Petrography and geochemistry of Middle Permian Tavantolgoi formation, Baruunnaran coal deposit, southern Mongolia

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Baruunnaran coal deposit is located in southern Mongolia and belongs to Tavantolgoi coal zone of South Gobi Basin. Coal seams are hosted in Middle Permian Tavantolgoi formation, which is subdivided into lower and upper member based on lithological characteristics. Twelve core samples, consisting of sandstone and mudstone, were collected from exploration drill holes.

The provenance, paleoweathering and tectonic setting of source area of coal-bearing Tavantolgoi formation were studied. This is the first petrographical and geochemical study. The studied sandstone samples consist of volcanic rock fragments, quartz and feldspar and can be classified into three types: litharenite, feldspathic litharenite and lithic arkose. They are generally sub-rounded and moderately sorted. Using various ternary diagrams, sandstone provenances are interpreted to be the magmatic arcs, recycled orogens and mixed orogenic sands.

Based on the results of inorganic geochemistry, sandstones are classed as greywacke, arkose and litharenite. The sandstone samples are depleted in Ca, Na, Ka, Ba, Rb and enriched in Si and Al compared with Upper Continental Crust (UCC), probably due to abundant volcanic rock fragments and lack of feldspar. Low values of the index of compositional variability in sandstone and mudstone compared with Post-Archean Australian Shale (PAAS-0.85) suggest a mature source. Chemical Index of Alteration (CIA) values of samples from the lower member range from 74 to 85 after correction for K-metasomatism, indicating moderately weathering in a tectonically active source. But CIA values of samples from the upper member range from 65 to 71, indicating weak to moderate weathering in a same tectonic condition. Major and immobile trace elements ratios (Th/Sc, Zr/Sc, Ce/Sc, Ti/Zr) indicate that the samples were sourced from andesite, dacite and rhyolite. REE data show slightly LREE enrichment and flat HREE segments, with negative Eu anomalies somewhat less than UCC. Chondrite-normalized patterns are generally similar to that for average Paleozoic andesite. Major elements discriminants (K_2O/Na_2O-SiO_2/Al_2O_3, DF2(Arc-Rift-Col)m1-DF1(Arc-Rift-Col)m1) indicate an evolved continental island arc and collision condition. This result is consistent with the collision of South Mongolia and North China block during early Permian period.