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Significant Enrichment of Ga, Rb, Cs, REEs and Y in the Jurassic No. 6 coal in the Iqe Coalfield, northern Qaidam Basin, China

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This paper presents new results on the mineralogy and trace element geochemistry of the particular enriched rare metals in the Jurassic No. 6 coal from the Iqe Coalfield, Qaidam Basin, China. The findings of this study are based on new data and evidence that suggests that the considerable enrichment of Ga-Rb-Cs-REEs and Y in the No. 6 coal of the Iqe Coalfield may be a hidden treasure with yet-to-be-realized additional economic potential, if such rare metal enrichment is proven across the Iqe Coalfield.

The No. 6 coal of the Middle Jurassic in the Iqe Coalfield is classified as a medium volatile (22.8%) bituminous coal, with high-ash (40.9%), low-sulphur (0.27%), and $R_{o, \text{ran}}=0.76\%$. Minerals in the No. 6 coal seam include clay minerals (kaolinite and illite), quartz, siderite, and trace amounts of dolomite, rutile, and pyrite.

Based on the statistical analysis among elements and the correlation coefficient analysis of specific elements with ash yield, SiO_2 , and Al_2O_3 , the inorganic and organic affinity of elements are determined. Ga is found to be associated with K-rich clay minerals (e.g., illite), which is more than likely derived from the Qilian Mountains during the accumulation stage of peat swamps; these clay minerals are most likely the carriers of both Rb and Cs in the No. 6 coal seam in the Iqe Coalfield. In contrast, REY elements are more likely to be associated with phosphates, such as apatite, in this coal; L-REY and M-REY may occur in both inorganic and organic matter, whereas H-REY may be mainly associated with organic matter. The No. 6 coal seam of the Iqe Coalfield is found to be enormously enriched in Ga, Rb, Cs, REEs, and Y and can be further enriched in their combustion products (e.g., fly and bottom ash). The results of this study strongly indicate that Ga, Rb, Cs, REEs, and Y in the No. 6 coal seam may have potential significant economic value for the recovery of these rare elements during coal utilization.

