic mineralization phenomena which accompanies the dolomitization on the eastern flank of the Hebron Anticlinorium, as well as in the Judean Desert, were initially examined (Gilat, 1980), and related to major fault zones. They may have resulted from hydrothermal replacement activity in an area of more than 20 km^2. The affected rocks exhibit brecciated epigenetic dolomite, with black calcite veins, having high contents of Mn, Ba, Pb, and traces of Ag. Geochemical prospecting is planned.

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