

Basin evolution and coal geology of the Donets Basin (Ukraine, Russia): Implications for CBM potential

R.F. SACHSENHOFER¹, V.A. PRIVALOV²

¹University of Leoben, Peter-Tunner-Str. 22, 8700 Leoben, Austria,
reinhard.sachsenhofer@unileoben.ac.at

²Donetsk National Technical University, 83000 Donetsk, Ukraine, vitaliy.privalov@gmail.com

The Donets Basin covers an area of 60,000 km². The Carboniferous part of the basin fill hosts about 130 seams (>0.45 m). Coal seams are typically thin (0.6-1.0 m), but have a wide lateral distribution. Total coal thickness is about 60 m. Economic coal seams occur in Serpukhovian to Moscovian strata. Today there are 205 active mines, most of them with workings more than 1000 m deep.

Serpukhovian coals are found along the SW basin margin. The coal is rich in inertinite and liptinite and often very poor in ash and moderate in sulfur. Bashkirian and Moscovian seams have a significantly wider areal extent, with some seams covering the entire Donets Basin. These seams usually contain vitrinite-rich coal with high ash yields and high sulphur contents.

The coal is generally of meta-anthracite rank. Low-rank coals are restricted to the western and northern basin margins. The rank of the coal is controlled by temperatures during maximum (Permian) burial. The resulting coalification pattern was overprinted by a Permo-Triassic heating event, most probably caused by magmatic intrusions. Fission track data suggest a complex uplift history with late Permian and late Cretaceous cooling episodes.

Coal mines in the Donets Basin are among the gasiest in the world. The average methane content is 14.7 m³/t, but some seams even contain more than 100 m³/t mined coal. The high methane content presents a severe mine safety problem, but represents also a high potential for CBM projects. The isotopic and chemical composition indicate the thermogenic origin of methane. Methane occurs within the coal seam, but also within sandstone reservoirs. There is a clear depth dependency of the gas composition. Within the uppermost few hundred meters CH₄ is often missing and N₂ and CO₂ are prevailing (gas weathering zone). Below this zone follows a transition zone and the methane zone with more than 70 % CH₄. The thickness of the gas weathering zone is probably related to the present day stress field.

There are large areas with high rank coals within the Donets Basin where no methane, but significant amounts of CO₂ occur (up to 35 m³/t coal). Perhaps the lack of methane is due to demethanization during major uplift and the occupation of the free space by CO₂. The Donets Basin, thus, may serve as a natural laboratory for CO₂ sequestration in coal seams.