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New geochemical data of the Mecsek Hard Coal Formation

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Critical raw materials are essential for the efficient functioning of Europe's economy. The Miskolc University manages the EU supported project (CRITICEL – www.kritikuselemek.uni-miskolc.hu) to carry out research in relation to critical raw materials in Hungary.

Coal may be enriched in certain trace elements (B, Be, Ge, Mo, U, V) because of the absorption capacity of organic matter that is why the geochemistry of coal is an important exploration target.

The Eastern-Mecsek Mts. (SW-Hungary) contains important hard coal deposits, with identified resources of about 1 billion tonnes. The Mecsek Hard Coal Formation was deposited during the Late Triassic - Early Jurassic (Hettangian, Early-Sinemurian) in a half-graben sloping towards south, with coal seams becoming thicker towards the south (Nagy, 1969). Historic assays indicate high trace metal (Be, Ga, Ge, Li, Mo, Nb, Pb, Sn, Ta, Tl, Zr) concentrations.

The source of the abovementioned elements in the coal may be linked to the neighbouring exposed granitic and metamorphic rocks formed in the Carboniferous and the alkaline basalt sills (and fonolite intrusives) formed in the Cretaceous.

Our aim is to collect geochemical data by using modern analytical techniques (ICP-OES, AAS, XRF, RTG, SEM) to reveal the concentration of the trace elements, compare the analysed areas and give a genetic model for the origin of these elements.

The samples were collected from three areas of the Mecsek Mts.: Pécsszabolcs (17 composite samples from 97 core sample), Pécs-Vasas (16 samples) and Nagymányok (8 samples). ICP investigation was carried out by ALS Global and MFGI for 64 elements. Samples are represented by coal, natural coke, alkaline basalt and metabasalt, tuffite, marl and siliciclastic rocks such as sandstone and claystone.

The geochemical data show high average niobium (142 ppm) and tantalum (10 ppm) concentrations in the Pécsszabolcs area, where these elements are enriched 30-35 times compared to the average Earth crust concentration. In the Pécs-Vasas area, these concentrations are lower, the Nb and Ta contents are 6-8 times that of the average Earth crust concentration. Furthermore the average zirconium concentration is about 444 ppm at Pécsszabolcs (it means 12.34 times higher values, than the average Earth crust), but at Pécs-Vasas this concentration is also lower (average 145 ppm – 4 times higher values than the average Earth crust) (Seredin & Finkelman, 2008). Hafnium also shows enrichment in these samples. At Pécsszabolcs 11.8 times higher than the average Earth crust (13.8 ppm), in opposite to Pécs-Vasas where these values are 3 ppm which means 2.5 times enrichment compared to the average Earth crust.

There are some differences between the correlation coefficient of Nb and Ta in the Pécsszabolcs (0.95) area compared to Pécs-Vasas (0.89).

The Rare Earth Element (REE) assays also show differences between the abovementioned two areas. At Pécsszabolcs the ∑RFF is 332.44 ppm in average, while at Pécs-Vasas this value is 166.93 ppm.

The Nb, Ta, Hf, Zr and REE enrichment in the coal assemblage shows a 'primary' (or older) effect of the weathering of the Carboniferous granite and a secondary alkaline magmatic overprint during the Cretaceous. The primary effect might be stronger on the northern area due to paleogeographical conditions, while the latest secondary overprint might be even more effective in the Pécsszabolcs area.

Our aim is to reveal the enriched phases by XRF, RTG and SEM to separate the phases responsible for the enrichment and reveal the origin of these elements.

Nagy, E. (1969): Bull Hung Geol Inst, 51/2: 289–319.
Seredin, V. V., Finkelman, R. B. (2008): Int J Coal Geol, 76: 253-289.

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