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3D Geological Modeling of CoalBed Methane (CBM) Resources in the Taldykuduk Block Karaganda Coal Basin, Kazakhstan

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Coal Bed Methane (CBM) is gas stored in coal layers. It can be extracted from wells after hydraulic fracturing and/or solvent injection, and secondary recovery techniques such as CO_2 injection. Karaganda Basin is a very favorable candidate region to develop CBM production for the following reasons: (i) Huge gas potential; (ii) Available technologies for extracting and commercializing the gas produced by CBM methods; (iii) Experience in degassing during underground mining operations for safety reasons; (iv) Local needs in energy for producing electricity for the industrial and domestic market.

The objectives of this work are to model the Taldykuduk block coal layers and their properties focusing on Coal Bed Methane production. It is motivated by the availability of large coal bed methane resources in Karaganda coal basin which includes 4 300 Bm3 equivalent 2 billion tons of coal (B = billion = 109) with gas content 15-25 m3/t of coal (for comparison San Juan basin (USA) has < 20 m3/t). The CBM reserves estimations are about: Saransk block, 26.3 Bm3 and Taldykuduk block, 23.5 Bm3. Methane (CH4) can be considered as an environmentally-friendly fuel compared to coal. Actually, the methane extracted during mining is released in the atmosphere, collecting it for recovering energy will reduce CO_2 equivalent emissions by 36 Mt, good news regarding climate warming issues. The exploitation method will be based on a EOR technology consisting in injecting CO_2 which replaces methane in pores because it has a higher adsorption capacity than CH4; exploiting CBM by CO_2 injection provides thus a safe way to sequestrate CO_2 in adsorbed form.

The 3D geological model was built on Gocad/Skua using the following available data set: 926 wells and large area (7 x 12 km). No seismic data; coal type and chemical components (S, ash, . . .); unreliable available cross-section & maps due to old acquisition; quality mature coal; complex heterogeneous fractures network reported on geological cross sections; and utilization issues of the water extracted in the early stages of exploitation. The resulting 3D faulted model which includes more than 100 of faults will be further used to simulate the secondary recovery of methane by injecting CO_2. The simulation will be carried out on a flow simulator assuming a two phase dimensionless formulation of CBM production in a double porosity model considering two domains: the matrix (m) and the fracture (f) for which the initial and boundary conditions are different. The resulting comprehensive 3D models had helped in better understanding the tectonic structures of the region, especially the relationships between the fault systems.