

Biostratigraphic and Environmental Aspects of the Late Miocene-Early Pliocene Deposits in Develiköy (Manisa, Turkey)

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With 3 Figures

Kurzfassung

Nach bisheriger Kenntnis besteht die jungobermiozän-unterpliozäne Schichtenfolge von Develiköy (Manisa, Türkei) aus einer unteren klastischen Einheit (Çamlı-Formation) und einer oberen karbonatisch-klastischen Einheit (Urla-Formation). Diese Schichtfolge wird diskordant von gleichmäßig rötlichen klastischen Sedimenten (Halitpaşa-Formation) mit noch unbekanntem Alter überlagert. Die untere Altersgrenze für die Urla-Formation ist aufgrund des Vorkommens von Säugern Turolium. Das bisherige Mindestalter Unterpliozän kann, basierend auf Mollusken und Algen, auf höhere Teile der Formation ausgeweitet werden. Die fossile Flora und Fauna weisen darauf hin, daß die Urla-Formation in einem limnisch-lakustrischen Flachwasser-Milieu abgelagert wurde.

Abstract

The known late Late Miocene to Early Pliocene sequence in Develiköy (Manisa, Turkey) consists of a lower clastic unit (the Çamlı formation) and an upper carbonate-clastic unit (the Urla formation). This sequence is overlain unconformably by uniformly reddish clastic deposits (the Halitpaşa formation) as yet of unknown age. The lower age limit for the Urla formation is Turolian on the basis of mammalian evidence. The known Early Pliocene upper age limit may be extended to the higher parts of the formation on the basis molluscs and algae. Fossil flora and fauna suggest that deposition of the Urla formation took place under fresh water, shallow, lacustrine conditions.

Introduction

The Develiköy area lies 6 km SE of Saruhanlı (22 km NE of Manisa) (Fig. 1). The Late Cenozoic sedimentary assemblage in the Develiköy area consists of two different sequences separated by a low-angle unconformity (Fig. 2): a lower, mainly light-colored, clastic and carbonate sequence, and an upper, reddish, clastic sequence. The lower sequence is known to

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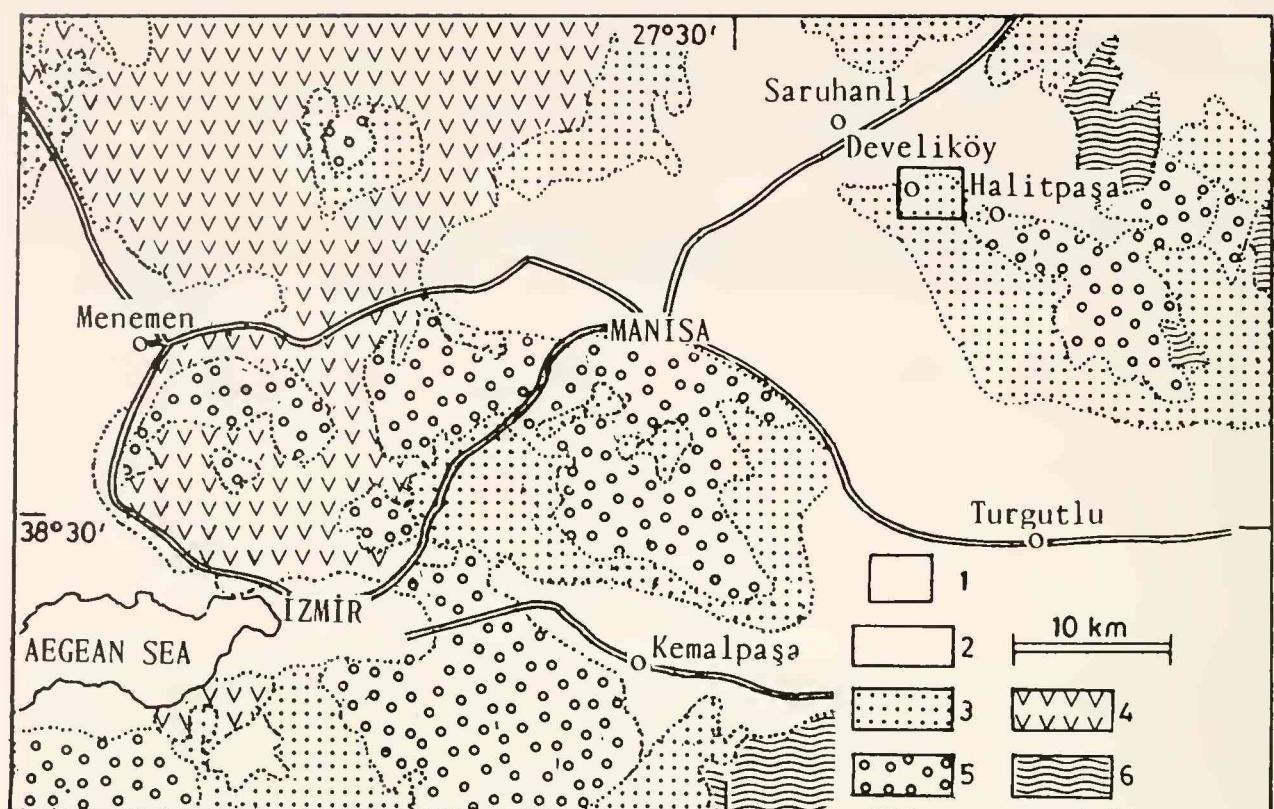


Fig. 1: Location of the study area. 1, Develiköy; 2, Alluvium; 3, Late Cenozoic sedimentary rocks; 4, Late Cenozoic volcanic rocks; 5, Late Cretaceous-Early Paleocene olistostrome-turbidite unit; 6, Menderes crystalline rocks.

be late Late Miocene (OZANSOY, 1960) to early Early Pliocene (SEN et al., 1989) in age. This sequence is divisible into a lower clastic unit, the Çamlı formation, and an upper carbonate-clastic unit, the Urla formation (Fig. 2), in terms of stratigraphical nomenclature proposed by KAYA (1981). No age diagnostic fossil is recorded from the reddish clastic sequence. This study presents new faunal and floral elements for the late Late Miocene to Early Pliocene deposits, on the basis of a composite and partial stratotype (Fig. 3) introduced for the first time.

Çamlı formation

This unit comprises primarily light-colored conglomerates and pebbly lithic sandstones, and minor sandy to pebbly mudrocks and limestones. It rests unconformably on the Late Cretaceous to Early Paleocene ophiolite-related rocks. The deposition took place in alluvial fan environment bounded by a developing fresh water lake. The depositional aspects of the basal fanglomerate suggest the control of growth faults.

Urla formation

This unit consists of light-colored limestones, mudrocks and sands which intergrade laterally and vertically. The composite stratotype for the upper part of the formation is situated between the map coordinates 56.67: 82.09 and 56.31: 82.09 (K19-d2). The limestones are fresh water lacustrine deposits. They are locally rich in fresh water oncoids, composite algal encrustations and fragmented algal and molluscan detritus. They exhibit widespread syndepositional, contractional structures. Mudrocks, which are variably calcareous, bear primarily the late diagenetic imprints of carbonate enrichment under the control of fracture

systems. Sands are texturally mature, and occur as coastal dunes and channel fillings. The contact between the Urla formation and the Çamlı formation is conformable and gradational in local sense, but diachronous in areal scale.

Age. - The Urla formation contains a wide assortment of fossils that include macro- and microvertebrates, ostracods, gastropods, algae and fish remnants. Two fossil horizons are known from previous work (Fig. 3):

H* 111: OZANSOY (1960) recognized first mammals: *Mustela* sp., *Lycyaena* sp., *Dipoides anatolicus* OZANSOY, *Hipparrison matthewi* ABEL, *Tragocerus* sp., *Palaeoryx* sp., *Gazella gaudryi* SCHLOSSER and *G. depertida* GERVAIS, and assigned a late Late Miocene age in terms of time scale of STEININGER et al. (1990). ARSLAN (1984, 1987) collected *Hipparrison* sp. and *Crocuta eximia* (ROTH and WAGNER) from the same fossil horizon, and reported an Early Vallesian age.

H 130: About 22 m above H 111 ŞEN et al. (1989) introduced a microvertebrate fauna comprising *Castillomys debrijyni* ŞEN, JAEGER, DALFES, MAZIN and BOCHERENS, *Apodemus* sp., *Pseudomeriones* sp., *Spermophilinus* sp. and *Prolagus michauxi* LOPEZ MARTINEZ in the upper part of the lower unit, and recorded an Early Pliocene (Early Ruscinian) age.

New evidence for the lower age limit of the Urla formation is as followed:

H 212 is the oldest mammalian fossil horizon, about 52 m below H 111. *Hipparrison matthewi* ABEL assignes a Turolian age to the basal part of the Urla formation.

H 111: The recent recognition of *Hipparrison matthewi* ABEL, *H. mediterraneum* ROTH and WAGNER and *Tetralophodon longirostris* (KAUP) indicates a Turolian age for this known fossil horizon.

Molluscs and algae in still younger strata may suggest Early Pliocene termination of the Urla formation.

H 71: The Alga *Nitellopsis (Tectochara) meriana* (ALEX BRAUN ex UNGER) GRAMBAST et SOULE MÄRSCHE signifies an upper age limit of Pliocene (B. BASSLER, pers. comm.).

H 85: The Gastropod *Gyraulus* aff. *crista* (DRAPARNAUD), in accordance with mammalian chronology, is indicative for an upper age limit of Early Pliocene age.

Environment.- In the upper half of the Urla formation the mudrocks are sporadically rich in molluscs, ostracods, fish remnants, Characeae-oogonians and seeds. The molluscs represented by the families of Valvatidae (*Valvata*), Bithyniidae (*Bithynia*), Planorbidae (*Anisus*, *Gyraulus*) and Lymnaeidae (*Galba*, *Stagnicola*, *Radix*) are as a whole fresh water residents, however tolerable to very slight brackish water conditions. The lacustrine environment is influenced periodically by swamps (e.g., *Galba* and *Stagnicola*), rivers and lakes (e.g. *Bithynia*). The fish remnants include pharyngeal teeth and otoliths of the Cyprinidae. The genus *Alburnus*, *Cyprinus*, *Tinca* and *Prolebias* are also fresh water indicators. The water plantain *Alisma plantago-aquatica* LINNAEUS signifies slowly flowing waters or swamps. *Scrophularia peregrina* LINNAEUS and related brown wort-plants may represent climatic conditions similar to those of the drier parts of the Mediterranean macrovertebrates.

The fossils are primarily life assemblages, and less commonly death assemblages. Land-derived fossils (gastropods and vertebrates) are in minor amounts.

*H: Horizon

Halitpaşa formation

The name Halitpaşa formation is here applied to a primarily brownish red and heterogeneous rock succession of mudrocks, conglomerates and sandstones, and very minor limestone and coal. Partial stratotype representing the base of the unit, is exposed between 56.31: 82.09 and

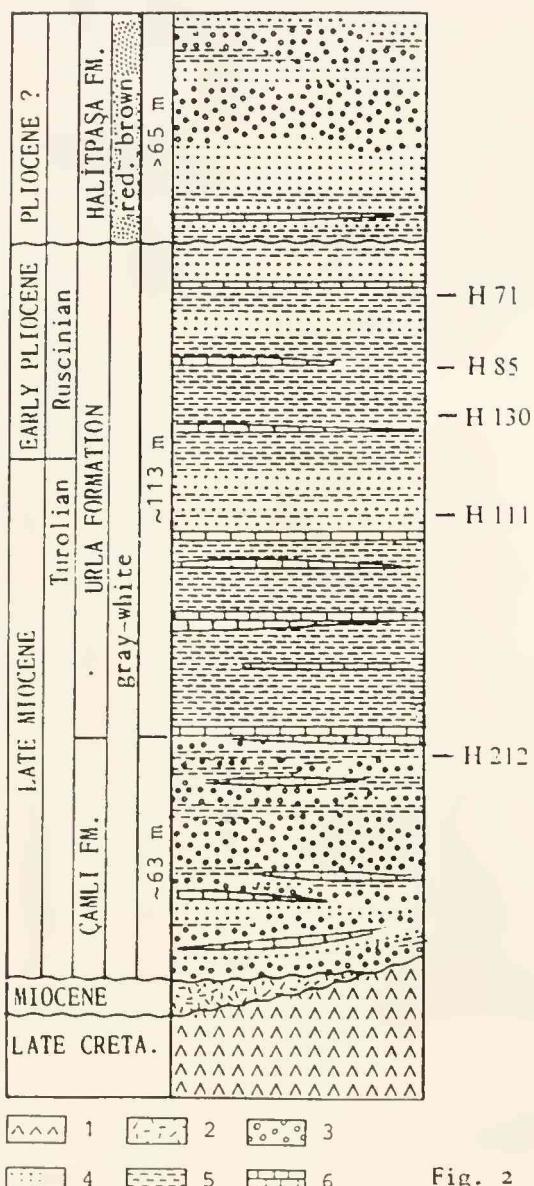


Fig. 2

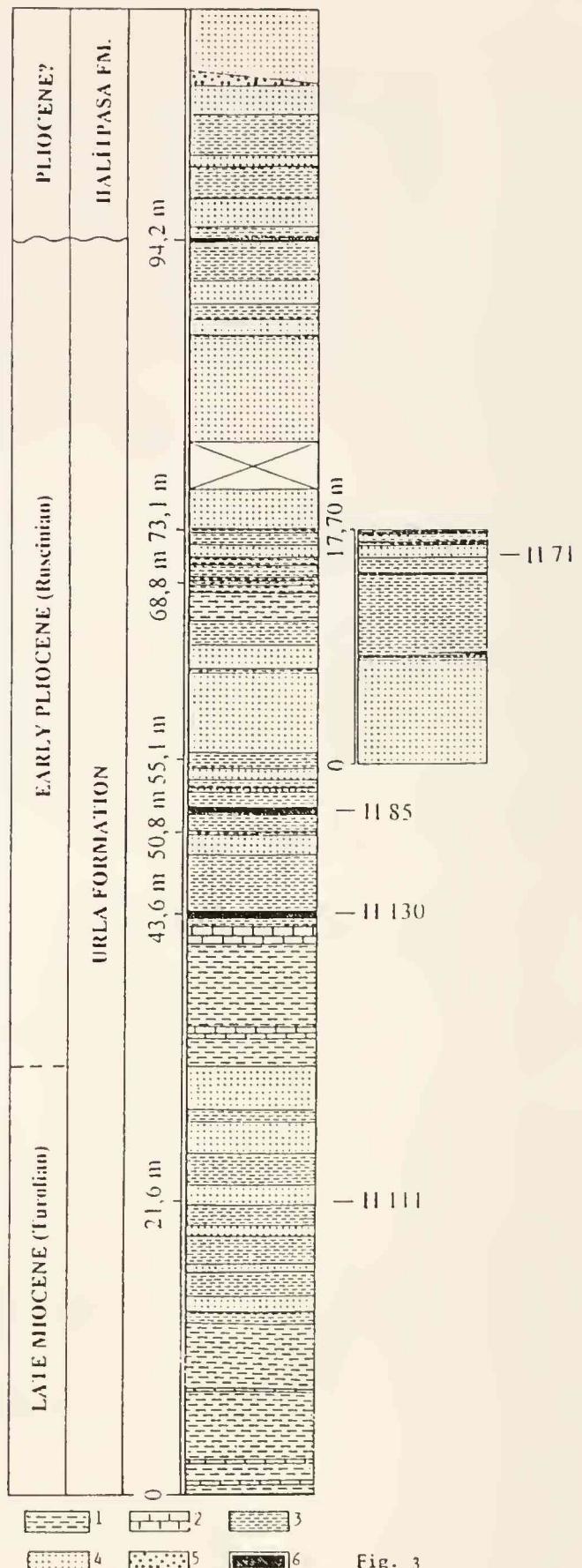


Fig. 3

Fig. 2: Generalized rock succession of the study area. 1; Ophiolite – related olistostrome; 2, intermediate volcanic rocks; 3, conglomerate; 4, sand, sandstone; 5, mudrocks; 6, limestone.

Fig. 3: Composite stratotype for the upper part of the Urla formation and the lowermost part of the Halitpaşa formation. 1, limy mudrocks; 2, limestone; 3, mudrocks; 4, sand; 5, conglomerate; 6, coal and coaly mudrocks.

Both figures not to scale.

56.31: 82.03 (K19-d2) (Fig. 3). The brownish red mudrocks which characterize the unit, include poorly to moderately indurated mudstones and sandy mudstones.

The Halitpaşa formation rests with a low-angle erosional unconformity on the Urla formation. The formation is seemingly free of age diagnostic fossils.

Conclusions

The lacustrine upper part (the Urla formation) of the Late Miocene to Early Pliocene deposits has an early age limit of Turolian. Layers stratigraphically younger than the known fossil horizon that yielded an Early Pliocene age seem to persist in this age. Floral and faunal evidence indicates that the Turolian-Early Pliocene deposition occurred in freshwater, shallow, lacustrine environment.

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