



Petrological, geochemical and isotopic characteristics of lignite and calcified lignite from mining area Pesje, Velenje Basin, Slovenia

Mirijam Vrabc (1), Miloš Markič (2), Marko Vrabc (1), Radojko Jačimović (3), and Tjaša Kanduč (3)

(1) University of Ljubljana, Faculty for Natural Sciences and Engineering, Department of Geology, Ljubljana, Slovenia (mirijam.vrabc@geo.ntf.uni-lj.si), (2) Geological Survey of Slovenia, Dimiceva 14, SI-1000, Ljubljana, Slovenia, (3) Jozef Stefan Institute, Jamova cesta 39, SI-1000, Ljubljana, Slovenia

Lignite (organic rich) and calcified lignite (inorganic rich) samples from excavation field -50c mining area Pesje, Velenje Basin, Slovenia were investigated. During geological and structural mapping lignite and calcified lignite samples were systematically taken for determination of their petrological, geochemical and isotopic characteristics. Lignite is composed of fine detritical gelified matrix. At least five different types of calcified lignite were recognized forming laminations, calcifications after wood, petrified wood and complete replacements of lignite with carbonate. All measured parameters so far indicate geochemical processes during sedimentation of the Velenje Basin. After macroscopic description samples were split to organic and inorganic component (Ward, 1984) and powdered in an agate mortar for geochemical and isotopic analyses. Major and trace elements (As, B, Ba, Cd, Co, Cr, Cu, Hg, Mn, Mo, Sb, Se, Th, U, Zn) in these samples were determined by instrumental neutron activation analysis (INAA) using k₀ standardization method (Jačimović et al, 2002). The isotopic composition of carbon and nitrogen was determined using a Europa 20-20 continuous flow IRMS ANCA-SL preparation module. A 1 mg amount of a sample was weighed in a tin capsule for carbon and 10 mg for nitrogen analysis. Samples for carbon analyses were pretreated with 1 M HCl to remove carbonates. Carbonate samples from carbonate-rich strata and calcified xylite were first roasted at 450 deg C (Krantz et al., 1987). Three milligrams of carbonate sample was transformed into CO₂ by reaction with anhydrous H₃PO₄ at 55 deg C under vacuum (McCrea, 1950) and measured with GV 2003 isotope ratio mass spectrometer. Measured isotopic composition of oxygen as VPDB values was recalculated to the VSMOW reference standard to enable the comparison with data from other coal basins. SEM/EDXS of carbonate rich sediments was performed with JEOL JSM 5800 electron microanalyzer scanning electron microscope energy dispersive X-ray spectroscopy at the Department of Ceramics at the Jožef Stefan Institute.

Geochemical characteristics of major and trace elements indicate that the values of major and trace elements are comparable to world average coal (Zhang et al., 2004). Isotopic composition of carbon and isotopic composition of nitrogen of investigated samples indicate values from to -29.4‰ to -23.7‰ and 1.8‰ to 5.9‰ respectively. Lower value of isotopic composition of carbon indicates higher gelification (values up to -29.4‰) and higher value of isotopic composition of nitrogen (values up to 5.9‰) indicate higher mineralization. The results of SEM/EDXS microscopy revealed that in calcified lignite chemical composition of calcite prevails. Traces of diagenetic pyrite were also found, indicating localized anoxic conditions during sedimentation. Values of isotopic composition of CCaCO₃ range from -2 to +13 and indicate temperature of precipitation from 17.3 to 35 deg C, which is similar to results obtained in previous studies (Kanduč et al., 2012).

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