Cenub Doğu Türkiye'de Tersiyer-Kretase Hududu

Ö Z E T

Cenup doğu Türkiyede görünüşe göre devamlı bir teressüp neticesi olarak husule gelen Germav şayilleri foraminiferlerini tetkik ederken bu formasiyonun yaşı probleminin Akdeniz havzasında şimalî Afrika, Mısır, Suriye, Lübnan ve Filistinde de mevcut olması dolayısiyle bu meselenin Türkiyedeki durumu üzerinde M.T.A. laboratuvarlarında incelemeler yapılmıştır. Bu bölgede Germav formasyonu 800 metre kadar bir kalınlık arzeder. Üstünde kırmızı Gercüş formasiyonu altında bazen orbitoitli kalker bazen kırmızı yeşil tabakalar bazen de kısmen dolomitli olan masif kalker bulunmaktadır. Germav formasiyonunun iist kısmı alt Eosen alt kısmı üst kretasedir. Sahada bazı yerlerde glokonitli bir tabakanın iist kretase ile alt Eoseni ayırdığı görülür. Germavın iist ve orta kısımlarını teşkil eden 500 metrede bulunan 87 espes bir Paleosen yaşına işaret etmektedir. Buna mukabil alt Germavda bulunan 102 espes kati surette iist kretaseye işaret etmektedir. Bunlar arasında Danyen görülmediğinden ve iki grup mikrofosil arasında bariz bir fauna değişikliği olmasından Germavda Daniyene tekabül eden bir boşluk olduğuna binaenaleyh Daniyenin mevcut olmadığı neticesine varılmaktadır.

The Cretaceous Tertiary Boundary In South Eastern Turkey [1])

by A. TEN DAM[2]

I — Introduction

During the course of a study of the foraminiferal fauna from the argillaceous-marly beds of the Germav Formation in South Eastern Turkey, formation constitung the Cretaceous-Tertiary boundary, apparently deposited in continuous sedimedtation, the problem has arisen what age must be attributed to these beds. Since the same problem exists almost everywhere in the mediterranean region, as well in Egypt and French North Africa, as the other countries of the Near East, and since a definite solution of this problem is far from acquired, it seems useful to present here a short note on this problem as far as Turkey is cancerned.

The paleontological study of the argiltaceous marly beds of the Germav Formation has been executed in the Micropaleontological Laboratory of M.T.A. Enstitüsü at Ankara during the winter season of 1951-1952 by Dr. A.ten Dam. A study of the underlying massive limestones will be done by Dr. A. S. Erk.

II — Historical

Although there exists a fairly extensive literature on the Cretaceous Tertiary boundary in the Mediterranean contries and in the Near East, only a few details are known on the microfauna of these beds and even less has been published on this boundary in Turkey.

These are mainly Tromp (Lit. 1941, 1942, 1943, 1949) and, Tromp and Mehlika Taşman (Lit. 1942) who published some details on the age of the transition beds between Cretaceous and Tertiary in SE Turkey. Tromp gave

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(1)Paper presentend during the meeting of the Geological Society of Turkey on 20-23 February 1952.

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us some valuable details on age, nature, and microfauna of these transition-bads in his papers and although he certaiuly well observed the sharp boundary between the cretaceous and tertiary microfaunae, his determinations of the age of the represented cretaceous and tertiary formations have not alvays been very satisfactory, since Tromp had no possibility to do any detailed scientific paleontologic analysis. Since however M.T.A. Enstitüsü has put at our disposition an extensive micropaleontologic documentation it became important and also possible to start a detailed study of the foraminiferal faunae in the Germav Formation. It is only such a detailed study of the different species of foraminifera represented that could give us an exact idea of the age of these transition beds.

III — Geography

The Germav Formation, discussed in detali in this paper, is outcropping and has been drilled in the SE of Turkey, in the area between Diyarbakır in the W and Cizre to the E, limited in the N by the Bitlis mountains and towards the S by the Syrian frontier.

A general review of the stratigraphy in this region has been given by C. E. Taşman (Lit. 1949) and N. Egeran (Lgt. 1951).

IV — Lithology

It would be extremely difficult, if not impossible to trace the exact limit between Gretaceous and Tertiary in SE Turkey, if one had to base this on lithology only, since there is apparently no indication of a sedimentation break in the transition beds. In the field it is thus almost impossible, in most of the cases, to draw this limit.

The transition beds from Upper Cretaceous to Tertiary in SE Turkey are formed by a marly-argillaceous formation, known as Germav Formation. It is a very monotonous complex of argillaceous marls, or silty shales of grey to dark grey colour. In its upper part there are frequently intercalations of sandy shales and calcareous sandstones. Laterally this upper part of the series is interfingering with a more calcareous section, the Becirman Limestones. In the middle part of the Germav Formation we generally observe a decrease of sandy and silty intercalations, local-

ly with some thin limestone intercalations and towards the base again some sandy intercalations. The lower part of this formation is generally more uniformly shaly or silty and only occasionally shows some sandy horizons. The total thicknes of the formation may reach well over 800 meters.

The Germav Formation is overlain by redcoloured gypsiferous beds, principally composed of sandy shales and claystones, or argillaceous sands with some limestone intercalations locally. The red beds are for the greatest part certainly of continental origin, where as the limestone-beds represent marine invasions. This formation is hnown under the name of Gercüş Formation.

The Germav Formation is underlain by soft Orbitoidal limestones, which overlie red and greem marly beds or directly the massive partly dolomitic limestones.

In the fieled it is however locally possible to find a sandy glauconitic bed appoximately indicating the limit between Cretaceous and Tertiary. Whether this glauconitic bed is a constant feature or if it is only locally developed is not known with certainty .

It is clear from this short description that there is apparently no sharp indication for a sedimentation break between Cretaceous and Tertiary in the monotonous complex of grey shales of the Germav Formation, although it is possible that the locally observed glauconitic bed near that limit, represents such a break of sedimentation.

V — Paleontology and Stratigraphy

We have seen that it is extremely difficult to trace any limits in the monotonous marly series of the Germav Formation. Tromp contributed greatly to the solution of this difficulty by proving that it is possible to trace a very distinct limit in this formation separating Cretaceous from Tertiairy by means of Micropaleontology. Unfortunately Tromp has not been able to date exactly these beds, since he had not sufficient literature at his disposition to be able to make a specific analysis of the microfanuae. His method of quantitative generic microfaunal analysis is certainly satisfactory for tracing several distinctive assemblages in the

cretaceous and tertiary Germav-beds; these assemblages represent by no means different stratigraphic units, but simply facies units. Tromp considered that in the Germav Formation were included : Middle Eocene, Lower Eocene (including Paleocene), Maestrichtian, Campanian and a great part of Santonian. This stratigraphic conception is not based on any paleontologic evidence as far is concerned specific determinations and is decidedly entirely erroneous.

Since Arni's studies we know that the limestone intercalations in the Gerçüş Formation, overlying the Germav, are clearly characterised by the presence of:

CAMERINA PARVULA (Cushman) 1919

CAMERINA PRAELUCASl (Douvillé) 1924

CAMERINA RURDIGALENSIS (de la Harpe) 1926 whereas in other localities has been observed :

LOCKHARTIA CONDITI (Nuttal) 1926

This assemblage of Nummulites and Lockhartia proves us that the Gerçüş Formation cannot be considered as being younger than Lower Eocene (Ypresian), all of these species starting in the Upper Paleocene and typical for the Lower Eocene. So we must accept, that the Germav Formation is overlain by Lower Eocene (Ypresian).

Towards the base we know that the Lower Germav is overlying the soft limestones containing Orbitoides. These limestones are characterised by the presence of :

OMPHALOCYCLUS MACROPORUS (Lamarck) 1825

ORBITOIDES APICULATA Schlumberger 1902

ORBITOIDES MEDIA (d'Archiac) 1837

This assemblage of larger foraminifera is characteristic all over the world for the Maestrichtian and perhaps just still for the uppermost part of the Campanian. Tromp (Lit. 1941) tried to prove that these Orbitoids have a much larger vertical occurence, going from the Turonian up into the Maestrichtian, without any scientific paleontological evidence. Since we find in Turkey that these Orbitoids are frequently associated with typically Maestrichtian Globotruncana's and since there are no traces

of Turonian pelagic foraminifera in these beds, we must accept that the generally accepted conception, that these Orbitoids are typical for Maestrichtian, is true. So it must be considered as a fact that the Germav Formation is overlying beds of Maestrichtian or Campanian age.

With the knowledge that the Germav is overlain by Lower Eocene (Ypresian) and underlain by Maestrichtian or Upper Campanian we have to proceed to an analysis of this formation.

Detailed and specific study of the microfaunae from the Germav in SE Turkey prove us that there exist in this formation two enirely different microfaunal units, one belonging to the Tertiary, the other to the Cretaeeous. Already Tromp has distincly traced this limit, although his studies were not based on specific microfaunal analysis.

The Upper and Middle parts of the Germav Formation, reaching a total thickness of over 500 meters, are charaeterised by a microfauna composed of 87 species:

12 % new species

22 % nomina nuda (due to bad preservation)

43 % species only known from the Paleocene all over the world

10 % species continuing from the Upper Cretaceous

6 % species continuing into the Eocene

7 % species that are stratigraphically indifferent.

The faunal character is decidedly paleocene. This paleocene faunal character would even be still more pronounced if the paleocene microfaunae from the mediterranean countries would be better known, since a great part of the new species are also occuring in the Paleocene of French Morth Africa.

It might be possible that the top of the Germav with the main Lockhartia-horizon (a new species of the genus: LOCKHARTIA DAVIESI Ten Dam) belongs already to the Lower Eocene (Ypresian). The microfauna of this horizon apart from Lockhartia and some Miliolids is relatively poor and badly preserved so that it is difficult to determine exactly its age, although the presence of pelagic paleocene foraminifera suggests a paleocene age. Since this same species of Lockhartia has been observed

also deeper in the typical Paleocene, it seems better to consider also the main Lockhartia horizon of the Upper Germav as Paleocene.

The pelagic forms, which have certainly to be cosidered as the most constant, from a stratigraphical point of view, due to their worldwide distribution and their way of life more apt to rapid migrations and due to their restricted vertical distribution, are typically paleocene:

GLOBIGERINA PSEUDOBULLOIDES Plummer 1927

GLOBIGERINA TRILOCULINOIDES Plummer 1927

GLOBOROTALIA ACUTA (Toulmin) 1941

These three pelagic forms, occuring all along the shaly section of the Upper and Middle Germav, are the typical pelagic index-foraminifera for the Paleocene of the mediterranean region as well as for Trinidad, Venezuela and the Southern United States and we find them equally well represented in the Paleocene of NW Europe and the Caucasus.

The Upper and Middle Germav must thus be considered as typically of Paleocene age.

On the contrary the Lower Germav, reaching thicknesses over 300 meters, is characterised by an entirely different microfauna composed of 102 species :

9 % new species.

21 % nomina nuda (due to bad preservation).

63 % species only recorded from the Upper Cretaceous and mainly from Maestrichtian or Campanian.

3 % species continuing into the Paleocene.

2 % species continuing into the Econe.

2 % species continuing into the Neogene.

The faunal character is decidedly Upper Cretaceous and even mainly Maestrichtien or Upper Campanian, only 7 % of the species continuing beyond the Cretaceous-Tertiary boundery. As for the exact age of these beds we will have to refer again principally to the pelagic elements in the microfauna, because of the stratigraphic value of these forms and their worldwide distribution. The Globigerines are represented by:

GLOBIGERINA CRETACEA d'Orbigny 1840 GLOBIGERINELLA ASPERA (Eherenberg) 1854

both speeies occuring typically in the Upper Cretaceous beginning with the Cenomanian. The Globotruncanae, typical incex-fossils for the Upper Cretaceous, on the contrary show a very characteristic assemblage, principally composed of species with a simole keel:

GLOBOTRUNCANA STUARTI (de Lapparent) 1918

GLOBOTRUNCANA CONICA White 1928

GLOBOTRUNCANA ARCA (Cushman) 1926

GLOBUTRUNCANA LUGEONI Tilev 1951

The occurence of Globotruncana stuarti and Globotruncana conica in nnmerous specimens all along the lower Germav section proves that the Lower Germav belongs without any doubt in the Maestrichtian. The presence of numerous specimens of well developed Gümbelina's as:

GÜMBELINA COSTULATA Cushman 1928

GÜMBELINA PLUMMERAE Lotterle 1937

GÜMBELINA ULTIMATUMIDA White 1928

is a supplementory proof for the Maestrichtian age of this section.

So it is quite evident from the microfaunae that the Germav Formation can be divided in a Paleocene part and a Maestrichtian part.

In the microfaunae there is no trace whatsoever of Danian. It is even remarkable that the break Maestrichtian Paleocene is such an abrupt one. On the exact boundary we can observe that from one sample to another almost the entire microfaune disappears and an entirely new microfauna starts, alhough the lihtologic facies seem to be exactly the same. It seems to me extremely difficult to imagine that such an abrupt change of fauna might be possible without any break in the sedimentation Although the formation is lithologically identical at both sides of the Cretaceous-Tertiary boundary and one would be tempted to accept here continuous sedimentation, the microfaunal content and especially the fundamental break in the microfauna suggests strongly a more or less important break in the sedimentation, which. could correspond with the Danian, not represented in this part of Turkey.

Elsewhere in the world the Danian constitutes the transitionbeds from Cretaceous to Paleocene, especially from a microfaunistical viewpoint; from bottom to top the typically cretaceous foraminifera as Globotruncana and Gümbelina disappear rapidly, although the benthonic cretaceous forms continue almost to the top of the Danian and gradually more and more paleocene foraminifera begin to occur. These transition beds are decidedly not represented in the Germav Formation. In certain parts of North Africa and the Near East we know beds in between the Maestrichtian and the typical Paleocene with such a transitional fauna, corresponding with the Danian formation group. If these beds are not represented in the Germav Formation it becomes rather probable, notwithstanding the lithologic uniformity, that there is a break in the sedimentation between Maestrichtian and Paleocene. This is a very important conclusion for the Near East and even Nordh Africa where several authors arrived to the conclusion that there does not exist and never did exist Danian and where other authors imagine that there is only Danian and no Paleocene.

Vl — Comparison With Other Regions:

In his paper 0n the Cretaceous Tertiary bonndary in the Near East, Tromp poses the thesis that it would be superfluous to accept the existence of a Danian formation-group for the Near East and North Africa in the transition beds from the Cretaceous to the Eocene. In a recent artical on the geologic history of Egypt Tromp (Lit. 1951) insists once more on the non-existence of Denian in the Near East.

We know however in Egypt marly beds overlying the Maestrichtian and underlying the Eocene or possibly the Paleocene, the <<Esna>> shales, reaching according to Nakkadv (Lit. 1950) thicknesses of several hundreds of meters. In the geological literature on Egypt these beds are generally considered as Danian. Tromp, denying the existence of Danian, considers them as Lower Eocene or Paleocene. Recently Nakkady (Lit. 1950) described the new species of foraminifera from the Esna shales and gave a list of all the species occuring in these beds. Unfortunately he did not give a list of the vertical distribution of his species, but from his text it is sufficiently clear that the typical Cretaceous pelagic

lorms as Globotruncana and Gümbelina disappear almost at the base of this formation, where as the rest of the Esna shales shows a microfauna with numerous benthonic elements of the Cretaceous mixed with some paleocene foraminifera. This microfauna, although apparently in exactly the same facies as the Paleocene of SE Turkey, is nevertheless entirely different from the microfaunae of the Maestrictian as well as of the Paleocene of SE Turkey. The pelagic elements are represented by:

GLOBIGERINA CRETACEA var. ESNEHENSIS Nakkady

1950

GLOBOROTALIA VELASCOENSIS (Cushman) 1927 and seems to be closely related to, if not identical with, the microfaunae of the Danian of North Africa, Trinidad, Mexico and and the Caucasus.

Marie (Lit. 1949) mentioned a closely related microfauna, considered by him as Danian, with:

GLOBOROTALIA VELASCOENSIS (Cushman) 1927

with clear benthonic cretaceous characters, but without Globotruncana or Gümbelina from beds with:

OSTREA OVERWEGI

CARDITA BEAUMONTI

ROUDAIREA DRUI from North Africa (Morocco) where there is apparently continuous sedimedtation between Maestrichtian and Yrpesian, Higher on these same beds however contâin a typical paleocene microfauna with:

GLOBIGERINA PSEUDOBULLOIDES Plummer 1927

GLOBIGERINA TRILLOCULINOIDES Plummer 1927

GLOBOROTALIA ACUTA (Toulmin) 1941 and other typically tertiary benthonic elements, formation which Marie correlates with the Will-Point Formation and the Upper Midway Formation of the USA, as well as with the Paleocene of NW Europe.

Hilly and Sigal (Lit. 1951) mentoined a microfauna similar to that of marie from Morocco, in the beds with Cardita beaumonti in Algeria. Evidently the transition beds of Maestrichtian to Ypresian in Morocco

and Algeria, characterised by Cardita beaumonti, Ostrea overwegi and Roudairea drui, apperently depposited in continuous sedimentation according to their lithologic uniformity, can represent both Danian and Paleocene. In other parts of Algeria these transition beds in the same facies are characterised only by a distinctly paleocene microfauna, as mentioned by Sigal (Lit. 1949) and ten Dam (Lit. 1948), although the macrofauna is still characterised by Cardita beaumonti, without any trace of a Danian microfauna. Although these beds lithologically suggest continuous sedimentation from Cretaceous to Eocene, we must also there accept a break in the sedimentation between Meastrichtian and Paleocene, corresponding to the Danian, represented not far from there.

In this comparison with other regions we should not forget to mention the important paper of Wicher (Lit. 1949) on the Uppermost Cretaceous of the Tampico embayment area of Mexico compared with beds of the same age in the Caucasus, Austria, Germany and Poland. In this paper Wicher proves the existence of a Danian and a Maestrichtian microfauna with world-wide distribution, both characterised by typical species, the same from Mexico to the Caucasus. For the Danian it is the microfaunae with:

GLOBOROTALIA VELASCOENSIS (Cushman) 1927

typical for the Danian of the mediterranean region, with associated microfauna with still mainly cretaceous character, although without Globotruncana and Gümbelina and already with some paleocene elements. It is amazing that this microfauna of the transition-beds from Maestrichtian to Paleocene has such a worldwide distribution as is so uniform as suggested by Wicher.

Finally Cushman and Renz (Lit. 1946) described a rich microfauna from the Lizard Springs Formation of Trinidad (BWI), with the same Danian character.

It is clear from the preceding pages that there exists a transition-microfauna between the Maestrichtian and the Paleocene over great parts of the world, considered to be of Danian age. If this fauna is lacking in the transition beds on the Cretaceous Tertiary boundary in SE Turkey, whereas in neighbouring countries this fauna may be represented if sed-

imentation-conditions were favorable, our conclusion must be that in the Germav Formation of SE Turkey no Danian is represented, so that we must aceept a break in the sedimentation in this monotonou series.

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