



Distribution and geochemical characterization of coalbed gases at excavation fields at natural analogue site area Velenje Basin, Slovenia

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Unconventional gas resources, including coal bed methane and shale gas, are a growing part of the global energy mix, which has changed the economic and strategic picture for gas consuming and producing countries, including the USA, China and Australia that, together are responsible for around half the currently recoverable unconventional gas resources. However, CBM production was often hindered by low permeability and mineralization in cleats and fractures, necessitating the development of cost effective horizontal drilling and completion techniques. Geochemical and isotopic monitoring of coalbed gases at excavation fields in Velenje Basin started in year 2000, with the aim to obtain better insights into the origin of coalbed gases. Results from active excavation fields in the mining areas Pesje and Preloge in the year period 2014–2015 are presented in this study. Composition and isotopic composition of coalbed gases were determined with mass - spectrometric methods. The chemical (methane, carbon dioxide, nitrogen) and isotopic composition of carbon in methane and carbon dioxide in the Velenje Basin vary and depend on the composition of the source of coalbed gas before excavation, advancement of the working face, depth of the longwall face, pre-mining activity and newly mined activity. The basic gas components determined in excavation fields are carbon dioxide and methane. Knowledge of the stable isotope geochemistry of coal bed and shale gas and the related production water is essential to determine not only gas origins but also the dominant methanogenic pathway in the case of microbial gas. Concentrations of methane at active excavation fields are changing from 1.8 to 63.9 %, concentrations of carbon dioxide are changing from 36.1 to 98.2% and CDMI (Carbon Dioxide Methane Index) index from 0.2 to 100 %. Isotopic composition of carbon dioxide is changing from -11.0 to -1.9‰, isotopic composition of methane from -71.8 to -43.3‰, isotopic composition of deuterium in methane from -343.9 to -223.1‰, respectively. Further, these characteristics of methane have been compared with those observed in other coal sedimentary basins worldwide. The isotopic compositions of carbon and hydrogen in methane in the excavation fields show its biogenic origin, while a high Carbon Dioxide Methane Index (CDMI index) indicates the bacterial and endogenic origin of carbon dioxide.