

COALBED GAS OF BIOGENIC ORIGIN IN THE MIOCENE SOMA BASIN (WESTERN TURKEY)

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The Neogene Basins of Turkey contain as much as 9 billion tons of lignite-rank coal (Şengüler, 2001; Tuncalı et al., 2002). The Miocene Soma Basin, a rift basin trending NE-SW in the Aegean Extensional Province (EAP) of Western Turkey, is estimated to contain at the least one billion tons of lignite and about half of this reserve is present at depths greater than 600 m (Turkish Coal Enterprises, 2006). Miocene marl/limestone units and Pliocene clastics and volcanic tuffs overlie the Miocene coals of the Soma basin. In the Soma Basin, Turkish Coal Enterprises (TKİ) has conducted open cut coal mining and underground coal mining activities for several decades in the Northern and Central part of the basin, respectively. Recently, coal exploration activities have been extended to the Southern part of the basin by means of exploratory drillings. In this context, two boreholes encountering a coal seam (M2) up to 20 m thick were evaluated. The M2 coal seam was encountered between 900 and 940 m depth in two boreholes drilled approximately 1 km apart. Wellhead gas content was measured on coal cores following the USBM method (Diamond and Levine, 1981). Additionally, coal was placed in hermetically sealed canister and desorbed gas was analyzed in laboratory for chemical composition (by FTIR gas analyzer) and ^{13}C isotope (by GC-IRMS). Coal characterization was completed by means of Rock Eval (RE) Pyrolysis, Proximate and Ultimate analyses, as well as microscopic analyses for typing of macerals and vitrinite reflectance measurements.

The wellhead gas content measurements (six core measurements from two boreholes) indicate that as much as 4 m^3 gas / ton coal is present in the coal recovered from 900 to 940 m below the surface. The rank of coal based on vitrinite reflectance measurements is lignite to sub-bituminous (0.40 to 0.45 % Ro); supported by RE Tmax values of 420°C . TOC content of the coal samples vary between 53 to 73 %. The composition of the gas is dominantly methane (more than 99.4 %) and the $^{13}\text{C}/^{12}\text{C}$ isotope ratio of methane is 61 to 65 per mil. Considering the chemical composition of the gas and the $\delta^{13}\text{C}$ isotope of the methane, the source of the coal gas is biogenic probably generated by bacteria that are introduced to the coal seam by fresh water following mainly the normal faults bordering the graben structure. The maceral analyses show that coal samples on average contain more than 60 %

huminite/vitrinite. Hydrogen Index values derived from RE analyses range from 220 to 360; supporting the results of microscopic observations suggesting dominant huminite/vitrinite occurrence. Adsorption on the internal coal surface is considered as the primary mechanism of gas storage in coals and the surface area, which controls the gas adsorption capacity, is in general a function of the micro-pore volume (Levy et al., 1997; Crosdale et al., 1998).

The vitrinite/huminite maseral content has positive correlation with gas sorption capacity (Levy et al., 1997); meaning that at a given pressure, the higher percentage of micro-pore dominated huminite/vitrinite the more gas adsorption capacity. In this context, the Miocene Soma lignites have good micro-pore properties in respect to gas adsorption.

Coalbed gas potential of Zonguldak hardcoal basin in Turkey was extensively studied and the results reported (Yalçın et al., 2002 for a review). In this study, however, we report the first findings on occurrence of coalbed gas of biogenic origin in Turkey. Preliminary evaluation, based on limited analyses and results summarized above, on gas potential of the Miocene Soma Basin is encouraging, yet further investigations are underway. In case, further research support the economic feasibility for biogenic coal gas, a good justification and ground will have been established for conducting similar studies for other coal-bearing Neogene basins in Turkey.

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