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SEDIMENTARY CHARACTERISTICS OF TERRESTRIAL PALEOCENE DEPOSITS IN NORTHERN ANKARA REGION, TURKEY

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ABSTRACT

The terrestrial Paleocene sequences at the north of Ankara are chiefly composed of alluvial fan deposits, braided and meandering river sediments and lacustrine carbonate mudstones. In a limited area, only around Orhaniye village, fine-grained volcanoclastics and lavas are observed. All these deposits are in a vertical order both grain size and depositional environment and they pass into marine Eocene units.

INTRODUCTION

A thick terrestrial Paleocene sequence extending from east to west, has been found at the north of Ankara, typically around Orhaniye village (Fig. 1). Paleogene sequences (Paleocene-Eocene-Oligocene) are quiet different, however older units are similar to each other in Ankara region, see, in the southern of Ankara; Haymana-Polatlı basin, and more east, in the vicinity of Kırıkkale-Çankırı basin, Paleocene is marine but only in the study area it is completely terrestrial. All marine Paleocene deposits have been studied in detail (Haymana-Polatlı region: Yüksel, 1970; Gökçen, 1976; Ünalan et al., 1976; Batman, 1978, Kırıkkale-Çankırı-Kalecik region: Norman, 1972; Şenalp, 1974; Ünalan and Harput, 1983, Akyürek et al., 1984).

The aim of this article is only to introduce sediment types and depositional characteristics of the terrestrial Paleocene deposits. To establish the certain stratigraphy and paleogeographic reconstruction further studies are needed.

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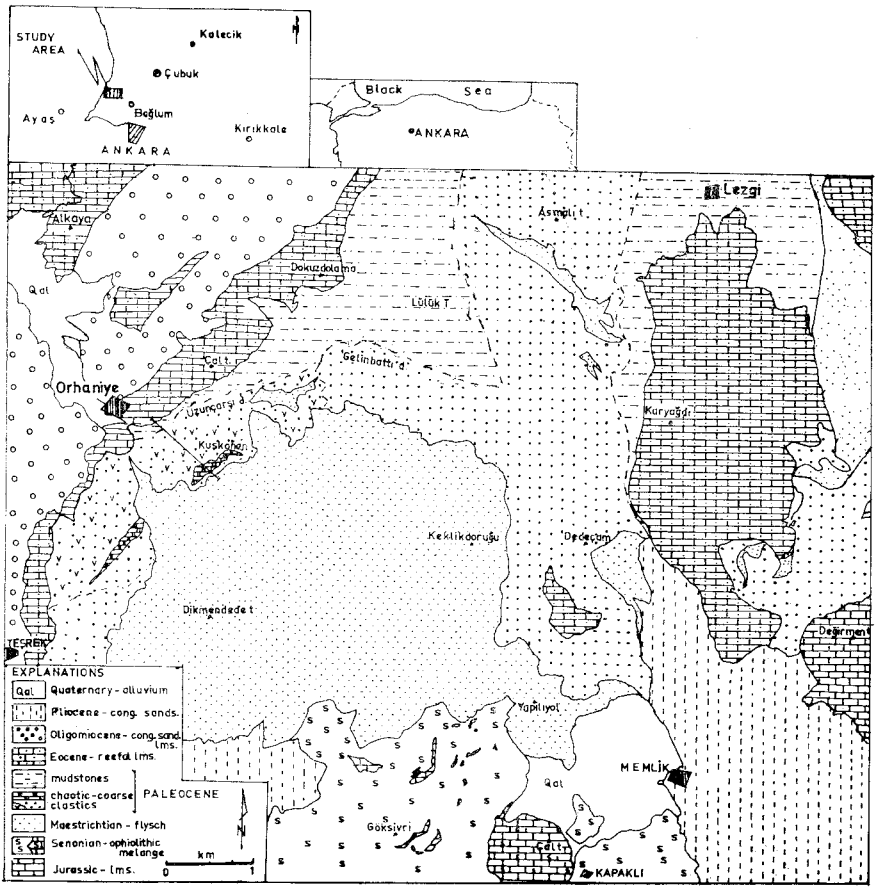

Figure 1. Generalized geological map of the study area.

GEOLOGICAL SETTING

Geological framework of the investigation area has been firstly settled by Erol (1954) and Erk (1957). According to these studies, Paleocene deposits cover the Upper Cretaceous flysch with an angular disconformity. On the other hand, stratigraphic boundary of Cretaceous-Tertiary or the terrestrial and marine facies is transitional fairly far from here, in Göynük-Seben region (Saner, 1978), where sedimentary facies are also similar to Ankara Region.

Terrestrial Paleocene deposits do not include any typical fossils except plant debris and any data could not be obtained to date these

sediments. Our unterminated palynological research may give some certain results in future, and, for the time being it was accepted they had been in Lower (?) – Middle – Upper Paleocene age by comparison. They are covered concordantly by Eocene sediments and there is a transition zone requiring biostratigraphic studies between Paleocene and Eocene (Fig. 2). Typical Eocene unit consists of reefal limestones of Lutetian age. Terrestrial Oligocene and lacustrine Miocene deposits are extensively found in the study area (Fig. 1).

The paleocene deposits which have been investigated by stratigraphic measured sections have 150–350 meter thickness.

SEDIMENTARY CHARACTERISTICS

In the vicinity of Orhaniye village, at the north of Ankara, Paleocene has a chaotic feature as sediment type and their lateral and vertical interrelations. By means of measured sections, it was understood that the main lithology consists of clastics and to a lesser extend volcanics and carbonates within the clastics (Fig. 3, 4). Somewhere, especially in the eastern and northern of the study area, clastics are the only sediments of the Paleocene. A measured section (Fig. 2) was given from complex-chaotic Paleocene units.

A– *Clastics:* Red color is a representative feature of the clastics and it gets easier to distinguish them from other sediments. All clastics which are made of abundantly mudstones and conglomerates, have been deposited under the control of fluvial and alluvial fan systems (Fig. 3,4).

A. 1. Fluvial deposits are chiefly braided types at the lower and middle of the sequence but meandering river deposits are generally placed at the upper parts (Fig. 3).

A. 1. 1. Braided river deposits, in here, own classical sedimentary features given in Bull (1972) and Rust (1979), and they are thick sandstones or conglomeratic units interbedded with thin mudstone beds. Conglomerates are in lense-like bodies 1–4 m thick and 50–250 m lateral extention. Some beds are well-compacted but the other textural features are similar to each others. Gradation and pebble orientation are the most visible characters. In the upper parts of the conglomerates, low-angle planar cross-bedding is often observed. They are usual sedimentary structures resulted by lateral migration

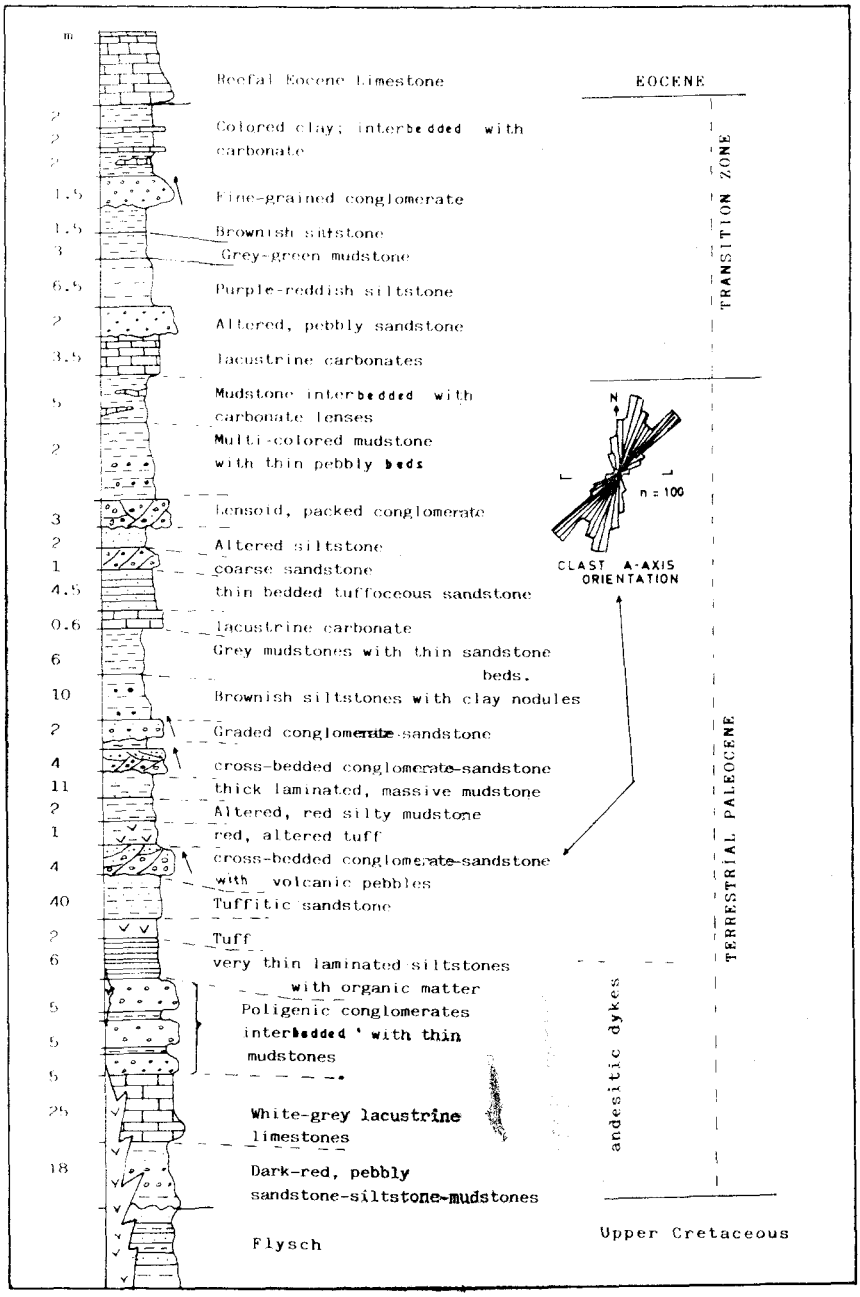

Figure 2. A measured stratigraphic section near Orhaniye village. Note the litology distribution and stratigraphic boundaries between the systems

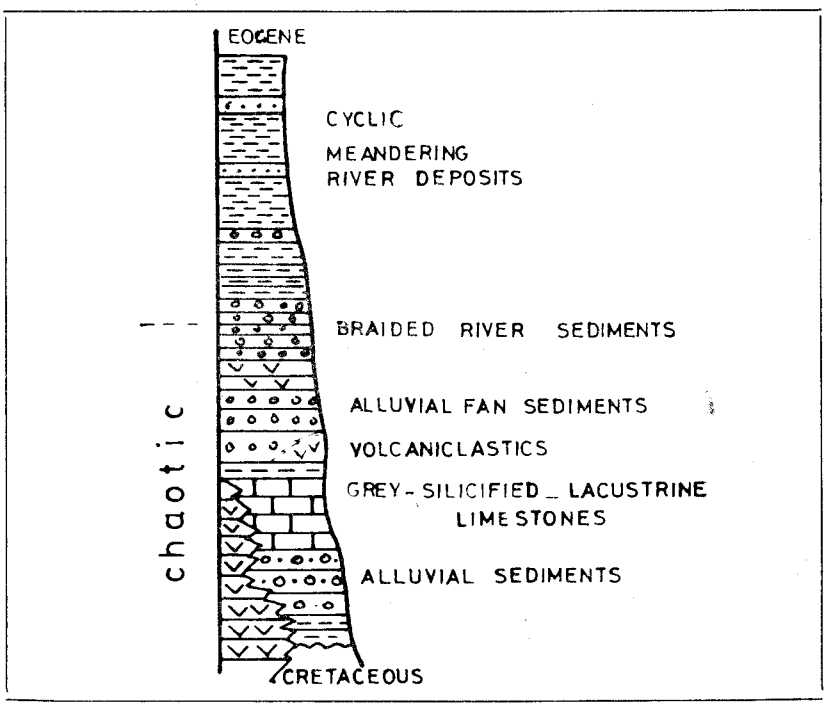

Figure 3. Generalized vertical arrangement of terrestrial Paleocene deposits (non-scaled)

of channel bars (Smith 1970; Harms et al., 1975). Small ripple laminations are also seen rarely in very fine-grained sandstones and they represent the top of channel bars.

Thin mudstone layers dividing conglomerates and sandstones are always red colored and laminated, and they randomly contain plant fragments. In some places, laminae are deformed by weathering, erosional surfaces and scarce coarse grains. They might have been accumulated as bar-top deposits (Cant and Walker, 1976) in braided systems.

A. 1.2. Meandering fluvial deposits are the essential sediments of the terrestrial Paleocene, and they constitute dominantly the upper parts of the sequence. These sediments are mainly thick clayey mudstones interbedded with thin sandstones and fine-grained conglomerates (25–150 cm.). Color is not constant and it ranges from blue, green to brown, red, gray depends on alteration and sedimentary composition. They can locally include loose, small pebbles and coarse sand

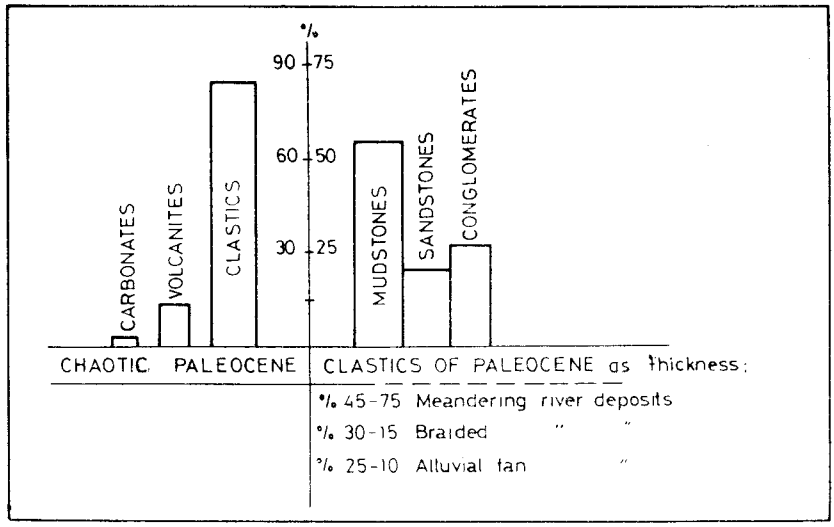

Figure 4. Lithologic composition of the terrestrial Paleocene sequence.

grains. Parallel lamination is the most descriptive structure and it displays that mudstones have been deposited as overbank and flood plain sediments.

Cyclic deposition is very well seen in these clastics and in two seperate measured-sections (Gelinbattı and Kumlu dere; around Lezgi village), 5 and 7 = 12 cycles fining upward, 7–9 m thick each were counted. Consequently these cycles give a certain evidence for the great thickness of the terrestrial deposits and they also present the effective epirogenic movements (Collinson, 1978; Hallam, 1981) during the Paleocene.

Vertical accretion (see Walker and Cant, 1979) becoming clear with parallel and tabular laminated beds in the mudstones is another common depositional character, especially in fine-grained flood plain and swamp deposits. They are dark, laminated beds 0,3–2,5 m thick and 750–1300 m lateral extended in Uzunçarşılı dere, at the north-east of Orhaniye village. Some leaf fragments and carbonized organic matter are seen within the dark colored laminae. At the same area, but stratiphically upper than the vertical accretion sediments, there are light-colored, laminated, lense-like beds. They can be adopted as ox-bow lake and/or bar-loop sediments. Additionally, these latter sediments are observed close to coarse detritics.

As for conglomerates and sandstones within mudstones, they are assymmetric lenses which possess cahannel-fill and bar-features. Planar and trough cross-bedding and well-compaction are typical. Partly vadose carbonate and to great extend ferrinuous sandy matrix give rise to the compaction. Gradation and lateral grain-size decreasing are visible, and in addition, sorting is better than other types of conglomerates in the sequence. Their thicknesses are variable and were measured in 0,75–3,5 meter.

A. 2. Alluvial fan deposits: These are found in the middle parts of the sequence, and they are composed of abundantly braided river sediments and partly debris-flow deposits (Fig. 3).

A. 2.1. Braided units of the fan deposits have largely Gm, Gms, Gp, Fm and Sh subfacies of Miall (1977) and Rust (1979). Grain-size varies from boulder to silt but medium-fine pebbles are common constituents, and also lateral grain-size decreasing is distinctive feature. They are generally weak-compacted and roundnesses of all pebbles are very well (round. degree: 0,5–0,9) although sorting is fairly low. These polygenic pebbles have been derived from commonly Jurassic limestones and older metamorphic rocks. Volcanic pebbles are only locally abundant, eventhough volcanic sand grains are well-spreaded due to easy desintegration of volcanic pebbles.

Braided river deposits of alluvial fans are generally made of lensoid conglomerates (Gm subfacies) divided thin pebbly mudstones (20–75 cm thick; Fm and Sh subfacies). Gradation and imbrication are typical features in these conglomerates. Pebbly mudstones dividing the conglomerates have been interpreted as sandy braided fluvial deposits. These well-compacted units have erosional base contacts and small planar cross-bedding in fine-grained parts.

A. 2.2. Debris-flow units of the alluvial fan deposits are the gravelly beds characterized by lack of imbrication and pebble orientation. They display visible inverse-gradation and low-rate of matrix, and nearly all pebbles have thick ironoxide films. These units can be compared with Facies A of Feyter and Molenaar (1984). According to their textural features they must be formed by high viscose debris flows. The low rate of matrix might be resulted of leaching after deposition. This kind of subaerial debris flows can be observed especially in subtropic areas (Bull 1972; Feyter and Molenaar 1984; Shultz 1984).

Clast-supported texture, ironoxide films around the pebbles, dark-red color and ooid-like dissolution features on pebble surfaces may present the arid climatic conditions.

Some carbonate pebbles of alluvial fan deposits bear circled but small-scale, oolite-like "dissolution features" on their surfaces. These odd and unknown surface textures/structures can represent the weathering for a long time, freely, in subtropic areas.

All alluvial fan deposits are typified by their dark-red and they have been deposited at the middle parts of the paleocene sequence (Fig. 3).

B– *Carbonates:* These deposits are micrites or carbonate mudstones which are conciderably found at the lower part of the Paleocene sequence, however they can be observed as thin beds (3–50 cm) in various levels (Fig. 2). The latter ones are laminated-clayey carbonate mudstones and their lateral continuities are limited in 25–110 m.

An important thick carbonate level as 5–25 m as, exposes at the south of Orhaniye village and it is easy mapable by its white-gray color among the red clastics (Fig. 1). The locally silicified and laminated carbonate mudstones have the typical features of lacustrine limestones. Each bed varies between 10–75 cm and interbedded with thin marl and volcanic tuff layers. Desiccation breccias and mud-cracks are common. They include only rare Ostracod shell fragments.

C– *Volcanics:* Volcanics which can be observed clearly along Uzunçarşılı dere near Orhaniye, are also limited exposures like carbonates (Fig. 1,4). They are mainly fine-grained, vary-colored, laminated lithic and crystal tuffs and tuffites. Some layers can reach 10 meter thickness. Most of the volcanics are grouped at the lower and middle part of the sequence. Random individual beds may pass into the alluvial plain deposits at upper levels.

Additionally some andesitic-basaltic dykes cutting the Cretaceous flysch and some basaltic lavas are found in the Paleocene sequence, but their relationship with tuff are not clear in this area. These lavas and dykes may be interrelated with Paleocene crystaline rocks in Kırıkkale region, that have been introduced by Norman (1972).

DISCUSSION AND CONCLUSION

Terrestrial Paleocene at the north of Ankara and its sedimentary characteristics have been firstly introduced. To this preliminary notes, Paleocene were occupied in general by alluvial fan, fluvial, alluvial plain and lacustrine deposits (Fig. 3,4). All these clastics are accompanied with volcanics in a limited area, especially at lower and middle of the sequence. Vertical arrangements of the sediments take the attention that coarse alluvial and fluvial sediments change to the meandering river and flood-plain deposits through the upper parts. This gradational changement is ended in Lutetian sediments that is formed by reefal limestones.

Facies distribution of the Paleocene in Central-North Anatolia have been outlined by previous works (fig. 5) and discussed by Norman et al. (1980). Lateral facies changements between marine and terrestrial Paleocene deposits are not seen because of young sediment covers. Only in the Kalecik area, Akyürek et al. (1984) informed that Paleocene sediments consisted of alluvial plain and deltaic sediments, that is, Paleocene is transitional.

If these data are interpreted all together, it must be adopted that the study area is the lateral extention of Kızılçay Group through the east. Sedimentary facies of Kızılçay Group is known well by various research (Altınlı, 1974; Saner, 1978; Kazancı, 1980; Varol 1980; etc.)

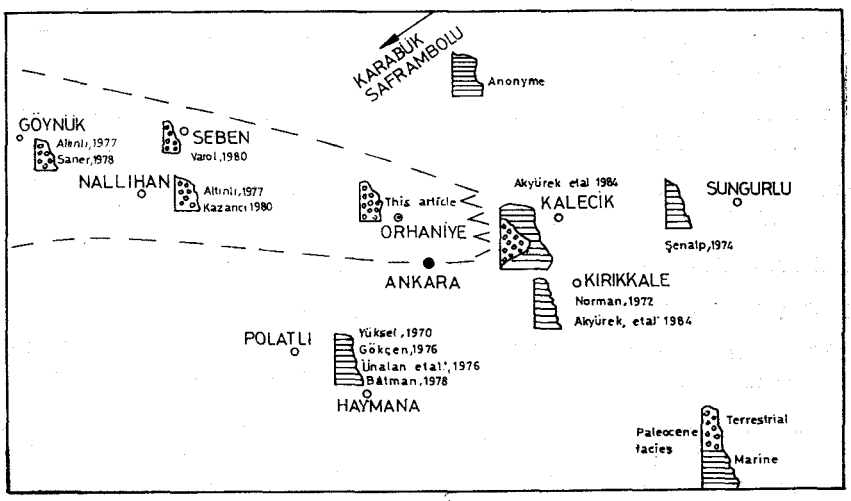

Figure 5. Known Paleocene facies in Central Anatolia according to pevious studies and the extention of terrestrial deposits.

and they composed of alluvial plain, fluvial, lacustrine and lagoonal sediments. So, the north of Ankara, as lateral extention of Kızılçay Group/Bilecik–Göynük–Seben–Nallıhan, was positive area during the Paleocene (Fig. 5).

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