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Micropaleontology and paleoecology of the Neogene sediments in the Adana Basin (South of Turkey)

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ABSTRACT

This paper analyses the stratigraphical features and fossil associations (ostracod and planktonic foraminifer) of the late Miocene deposits in the Adana Basin. In this research, numerous samples were collected from the sediments, both below and above the Messinian evaporitic layers which cropped out in the western and middle part of the Adana Basin, due to paleoenvironmental changes during the Messinian salinity crisis. The fine-grained sediments below the gypsum layers surrounding Topçu and Karayayla villages located in the western part of the Basin are sterile. Nodular anhydrite and enterolithic structures are well developed in these selenitic gypsum layers, which are supposed to represent a sabkha environmental condition. In the middle part of the Adana Basin, some re-sediment detritic gypsum deposits cropped out around Semiramis village houses. The lithological characteristics and faunal assemblages of the sediments both below and above these evaporites are more or less similar to each other. Fossil fauna (ostracod and planktonic foraminifera) demonstrate that these sediments are not older than latest Tortonian, as suggested by the presence of *Neogloboquadrina humerosa*, and not younger than earliest Messinian, as suggested by the last occurrence of *Globigerinoides bulloideus*. Similar planktonic assemblages were found in the drill log bored east of the Adana Basin, where there was no evaporitic occurrence. Both the planktonic species and the presence of *Globorotalia suterae* (from 7.81 Ma to 7.24 Ma) point that also these fine granied sediments a late Tortonian-early Messinian in age. The quantity of kaolinite recorded is relatively higher in the Tortonian-early Messinian than in the late Messinian sediments. All data show that, during the latest Tortonian-earliest Messinian time interval, the area was characterised by shallow marine environments and humid climatic conditions.

1. Introduction

The salinity crisis that affected the Mediterranean is one of the most crucial paleocenographic events during the Messinian. Since its discovery, extensive research has been done and numerous papers have been published depicting the paleoenvironmental conditions of the salinity crisis (Hsü, 1972; Hsü et al., 1973, 1977; Sissingh, 1975; Cita et al., 1980; Herman, 1987; Weijermars, 1988; Benson and Rakic El Bied, 1991; Clauzon et al., 1996; Nazik et al., 1997; Flecker and Ellam, 1999; Krijgsman et al., 1999; Blanc-Valleron et al., 2002; Fortuin and Krijgsman, 2003; Pierre and Rouchy, 2004; Gorini et al., 2005; Drinia et al., 2007; Gliozzi et al., 2007; Gillet et al., 2007; Rouchy et al., 2007; Krijgsman and Meijer, 2008).

The drastic changes induced in the circum-Mediterranean resulted in the deposition during this period, of thick evaporitic bodies (halite, gypsum, anhydrite and other evaporitic minerals) with clays, marls, sands and some carbonates accumulated in the basin.

The Adana Basin is one of the several Neogene basins situated in the Eastern Mediterranean area, and its sedimentary filling provides a good record of the palaeoenvironmental changes that affected the Mediterranean during the Messinian salinity crisis (Fig. 1). Most of the earlier studies on this basin were mainly focused on general geology (Schmidt, 1961; Özer et al., 1974; Yalçın and Görür, 1984; Gürbüz and Kelling, 1993; Ünlügenç et al., 1990; Aksu et al., 2005; Büyükutku and Bağcı, 2005) and paleontology (Doruk, 1975; Nazik and Gürbüz, 1992; Safak and Nazik, 1994; Nazik, 1996; Öğrünç, 1996; Nazik et al., 1997; Öğrünç et al., 2000; Nazik, 2004; Demircan and Toker, 2004; Avşar et al., 2006). However, there are limited researches about the Messinian salinity crisis in the Adana Basin (Yetiş and Demirkol, 1986; Yetiş, 1988; Nazik and Gökçen, 1995; Nazik et al., 1997; Öğrünç et al., 2000; Darbaş et al., 2008). Yetiş and Demirkol (1986) and Yetiş (1988) emphasize that gypsum levels of the Adana Basin can be

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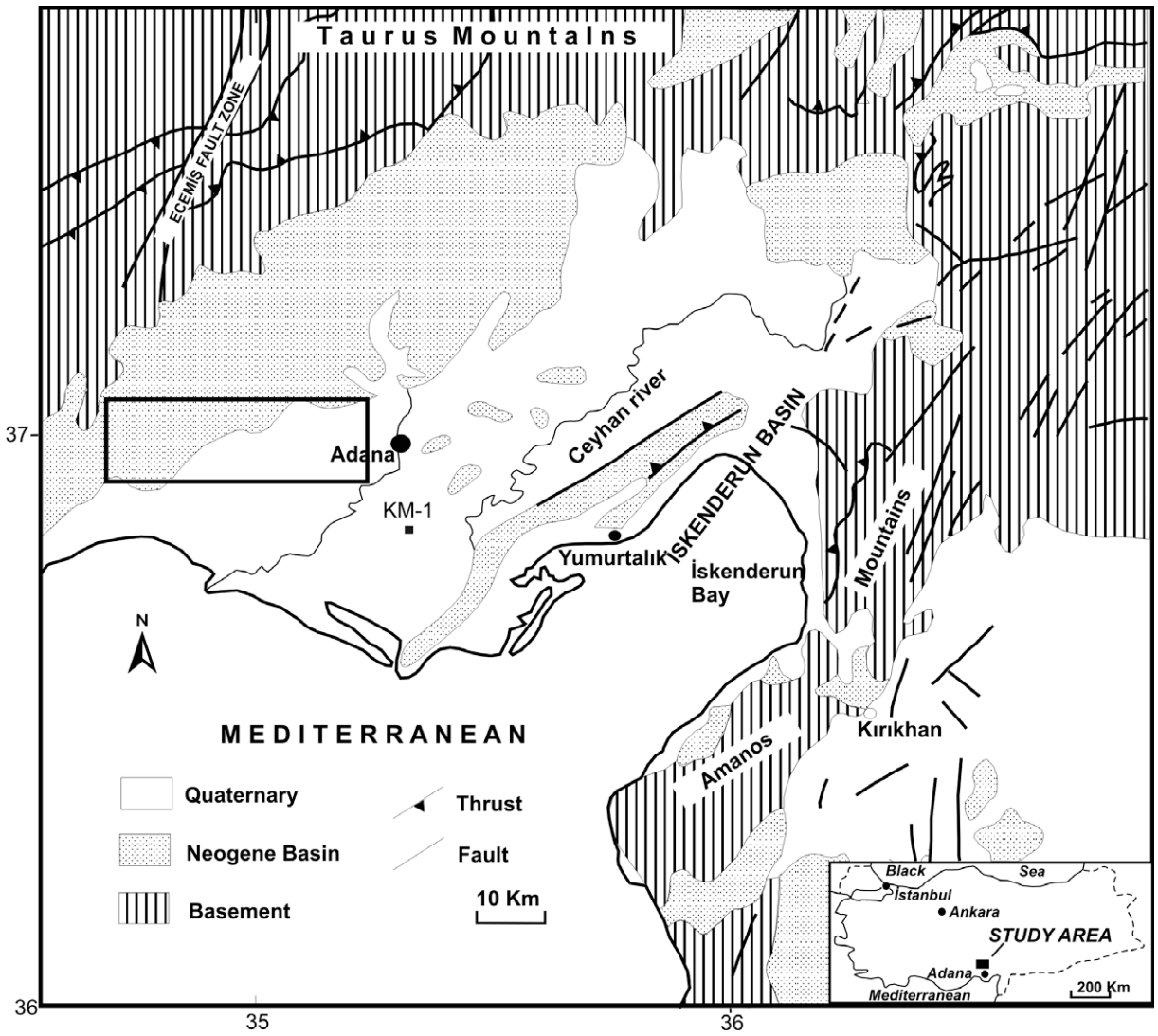

Fig. 1. Location map of the Adana Basin (from Gürbüz, 1999) and location of the KM-1 borehole.

correlated with the Messinian evaporites mentioned by Hsü (1972) and Hsü et al. (1973).

The purpose of this paper is to interpret the palaeoenvironmental changes of the Adana Basin during the Messinian salinity crisis. To achieve the objective, a multidisciplinary approach combining micropaleontology (ostracods and planktonic foraminifers), lithological features and clay mineralogy was used.

2. Material and method

This study was based on fossil planktonic foraminifers and ostracods from 195 samples collected in 10 measured stratigraphic sections and 447 samples from 10 well log. In this study, three stratigraphic sections and a well log are selected to describe events that occurred in the late Miocene in the Adana Basin. To identify planktonic foraminifers and ostracods, 100 g of rock material were washed through 100- and 150-mm-mesh sieves.

For clay mineralogy analyses, XRD identification was done at Hacettepe University, Department of Geology Engineering. The semiquantitative proportions were determined from powder diffractograms following an external standard method developed by Gündoğdu (1982).

Fossil photographs have been taken using SEM (Scanning Electron Microscope) at the Turkish Petroleum Company, Ankara. The illustrated fossil plates are housed in KSU (Kahramanmaraş Sütçü İmam University), Geology Engineering Department, Turkey.

3. General stratigraphy of the Adana Basin

The structural and stratigraphical evolution history of the main Adana Basin (SE Turkey) started after the late Eocene to Oligocene thrust emplacement of an ophiolitic complex and associated melange in the Taurides located in the northern part (Williams et al., 1995). Schmidt (1961) described a group of redbeds, namely Karsanti, Meydan and Garajtepe Formations, which developed well in the Karsanti Basin. These lithostratigraphic units have been combined into the Karsanti Formation in the latest studies (Yetiş, 1988; Ünlügenç and Demirkol, 1988). This formation consists mainly of marls and mudstones with pebbly sandstones, conglomerates and sandstones developed near the base (Fig. 2). The age of the Karsanti Formation was determined as Oligocene and, according to planktonic foraminifera and ostracod assemblages (Ünlügenç et al., 1993) the sediments record terrestrial and logoonal/littoral environmental conditions. Williams et al. (1995) mentioned that this formation was deformed by a compressional event of late Oligocene age in the northeast of the Adana Basin. In the early Miocene (Aquitanian) period, terrestrial redbeds belonging to Gildirli formation began to subside into a foreland basin