

Vegetational and climatic investigations in the Early Miocene lacustrine deposits of the Güvem Basin (Galatean Volcanic Province), NW Central Anatolia, Turkey

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Abstract

The palynological analysis of the Burdigalian (Early Miocene) successions of the Güvem Basin (NW Central Anatolia, Turkey) has been carried out with the aim of reconstructing the palaeovegetation. The pollen spectra indicate a flora dominated by trees such as *Quercus* deciduous type, *Carya*, *Carpinus*, *Ulmus/Zelkova*, *Engelhardia*, *Quercus ilex* type and Pinaceae. *Pterocarya*, *Juglans*, *Alnus*, *Salix*, *Liquidambar* and Oleaceae are represented by lower percentages. Herbs and shrubs are represented by minor amounts of Poaceae, Amaranthaceae/Chenopodiaceae, Asteraceae/Asteroideae, Brassicaceae, and the aquatics *Potamogeton*, *Sparganium* and *Typha*. The Burdigalian flora reflects a mixed mesophytic forest with *Quercus* deciduous type, *Quercus ilex* type, pine species, *Ulmus/Zelkova*, *Engelhardia*, *Carya*, *Carpinus*, *Pterocarya*, etc., sparsely interspersed with open herbaceous areas. This flora reflects a warm-temperate climate. The fluctuations in abundances of broadleaved trees and xerophytes may represent fluctuations of relatively wet and dry periods. The overall composition of the flora of the Güvem Basin reflects cooler conditions compared with other Early Miocene floras in Europe, which is possibly due to intense volcanic activity of the area.

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1. Introduction

The Galatean Volcanic Province (GVP) is located in the northwestern part of Central Anatolia (Fig. 1), which occurs within the Pontide structural division of Turkey (Ketin, 1966). The northern margin of the GVP is bordered by the North Anatolian Fault, whereas the southern margin is surrounded by a continental clastic sedimentary sequence which interfingers with the volcanics. Two different volcanic cycles have been recognised in the GVP (Keller et al., 1992; Toprak et al., 1996; Wilson et al., 1997). Miocene volcanic activity is widespread. The Early Miocene older cycle is dominated by intermediate-acid lava flows and associated pyroclastics with relatively minor occurrences of alkali basaltic lava flows, whilst

the Late Miocene younger cycle consists of small-volume alkali basalt flows capping the older volcanic sequence (Wilson et al., 1997). Radiometric age determinations indicate an age of 17 to 20 Ma for the older cycle (Türkecan et al., 1991; Keller et al., 1992; Wilson et al., 1997; Tankut et al., 1998a) and 9 to 11 Ma for the younger cycle (Keller et al., 1992; Wilson et al., 1997; Tankut et al., 1998a).

The GVP comprises a number of volcanic complexes intimately associated with the development of a series of sedimentary basins. The Pelitçik, Güvem and Orta Basins are examples (Fig. 1B). These basins are contemporaneous with the volcanic complexes in the vicinity (Toprak et al., 1996). The lithologies and ages of the sequences deposited in these isolated basins are somewhat different from each other. The Early Miocene freshwater deposits of the Güvem Basin have been known for their rich record of plant macrofossils (Kasaplıgil 1977; Erdei et al., 2002) as well as animal fossils (Kasaplıgil 1977; Paicheler et al., 1978; Rückert-Ülkümen 1985, 2003). Baki Kasaplıgil was the first scientist who recognised the

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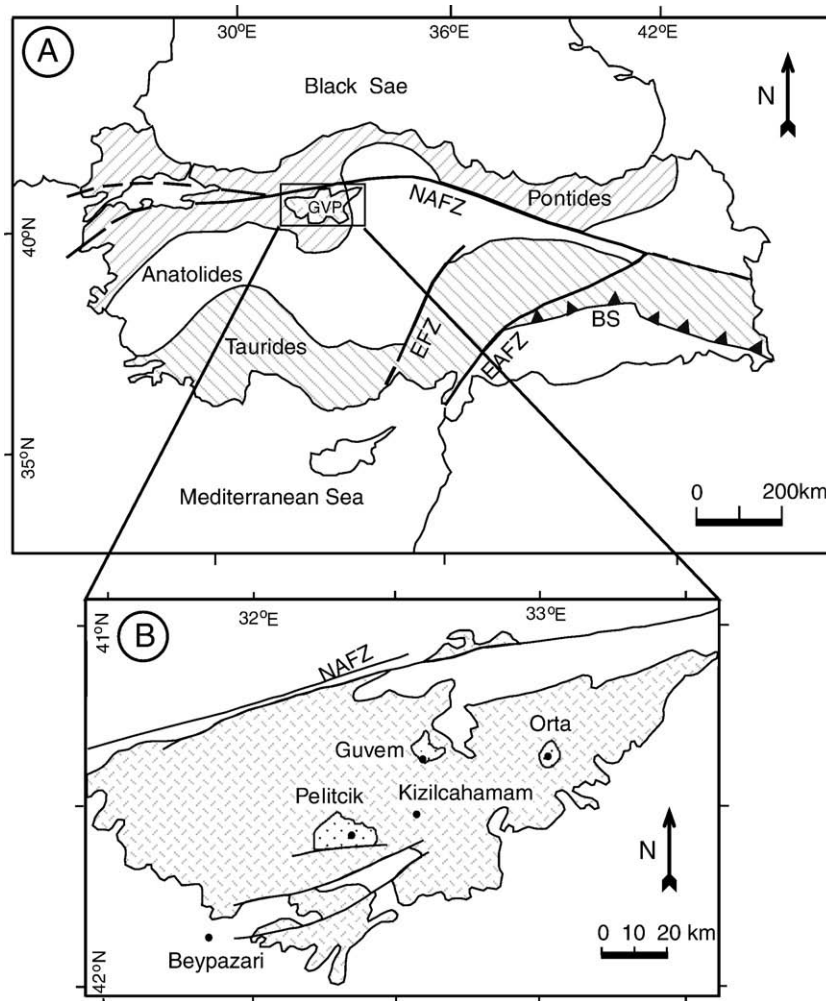


Fig. 1. Location of study area. (A) Geological sketch map of Turkey shows the major geotechnical elements (the Pontides, Anatolides and Taurides) and the major fault zones (NAFZ: North Anatolian Fault Zone, EAFZ: East Anatolian Fault Zone, EFZ: Ecemiş Fault Zone, BS: Bitlis Suture Zone). The hatched area indicates Galatean Volcanic Province (GVP). (B) The Galatean Volcanic Province, located in the Pontide structural area. The dotted areas indicate Neogene sedimentary basins.

abundance of fossils in the area (plant macrofossils: cones, fruits, seeds, leaves and branches; animal fossils: skeletal impressions of fishes, frogs and insects). He reported several fossil sites that are scattered in an area 15 km long and 7 km wide (Kasaplıgil, 1977). Collections of Kasaplıgil were confined mainly to the Beşkonak and Kadioğlu sites of the Güvem area. Kasaplıgil (1977) for the first time draw attention to the exceptionally high scientific value of the area and suggested its protection. Later, following efforts of the General Directorate of Mineral Research and Exploration Institute (MTA) in Ankara, the Güvem fossil site became formally protected. Today, official permission is needed to enter the area.

As mentioned above there are some earlier studies on plant macrofossils and animal fossils of the Güvem area and currently a few plant macrofossils are exhibited in the Natural History Museum of MTA. However, to date there is no palynological information from the Güvem Basin, except a few pollen grains identified by Kasaplıgil (1977) and Fourquin et al. (1970). This study therefore aims to investigate palynologically the Güvem deposits in order to reconstruct the Early Miocene vegetation and to discuss its paleoclimatic implications.

2. Güvem Basin

The formation of the GVP is related to the closure of the northern branch of the Neotethys with the collision between the African Plate in the south and the Eurasian Plate in the north. During the Late Oligocene–Miocene, continuing post-collisional convergence between the Sakarya Continent (south-facing northern active margin of the northern Neotethys) and the Menderes–Tauride Platform led to the thickening of the crust, uplift and subsequent emergence of a broad ENE–WSW trending intermontane basin. This basin was later structurally separated into several small-scale successor basins with an infill of a thick fluvio-lacustrine volcano-sedimentary sequence accompanied by calc-alkaline, and later alkaline volcanism (Kocyiğit et al., 2003 and references therein). The Güvem Basin is one of these isolated basins within the GVP containing thick fluvio-lacustrine sedimentary infills interfingering with the volcanic rocks (Paicheler, 1978; Toprak et al., 1996). In a relatively short period without magmatic activity, a lacustrine regime, in which a rich variety of fauna and flora developed, expanded in the Güvem Basin. The continental clastic sequence

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