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Southward migration of arc magmatism during latest Cretaceous associated with slab steepening, East Pontides, N Turkey: New paleomagnetic data from the Amasya region

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ABSTRACT

A new paleomagnetic study was carried out on the Fındıklı formation in the Amasya region, which is to the north of the Ankara-Erzincan Neotethyan suture zone, in order to better understand the paleogeographic evolution of the Pontides tectonic belt during the Maastrichtian. Samples were collected from volcanoclastic sandstones and lavas at 51 sites. Rock magnetic experiments identified pseudo-single domain (PSD) titanomagnetite as the main magnetic carriers at the majority of sites. Progressive thermal and alternating demagnetization revealed that the characteristic remanent component is removed between 400 and 580 °C or 20–100 mT, respectively. A high temperature component, which indicates the presence of titano-hematite, is found only in some lavas. Declinations show a systematic dispersion across the study area related to tectonic rotations about vertical axes. Inclinations are consistent, however, and yield a mean paleolatitude of 20.0°N ± 2.5° for the Maastrichtian. Comparison of the results from this study with the reference direction of the East Pontides from the Turonian–Campanian is best explained with a model involving slab roll-back and marginal basin formation between 90 and 65 Ma period.

1. Introduction

The southern Eurasian margin in northern Turkey is presumed to represent a long-lived active margin of the North Tethys, which is characterized by: (1) episodic formation of continental and oceanic arc magmatism; (2) growth of subduction–accretion complexes; (3) opening and subsequent closure of marginal basins; (4) terrane accretion/collision; and (5) strike-slip displacement in much of the Late Palaeozoic to early Tertiary (Robertson and Dixon, 1984; Ustaömer and Robertson, 1997; Rice et al., 2006, 2009; Stampfli and Borel, 2002; Yılmaz et al., 1997a). The North Tethys or the northern branch of Neotethys in this area closed during the Palaeocene, which led to collision of the East Pontides to the north with the Kırşehir Massif and the Menderes-Taurus Platform to the south (Sengor and Yılmaz, 1981; Okay and Şahintürk, 1997; Okay and Tüysüz, 1999; Rice et al., 2006, 2009; Fig. 1). The collision zone is marked by an ophiolitic suture zone, the İzmir-Ankara-Erzincan Suture (IAES). The IAES, separating Eurasia to the north from the Gondwanan fragments to the south, is a more than 1000 km long belt that merges with the Sevan-Akera suture in Trans-Caucasus further east. The suture makes a large loop in Central Anatolia near Amasya and trends E-W further east, delimiting the southern boundary of the East Pontides (Fig. 1). The direction of subduction of the IAES was dominantly northward in Late Mesozoic (Sengor and Yılmaz, 1981; Okay and Şahintürk, 1997; Ustaömer and Robertson, 1997; Rice et al., 2006, 2009); a thick sequence of arc-type volcanics and plutonic rocks were emplaced upon the East Pontide crust in response to northward subduction of Tethys in Late Mesozoic time (Adamia et al., 1977; Akın, 1978; Sengor and Yılmaz, 1981; Okay and Şahintürk, 1997; Okay and Tüysüz, 1999). A rifted volcanic arc and marginal basins were also formed within the Tethys, inboard the E Pontide arc (Tüysüz, 1990; Ustaömer and Robertson, 1997; Rice et al., 2006, 2009). The present Black Sea is widely believed to have rifted as a back-arc basin behind the East Pontide arc in Late Mesozoic (Zonenshain and Le Pichon, 1986; Görür, 1988; Dercourt et al., 1993; Okay et al., 1994; Spadini et al., 1996; Banks, 1997; Görür and Tüysüz, 1997; Robinson, 1997; Ustaömer and Robertson, 1997). The N-S width of Black Sea is ca 300 km and much of its basement is underlain by oceanic crust or highly attenuated continental crust (Zonenshain and Le Pichon, 1986; Finetti et al., 1988; Görür, 1988; Dercourt et al., 1993; Okay et al., 1994; Banks, 1997; Nikishin et al., 2003; Minshull et al., 2005; Shillington et al., 2008,

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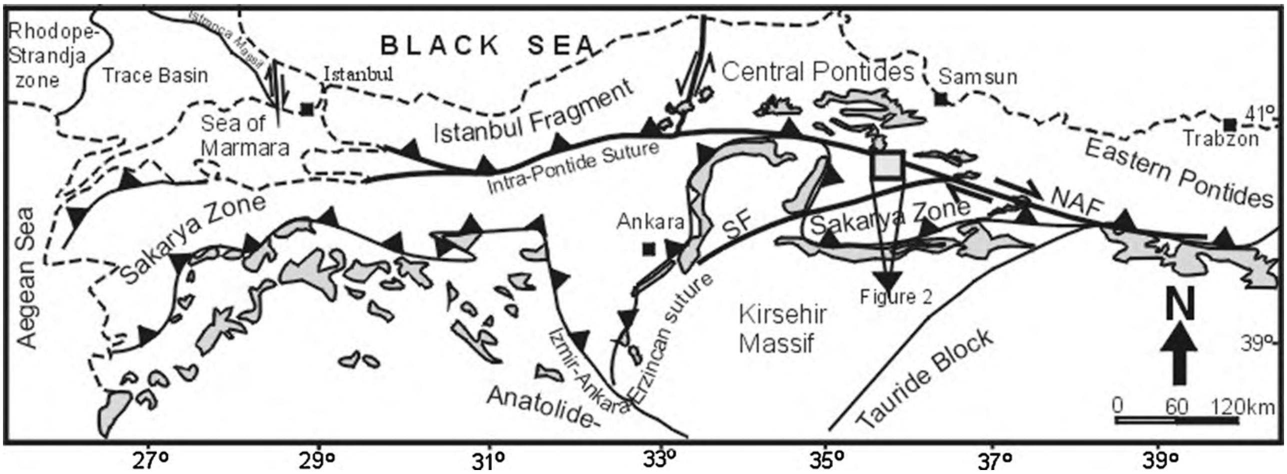

Fig. 1. Location map of the investigation area showing the main tectonic divisions of Anatolia. The Cenozoic ophiolitic assemblages are illustrated as gray colour (Yılmaz et al., 1995). Shadowed box shows the sampling area. Abbreviations: SF:Sungurlu Fault; NAF: North Anatolian Fault.

2009). Arc magmatism in the East Pontides commenced in the Turonian (Taner and Zaninetti, 1978; Okay and Şahintürk, 1997) and stopped by the Campanian as a result of roll-back of the subducting Neotethyan slab (Rice et al., 2006, 2009). Pelagic micrites and shales were deposited in the southern part of the East Pontides in the Maastrichtian but a volcanic-sedimentary basin was formed further south in the Amasya region at the same period. This southerly located mid-Campanian–Maastrichtian basin was previously interpreted either as a fore-arc basin (Rojay, 1993), as a rifted-marginal basin (the Beldağ Basin, Yılmaz et al., 1997a), or as a back-arc basin (Ustaömer and Robertson, 1997; Rice et al., 2006, 2009).

Several paleomagnetic studies on Late Cretaceous volcanics and sediments of the Pontides have a mean paleolatitude of approximately 23.0°N (Van der Voo, 1968; Lauer, 1981; Sarıbudak, 1989; Channell et al., 1996; Çinku, 2004). In a more detailed study carried out in the East Pontide arc Channell et al. (1996) reported a mean paleolatitude of 25.5 ± 4.5°N.

The present study has been carried out to help understand the absolute migration of the locus of magmatism from the East Pontide arc in the north to the Amasya region. Furthermore it should help constrain the limits of the slab roll-back process, preceding collision at the active margin.

2. Geological setting and stratigraphy

The study area is located in the Amasya region in the south-western part of the East Pontides. Turkey. It is bound by the dextral

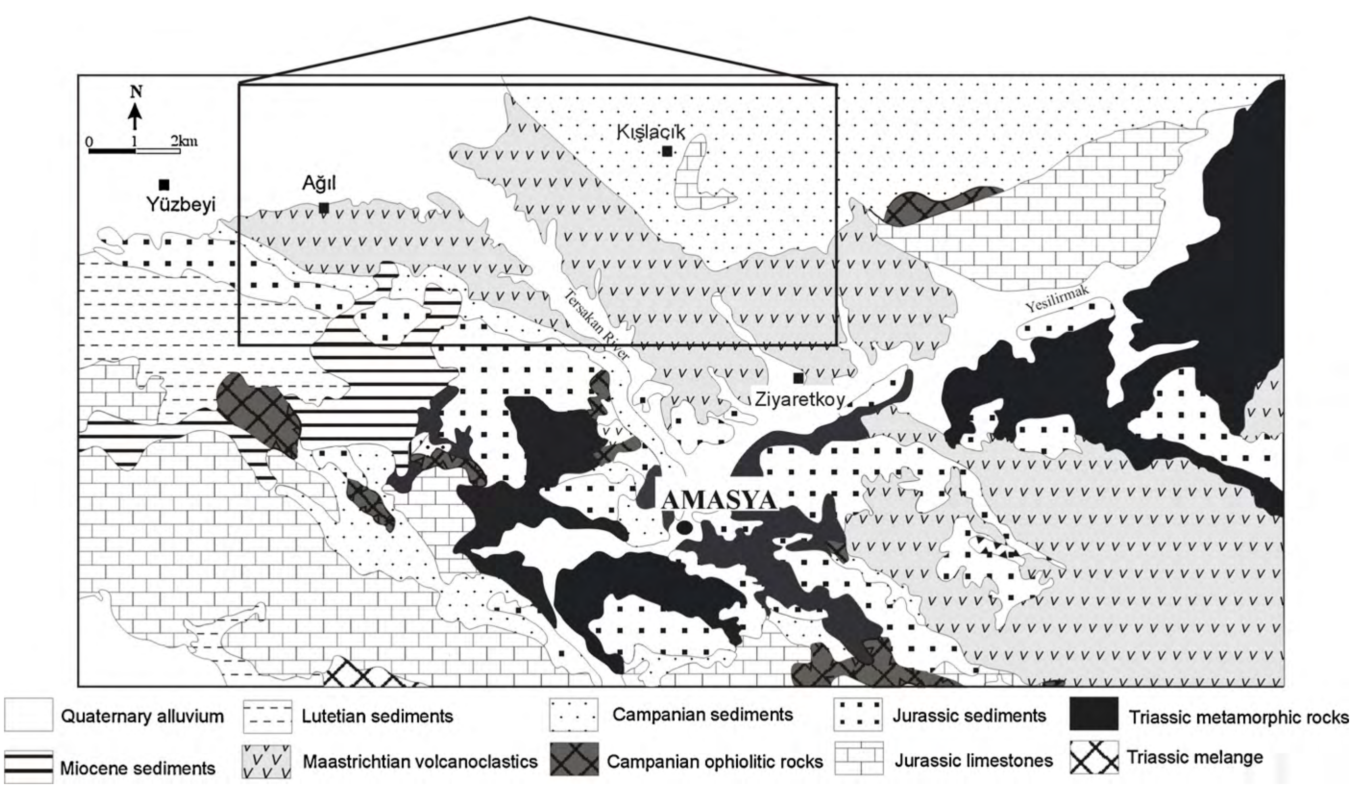

Fig. 2. Geological map, including the location of the sampling sites, of the area of investigation and its surroundings (after Özcan et al., 1980).