The position of Akkaşdağı mammal locality in the neo-tectonic framework of Çankırı basin, Turkey

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ABSTRACT
This paper presents tectonic features of the southern part of Çankırı basin where is located the rich late Miocene mammal locality of Akkaşdağı. Field observations and mapping demonstrated that the late Miocene-Pliocene deposits unconformaly overlie the pre-Neogene basement. The overall thickness of Neogene deposits increases toward NE. Horst-graben structure of pre-Neogene basement indicates that the Miocene fill took place under extensional tectonics which enlarged the basin toward SW.

KEY WORDS
Tectonics,
Miocene,
Çankırı basin,
Central Anatolia,
Turkey.

RÉSUMÉ
La position du gisement de mammifères Akkaşdağı dans la structure néotectonique du bassin de Çankırı, Turquie.
Le but de cette note est de présenter les traits tectoniques du secteur sud du bassin de Çankırı. Le riche gisement de mammifères, Akkaşdağı, daté du Miocène supérieur, est situé dans cette région. Les observations de terrain montrent que les dépôts mio-pliocènes recouvrent en discordance le substratum pré-néogène. L'épaisseur des formations néogènes augmente vers le NE. La structure en horst-graben du substratum indique une mise en place des formations miocènes dans un régime tectonique extensif qui a élargi le bassin vers le SW.

MOTS CLÉS
Tectonique,
Miocène,
bassin de Çankırı,
Anatolie Centrale,
Turquie.

INTRODUCTION

Çankırı basin, one of the prominent sedimentary basins in Central Anatolia, is surrounded by Eldivandağı, Ilgazdağı and Kösedağı, composed of mainly ophiolitic rocks of Neo-Tethyan suture zone, from west, north and east. Southern side of the basin is limited by Barandağı and Kökenezdağı having dominantly plutonic rocks and metamorphic rocks of Kırşehir block (Fig. 1). The basin is created by the closure of Neo-Tethyan Ocean between Sakarya continent and Kırşehir block during Cretaceous to Eocene (Şengör & Yılmaz 1981; Tüysüz *et al.* 1995; Erdoğan *et al.* 1996; Görür *et al.* 1998). The models on syn-collisional development of the Çankırı basin agreed that the oceanic lithosphere is consumed by a northward subduction (Tüysüz *et al.* 1995; Erdoğan *et al.* 1996).

The Late Tertiary post-collisional development of the basin, however, is a currently debated issue. Koçyiğit *et al.* (1995) suggest that the compressional regime due to intracontinental convergence continued until late Pliocene (Ankara Orogenic Phase). Following this time, a non-compressional tectonic regime proposed under the control of North Anatolian Fault zone (Koçyiğit *et al.* 1995). Seyitoğlu *et al.* (1997) re-examined the key locations of the "Ankara Orogenic Phase" model, and they argued, by using both field observations and geochemical characteristics of Galatian volcanics, that the intracontinental convergence must have ceased in early Miocene and replaced by an extensional regime due to orogenic collapse. Following late Pliocene, the effect of right lateral North Anatolian Fault zone becomes dominant in the NW of Central Anatolia.

Kaymakcı (2000) and Kaymakcı *et al.* (2001) suggest that compressional regime due to indentation of the Kırşehir block turns into an extensional tectonics in the middle of early Miocene. The extensional regime is suggested to continue until late Miocene. Late Miocene to recently, a transcurrent tectonic regime is believed to create compressional deformation in the basin's western margin.

Seyitoğlu *et al.* (2000, 2004) determined a nearly NNE-SSW trending tectonic sliver in the western margin of the Çankırı basin between Ankara and Çankırı. This tectonic sliver is limited by normal and thrust faults at western and eastern sides respectively. It becomes active following late Pliocene due to NW-SE compression which is created by the North Anatolian Fault zone and its splay, Kırıkkale-Erbaa Fault zone (Fig. 1).

Akkaşdağı fossil site (Sen *et al.* 1998; Kazancı *et al.* 1999) is located to the south of the Kırıkkale-Erbaa Fault zone, outside of this compressive area. Tectono-sedimentary development of the site is therefore important to test the regional tectonic models.

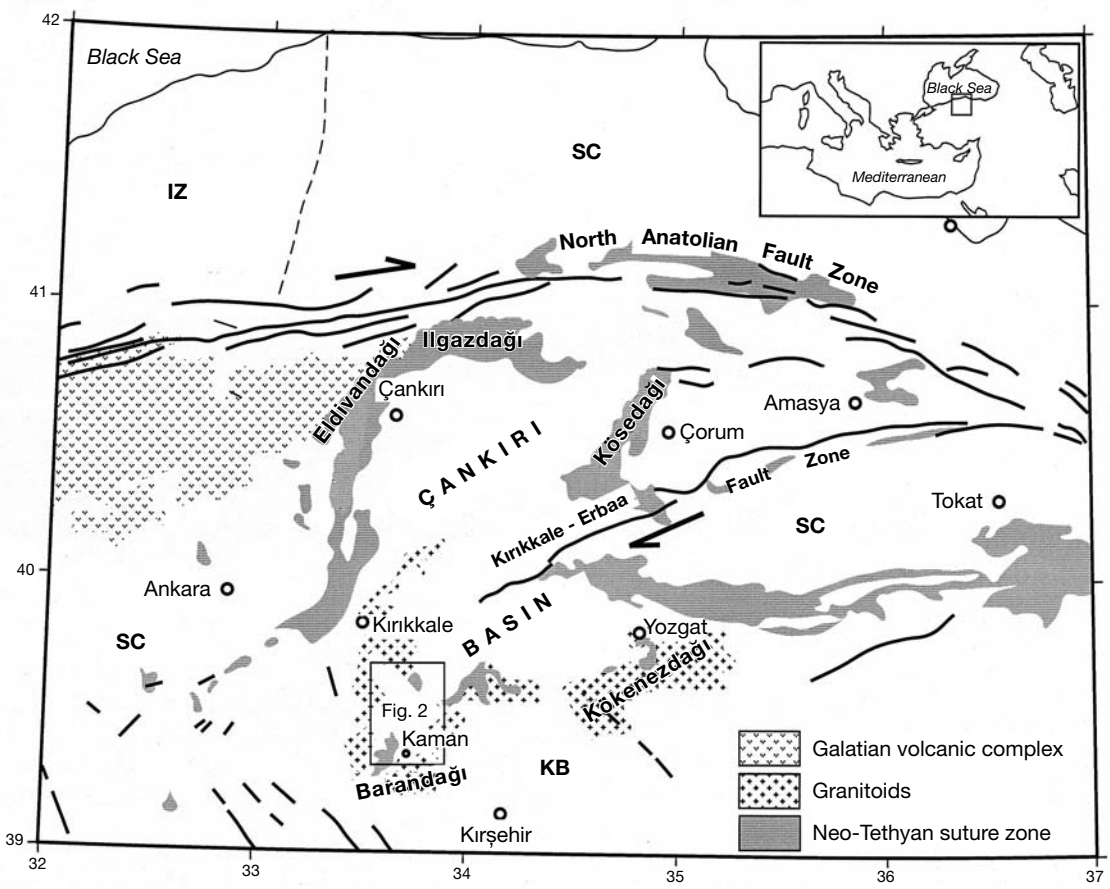

FIG. 1. — Location of Akkaşdağı area in the neo-tectonic framework of Central Anatolia. Abbreviations: **IZ**, Istanbul Zone; **SC**, Sakarya Continent; **KB**, Kırşehir Block (Okay & Tüysüz 1999).

FIELD OBSERVATIONS

The Kırşehir massif referring to the NW part of the Central Anatolian metamorphic complex, ophiolitic rocks of the Neo-Tethyan suture zone, granites and Eocene sedimentary rocks constitute the pre-Neogene basement in the research area (Seymen 1984; Göncüoğlu 1986; Göncüoğlu *et al.* 1991; Okay & Tüysüz 1999) (Fig. 2).

In a quarry, 1 km SSW of Ceritkale village (Fig. 2), at Topaktaş Tepe, granites heat limestones containing Eocene nummulites. This observation indicates a post-Eocene granite emplacement in the region. The outcrop shows strong cataclasis that needs further investigation.

Neogene succession having Akkaşdağı fossil locality is mainly composed of reddish fluvial, fluvio-lacustrine sandstones and mudstones (Sen *et al.* 1998; Kazancı *et al.* 1999, 2005). Two different marker layers can be distinguished in the lower and upper parts of the succession. The lower part contains nearly horizontal mammalian fossil bearing tuff layer which has limited distribution. The upper part, however, has a lacustrine limestone with an overall thickness of 10-15 m that increases towards SW.

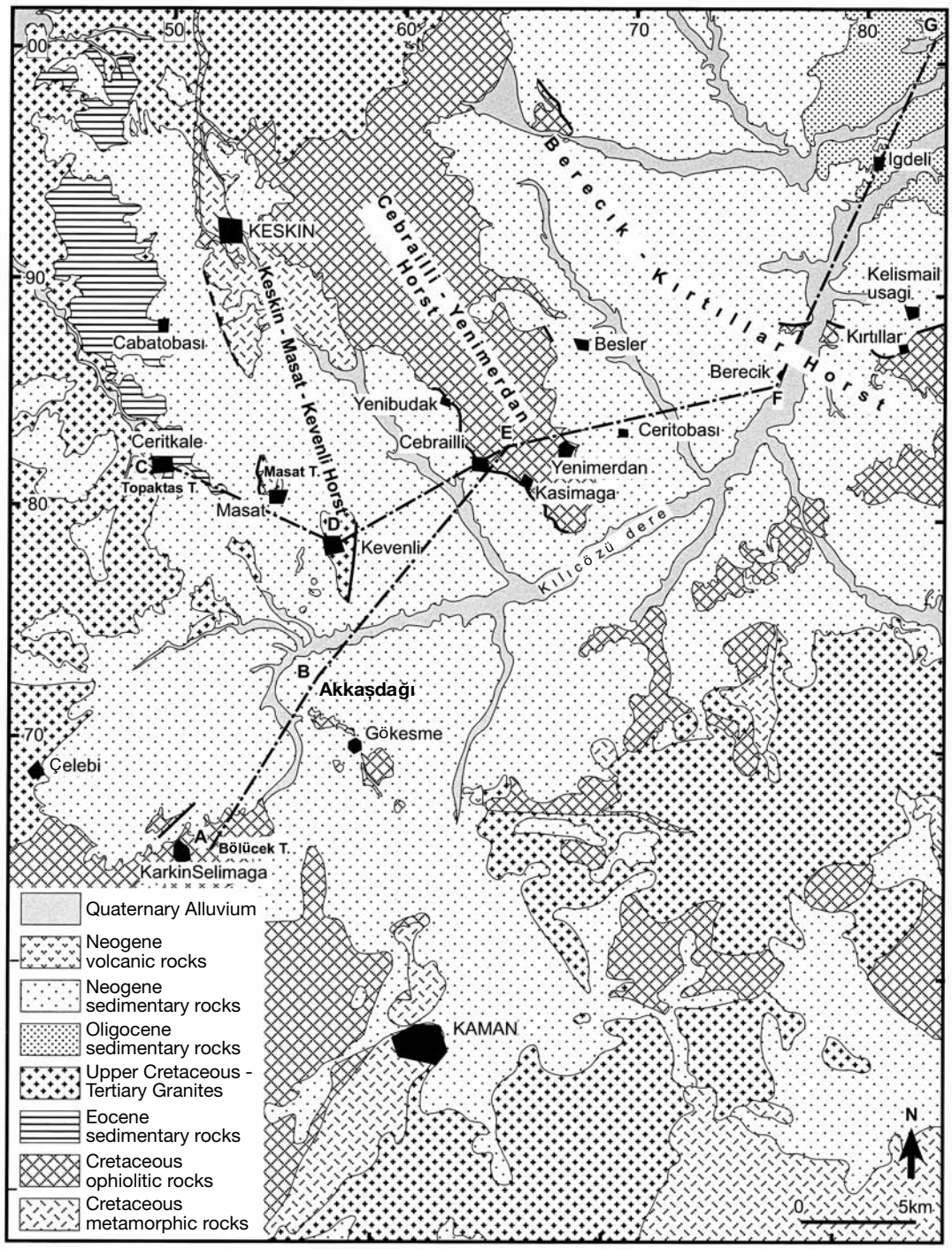

FIG. 2. — Geological map of the Akkaşdağı area, modified from 1/100.000 scale MTA map.

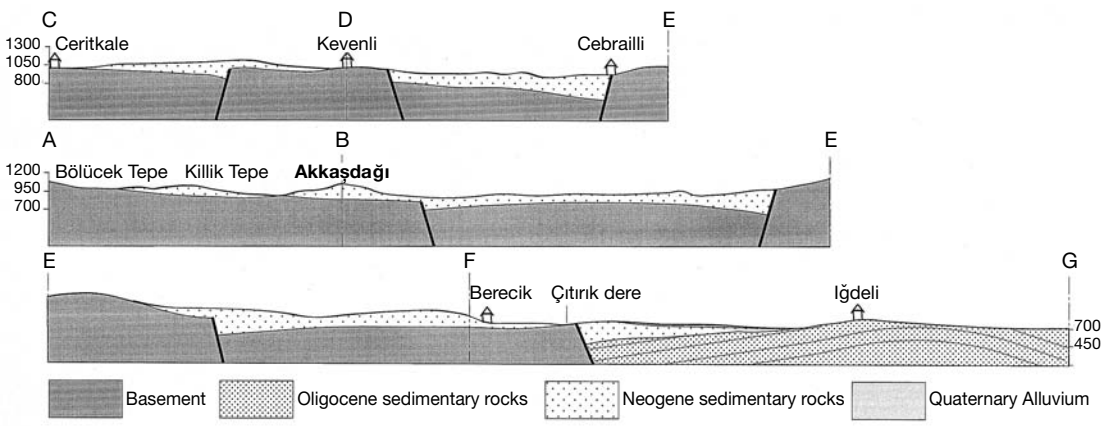

FIG. 3. — Geological cross sections, see Figure 2 for locations.

In order to establish tectono-sedimentary position of the Akkaşdağı fossil locality, which is located on SW of the Çankırı basin, NE-SW trending main and E-W trending supplementary geotraverses have been completed (Figs 2; 3). In the SW end of the main geotraverse, the limestones of the upper part of the Neogene succession unconformably overlay the basement. The overall thickness of overlapping deposits increases towards NE as can be seen in a cross section between Bölücek Tepe and Akkaşdağı (Fig. 3).

The Neogene succession overlaps NNW-SSE trending horsts in the area. These are from west to east Keskin-Maşat-Kevenli, Cebrailli-Yenimerdan and Berecik-Kırtıllar horsts (Fig. 2).

The SW margin of the Keskin-Maşat-Kevenli horst is limited by an oblique normal fault which has N5E, 85NW fault surface with 40° rake of slickenlines in the west of Maşat Tepe (Figs 2; 3). This fault is also apparent between Cabatobası and Keskin. In the hanging wall of this fault, poorly sorted angular boulder-cobble conglomerate (max diameter: 55 cm) with sandstone layers are observed in the west of Maşat Tepe whereas further to the north, in the east of Cabatobası, red sandstones and white limestones are the dominant lithology in the hanging wall. Although Keskin-Maşat-Kevenli horst is covered by thin Neogene sedimentary units between Maşat and Kevenli villages, the overlapping section is considerably thick in the Akkaşdağı locality (450 m). The NE faulted margin of the Keskin-Maşat-Kevenli horst can be seen in 1 km east of Kevenli village (Fig. 2).

The SW margin of the Cebrailli-Yenimerdan horst (Figs 2; 3) is limited by a fault. Its trace shows a moderately SW dipping surface in Yenibudak and Cebrailli villages where N54W, 50SW surfaces constitute fault parallel joints. In the hanging wall, granule conglomerate-greenish mudstone, fine sandstone-mudstone alternations are dipping 20-30° NE towards the fault. This dipping becomes horizontal upward in the section indicating a wedge shape geometry that implies syn-sedimentary feature of this fault (Fig. 3).

In the NE margin of the Cebrailli-Yenimerdan horst, Neogene succession of granule conglomerates and limestones unconformably cover the basement at west of Yenimerdan village. This margin of the horst might have faulted/overlapped relationship because a buried fault can be traceable in the deeply incised valley floor at west of Beşler village (Fig. 2).

The last paleohigh distinguished in the study area is the Berecik-Kırtıllar horst. The basement outcrops in the Çıtırık dere, north of Berecik village (Figs 2; 3). The northern side of the Çıtırık dere shows a NE dipping fault trace, however, in the southern side of the ravine, Neogene conglomer-

ates unconformably overlies the basement (Fig. 3). The fault trace can be followed further SE around Kelismailuşağı village (Fig. 2) where the fault topography is clearly observed. This paleo-high having NE dipping fault could have limited the southeast margin of the Çankırı basin during Oligocene times because in the hanging wall Oligo-Miocene gypsum unit with underlying red clastics take place but such units are not observed in the footwall. In the hanging wall of this basin margin fault, the Oligo-Miocene gypsum unit shows an open folding with kilometer scale wavelength, and an ungular unconformity is apparent between Neogene succession and the gypsum unit around Iğdeli village (Figs 2; 3).

DISCUSSION AND CONCLUSION

It can be concluded from the field observations that Berecik-Kırtıllar horst acted as a SW margin of Oligo-Miocene Çankırı basin. During late Miocene, the Çankırı basin enlarged towards SW and fossil bearing (Akkaşdağı locality) sedimentary succession overlaps the basin margin fault and horst-graben system on its footwall. This in turn suggests an extensional regime in the SW of Çankırı basin in the Miocene, particularly in the late Miocene due to the age data obtained from the Akkaşdağı locality. This result is in agreement with the data (Karadenizli *et al.* 2003; Savasci & Seyitoğlu 2004) showing the sedimentary units deposited under an extensional tectonics in early-middle Miocene times at the western margin of Çankırı basin where post-late Pliocene NW-SE compression induced tectonic slivers masks the earlier basin configuration. The Akkaşdağı area is in the south of Kırıkkale-Erbaa fault and outside of the area undergoing post-late Pliocene NW-SE compression (Seyitoğlu *et al.* 2000, 2004). No observed thrusting between Neogene succession and the basement supports the view of Seyitoğlu *et al.* (2000) suggesting that the post-late Pliocene thrusting is limited to the area of NW margin of the Çankırı basin between the North Anatolian Fault and Kırıkkale-Erbaa Fault (Fig. 1).

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