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Petrographic characteristics and depositional environment of Miocene Çan coals, Çanakkale-Turkey

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ABSTRACT

In this study, petrographic examinations along with proximate, calorific value, ultimate, sulphur form and XRD analyses were performed in order to determine the coal characteristics and the depositional environment of the Miocene Çan coals. Seventy coal samples were taken from cores and open pit mines.
The investigated Çan coals are humic coals and classified as lignite to sub-bituminous coal based on the random huminite reflectance (0.38–0.54% R_r), volatile matter (45.50–62.25 wt.%, daf) and calorific value (3419–6479 kcal/kg, maf). The sulphur content of the Çan coals changes from 0.30 up to 12.23 wt.%, and a broad range of ash contents was observed varying between 2.46 wt.% and 41.19 wt.%. Huminite is the most abundant maceral group (74–95 vol.% mmf) consisting of mostly humocollinite (gelinite) which is followed by relatively low liptinite (2–18 vol.% mmf) and inertinite content (2–13 vol.% mmf). In general, major mineral contents of coal samples are clay minerals, quartz, mica, pyrite and feldspar.
The Çan–Etili lignite basin consists of mainly volcano-clastics, fluviatile and lacustrine clastic sediments and contains only one lignite seam with 17 m average thickness. In order to assess the development of paleo-mires, coal facies diagrams were obtained from maceral composition. According to the Vegetation Index (VI) and Ground Water Index (GWI), the Çan coal accumulated in inundated marsh, limnic and swamp environments under a rheotrophic hydrological regime. In general, the facies interpretations are in accordance with the observed sedimentalogical data.

1. Introduction

The Early–Middle Miocene-aged Çan–Etili lignite basin is located in NW Anatolia, encompassing the Çan, Etili and Bayramiç regions which occur to the north of the Kazdağ Horst in the Biga Peninsula. The basin unconformably overlies the Oligocene-aged Çan volcanics. The basin resembles a caldera developed by volcanic and tectonic activities. In the Çan basin total coal reserves are over 100 Mt and main production is consumed in the 210 MW capacity Çan coal-fired power plant.

Although there are a number of studies dealing with the coal properties and quality parameters of Çan basin coals (Gürdal, 2008, 2009; İnaner and Karayiğit, 2008), this is the first detailed investigation on the coal petrographic characterization and the interpretation of coal facies and depositional environment. The results from petrographic analyses have been evaluated in the light of the sedimentological investigations of the basin.

2. Geological setting

The Çan–Etili basin is located to the north of Mount Kazdağ, Biga Peninsula, northwestern Anatolia (Fig. 1). The basement of the Çan coal basin is represented by a thick metamorphic sequence called the Kazdağ Group with ophiolitic associations and volcanic–plutonic successions. These metamorphic basement rocks are overlain tectonically by an Upper Cretaceous ophiolitic mélange (known as Çetmi Ophiolite Melange (Okay et al., 1990)) in western and northwestern parts of Kazdağ.

In the region, volcanic rocks with various chemical compositions are interbedded with a Cenozoic sedimentary sequence more than 2500 m thick (Ercan et al., 1996; Siyako et al., 1989). In this period, Eocene marine deposits and calc-alkaline volcanics were laid down. The products are Eocene-aged sandstone and limestone with andesite, dacite, trachyandesite and rhyodacite. During Oligo-Miocene, a new magmatic activity started in the region and shallow granitoid intrusions (i.e. Evciler, Kestanbol, Karabiga, Kuşçayırı, Ilıca-Şamlı and Nevruz-Çakırova intrusions) were formed.

During early to middle Miocene, Çan lignite basin developed on these volcanic foundations above an obvious unconformity. The sediments of the Çan–Etili lignite basin are composed of bituminous shale and claystone with intercalated lignite, sandstone, siltstone and tuff. In the Upper Miocene–Pliocene, conglomerates, sandstone, mudstone and limestone were deposited indicating a fluvial and lacustrine environment. During the late Miocene, new volcanic activity occurred due to the combined effects of extensional and strike-slip tectonics (Yılmaz et al., 2001) and in this period alkaline basalts were extruded.

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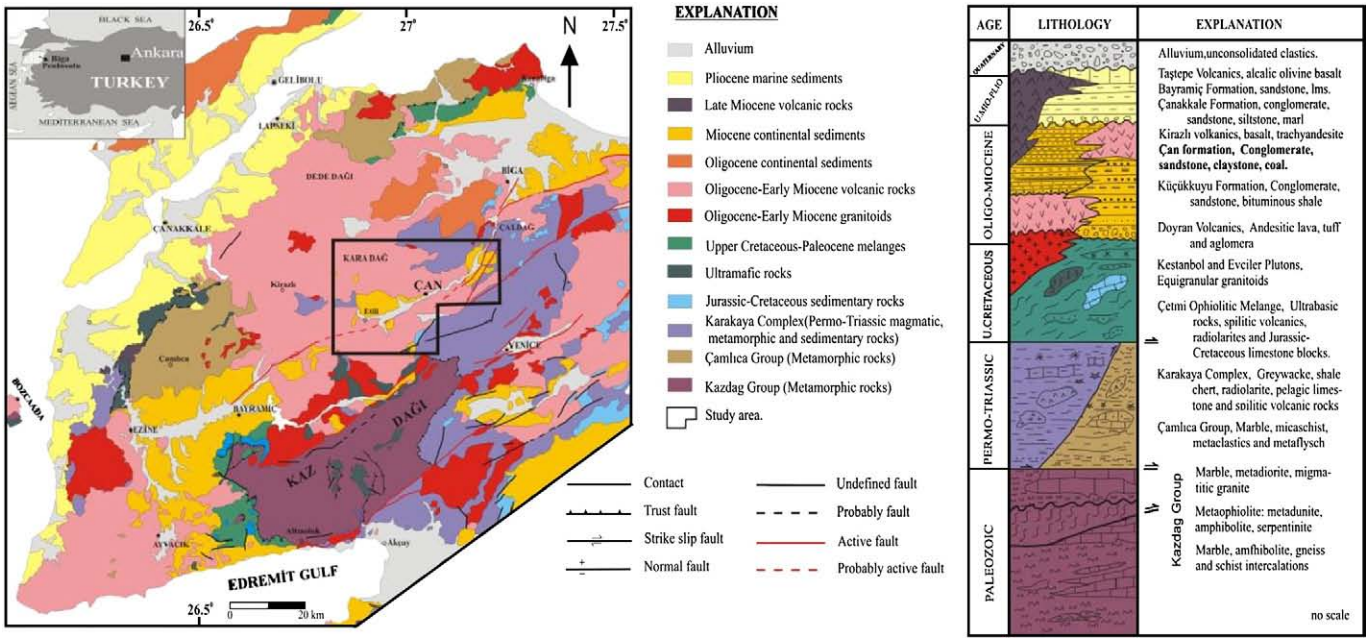

Fig. 1. Geological map and generalized stratigraphic column of the Biga Peninsula (modified from: Okay et al. (1990); Ercan et al. (1995); Okay et al. (1996), Duru et al. (2004)).

2.1. Stratigraphy of the Çan lignite basin

The lignite-bearing sedimentary formation covers the Çan volcanic rocks with an unconformable contact (Fig. 2). The Çan formation starts with a thin conglomerate level above the unconformity on the volcanic suite. The formation outcrops over 84 km^2 area around Çan and Etili towns (Fig. 2). It contains heterogeneous lithologies, such as conglomerate, sandstone,

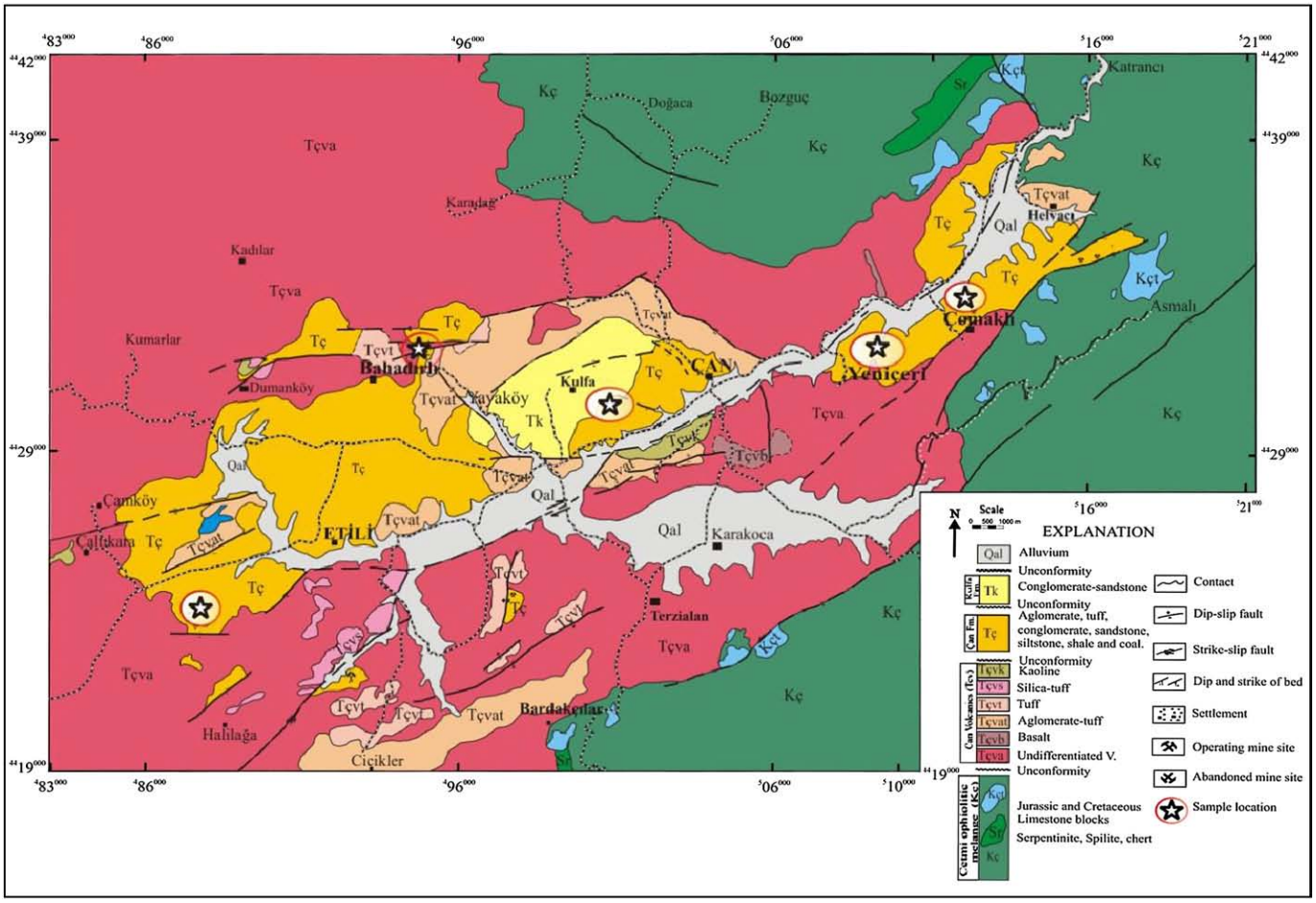

Fig. 2. Geological map of the Çan–Etili region.