Late Miocene transcurrent tectonics in NW Turkey: evidence from palaeomagnetism and $^{40}$Ar–$^{39}$Ar dating of alkaline volcanic rocks

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Abstract – A number of intra-continental alkaline volcanic sequences in NW Turkey were emplaced along localized extensional gaps within dextral strike-slip fault zones prior to the initiation of the North Anatolian Fault Zone. This study presents new palaeomagnetic and $^{40}$Ar–$^{39}$Ar geochronological results from the lava flows of NW Turkey as a contribution towards understanding the Neogene–Quaternary tectonic evolution of the region and possible roles of block rotations in the kinematic history of the region. $^{40}$Ar–$^{39}$Ar analyses of basalt groundmass indicate that the major volume of alkaline lavas of NW Turkey spans about 4 million years of episodic volcanic activity. Palaeomagnetic results reveal clockwise rotations as high as 73° in Thrace and 33° anticlockwise rotations in the Biga Peninsula. Movement of some of the faults delimiting the areas of lava flows and the timing of volcanic eruptions are both older than the initiation age of the North Anatolian Fault Zone, implying that the region experienced transcurrent tectonics during Late Miocene to Pliocene times and that some of the presently active faults in the region are reactivated pre-existing structures.

Keywords: palaeomagnetism, block rotation, $^{40}$Ar–$^{39}$Ar ages, alkaline volcanism, NW Turkey, strike-slip faulting, North Anatolian Fault Zone.

1. Introduction

The Neogene tectonic evolution of NW Turkey has been largely influenced by the development of a number of strike-slip fault systems that resulted from collision of the African and Arabian plates with the Eurasian Plate. The main collision between the Eurasian and Arabian plates took place along the Bitlis–Zagros Suture Zone (Fig. 1a) and is also assumed to have caused the major shortening and uplift in Eastern Anatolia and the westward extrusion of the Anatolian Block (Mckenzie, 1972; Şengör, Görür & Şaroğlu, 1985). Internal deformation within the Anatolian Block as a result of this collision involved both internal imbrication and the formation of numerous strike-slip faults and related structures. The development of the latter may have been influenced by lateral variations of lithospheric rheology and the pre-existing structural framework (Dewey et al. 1986). The westward escape of the Anatolian Block is coupled with back-arc extension in the Aegean and accommodated by two major strike-slip faults: the dextral North Anatolian Fault Zone and the sinistral East Anatolian Fault Zone. Interaction of the westwards motion of the Anatolian Block with the dextral strike-slip motion of the North Anatolian Fault Zone and roughly N–S-directed Aegean extension system (Gürer et al. 2003; Flerit et al. 2004) led to a change in the movement of the Anatolian Block relative to the Eurasian Plate from westwards to southwestwards as the style of deformation also changed from pure strike-slip along the eastern to transtensional mechanisms along the western segments of the North Anatolian Fault Zone. These relationships also led to anticlockwise rotation of the Anatolian Block (Rotstein, 1984; Oral et al. 1995; Reilinger et al. 1997; McClusky et al. 2000) and bifurcation of the North Anatolian Fault Zone into a number of dextral strike-slip faults with normal components and development of small distributed pull-apart basins in NW Turkey (Fig. 1b).

The Neogene tectonic evolution of the Thrace basin is less well understood but has been attributed to the Thrace Fault Zone (e.g. Perinçek, 1991; Turgut, Türksal & Perinçek, 1991; Görür & Okay, 1996). According to Perinçek (1991), the Thrace fault is the abandoned westernmost extension of the North Anatolian Fault Zone and has not played a significant role in the tectonic development of the region since the Late Miocene. More recently, Yalıtar & Alpar (2002) proposed that many of the strike-slip faults in NW Turkey (including the Edremit, Yenice, Etili, and Ganos faults, Fig. 1) are dextral splay faults of the ‘so called’ Thrace–Eskisehir Fault Zone and played a major role in tectonic development of the region prior to

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