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## Rare Earths and Other Minor Elements in Hungarian Coal Formations

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During the 1960s, several sampling campaigns were carried out to determine the trace element content of domestic hard coals, brown coals, and lignites, which were major resources of Hungary's energy production. The results of these surveys were not of any commercial interest in those times. As part of the 2012, 2018, and 2024 work programs, these records were revisited because many of the elements were ranked as of critical or strategic importance.

The available historic data are sporadic and of poor quality by today's standards, but sufficient to highlight and compare different critical element enrichments. The highest concentrations (reaching over 600 ppm total REE average values) are found in the Mecsek Coal Basin hard coals, claystones, and carbonaceous clays of Jurassic age. There are also high Sc, Be, Hf, Ge, Ta, Nb, Ga, Hf, and Zr anomalies. Anomalous concentrations of vanadium (with maximums over 1,600 ppm V) are characteristic of the Cretaceous Ajka sub-bituminous coals. Enrichments of Ge were recorded in the Miocene Borsod basin coals, with maximums over 300 ppm Ge. A similar sampling program is now being carried out in the Pliocene coals, the Visonta and Bükkábrány lignite mines. The data also point to the untested potential of coal residues and disposed fly ash.

These poorly known enrichments may mean radically new exploration objectives in the coal deposits, which recently faced closures due to the restrictions imposed on fossil fuel based energy production. In the present global geopolitical turmoil, it is increasingly important to get reliable information about the geology, resources, and availability of critical raw materials within the borders. The approach that has been offered in our study may be a serious contribution in this regard.