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New Neogene and Lower Quaternary vertebrate faunas in Turkey

by

Otto Sickenberg & Heinz Tobien *)

With 1 Figure and 1 Table

Zusammenfassung: In den letzten Jahren wurden zahlreiche Vorkommen fossiler Vertebratenreste (Groß- und Kleinsäuger) in Anatolien neu entdeckt und bearbeitet. Ihre faunistische Zusammensetzung (vorläufige Faunenlisten) und ökologische Ausdeutungen werden mitgeteilt. Biostratigraphisch werden die Funde ins höhere Miozän, Pliozän nnd tiefere Pleistozän eingestuft. Die Untersuchnngen werden in den folgenden Jahren fortgesetzt.

Abstract: During the last few years several localities of fossil vertebrates (macro- and micromammals) were discovered in Anatolia. There are faunas of different ages: Upper Miocene, Pliocene and Lower Pleistocene. The faunal association and their ecologic interpretation is discussed.

Introduction

A successful exploration of the lignite deposits in Turkey was dependent upon elucidating the stratigraphy in the Cenozoic basins of this region. During the reconnaissances made for this purpose within the framework of the lignite programme the field geologists of the working teams paid particular attention to fossil occurrences of all kind. Apart from the lithostratigraphic subdivision of the various basin fills the biostratigraphic one was looked upon as of main interest. The discovery of a great number of hitherto unknown localities of vertebrate faunas was one result of these endeavours. Considering the localities already known to and explored by the Turkish part the positive statement can be made that, according to present knowledge, in the Anatolian part at the least the greatest density of localities exists of all Asia. The sorting-out of the material necessary for the age determination of the occurrences was so promising that it was decided to make the recovery an evaluation of further vertebrate remains object of an independent research programme to be executed by quite a great number of experts. Pursuing the programme has been enabled hy the generous sponsorship by the "Deutsche Forschungsgemeinschaft" (DFG), to

*) Author's addresses: Prof. Dr. O. Sickenberg, Niedersächsisches Landesamt für Bodenforschung, 3 Hannover-Buchholz, Alfred-Bentz-Haus, Postfach 54. — Prof. Dr. H. Tobien, Paläontologisches Institut der Johannes-Gutenberg-Universität, 65 Mainz, Saarstraße 21, Postfach 3980.

whom our most cordial thanks are due. At the same time we wish to express our gratitude to the Turkish colleagues, in particular to Professor Dr. SADRETTIN ALPAN (Director General, Maden Tetkik ve Arama Enstitüsü, Ankara), who by their appreciative support have first rendered the excavations feasible. These excavations were made in the spring of 1968, continued in the autumn of 1969, and will this year be completed in the main. It was worked in two groups, of which the one, under the direction of TOBIEN, mainly operated in S.W. and W. Anatolia, whereas the other one, directed by SICKENBERG, carried out the excavations in Central Anatolia. Object of this research programme has not only been the investigation of the recovered remains from the anatomic and taxonomic point of view. Additional objects of the exploration have been the subdivision of the Neogene and Lower Quaternary deposits on the basis of vertebrate paleontology, the determination of the climatic conditions and their variations during this period, as also the investigation of the zoogeographic relations of the various faunas and thus an elucidation of the paleogeographic picture. The results obtained hitherto are so remarkable that the authors decided to publish them already now, prior to the completion of the investigations, in the form of a preliminary information. But they are certainly aware of the fact that the final settlement of most of the problems will only be possible after most careful studies. As has been mentioned before, a great number of colleagues takes part in the programme, they jointly strive for solving the existing problems. The two authors are, so to say just the speakers of the team to the members of which they are much obliged for stimulations and clarifying discussions. They may be allowed to leave out here the individual names, but they do not want to omit praising the merits of their colleague, Dr. BECKER-PLATEN, with respect to this enterprise and the realization of this report.

Tertiary faunas

Preliminary remark: To represent the geology within the areas of the localities appears to be needless, it may be referred to the pertaining chapter of this book, or to the relevant publications (partly in preparation). The lithostratigraphic division elaborated by the members of the lignite group has been taken over as it had in the essential parts proved its value. This applies especially to the S.W. and W. Anatolian areas for which BECKER-PLATEN (see this volume) has set up the lithostratigraphic scheme, the application of which, within certain limits, was also possible to Central Anatolia. In the following, the faunas of the individual localities are described

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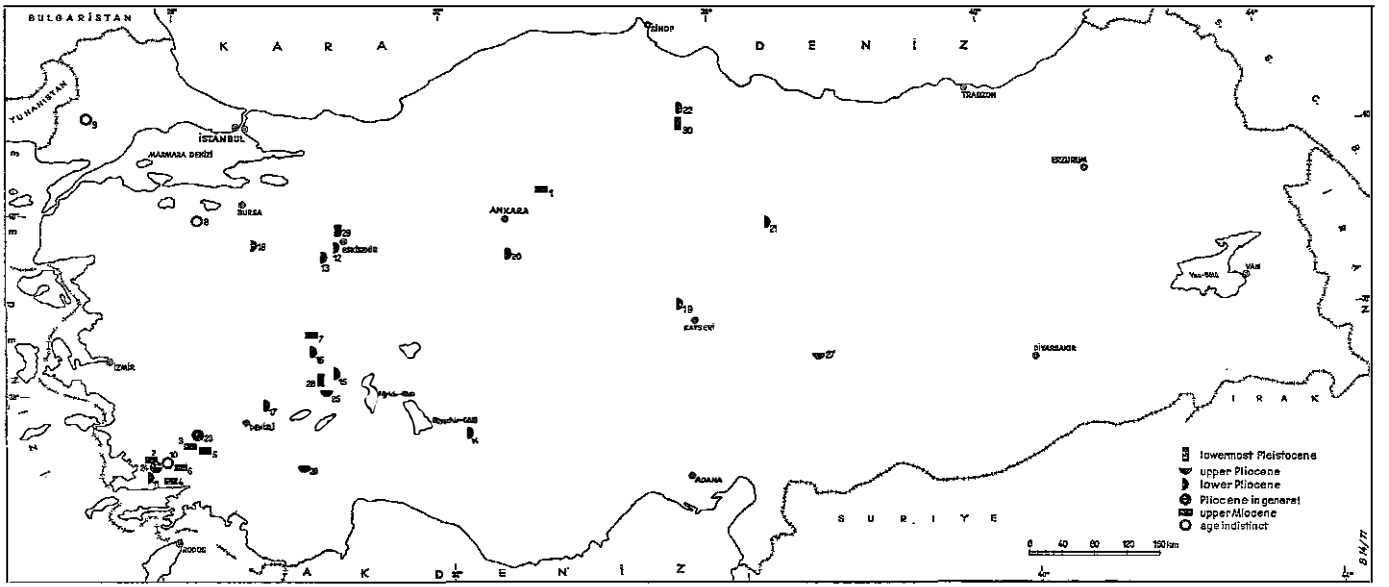
Figure 1: New Neogene and Lower Quaternary vertebrate faunas in Turkey:

1. Ankara-Kalecik-Çandır, 2. Muğla-Milas-Sarı Çay, 3. Muğla-Yatağan-Mesevle, 4. Muğla-Yerkesik-Çatakbağyaka, 5. Denizli-Kale-Berdik, 6. Muğla-Yatağan-Eskihisar, 7. Kütahya-Dumlupınar, 8. Bursa-Mustafakemalpaşa-Paşalar, 9. Edirne-Uzunköprü-Dereikebir, 10. Muğla-Yatağan-Yeni Eskihisar, 11. Muğla-Milas-Ulaş, 12. Eskişehir-Akçayır, 13. Kütahya-Sabuncu-Sofça, 14. Konya-Hatunsaray-Kayadibi, 15. Afyon-Sandıklı-Garkın, 16. Afyon-Sandıklı-Kınık, 17. Denizli-Çal-Mahmutgazi, 18. Kütahya-Tavşanlı-Harmancık, 19. Kayseri-Himmetdede-Yemliha, 20. Ankara-Gölbaşı-Zivra, 21. Sivas-Derekli-Kahnköy, 22. Samsun-Havza-Köprübaşı-Ersandıkköy, 23. Aydın-Bozdoğan-Amasya, 24. Muğla-Milas-Beçin, 25. Afyon-Dinar-Akçaköy, 26. Burdur-Tefenni-Hasanpaşa, 27. Maraş-Elbistan, 28. Afyon-Sandıklı-Gülyazı, 29. Eskişehir-Yukarı Sögütönü, 30. Amasya-Merzifon-Kamışlı.


BULGARİSTAN
YUNANİSTAN
K A R A D E N İ Z
İSTANBUL
MARMARA DENİZİ
BURSA
ANKARA
ESKİŞEHİR
SİNOP
TRABZON
ERZURUM
VAN
KAYSERİ
DİYARBAKIR
İZMİR
ADANA
I R A K
S U R İ Y E
A K D E N İ Z
lowermost Pleistocene
upper Pliocene
lower Pliocene
Pliocene in general
upper Miocene
age indistinct
0 40 60 120 150 km

according to their faunistic composition, geological age, ecological conditions and their zoogeographical association. The position of the localities can be taken from the attached map (cf. fig. 1). In all faunas the mammals are predominating by number, all other groups of vertebrates, bird, reptile and amphibian remains are rarities except for the fragments of land tortoises. In the limnic formations also fish occur (denticules, pharyngeal teeth, vertebrae), in most cases from the Leuciscidae family. In many drilling cores they were the only vertebrate remains obtained. Their treatment, too, is envisaged. In this paper it is not intended to strive for completeness the fauna as it is hardly possible at the present state of treatment. So we just content ourselves with specifying the families, or genera, as far as they are in the position to characterize the pertaining associations owing to their condition of predominance. To avoid going beyond the frame of representation, the mentioning of species was generally dispensed with, apart from a few exceptions, although it might have been possible in many cases. A large part of the material found, however, is still awaiting the species determination. Therefore it has not been possible yet to make a final assignment of the single faunas to certain age stages. But it can certainly be taken from these specifications that in most cases a coordination can be made with an accuracy sufficient for the time being (cf. also table No. 1). At each locality it was noted whether the collections have been made within the framework of the lignite programme (BrkP) or of the DFG programme (DFGP) or whether the material was collected in both these programmes.

Miocene faunas

It has so far not been succeeded in encountering faunal complexes older than of the Upper Miocene. The majority of localities is situated in S.W. or W. Anatolia, yet one also in Central Anatolia, north of Ankara. As the latter appears to be the most important one as regards its variety of forms it may be placed in front.

1) Ankara-Kalecik-Çandır (BrkP, DFGP)

A number of lenticular beds in a sequence of more than 100 m thickness consisting of basal conglomerates and superposing varicolored, prevailingly grey-green, sandy, silty and gravelly layers (limnic-fluviatile and terrestric-fluviatile equivalents of the Turgut member). At least in part, the local accumulations of vertebrate material are to be attributed to the activity of Hyaenidae (an abundance of coprolites!). Differences in the forms among the various collecting levels are indicated.

The fauna is extremely rich and consists of at least 30 different mammalian taxa. Moreover there are eggshell fragments of Struthio, reptile remains, among them Varanus and Testudo, land snails and earthbee burrows. Among the macromammals there is a clear predominance of Bovidae (Gazellinae, ? Caprinae, Ovibovinae) besides various giraffes and cervides (? Euprox, Micromeryx). More scarce are Rhinocerotidae (Brachypotherium, Aceratherium, Elasmotheriinae) and Proboscidea (Deinotherium, "Mastodon"). Among the Carnivora mention be made of Hyaenidae (Percrocuta, Ictitherium) as well as of Felidae and Mustelidae, among them Plesiogulo. Of great zoogeographic importance is the occurrence of Triceromeryx and a representative of the Phacochoerus group. Index forms are also Listriodon, Anchitherium and Micromeryx. Dominating among the micromammals are Lagomorpha (Alloptox, Prolagus

oeningensis) besides Cricetodontidae and Insectivora. The landscapes corresponding to these associations were scrub steppes with loose growth and pure steppes. The zoogeographic relations clearly point to Inner Asia. The Tungur and Tsaidam faunas are equivalents in ecology and, in particular, in age. Few relations existed with India and with Central Europe (Prolagus oeningensis). Common features with the southern part of Europe (Central Serbia, Spain), however, can hardly be denied (Triceromeryx, Elasmotheriinae, etc.).

The localities of Miocene age are more numerous in the western parts of the country. They are situated partly in the Turgut member partly in a stratigraphically higher position at the contact of the Turgut-Sekköy members (cp. table 1).

Faunas of the Turgut member

2) Muğla-Milas-Sarı Çay (BrkP, DFGP)

Limnic-fluviatile depositions, mainly silt, sand and gravels. In most cases the fossils lie in thin lenses or layers originated in drifting together. The fauna mainly comprizes micromammals, whereas macromammals are of secondary importance (Gomphotherium, Anchitherium, 2 different Bovidae, 2 Carnivora). The micromammal fauna has so far been the most abundant one from the Miocene of Asia. Rodentia are by far predominating. In addition to a number of different Cricetodontinae mention be made of: Sciuridae, Gliridae (among them Glirulus), Spalacidae, Anomalomys, Eomys cf. catalaunicus. Additionally there are Insectivora, among them Soricidae. The Lagomorpha are represented by Alloptox. The age and the ecological conditions will be discussed further below.

3) Muğla-Yatağan-Mesevle (BrkP, DFGP)

The collection of the material did not yield any satisfying results owing to the fact that only few remains (Proboscidea, Ruminantia) could be recovered.

Faunas at the contact of the Turgut-Sekköy members

4) Muğla-Yerkesik-Çatakbağyaka (BrkP, DFGP)

Fluviatile sands and limnic silty marls. Macromammals were found almost exclusively, they were accompanied by two Rodentia, among them ? Steneofiber. Remains of Cervidae, among them Euprox, are comparatively frequent. Çatakbağyaka is the only occurrence among the localities investigated by us that has a notable share of the last-named group in the composition of the faunal assemblage. Bovidae, on the other hand, are great rarities. The remaining material at this locality comprizes Gomphotherium, Anchitherium, Brachypotherium, Ancylopoda, ? Palaeotragus.

5) Denizli-Kale-Berdik (BrkP, DFGP)

Silty marls.

Apart from a questionable remain of a Cervus the whole material only consists of Rodentia (2 Cricetodontinae, Gliridae, Eomyidae) and one Ochotonidae.

6) Muğla-Yatağan-Eskihisar (DFGP)

Single specimen from lignites: ? Gomphotherium.

7) Kütahya-Dumlupınar (BrkP, DFGP)

Silty marls of the Dumlupınar member (equivalents to the Turgut and Sekköy members).

The material discovered consists of nothing but a microfaunula: Talpidae, Gliridae, Cricetodontinae, ? Alloptox.

The Upper Miocene age of all faunas from the western part of Anatolia (2—7) cannot be doubted; yet a thorough treatment is still necessary, above all of the micromammals, to clarify the age relations. Possibly minor differences are discovered among the single localities, on the basis of which a detailed stratigraphy of the Upper Miocene would be enabled. Also the age relations to Çandır are still to be determined, what, however, is difficult because of the different ecologic character of the faunas. Presumably the Central Anatolian locality is slightly younger. In contrast to the faunal assemblage of Çandır, those of the western regions correspond to scrubwoods with somewath larger closed woods, in which isles of scrubwood steppes occurred here and there. The appearance of micro- as well as macromammals supports this assumption. Index forms are the Sciuridae, Castoridae, and Gliridae on the one hand, the frequent Proboscidea, the Cervidae and the rare Bovidae on the other hand. Most abundant in forests were the surroundings of Çatakbağyaka. The faunal assemblage of Sarı Çay was characterized by the addition of steppe elements (Giraffidae, Bovidae, Spalacidae). To what extent this fact is to be attributed to the diversity of local conditions, or whether climatic variations were thus expressed, can only be decided upon after an accurate age determination.

Whilst in the case of the localities described up to now the Upper Miocene age can be regarded as certain, further investigations will have to be waited for before final statements can be made regarding the age of the following localities:

8) Bursa-Mustafakemalpaşa-Paşalar (BrkP)

The fossil layer consists of conglomerates at the basis of a limnic-fluviatile sequence which according to the geological findings may be of Pliocene age. The fossil material, comparatively scarce so far, does not really justify such classification, for the material (Deinotherium, Anchitherium, ? Percrocuta, Schizochoerus) quite obviously suggests an Upper Miocene age. The excavations planned for this year, however, will surely contribute towards settling the problem of age determination.

9) Edirne-Uzunköprü-Dereikebir (BrkP)

Limnic-fluviatile sediments (presumably Ferrai formation).

A washing sample yielded a Cricetodon remnant of an obviously late form. Here, too, further investigations are envisaged.

10) Muğla-Yatağan-Yeni Eskihisar (BrkP, DFGP)

Limnic marls of the uppermost Sekköy member with a rich micromammalian fauna. Remains of macromammals are likewise frequent. Two fossil layers of little vertical distance in-between.

Compared to the conditions prevailing at the time when the ossiferous deposits of Sarı Çay, Çatakbağyaka, etc., were formed the environment of Eskihisar does not

show any decisive differences in feature: Gliridae, Cricetodontidae, Castoridae, Spalacidae, different Insectivora and Carnivora, besides Amphilagus (superstite), additionally remains of birds, lizards and tortoises. The macrofauna consists of Carnivora, Rhinocerotidae, Giraffidae and Bovidae.

In view of the geological facts, the fauna is ascribed to the basal Pliocene (equivalent of Ulaş = No. 11). The mammalian fauna does not permit, so far, a clear decision between Upper Miocene or Lower Pliocene.

Pliocene

Lower Pliocene (Pannonian)

At the turn of Miocene-Pliocene, a decisive faunal change took place which is characterized not only by the first occurrence of the genus Hipparion, but also by the immigration of southern elements (Africa, ? Arabia, ? India) under replacement and displacement of many earlier forms. There appear to be good possibilities of further subdividing the Lower Pliocene complex by mammal-paleontological methods.

11) Muğla-Milas-Ulaş (BrkP, DFGP)

Pumiceous tuffs of the uppermost Sekköy member therefore — owing to the lithostratigraphy — lowermost Lower Pliocene. Bone remains are scarce and of little evidential value: Hipparion, Bovidae, Rhinocerotidae.

12) Eskişehir-Akcayır (BrkP) and

13) Kütahya-Sabuncu-Sofça (BrkP)

The question of age and ecological position of the faunas of these two localities must remain open because so far an adequate treatment of the collections has not been possible. Considering the geological position — the fossil layers are situated in limnic-fluviatile and limnic sediments of the lower parts of the equivalents of the Pisidic formation — a Lower Pliocene age is to be assumed. The fauna seems to point to a very deep-lying section of the Pliocene. The excavations planned this year will probably help to bring about an age determination.

14) Konya-Hatunsaray-Kayadibi (BrkP, DFGP)

A great number of occurrences, in most cases in the form of slightly extended lenses, in a alternation of terrestric-fluviatile sediments intercalated by tuffs and tuffites (lower parts of the Pisidic formation) in the farther surroundings of the villages Kayadibi and Hatunsaray. The ossiferous deposits have up to now only yielded remains of macromammals. Proboscidea are clearly dominating in number (Choerolophodon and a large tetralophodont form), in the second place are Rhinocerotidae (Chilotherium and Diceros), then a very large Hipparion, Bovidae (Helicotragus? by far dominating, other genera scarce), Giraffidae (Palaeotragus, ? Samotherium), moreover Suidae, Carnivora, giant tortoises, Hyrax and "Crocodilus", the latter indicating the presence of permanent waters. The type of vegetation was steppe and gallery forests (?).

15) Afyon-Sandıklı-Garkın (DFGP)

Predominantly terrestric-fluviatile sediments (Yatağan lithofacies) of the lower parts of the Pisidic formation with remains of macromammals. The excavations have only just been started with. Presumably slightly younger than Kayadibi. The biotope was dryer than in Kayadibi. Choerolophodon, a tetralophodont Mastodon, Samotherium, Urmiatherium, Diceros, Hipparion (medium size), Gazella.

16) Afyon-Sandıklı-Kınık (BrkP, DFGP) and

17) Denizli-Çal-Mahmutgazi (BrkP, DFGP)

According to the composition as well as to the biostratonomic conditions bouth faunas belong to the same type. In both cases, a great number of ossiferous lenses are intercalated in the terrestric-fluviatile layers of the Pisidic formation. They are particulary frequent near Kınık. Micromammals (among them one Muridae) are very scarce. According to the spectrum of genera, they are pure steppe assemblages, inhabitants of forests are missing. Closest relations existed to the fauna of Samos, only the Bovidae may have been less important compared to those in the Greek locality.

Numerically the most frequent are a small-size and a medium-size Hipparion, the second place is taken by Samotherium. Among the Bovidae the following genera have been ascertained so far: Palaeoryx, Gazella, Oioceros, Parurmiatherium. The third place is taken by Rhinocerotidae (Chilotherium, Diceros); Proboscidea are scarce, the same as Suidae (Microstonyx) and Carnivora (Percrocuta, Ictitherium, Mustelidae). Most probably these faunas are geologically younger than those of the above-mentioned localities.

According to their age, the following localities will on the whole correspond to the localities of Kınık and Mahmutgazi. Yet the findings are too scarce to make a more exact classification:

18) Kütahya-Tavsanlı-Harmancık (BrkP)

Terrestric-fluviatile layers in a Yatağan lithofacies with Hipparion (small) and Rhinocerotidae.

19) Kayseri-Himmetdede-Yemliha (BrkP)

Terrestric-fluviatile sediments (equivalents of the Pisidic formation, Yatağan lithofacies) with Ictitherium, Hipparion, Rhinocerotidae, Bovidae.

20) Ankara-Gölbaşı-Zivra (BrkP, DFGP)

Alternative bedding of limnic and fluviatile sediments of the Pisidic formation (lower parts) with Hipparion, Rhinocerotidae (small) and Gazella. Possibly some what older than the beforementioned.

21) Sivas-Derekli-Kalınköy (BrkP)

Terrestric-fluviatile sediments in a Yatağan lithofacies with Hipparion, Ictitherium, Bovidae.

From the Pontus region only one fossil find is available from Pliocene sediments:

22) Samsun-Havza-Köprübaşı-Ersandikköy (BrkP)

Limnic sediments (silty marls, gyttja) with Aceratherium.

Considering the geological conditions, the fauna of the following localities must actually correspond to the upper parts of the Lower Pliocene, but this assumption requires palaeontological confirmation.

23) Aydın-Bozdoğan-Amasya (BrkP, DFGP)

Limestones, marlstones and silty marls of the lower Milet member.

Up to the present only a small fossiliferous layer with a scarce fauna of macromammals (Chilotherium, Hipparion, "Mastodon" [large]) and a few micromammals (Soricidae, Erinaceidae, Cricetodontinae, ? Cricetus, Spalacidae, Ochotonidae) has been discovered. Not before the final determination and further collections is it possible to give reliable information about age and ecological conditions.

24) Muğla-Milas-Beçin (DFGP)

According to the lithofacial features this locality can be assumed to be of the same age as that of Aydın-Bozdoğan-Amasya. The few surface discoveries are rather insignificant (Hipparion, Ruminantia).

Upper Pliocene

Since up to now it has not been succeeded in discovering any fauna which according to its variety of forms corresponds to an animal association of the "Roussillon" type, the question of whether the lower Upper Pliocene is represented must remain open! According to the present state of investigation it cannot be decided upon whether the reason lies in a faunistic gap, a temporary hiatus in the layers of the basin fillings, or in other biofacies conditions. With certainty, however, the occurrence of a fauna from the upper part of the Upper Pliocene can be proved:

25) Afyon-Dinar-Akçaköy (BrkP, DFGP)

Limnic layers of the higher parts of the Pisidic formation with humous intercalations. Macromammals are scarce and represented only by fragmental remains: Potamochoerus, Felidae, ? Leptobos, Cervidae (small), Hipparion, Didermoceros. The micromammals are more numerous: different primitive Microtini, Cricetulus, Apodemus, ? Parapodemus, ? Ochotona, ? Pliopentalagus, Soricidae. According to information received so far, there must have been active relations of zoogeographic nature with Europe. At least the near surroundings must have been rich in forests, even though the presence of closed forests cannot be assumed.

26) Burdur-Tefenni-Hasanpaşa (BrkP, DFGP)

This locality is also situated in limnic (partly humous) layers which alternate with fluviatile sediments (Pisidic formation) and, owing to the geological phenomena,

are supposed to be of the same age as those of Akçaköy. The few specimens do not admit of any final decision.

27) Maras-Elbistan (BrkP)

The basin deposits of Elbistan are also to be assigned to the higher parts of the Upper Pliocene, or even to the Lower Quaternary. The scarce findings (cf. Promimomys, Castor) were obtained from drilling-core material.

Pleistocene

The faunas of the three following localities positively belong to the Pleistocene. Whilst in two cases the fossil layers still represent the youngest parts of fillings of intramontane basins, the discoveries in the proximity of the locality Yukarı Söğütönü were made in real fluviatile terrace sediments (BECKER-PLATEN & SICKENBERG 1968 [1]).

28) Afyon-Sandıklı-Gülyazı (DFGP)

Different localities within the range of a sequence composed of silty-sandy marls, ot a thickness of approximately 100 m, in which repeatedly more strongly humous layers are intercalated (uppermost parts of the Pisidic formation). In the field, the fossiliferous beds are situated at some 100 m distance in-between them, and in the sequence they show different levels, but the fauna gives a rather uniform impression. Micromammals are scarce and restricted to the humous intersections. Apart from Microtini, Trogontherium and Desmana are dominating. The macrofauna is very rich in species. Hipparion occurs. Furthermore the list comprises about 20 species of Macedonitherium (Giraffidae), Leptobos, Gazella and other Bovidae, Camelidae, Cervidae. Carnivora (Hyaenidae, Felidae, Canidae) a. s. o.

29) Eskişehir-Yukarı-Söğütönü (BrkP, DFGP)

The material of interest was collected in various gravel pits in the surroundings of Eskişehir. They are individual findings occurring in a loose spread in sandy-pebbly terrace sediments: almost exclusively macromammals and a few Microtini. Most frequent is Equus, morever Canis, Vulpes, Camelidae, Gazella, Capra, at least two Cervidae, Rhinocerotidae, Anancus, Archidiskodon, Palaeoloxodon. The occurrence of Struthio has been confirmed by the presence of an eggshell fragment.

30) Amasya-Merzifon-Kamışli (BrkP)

Limnic-fluviatile sediments form the fillings of an intramontane basin in the Pontian region. In an ossiferous lense in the uppermost parts of this basin filling the following genera were discovered: Canis, Equus, Gazellospira or Spiroceros a. s. o.

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[1]) BECKER-PLATEN, J. D. & SICKENBERG, O.: Die unterpleistozänen Kiese von Eskişehir (Anatolien) und ihre Säugetierfauna. — Mitt. geol. Inst. Techn. Univ., 8, pp. 7—20, 2 figs., Hannover 1968.

All of these faunas are still to be assigned to the Lower Quaternary ("Villafranchian"), and yet a real contemporaneity does not appear to exist. According to determinations made so far, the faunal complex from the Sandıklı Basin rather seems to be the oldest; it is then followed by the terraces of Eskişehir. The youngest locality probably is the Kamışli fauna. On the other hand, the ecological character of the three localities is certainly the same. Steppe elements are absolutely dominating. The landscapes were open savannas and scrubsteppes which were crossed by forest along the water courses and lakes. In contrast to the Upper Miocene and Lower Pliocene Europe and Asia Minor were parts of a homogeneous zoogeographic region.

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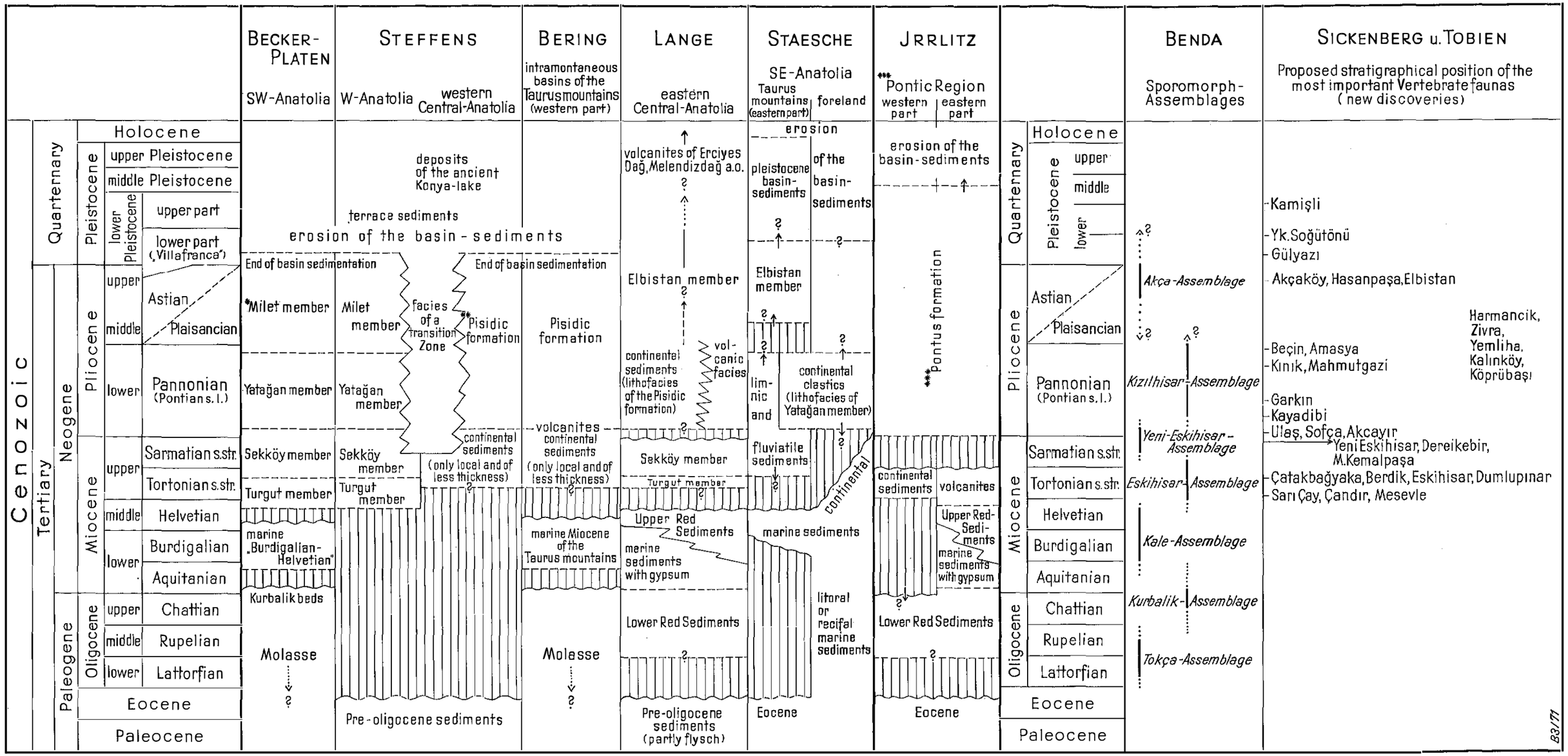
Table 1. Attempted correlation of schematic lithostratigraphic sections and biostratigraphic sequences from the most important regions of Turkey with the international chronostratigraphic units (not in scale). The continental sediments are correlated with the traditional subdivision of the Vienna-Basin mainly based on Vertebrates.



* See PHILLIPSON 1905—1915, OPPENHEIM 1919 et al.

** See TCHIHATCHEFF 1854, BUKOWSKI 1891, OPPENHEIM 1919 et al.

*** See NAUMANN 1896, NOWAK 1928 et al.