Available online at www.sciencedirect.com
SCIENCE DIRECT
Journal of Asian Earth Sciences 27 (2006) 194–206
Journal of Asian Earth Sciences
www.elsevier.com/locate/jaes

Platform–slope transition during rifting: The mid-Cretaceous succession of the Amasya Region (Northern Anatolia), Turkey

Cemil Yılmaz*

Department of Geology, Karadeniz Technical University, 61080 Trabzon, Turkey

Received 14 July 2004; accepted 17 March 2005

Abstract

The mid-Cretaceous rocks of the Amasya region, North Central Anatolia record the geological processes that occurred during the break up of the eastern Pontide carbonate platform which existed from mid-Jurassic to Early Cretaceous. The mid-Cretaceous sedimentary rocks consists of benthic foraminiferal packstones/grainstones of Ferhatkaya Formation, and limestone breccias, turbidites, pelagic foraminiferal wackestones/packstones and radiolarites of Sarilar Formation corresponding to platform, and slope/apron environments, respectively. The lithological development of these units was controlled mainly by active subsidence due to block-faulting affecting the Eastern Pontide carbonate platform. Due to the break-up of the platform during Late Barremian–Early Aptian times, slope and basin sediments were deposited on the deeper parts of the platform. Re-deposited sediments such as limestone breccias and calciturbidites document the infilling of asymmetric grabens during the mid-Cretaceous rifting phase. Re-deposited sequences, which were formed as a fault slope-apron sedimentary prism related to this rifting, were deposited during thinning-and-fining upward megacycles. A typical megacycle commences with breccias deposited at the base of a fault-scarp association. In addition, the upper part of the platform carbonates (Ferhatkaya Formation) includes neptunian dykes composed of red mudstones with pelagic fossils, indicating a period of extension.

Keywords: Carbonate facies; Basin analysis; Mid-Cretaceous; Platform–slope to basin; Neptunian dykes

1. Introduction

The tectonic setting of the Eastern Pontides (Fig. 1) is still a matter of debate. Several different scenarios have been proposed. Dewey et al. (1973) and Bektas (1986) suggested that subduction was directed southwards, starting in the Paleozoic and continuing until the end of the Eocene, whereas Adamia et al. (1977) and Tokel (1977) proposed that subduction was northward during the same period. Sengör and Yilmaz (1981) suggested that subduction was southward from the Paleozoic to the Jurassic and northward from the Late Cretaceous to the mid-Eocene. According to Golonka (2004), during Late Triassic–Early Jurassic times several microplates were sutured to the Eurasian margin, closing Paleotethys and during Jurassic–Cretaceous times a north-dipping subduction boundary was developed south of Pontides along this new continental margin. Ustaömer and Robertson (1997) proposed a scenario in which 'North-facing half-grabens formed in the north and were filled by turbiditic sediments, debris flows and limestone blocks derived from the carbonate platform in the Central Pontides. Early Cretaceous extension developed above a northward-dipping subduction zone and was a precursor to opening of the Black Sea as a back-arc basin in the Late Mesozoic–Early Tertiary'.

Mesozoic basins were formed by block faulting in northern, southern and axial zones of tectonic weakness in the Pontides magmatic arc which was formed by southward subduction (Bektas, 1984; Bektas et al., 1995, 1999). In this model the Black Sea is a remnant of the Paleo-Tethys Ocean and the Eastern Pontides are attached to a segment of the Neo-Tethys (back-arc basin; Sengör and Yilmaz, 1981) which was being subducted towards the south. Yilmaz et al. (1997) suggested that the Karakaya marginal basin was

* Tel.: +90 462 377 27 26; fax: +90 462 325 74 05.
E-mail address: cyilmaz@risc01.ktu.edu.tr

1367-9120/$ - see front matter © 2005 Elsevier Ltd. All rights reserved.
doi:10.1016/j.jseaes.2005.03.004

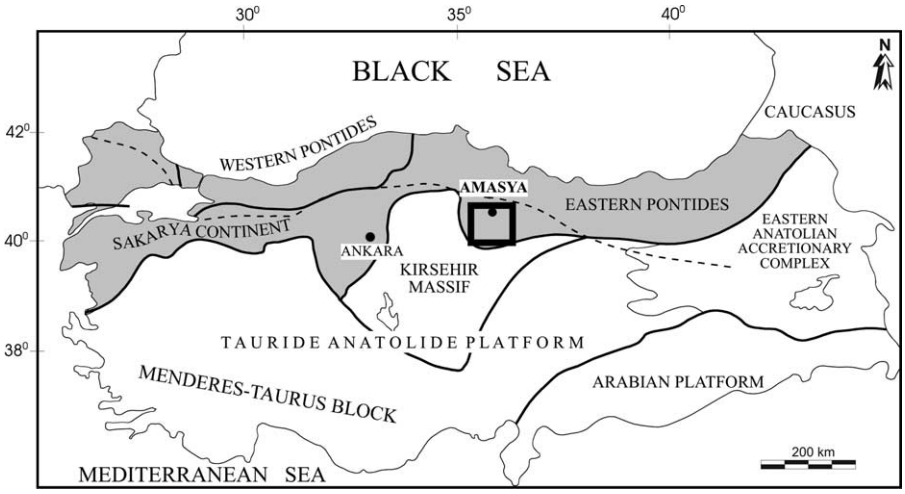

Fig. 1. Major tectonic units of Turkey (Yilmaz et al., 1997) and location of the study area.

generated behind volcanic arc during southward subduction in the Triassic.

After the closure of the Karakaya Basin by the continuing subduction in the latest Triassic, the Neo-Tethys (the Izmir–Ankara–Erzincan Ocean) opened up as a new basin during the Liassic. This Liassic rifting, characterized by thick coarse-clastic rocks, was accompanied by the eruption of alkaline and tholeiitic lavas. The north Anatolian Paleorift (NAPR) described by Koçyigit and Altiner (2002) in northern Turkey comprises the south-facing passive continental margin of the northern Neo-Tethys which developed during the Hettangian. In this basin, the Liassic is characterized by rift-related sediments (Sengör and Yilmaz, 1981; Görür et al., 1983; Bergougnan, 1987; Yilmaz et al., 1996; Koçyigit and Altiner, 2002) and overlain by the typical shelf carbonates.

The Jurassic–mid-Cretaceous Eastern Pontide carbonate platform, forms the south-facing passive continental margin of the Neo-Tethys Ocean. This carbonate platform was broken up by north–south transtensional tectonic movements during the mid-Cretaceous (oral communication Prof. O. Bektas, 2004). This conclusion was confirmed by Yilmaz (1997), Bektas et al. (1995, 1999), Rojay and Altiner (1998) and Eren and Tasli (2002) for the Eastern Pontides, and by Görür et al. (1983), Koçyigit et al. (1991) and Koçyigit and Altiner (2002) for the western Pontides, with a slight difference in timing. According to Rojay and Altiner (1998), the deposition of Jurassic–Lower Cretaceous carbonates in the Pontides represents the development of an Atlantic-type continental margin in the Neo-Tethys.

The main geological framework of the southern zone of the eastern Pontides was formed by two distinct rifting phases, one during the Lias and the other during the middle-late Cretaceous, separated by a quiet tectonic period. The first rifting episode is related to the break-up of the Hercynian granitic basement and the opening of the Neo-Tethys Ocean. The second episode was related to the break-up and drowning of the carbonate platform and is reflected in a rapid transition from a platform carbonate environment to a pelagic facies (Yilmaz et al., 1996; Bektas and Çapkinoglu, 1997).

The relationships between shallow-marine carbonates and re-deposited pelagic sediments are documented in the Cretaceous succession of the Eastern Pontides. The re-deposited sequence is a sensitive indicator of tectono-sedimentary conditions (Bektas, 1986; Yilmaz, 1993; Bektas et al., 1995; Bektas and Çapkinoglu, 1997; Bektas et al., 2001). The purpose of this paper is to illustrate the characteristics of the middle Cretaceous platform-basin transition, which has already been reported by numerous authors (Seymen, 1975, 1993; Altiner et al., 1991; Tüysüz, 1996; Yilmaz, 1996; Yilmaz et al., 1996; Rojay and Altiner, 1998). Similar slope and basin facies sediments are reported from the mid-western Pontides (Rojay and Altiner, 1998; Koçyigit et al., 1991; Altiner et al., 1991; Koçyigit and Altiner, 2002).

The relationship between sediment supply and carbonate production, and accommodation space largely determine facies distribution. These factors are controlled by many parameters, the most important of which are tectonics, climate and eustatic sea-level changes (Bernaus et al., 2003). During the early Cretaceous, a greenhouse climate was characterized by warm oceans, high concentrations of CO_2 in the atmosphere and high global sea levels (Bernaus et al., 2003). Detailed paleomagnetic studies (Lauer, 1984) show that the study area was located around the Equator during the middle Jurassic and moved to 25°N latitude until Albian–Cenomanian (Fig. 2). So, it is evident that during Dogger–Albian times the paleogeographic position of the study area was ideal for the inititation and growth of a carbonate platform.

The present study deals with the following aspects: the geological setting of the Amasya region; microfacies characteristics of the platform, slope and basin sediments;