GEOLOGY OF THE ARIEF-BATUR LINE–MA'ALE HAMEISHAR ZONE

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Introduction

Geological mapping at a scale of 1:20,000 has been carried out in the the Ma'ale Hameishar area, between the faults of Makhtesh Ramon in the north, Meishar in the south, coordinate 140 (Israel grid) in the west, and coordinate 160 in the east.

STRATIGRAPHY

Rock units of Lower Cretaceous to Recent age are exposed in the mapped area. The recognized lithostratigraphic units are briefly described below.

Kurnub Group

Hathira Formation

Variegated sandstones of the Hathira Formation are exposed in the cores of the highest structures in the Nahal Hameishar area. Maximum thickness of the formation is 30 m.

Judea Group

Hazera Formation

The Hazera Formation of Albian-Cenomanian age has a mean thickness of 300 m in the studied area. The lower members (Hevyon, En Yorkeam and Zafit) build the slopes of most of the deep wadis that cross the area (especially Nahal Hameishar and Nahal Neqarot). The upper members (Arnon and Tamar) build the upper cliffs of these wadis, and the Hadav plateau which lies between the Ramon and Areif lineaments. The Hazera Formation is built mostly of carbonates and clays, and lies conformably on the Hathira Formation with a few layers of glauconitic sand at its base.

Ora Shale

The Ora Shale of Turonian age is exposed in the Govai Mountains, and at the base of the "Badad anticline" (which parallels the Areif lineament in this area). The thickness reaches 65 m. It is built mainly of marls and limestones and forms soft broad slopes, with a conspicuous cliff (Vroman Bank). It overlies the Hazera Formation in a slight erosional unconformity.

Gerofit Formation

The Gerofit Formation of Upper Turonian age is exposed over large areas south of the main fault and flexure. Its thickness varies between 75 and 115 m, and it is built mainly of limestone and dolomite. The formation lies conformably on the Ora Shale. Its upper part has been truncated in places due to a pre-Senonian uplift and therefore the younger Zihor and Menuha formations unconformably overlie the Gerofit Formation.

Zihor Formation

The Zihor Formation of Upper Turonian-Coniacian age is exposed south of the main fault where its thickness varies from 0 to 40 m.The formation thickens southward and westward, and wedges out toward the north and east. It is built of limestones and marls rich in fauna in its lower part and of dolomites in its upper part. In places, the formation overlies the Gerofit Formation conformably, and locally, in an erosional unconformity. In the latter case, the base of the Zihor Formation is marked by sandstones filling relief, and the underlying Gerofit Formation is jointed.

Mount Scopus Group

Menuha Formation

Menuha Formation of Santonian-Lower Campanian age is exposed south of the main fault. Its thickness generally varies from 40 to 80 m; in the vicinity of erosional channels (close to Har Massa) it thins to 20 m. The formation is mainly chalky with a fauna-rich marl layer. It generally overlies the Gerofit and Zihor formations conformably. However, a local unconformity is marked by a conglomerate built of chert pebbles with a green argillaceous envelope.

Mishash Formation

The Mishash Formation of Campanian age is exposed mainly in the southern part of the area. Its thickness varies from 26 to 125 m (south of the mapped area). The formation is built of massive chert in its lower part and of alternating chert, chalk, phosphorite and limestone in its upper part. Lateral changes occur in this part due to syntectonic sedimentation. Phosphorite thickens and is enriched in synclinal areas (Har Massa syncline). On the other hand, truncation has occurred in the higher structures, with the formation of an unusual bioclastic limestone lens which occurs near the lower part of the formation in a angular unconformity (Fig. 1).

Ghareb and Taqiye Formations

The Maastrichtian-Paleocene formations are exposed only in the Har Massa syncline, varying in thickness from 0 to 90 m. Thicker sections are known from drillholes in the structurally low areas. They are composed mainly of marly chalk and marl, with gypsum and limonite concretions. They unconformably onlap the Mishash Formation with a layer of ferruginous phosphorite at their base. Field relationships between the various units in the Har Massa syncline are shown in Figure 2.

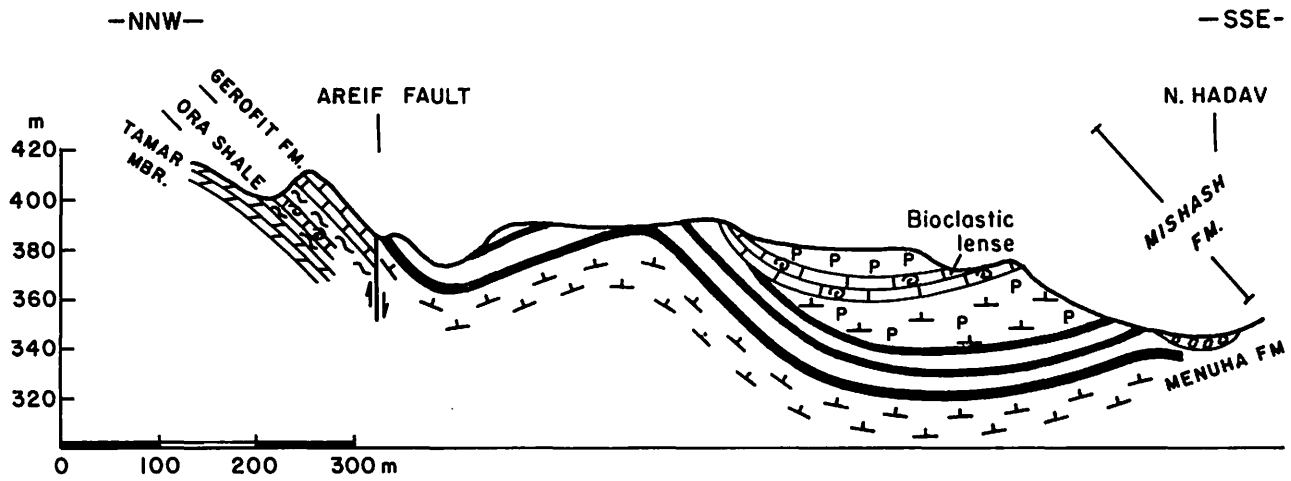

Fig. 1. Cross section through the Nahal Hadav structures.

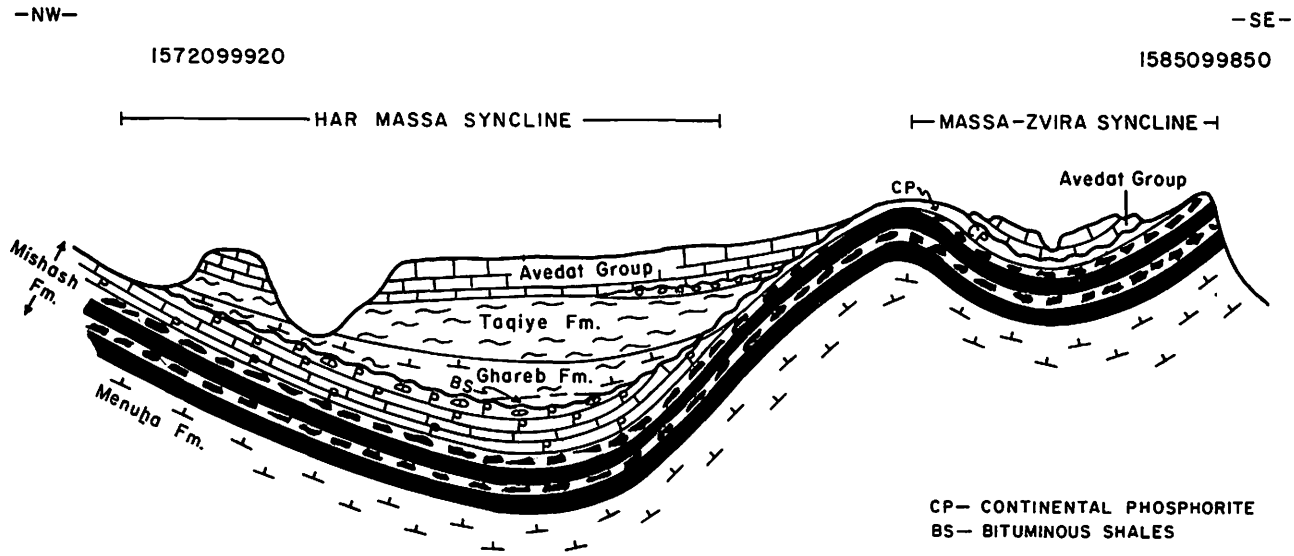

Fig. 2. Schematic cross section through the Har Massa and Massa-Zvira synclines.

Avedat Group

Mor Formation

The Mor Formation of Lower Eocene age is exposed in the lower parts of the Har Massa syncline where its thickness varies from 0-10 m. It consists of chalk with a few beds of chert nodules.

Paran Formation

This formation of Lower-Middle Eocene, is exposed in the vicinity of Har Massa. It is 95 m thick and composed of limestone and chalky limestone with limonite, and is rich in glauconite in its upper parts. It conformably overlies the Mor Formation where the latter is present, and forms an unconformity in the latters absence in structurally high areas (Fig. 2).

Matred Formation

The Matred Formation (termed the "Eshboren" Member of the Matred Formation by Benjamini, 1979) is of Middle-Upper Eocene age. It conformably overlies the Paran Formation, and is built of massive limestone locally rich in nummulites. Karstic caves are common. Its top is eroded, and the maximum thickness is 37 m.

Hazeva Formation

Conglomerates related to the Arava Conglomerate are exposed in the area as three different facies: 1. Hameishar Facies - limestone and chert pebbles, the latter from distal sources, are rare. Exposures of this facies are semi-continuous from Har Areif (where it occurs at a topographic high of 600 m) to the northern part of the Meishar (at an elevation of 430 m). This facies is similar to that of the Arava Conglomerate filling the Karkom basin. 2. Nahal Neqarot Facies - this consists of pebbles similar to those in the present-day valley, but occurring some 20-40 m above the riverbed. They are apparently relicts of the ancient Nahal Neqarot sediments which

filled the same drainage system. 3. "Channel" Facies - well rounded, exotic pebbles, locally with large boulders, fill a channel in rocks of the Judea Group close to Nahal Hameishar south of the main fault.

Structural Geology

Three main elements form the structural pattern of the mapped area:

1. Areif-Bature fault: This fault is part of the Negev-Sinai shear zone. It was mapped in the present work between Ma'ale Hameishar to Har Massa. It is a right lateral strike-slip fault, indicated by the direction of secondary structures and by the sense of movement on joints sub-parallel to the main fault. The amount of movement was calculated by measuring the shortening in structural cross-sections parallel to the fault which in the measured area has an en echelon pattern. The result was 250 m. Stratigraphic evidence suggets movement during the Neogene.
2. Mezad-Neqarot Fault: This fault trends N-S to N20E; it joins the Areif fault in the south, and almost reaches the Ramon fault in the north. It is sinistral strike-slip, with 170 m movement measured from sub-horizontal slickensides. It is also Neogene.
3. Badad Anticline: The anticline has a moderately dipping northern flank, and a steep flexure to the south which parallels the Areif and Mezad Neqarot faults.

The trends of the two main faults are not ideally oriented for a conjugate set of strike-slip faults. However, evidence for Senonian activity along parts of these faults,suggests that they are rejuvinations of one or more lines of weakness which could explain the geometric relationship between them. Movement on two sets of joints which are parallel to the main faults, suggest that the latter are contemporaneous.

Geological History

Lower Cretaceous to Coniacian – sedimentation of all units in relatively stable conditions, with no tectonic activity.

Coniacian to Lower Eocene – this period was characterized by the formation of fold structures along the Har Gevim-Har Massa-Nahal Hadav line (proto Areif-Bature line); erosional channels at base of Menuha Formation; truncation and variation in thickness in Mishash Formation and angular unconformities between the Mishash and overlying formations.

Lower-Upper Eocene – a tectonically inactive period of sedimentation of the Avedat Group (Arava and southern Negev facies).

Neogene-Recent – red sandstones filled relief formed due to post-Eocene uplift; faulting on the two main faults accompanied by folding and formation of the Badad anticline.

References

Benjamini, C., 1979. *The Geological History of Central and Southern Israel During the Eocene.* Unpub. Phd thesis, Hebrew Univ., Jerusalem, 2 vols., 83 p. (in Hebrew).

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REGIONAL STRATIGRAPHY OF ISRAEL: A GUIDE TO GEOLOGICAL MAPPING

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The present version of the regional stratigraphy of Israel is based on the lithostratigraphic units accepted and mapped today. These units are defined, in most cases, according to the International Code of Stratigraphic Nomenclature for the establishment of Groups, Formations and Members.

In special cases, names have been retained (although not valid), because of common use. Most of the units presented herein have been published in geological maps of Israel on a scale of 1:100,000 and 1:50,000.

The chart is not intended as a correlation table but only as a compilation of the stratigraphic sequence exposed in the geographic regions mentioned, i.e., Sinai, Southern Israel, Central Israel, Northern Israel, and the Golan. However, in the setup presented, the reader will be tempted to carry out his or her own correlation. In cases where such a correlation is not obvious, the reader is advised to refer to the list of sources given below.

The color and stratigraphic symbol which will be