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Properties of lignite from the Konya-Ilgin-Çavuşçu deposit and its potential use in a future power plant (Turkey)

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Abstract. The Konya-Ilgin-Çavuşçu lignite coalfield is located in the central part of Turkey. This coalfield has been mined in an open-pit manner by private companies. There is a single mined coal seam, the thickness of which varies between 1.10-37.15 m. A total of sixty five boreholes have been drilled in the area toward assessing the reserves. Confirmed and extractable reserves have been calculated by the polygon and isopach methods, depending on the boreholes drilled at different times. There is enough coal in the Ilgin-Çavuşçu coalfield to fuel a thermal power plant.

Key words: lignite, coalfield,Turkey

Introduction

Turkey currently has about 8.4 Gt. of lignite reserves, of which 3.9 Gt. are exploitable. Most of the known lignite deposits in Turkey have low calorific values and high ash, moisture, and total sulphur contents. Almost 80% of the total reserves have calorific values below 10.46 MJ . kg^{-1}. The lignites having calorific values lower than 10.46 MJ . kg^{-1} are generally consumed in power plants, while those having calorific values higher than 10.46 MJ . kg^{-1} are directed towards household and industrial uses. The majority of Turkish lignite deposits are worked as open-pit mines, though there are also some underground operations.

Miocene, Pliocene, and Quaternary coals are formed in limnic and limnic fluvial environments with some volcanogenic intercalations. The total extent of the coal-bearing Miocene (835.1 km^2) and Pliocene (526.9 km^2) deposits is 1,362 km^2 (Tuncali et al. 2002).

The lignite potential of the Konya region, whose coals have low calorific values and high moisture contents, can contribute to Turkey's energy requirements (Fig. 1). While the total confirmed lignite reserve is 447,924,615 tonnes, the total mineable reserve is 350,857,868 tonnes, while the total probable reserve is 80,763,455 tonnes (Inaner and Nakoman 1997).

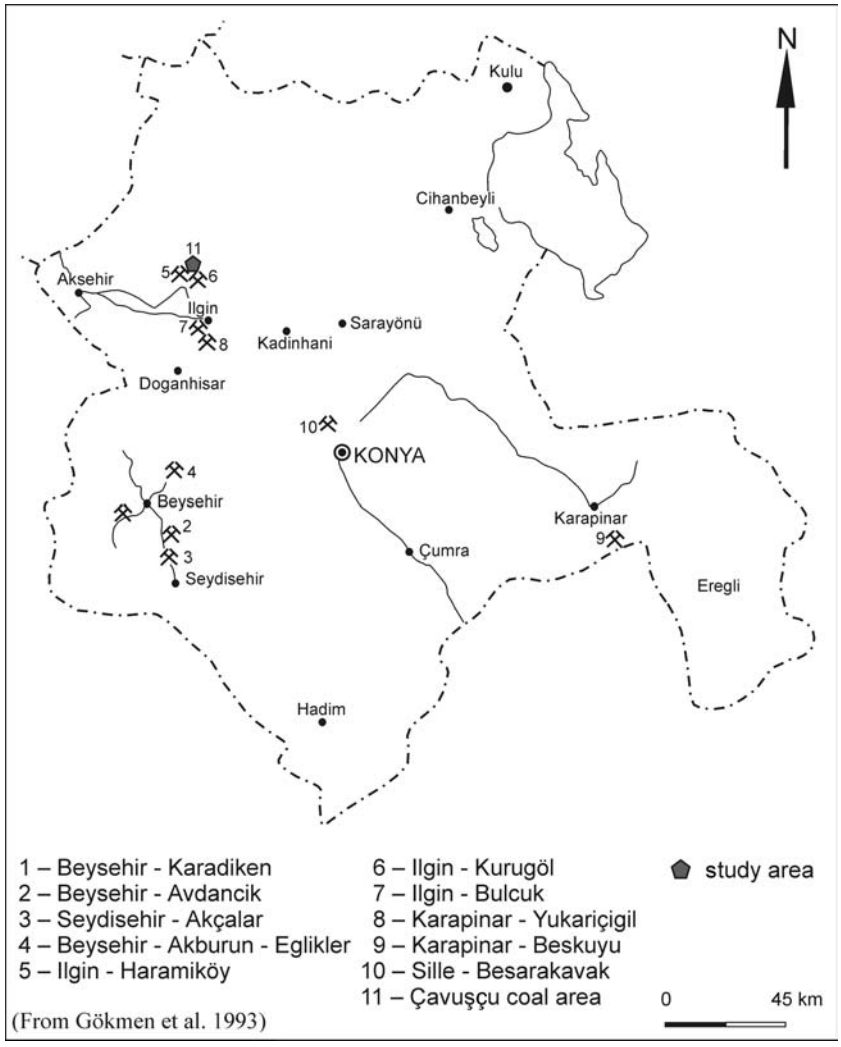

Figure 1. Location map of Konya region coalfields.

Exploration studies have been performed by the Akpinar Madencilik Company in this area (Akpinar Madencilik 1988). Sixty five boreholes were drilled in this coalfield toward assessing the reserves.

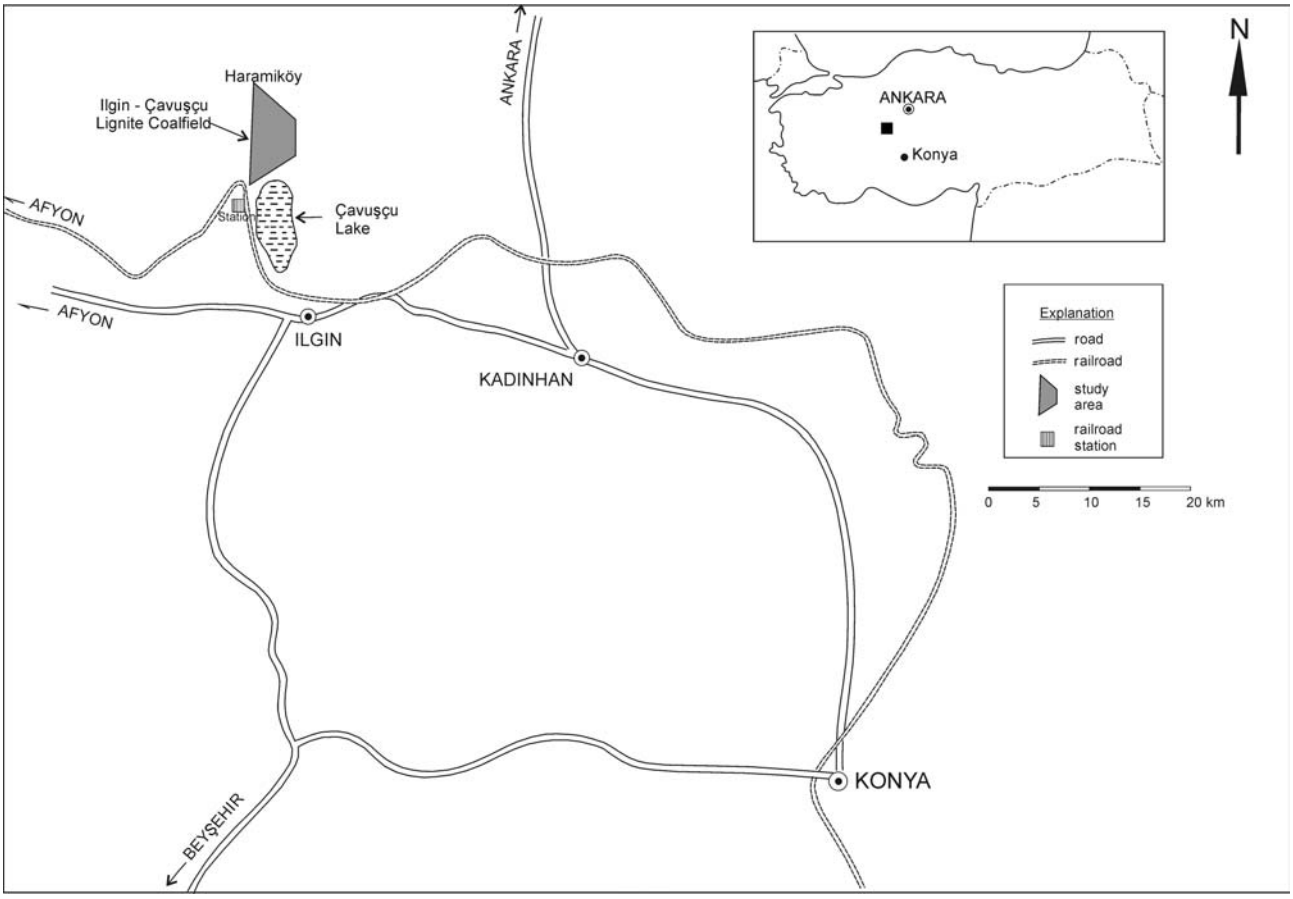

Figure 2. Location map of Konya-Ilgin-Çavuşçu lignite coalfield.

Dokuz Eylül University made a feasibility study in 1989 for the Akpinar Madencilik Company (Nakoman et al. 1989). Karayigit et al. (1999) determined the geological, geochemical, and palynological properties of the Ilgin area lignite deposits in the Konya province. A graduate-study project was undertaken by Ilter (2000) under the supervision of the present author.

Geology

The Konya-Ilgin-Çavuşçu lignite coalfield is located in the central part of Turkey (Fig. 2). This coal field has been worked as an open-pit mine by private companies in the north-western part of the Konya Province. The mined coal seam is of the Pliocene age (Gökmen et al. 1993) and its thickness varies between 1.70–37.35 m. The pre-Neogene rocks are made up of Paleozoic metamorphic schists and marbles, and Mesozoic crystalline limestones (Figs 3, 4). Coal-bearing sediments lie unconformably on the crystalline metamorphic substratum. The Pliocene coal-bearing units are made up of basal conglomerate, gravelly clay, sandstone, coal seam, marl, limestone, red coloured gravel, sand, clay, and mill. All units were covered by alluvium (Gökmen et al. 1993). Lignite generally appears as a single seam and is generally quite thick. Intercalations are rare. The basin is limnic, not paralic.

Economic evaluations

A total of sixty five reserve boreholes have been drilled in this coal field. Among these boreholes only forty five cut mineable coal thickness and were used in our calculations. Confirmed and mineable reserves were calculated by polygon and isopach methods, depending on the boreholes drilled in different years.

The confirmed reserves were calculated as 163,968,634 tonnes by using the isopach method with a 1 : 5000 scale map (Ilter 2000).

Suppositions for reserve calculations

For the reserve calculations 1 : 5000 scale maps were used. The borehole location map from the Akpinar Madencilik Company was used to determine the coal deposit's boundaries, and our calculations for reserve determinations are based on the borehole values obtained by the Akpinar Madencilik Company.

The following suppositions were made in order to determine the exploitable coal thickness in the reserve calculations:

– Coal formations having calorific values higher than 2.93 MJ . kg^{-1} in the original coal were included in the exploitable main coal layer thickness.

– The sterile formations of clay, marl, etc. in the coal layer were included in the coal seam if they were thinner than 0.50 m; if thicker, they were assumed as the interval thickness.
– Coal layers which are not directly related to the main coal seam and exist above or below it, were included into the main coal seam thickness if they were thicker than 1.00 m. Coal layers thinner than 1.00 m were assumed to be unexploitable.
– Coal and interval densities were taken as 1.3 and 1.8 ton . m^{-3}, respectively.
– Mining loss was assumed to be 10%, and the geological matching coefficients were considered to be 1.00–0.70 depending on the locations of polygons and faults.
– Dilution was assumed to be 0.10 m from the top and bottom of the seam.
– Existing analyses of the sterile layers thinner than 0.50 m have been taken as is. Where there are no analytical results, moisture was assumed to be 25%, ash 75%, lower calorific value 1 in the original coal, and moisture 5%, ash 95%, lower calorific value 1 in the dry coal in air.

The total coal-bearing area is 8,931,876 m^2, excluding the area still being mined today. The confirmed and workable lignite reserves are 168,379,425 and 144,569,064 tonnes, respectively, calculated based on the polygon method.

An overburden of 1,585,426,669 cubic meters, an intercalation overburden of 6,893,497 m^3, and a total overburden 1,592,320,167 are estimated in this coal field. The average overburden ratio was found to be 11.01 ton . m^{-3} for the whole coal field by the polygon method.

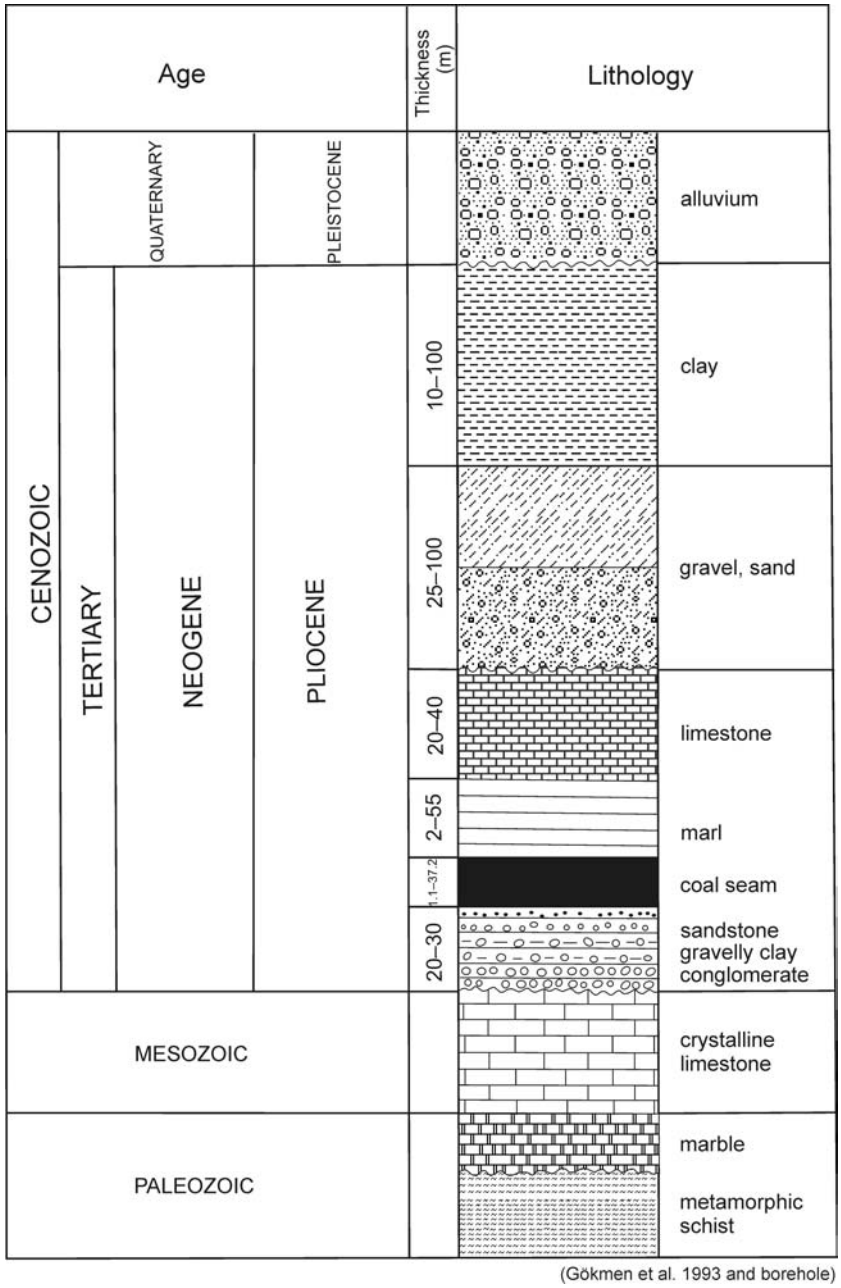

Figure 3. Schematic stratigraphic section of the Çavuşçu coalfield.

The chemical analyses have shown the water content to be 48.64%, and ash 20.30%, in the original coal, the calorific value of which is 8.24 MJ . kg^{-1}. The air dried coal is composed of 10.03% water and 30.82% ash, with a calorific value of 16.41 MJ . kg^{-1}.

Results

Mined coal is used for domestic heating and for industrial purposes, especially by the sugar factories in the region. According to recent studies, the reserves in this coal field could supply a thermal power plant with a capacity of 2 × 240 MW for more than forty years. Building the thermal power is expected to take about three and a half years, with 2500–3000 workers expected to participate in its construction. Additionally, one thousand workers are to be employed in mining the coal deposit. The power plant is planned as a "build-operate-transfer" model to produce energy for thirty eight years. When this project is finished, it will have positive effects on the Ilgin area, as the power plant will constitute an important contribution to Turkey's energy production.

References

Akpinar Madencilik (1988): Annual Report (Unpublished). Konya.
Ilter Ö. (2000): Reserve estimation of Konya-Ilgin-Çavuşçugöl lignite coalfield by polygon and isopach methods. Graduate thesis, Dokuz Eylul University, Izmir.
Inaner H., Nakoman E. (1997): Lignite Possibilities of Konya Region and

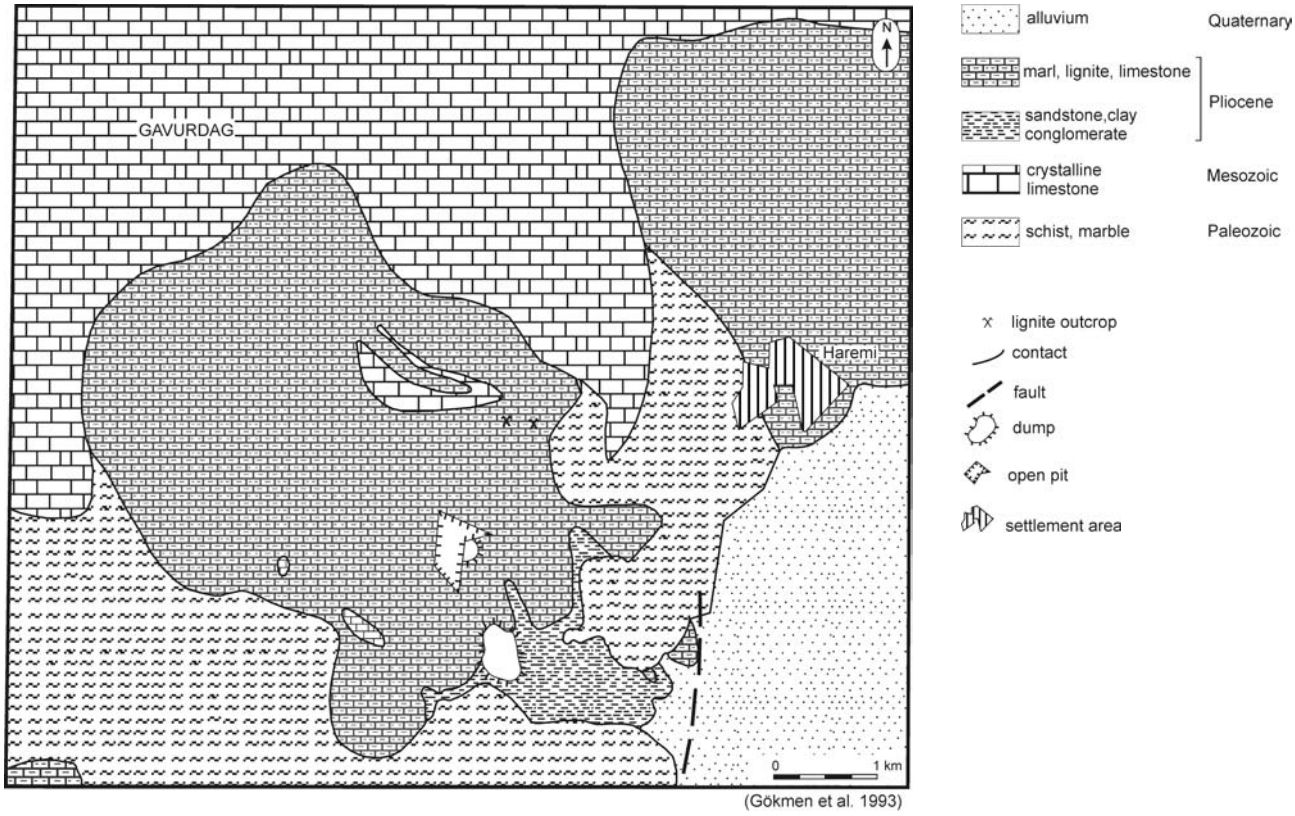

Figure 4. Geological map of Konya-Ilgin coalfield area.

its Importance for Turkey. Selçuk University, Engineering and Architect Faculty, Geology Department, 20th Geology Symposium Abstracts, Konya, 28–29.

Gökmen V., Memikoğlu O., Dagli M., Öz D., Tuncali E. (1993): Lignite Inventory of Turkey. Mineral Research and Exploration Directorate Publ., Ankara.

Karayigit A. I., Akgün F., Gayer R. A., Temel A. (1999): Quality, palynology, and palaeoenvironmental interpretation of the Ilgin lignite, Turkey. International Journal of Coal Geology 38, 219–236.

Nakoman E., Köse H., Çalapkulu F., Inaner H., Çebi Y., Simsir F., Onargan T., Konak G., Kemal M., Ergin Z. (1989): Pre-feasibility study of Konya-Ilgin-Çavuşçu lignite coalfield. Dokuz Eylul University, Engineering and Architect Faculty, Izmir.

Tuncali E, Ciftçi B., Yavuz N., Toprak S., Köker A., Açik H., Gencer Z., Ṭahin N. (2002): Chemical and technological properties of Turkish coals. Mineral Research and Exploration Directorate Publ., Ankara.