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GEOLOGY OF THE AREA NORTH OF YOZGAT (NORTH CENTRAL TURKEY)

BY

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RÉSUMÉ

Des sédiments Crétacés et Tertiaires, ainsi que du mélange ophiolitique et des roches volcaniques plus jeunes affleurent au N de Yozgat. Des études micropaléontologiques, à l'aide surtout des Foraminifères planctiques furent nécessaires afin de donner un âge aux roches sédimentaires. La configuration tectonique actuelle est due principalement à des mouvements relativement jeunes.

ABSTRACT

Cretaceous and Tertiary sediments, ophiolitic mélange and younger volcanics outcrop N of Yozgat. Micropaleontological studies, with the help mostly of planktonic Foraminifera, were useful in order to give ages to the sedimentary rocks. The present tectonic setting is due mainly to fairly young movements.

INTRODUCTION

BAILEY and MCCALLIEN (1950, 1953) were the first to study in detail the ophiolitic mélange in this area, and named it the "Ankara Mélange". The surroundings of Yozgat were mapped by KETIN (1955) on a 1:100 000 scale. His report was further developed in the Explanatory Test of the Geological Map of Turkey, Kayseri Sheet (KETIN 1963).

DESCRIPTION OF THE UNITS

A. THE OPHIOLITIC MELANGE

The ophiolitic mélange is defined as an olistostromal and tectonic mixture of ophiolitic material and sediments of oceanic origin with exotic blocks (GANSSER, 1974). It consists in this area of serpentinites, pillow basalts, diabase dykes, radiolarites, exotic limestone blocks and beds of pink silty limestone.

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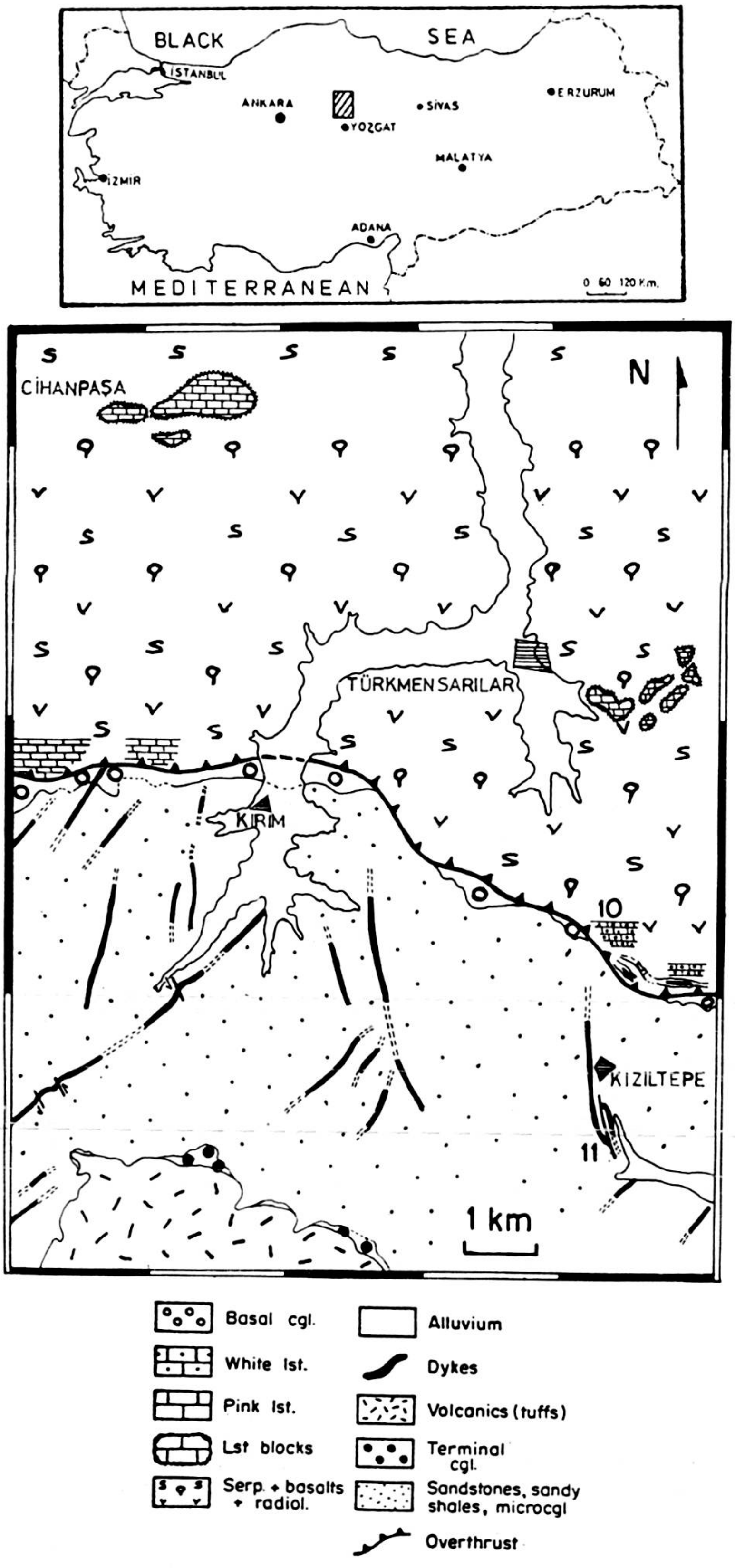


FIG. 1.—Index map and geologic map of the area of study (Yozgat i33-b1 sheet)

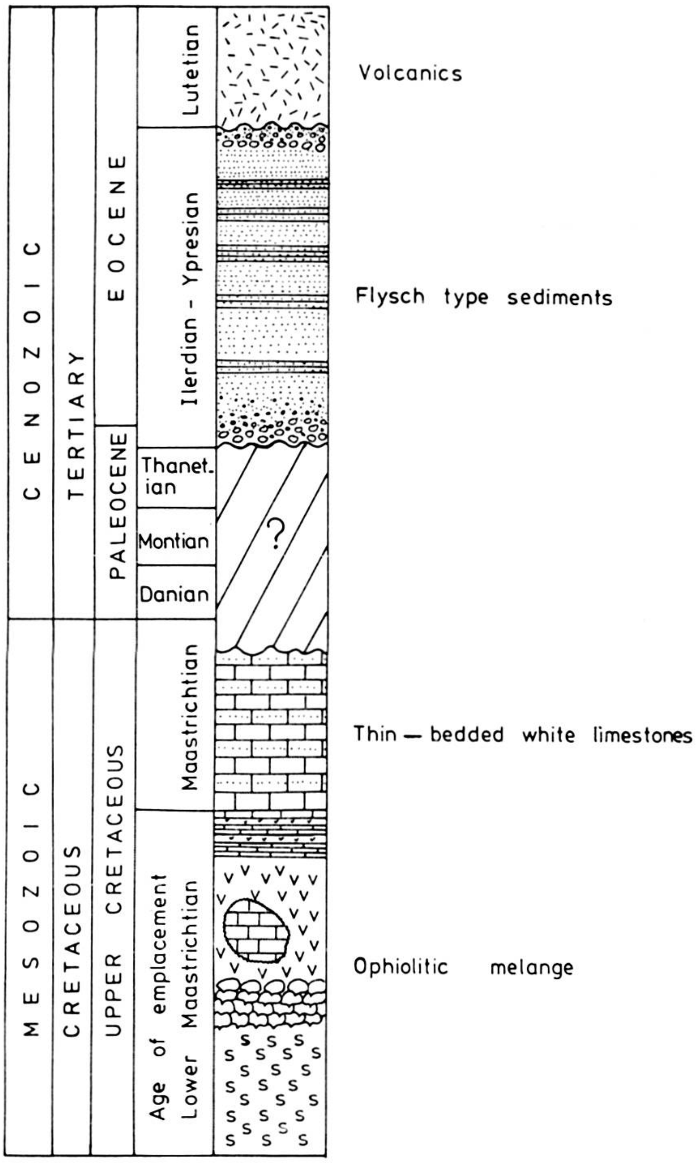


FIG. 2.—Synthetic stratigraphic section of the area of study (not to scale).

Good outcrops of serpentinite, pillow basalt and radiolarite exist along the road between Kirim and Cihanpaşa.

The limestone blocks, milky white in colour, can be particularly well observed at Cihanpaşa and W of Türkmensarilar. Limestone samples (collected mainly W of Türkmensarilar) are of grainstone type, and contain ooids. This suggests that they were formed in a shallow subtidal environment. They contain the following microfossils:

Protopeneroplis trochoangulata SEPTFONTAINE
Lithocodium aggregatum ELLIOTT
Bacinella irregularis RADOICIC
Dasycladaceae

This association indicates a Berriasian age.

The pink silty limestones are very well exposed along the overthrust line W of Kirim and on a ridge N of Kiziltepe. The pink limestone samples are the youngest sediments found in the ophiolitic mélange. N of Kiziltepe, relics of pink limestone are observed inside vesicular pillow basalts; this illustrates the environment into which the pillow basalts were erupted. The pink silty limestones are of mudstone type, and were probably formed in a pelagic environment. They contain:

Globotruncana lapparenti BOLLI
Globotruncana bulloides VOGLER
Globotruncana arca CUSHMAN
Hedbergella spp.
Heterohelix spp.
Nodosaria spp.
Lenticulina spp.

This assemblage indicates an Upper Campanian-Lower Maastrichtian age.

B. The thin-bedded white limestones

They consist of an alternation of thin beds of silty (average thickness approx. 50 cm) and sandy limestone (20 cm). They are exposed along the overthrust line and as a result of thrusting, they are intermingled with the pink limestones. The white sandy limestones show graded-bedding and contain chips of ophiolitic mélange material indicating that their deposition post-dates the ophiolitic mélange. In addition to mélange fragments, the sandy limestones also contain intraclasts of white silty limestone (which is of mudstone type). A stratigraphic normal section was measured N of Kiziltepe where a tectonic lens (Fig. 3, No. 10 on map of Fig. 1) of thin-bedded white limestones dips steeply to the N. The following microfauna was found in the sandy limestones:

Globotruncana bulloides VOGLER
Globotruncana aff. contusa (CUSHMAN)
Globotruncana fornicata PLUMMER
Globotruncana aff. gansseri BOLLI
Globotruncana lapparenti BOLLI
Globotruncana stuartiformis DALBIEZ
Globotruncana stuarti (DE LAPPARENT)

Owing to the detritic nature of the white sandy limestones, these microfossils are possibly reworked into the sediment, and hence their stratigraphic value is limited.

The white silty limestones contain:

Globotruncana arca (CUSHMAN)
Globotruncana contusa (CUSHMAN)
Globotruncana fornicata PLUMMER
Globotruncana gagnebini TILEV
Globotruncana gansseri BOLLI
Globotruncana lapparenti BOLLI
Globotruncana stuartiformis DALBIEZ
Globotruncana stuarti (DE LAPPARENT)
Praeglobotruncana citae (BOLLI)
Rugoglobigerina rotundata BRÖNNIMANN
Rugoglobigerina spp.
Planoglobulina acervulinoides EGGER
Heterohelix spp.
Heterohelix globulosa EHRENBERG
Pseudotextularia elegans RZEHAK
Nodosaria spp.

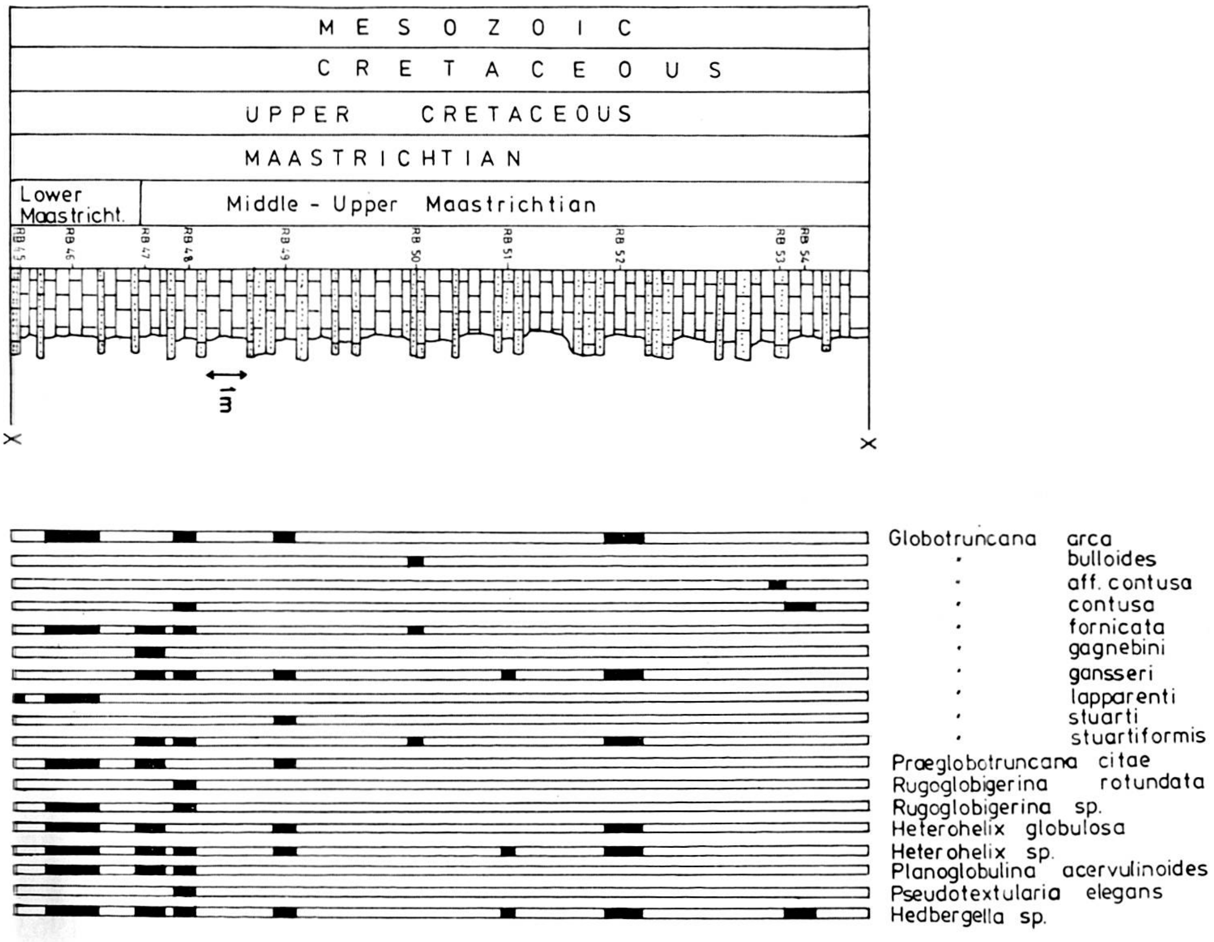


FIG. 3.—Stratigraphic section measured in the thin-bedded white limestones.

The microfauna available in the white silty limestones can be considered as giving a definitive age for this sequence. Based on the microfaunal evidence from the silty limestones in this stratigraphic section (Fig. 3), deposition began in Lower Maastrichtian times and continued till Middle or perhaps even Upper Maastrichtian; however *Globotruncana mayaroensis* was not found.

The features described in the above paragraphs suggest that the sequence of thin-bedded limestones is of turbiditic nature.

C. The flysch type sediments

They begin with a basal conglomerate, 50 to 200 m thick (KETIN, 1955; 1963).

This conglomerate is well exposed around the village of Kirim and at various places along the overthrust line. It consists of cobbles and small boulders.

The basal conglomerate is followed by monotonous layers of microconglomerate, carbonate cemented sandstone and sandy shales, 1,000 to 1,200 m thick (KETIN, 1955). Vertical and lateral changes may occur between microconglomerate, sandstone and sandy shale. Graded bedding is observed in the microconglomerates. The sandstones contain much ophiolitic mélange material and therefore may be classed as greywackes. The flysch type sediments are generally grey-green, sometimes brownish due to weathering. These layers show much parasitic folding and bedding plane slip.

The microconglomerates, sandstones and sandy shales are overlain by a terminal conglomerate 10 to 15 m thick (KETIN, 1955).

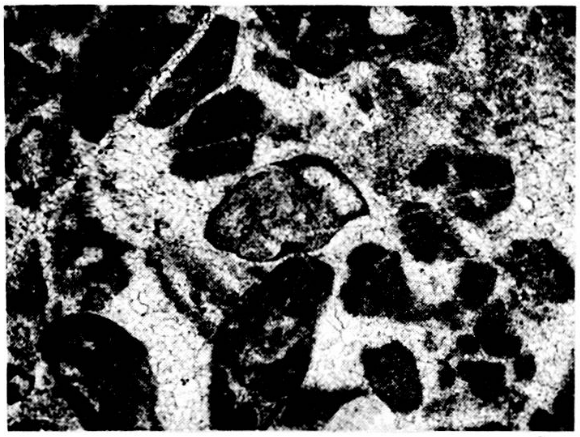
These clastic flysch sediments dip towards the N. They are overturned to the S into a recumbent syncline as a result of the overthrust of the mélange and the thin-bedded white limestones (Fig. 4).

The flysch type sediments proved to be poor in fossils. A few undetermined *Nummulites* were found along with a single specimen of *Assilina pustulosa* DONCIEUX. Sandy shales provided a few *Anomalinidae* which appear reworked. Some vegetal imprints were also observed. The above fossils indicate a Lower Eocene age. An Ilerdian-Ypresian interval may be defined on the basis of the occurence of *Assilina pustulosa*, but owing to the possibility of reworking, it should be noted that these sediments could be younger. K/Ar dates (see below) of diabase dykes cutting the flysch type sediments indicate that these sediments are Lutetian or older.

D. The volcanics

They are of two types: basaltic and andesitic tuffs and agglomerates, and diabase dykes which cut the flysch type sediments.

The age of volcanic activity was shown to be Lutetian by KETIN (1955, 1963; 1966). This was confirmed by K/Ar measurements carried out at the Depart-



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2

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6

PLATE 1

1. *Protopeneroplis trochoangulata SEPTFONTAINE*
   approx. ×45
2. *Lithocodium aggregatum ELLIOTT*
   approx. ×30
3. *Globotruncana lapparenti BOLLI*
   approx. ×120
4. *Globotruncana stuarti (DE LAPPARENT)*
   approx. ×45
5. *Globotruncana bulloides VOGLER*
   approx. ×45
6. *Globotruncana aff. contusa (CUSHMAN)*
   approx. ×110

Photos 3 to 6 are from samples from the white sandy limestones.

ment of Mineralogy of the University of Geneva, which gave the following results:

Sample (WR)	%K	$^{40}Ar_{RAD}nl/g$	$\%^{40}Ar_{RAD}$	Age ($\pm$2 S.D) M.y.
1. RB 41	1.824	3.135	65.0	44 $\pm$ 6
2. RB 71	1.342	2.272	44.9	43 $\pm$ 8

Average age = 43 $\pm$ 5 M.y.

Analyst: H. A. F. De Souza.

1. RB 41: SE of Kirim, SSE-NNW trending dyke cutting the flysch type sediments. Olivine basalt with intergranular and trachytic texture. Quite fresh.
2. RB 71: S of Kirim, basalt with large Augite phenocrysts. Basalt was found within the tuffs. Quench texture due to fast cooling.

The tuffs are white to dark yellow, occasionally light purple. They are highly altered, and lie unconformably over the flysch type sediments. Two dominant directions are observed for the dykes cutting the flysch sediments, namely SW-NE and SSE-NNW. No intersection between these two directions was found and their relative ages are unknown. These dykes can often be followed over long distances as they form most of the ridges and hilltops in this area.

TECTONIC OBSERVATIONS

A N-S overthrust of Late Oligocene or Miocene age (ARIKAN, 1976) pushes the ophiolitic mélange and the thin-bedded white limestones over the flysch type sediments. The thrusted rocks locally cover the flysch basal conglomerate.

The axis of folds in the flysch type sediments is mainly E-W, with variations to NW-SE and NE-SW.

CONCLUSIONS

Mesozoic and Tertiary tectonic evolution in this area of Turkey was complicated because of continental collision and subsequent deformation. Detailed sedimentological and paleontological studies are the only way to improve our understanding of this tectonic evolution. Micropaleontological observations provided information concerning the stratigraphic position (Upper Cretaceous and Tertiary) of the sediments outcropping in this area. The structures currently observed in the field are the result of Tertiary movements. The Lutetian sediments shown by KETIN

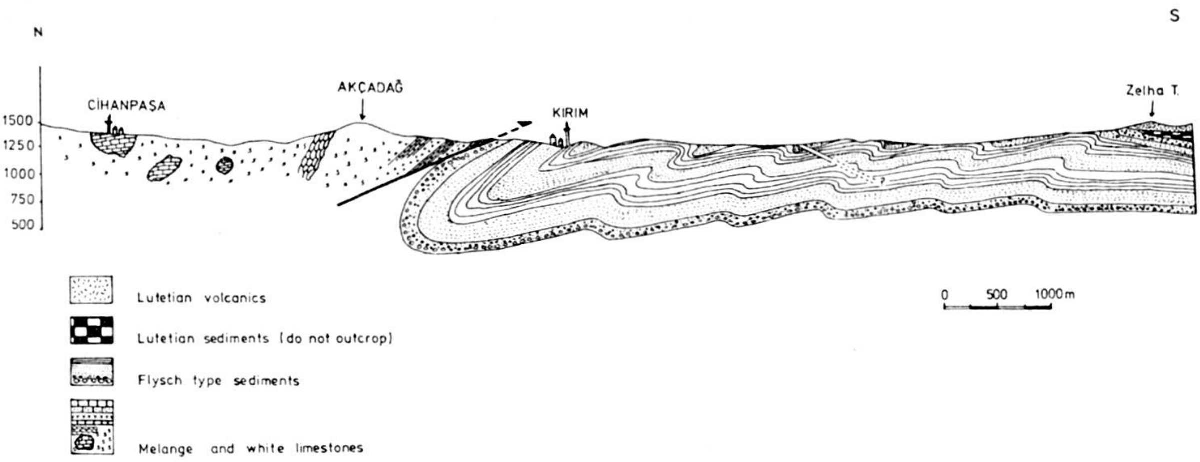

FIG. 4.—N-S cross-section through the area of study.

(1955) on his 1:100,000 scale geologic map are absent in our area of study. This area is not very promising for oil exploration unless substructures are revealed by drilling.

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