

Cenub Dođu Türkiye'de Tersiyer-Kretase'Hududu

Ö Z E T

Cenup dođu Türkiyede görünüşe göre devamlı bir tereşsüp neticesi olarak husule gelen Germau şayi Heri foraminiferlerini tetkik ederken bu forması y onun yaşı -probleminin Akdeniz havzasında şimalî Afrika, Mısır, Suriye, Lübnan ve Filistin'de mevcut olması dolayısıyla bu mesele'nin Türkiye'deki durumu üzerinde M, T. A, laboratuvarlarında' incelemeler yapılmıştır. Bu bölgede Germau formasyonu 800 metre kadar bir kalınlık arzeder. Üstünde kırmızı Gercüş formasyonu altında bazen orbiioifli kalker bazen kırmızı yeşil tabakalar bazen de kısmen dolomiitli olan masif kalker bulunmaktadır. Germao formasyonu y onunun üst kısmı alt Eosen alt kısmı üst kretasedir. Sadece bazı yerlerde glokonitli bir tabakanın üst kretase ile alt Eoseni ayırdığı görülür. Germau'nun üst ve orta kısımlarını teşkil eden 500 metrede bulunan 87 esp'es bir Paleosen yaşına işaret etmektedir. Buna mukabil alt Germau'da bulunan 102 espes katmanında üst kretaseye işaret etmektedir. Bunlar arasında Daniyen görülmediğinden ve iki grup mikrofosil arasında bariz bir fauna değişikliği olmasından Germau'da Daniyene tekabül eden bir boşluk, olduğuna binaenaleyh Daniyeniti. mevzuft ölmediği neticesine. Darılmaktadır» . . .

The Cretaceous -Tertiary Boundary.In South- Eastern Turkey *)

bu A. TEN DAM

I — InterductSon

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 concerned.

The paleontological. study of' the argiltaceous - marly beds of the Germav Formation has been executed in the Micropaleoiiitological Laboratory of MTA 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 Ore» taceous 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 us some valuable details on age, nature, and microfauna of these'transition-beds in Ms

1) Paper presenten-d during" the meeting of the Geological Society of Turkey'on .20 - 23 February 1952,

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-papers and although he certainly 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 always been very satisfactory, since Tromp had no possibility to do any detailed scientific paléontologic 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 detail 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« •

'À general review of the stratigraphy in this region has been given by O. E. Taşman '(Lit 1949) and N. Egeran (Lşt 1951),

IV — Lithology

It would be extremely difficult, if not impossible to trace the exact limit between Cretaceous 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 Forma-

tion we generally observe a decrease of sandy and silty intercalations, locally 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 thickness 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, whereas the limestone-beds represent marine invasions« This formation is known under the name of Gercüş Formation.

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

In the field it is however locally possible to find a sandy glauconitic bed approximately 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»

¥ — 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 Tertiary 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 microfossils. 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 faciès 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** paléontologie evidence as far is concerned specific determinations and is decidedly entirely erroneous.

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

CAMERINA PARVULA (Cushman) 1919

CAMERINA PRAELUCASI (Douvillé). 1924

CAMERINA RURDIGALENSIS (de la Harpe) 1926

whereas in other localities has been observed :

LOGKHARTIA CONDITI (Nuttal) 1926

This assemblage of **-Nummulites** and **Lockhartia** proves us that the, Gercüş 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 :

OMPHALOCYCLÜS MACROPORUS " (Lamarck) 1825

-ORBITOIDES APICTILATA Schlumberger 1902

ORBITOIDES MEDIA (d'Archiac) 1837 ' . y

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 occurrence, 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 Ger ma v 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 entirely different • microfaunal units, one belonging to the Tertiary , the other to the Cretaceous, Already Tromp -has distinctly 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 characterised by a microfauna composed of 87 species :

- 12 o/ new species
- 22 ö/ 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 o/ species continuing into the Eocene
- 7 % species that are stratigraphically indifferent«

The faunal character is decidedly paleocene. This paleocene fauna! 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 occurring in the Paleocene of French jforth Africa«

It might be possible that the top of the Germav with the main Lockhartia - horizon (a new species, of the genus: LOCKHÂRTIÂ DÂVIESI 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 considered 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. TRILÖCULINÖIDES Plummer 1927

GLOBOROTAUA ACUTA (Toulmin) 1941

These three pelagic forms, occurring 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- 500 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 Eocene.

2 % species continuing into the Neogene,

The faunal character is decidedly Upper Cretaceous and even mainly Maestrichtian or Upper Campanian, only 7 % of the species continuing beyond the Cretaceous - Tertiary boundary. 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 (Ehrenberg) 1854

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

GLOBOTRUNCANA STUARTI (de Lapparent) 1918 .

- GLOBOTRUNCANA CONICA White 1928

GLOBOTRUNCANA ARCA (Cushman) 1926

GLOBOTRUNCANA LUGEONI Tiley 1951-

The occurrence of Globotruncana stuarti and Globotruncana conica, in numerous 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 Gumbelina's as :

' GÜMBELINA COSTULATA Cushman 1928

GÜMBELINA PLUMMERAE Loetterle 1937 "

GÜMBELINA ULTIMATUMIPA White' 1928

' is a supplementary proof for the Maestrichtian age of this section.

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

In the microfauna there is no trace whatsoever of Banian*. 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 microfauna disappears and an entirely new microfauna starts^ although the lithologic 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 transition-
 heels from Cretaceous to Paleocene, especially from a microfau-
 nistic viewpoint; from bottom to top the typically cretaceous
 foraminifera as *Globotruncana* and *Gumbelina* disappear rapidly,
 although the benthic cretaceous forms continue, almost to the
 top of the Danian and gradually more and more paleocene fora-
 minifera begin to occur. These transition-beds are decidedly not
 represented in the Gorm Formation." In certain parts of North
 Africa and the Near East we know beds in between the Maestrich-
 tian and the typical Paleocene with such a transitional fauna,
 corresponding with the Danian formation group. If these beds
 are not represented in the Gorm Formation it becomes rather
 probable, notwithstanding the lithologic uniformity, that there
 is a break in the sedimentation between Maestrichtian and Paleo-
 cene. This is a very important conclusion for the Near East and
 even North 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 Paleo-

¶1 — Comparison With Other Regions

In my paper on the Cretaceous Tertiary boundary 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 Cre-
 taceous to the Eocene. In a recent article on the geologic history
 of Egypt Tromp (Lit. 1951) insists once more on the non-existence
 of Danian in the Near East,

We know however in Egypt many beds overlying the Maest-
 richtian and underlying the Eocene or possibly the Paleocene,
 the «Esna» shales, reaching according to Nakkady (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 Lo-
 wer 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 occurring 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 forms as *Globotruncana* and *Gümbelii* disappear almost at the base of this formation whereas 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 microfauna of the Maestrichtian as well as of the Paleocene of SE Turkey. The pelagic elements are represented by :

GLOBIGERINA *CRETACEA* Yar, *ESNEHENSIS* Nakkady
' 1950

GLOBOROTALIA *VELAŞCOENSIS* (Oushman) 1927 .

and seems to be closely related to, if not identical with the microfauna of the Danian of North Africa, Trinidad, Mexico and the Caucasus.

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

GLOBOROTALIA *VELAŞCOENSIS* (Cushman) 1927

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

OSTREA *OVERWEGI*

- *CARDITA* *BEAUMONTI* ' ^ •

ROUDAIREA *DRUI*

from North Africa (Morocco) where there is apparently continuous sedimentation between Maestrichtian and Ypresian, Higher on these same beds however contain a typical paleocene microfauna with : ^ .

GLOBIGERINA *PSEUDOBULLOIDES* Plumer 1927

GLOBIGERINA *TRILLOGULINOIDES* Plummer .1927

GLOBOROTALIA *AOUTAT* (Toulmin) 1941

and other typically tertiary benthonic elements, formation which Marie correlates with the Will - Point Formation and the Upper Midway Formation of the US A, as well as with the Paleocene of NW Europe.

Hilly and Sigal (Lit. 1951) mentioned; a microfauna similar to that of Marie from Morocco, in the beds with *Cardita* *beaumonti*

ti in Algeria. Evidently the transition beds of Maestrichtian to Ypresian in Morocco and Algeria, characterised by *Gardita beaumonti*, *Ostrea overwegi* and *Roudairea drui*, apparently deposited 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 Sigàf (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 Maestrichtian and Paleocene, corresponding to the Bani-an, 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 microfauna with:

GLOBOROTALIA -VELASOOENSIS (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 world-wide 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 co-

untries this fauna may be represented if sedimentation - conditions were **favorable**, our conclusion must be that in the Germav Formation of SE Turkey no Banian is represented, so that we must accept a break in the sedimentation in this **monotonou sseries**.

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