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Confined deep water system development on the accretionary wedge (Miocene, Kahramanmaraş Foreland Basin, S turkey)

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ABSTRACT

According to theoretical studies, the foreland basin consists of: accretionary wedge (including wedge top or piggyback basin), foredeep, forebulge and backbulge depozones. All of them are parallel to the orogenic belts of the overlying and underlying plates. The closure of the southern branch of the Neotethys during the Late Cretaceous led to an oblique collision of the Arabian Plate and the Anatolide–Taurides Platform, leading to the development of the Miocene Kahramanmaraş Foreland Basin (KFB). Thus, the promontory shape of the Arabian Plate prevented the development of an accretionary wedge parallel to the orogenic belt. The accretionary wedge of the KFB includes blocks of various sizes and age (mainly Mesozoic limestone) scattered within an Early Tertiary matrix (mass wasting deposits and shallow to deep marine sediments). At the beginning of the Miocene, transtensional tectonism led to the development of half-graben basins on top of the accretionary wedge. These basins (namely; the Tekir and Çukurhisar) also cut the foredeep of the KFB obliquely (in contrast with the theoretical study). This paper focuses on the evolution and fillings of those basins. Initially, claystone and basin margin reef deposits filled the half-graben basins as a consequence of the Lower Miocene sea invasion. Then, long and narrow conglomeratic channels starting from the northern edge of the basins (fan-delta) progressed southwards, passing into sandy lobes, then into claystones. An activation of the boundary faults of the wedge top basin stopped the progression of the Lower–Middle Miocene sediments and led to their deformation. Then, the sedimentation of the KFB shifted towards the basin centre during the Middle Miocene.

Contents

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1. Introduction

Many recent studies have focussed on the sediment characteristics, fluid movements and geometry of sedimentary basins in active continental margins (including thrust–fold belts and foreland basins) due to their potential oil content (Lacroix et al., 2011). Despite the difficulties in investigating and evaluating foreland basin sediments, they are of great importance in the study of deformation in continental collision zones (DeCelles and Giles, 1996; Haughton, 2000; Sinclair and Tomasso, 2002; Mutti et al., 2003; Martin-Gonzalez and Heredia, 2011). Foreland basin development depends upon advancing thrust and fold loads caused by flexural subsidence in the front and rear zones of continent–continent and oblique continental collision settings (Garciacaro et al., 2011). In theory, a foreland basin consists of four distinct depozones: the wedge-top, foredeep, forebulge and backbulge, which develop parallel to the orogenic belt in between the overlying and underlying plates (DeCelles and Giles, 1996). The nature of these basins varies from terrestrial to deep-sea environments and can include confined turbidite system.

Intense tectonic activity in collision settings controls the irregularity of sea floor topography and geometry of a confined turbidite system (Lomas and Joseph, 2004). Eastern and southeastern Anatolia contains different examples of collision tectonics (including: thrust belts, plain areas and foreland basins, Dewey et al., 1986). The Cenozoic basins of Southern Turkey (including the KFB) are kinematically linked to the African–Eurasian plate collision (Golonka, 2004; Kelling et al., 2005), see Fig. 1. These plate movements caused the formation of broad foreland basins from Spain to Iran (Şengör and Yılmaz, 1981; Gürbüz and Gökçen, 1985; Önalan, 1988; Lihou and Allen, 1996; Yılmaz and Yıldırım, 1996; Bahroudi and Koyi, 2004; Boulton and Robertson, 2007; Boulton et al., 2007). The oblique continental collision of the Arabian Plate and Anatolide–Taurides Platform during the Early Miocene caused the confined wedge top basin development that obliquely cut the foredeep (Fig. 2; Önalan, 1988; Yılmaz et al., 1988; Yılmaz, 1993; Yılmaz and Gürer, 1996; Gül, 2004; Robertson et al., 2004). This observation is quite different from the theoretical foreland basin models (DeCelles and Giles, 1996; Mutti et al., 2003) and presents a different view of the recent oblique plate collision area (Garciacaro et al., 2011). Recent plate motions between the Caribbean Plate and northern South America have caused an oblique collision and point sourced delta system (Garciacaro et al., 2011). The KFB evolved under an oblique collision, but the promontory shape of the Arabian Plate caused the development of a half-graben basin. Therefore, an understanding of the morphological and lithological changes in the foreland basin over a short distance is very important for reservoir evaluation and deformation assessment of collision zones.

The KFB existed for up to ~75 km from east to west, extending north–south for ~50 km. It is situated in between the latitudes 37°30′–38°10′ N and longitudes 36°20′–37°00′ E (SE Turkey). The KFB is interpreted as a peripheral foreland basin due to consuming of Southern Neotethys Ocean, and basin development on underlying Arabian plate (Önalan, 1988). The orogenic wedge, wedge-top and foredeep part of the basin are located in north of Kahramanmaraş city. A shallow marine limestone depositing basin, Hatay underfilled foreland basin located in southern continuation of the KFB (Boulton and Robertson, 2007). The main purpose of this study is to document the development of peculiar confined turbidite systems on the accretionary wedge of the KFB (including: sedimentological characteristics, architecture and evolutionary stage) that obliquely cut the foredeep.

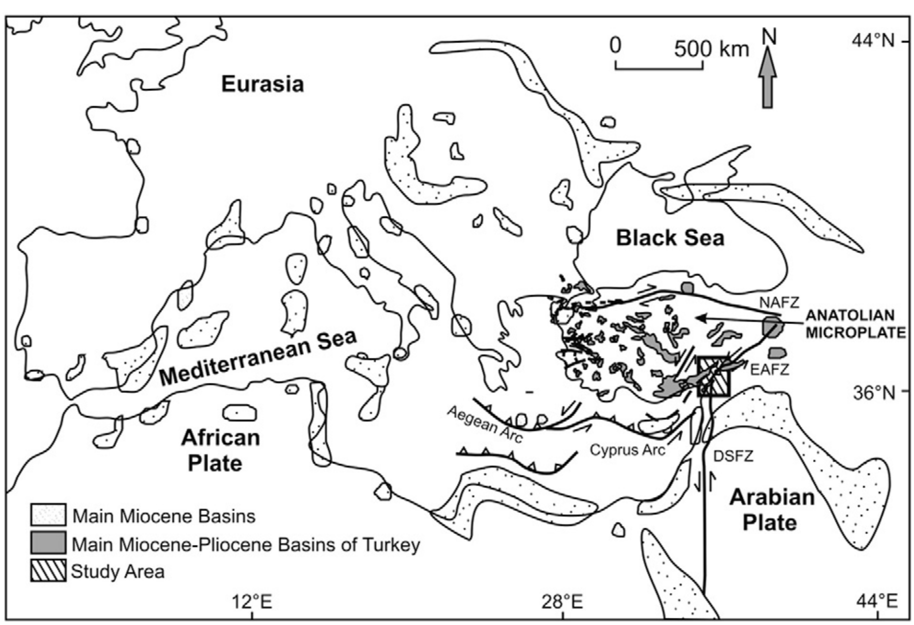

Fig. 1. The Miocene basins in Europe (modified after, Esteban, 1996), the Miocene and Pliocene deposits in Turkey (modified after, Kelling et al., 2005) and main tectonic zones in and around Turkey (NAFZ: North Anatolian Fault Zone; EAFZ: East Anatolian Fault Zone; DSFZ: Dead Sea Fault Zone; modified after, Boulton and Robertson, 2007).