Scientists uncover biogeochemical controls on occurrence and distribution of PACs in coals

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The organic matter in coal contains polycyclic aromatic compounds (PACs) of varying quantities in diverse soluble and insoluble forms. PACs in coal are of special interest for organic geochemical studies, as they have been successfully used as biomarkers and indicators of thermal maturity.

However, applying PACs in understanding the organic geochemistry of coal presents challenges. For example, what are the sources of PACs in coals? How do they transform over the long-term coal formation history? Is there any regular relationship between the PAC and macro-molecular structural changes?

Researchers from the University of Science and Technology of China (USTC) revealed the close relationships between the distribution of PACs in coals and the process of coal formation to identify the origin of PACs and their role as biomarkers.

Recently, a collaborative research group led by Dr. WANG Ruwei at USTC of Chinese Academy of Sciences and Dr. SUN Ruoyu at Tianjin University reviewed the application of geochemical parameters of PACs in coal as useful tools to trace the coalification process from a molecular perspective and to understand the biogeochemical processes (e.g. depositional environment, geological settings, igneous intrusion) occurring during coal formation. The study was published in *Earth-Science Reviews*.

Researchers conducted a comprehensive study on coals collected from the south margin of the North China coal basin and the coal mines in southwestern Illinois and eastern Pennsylvania in the U.S. The experimental results were presented in the framework of coal geology, coal petrology, coal chemistry and molecular dynamics.

Through analysis of previously published data with combined methods, researchers found that PACs in coal mainly derive from biosynthetic compounds of high plants and microbial/fungal precursors followed by rearrangement and fragmentation reactions during coal maturation. The occurrence of PACs are affected not only by coal rank, but also by their origins, e.g. depositional environment, precursor materials, formation history and geological ages.

Moreover, it was found that wildfire and igneous intrusion events in the coal-forming geological history could result in different relationship of reflectance vs. molecular signatures, which are quite different from those of the normally metamorphic coal.

More information: Ruwei Wang et al, A review of the biogeochemical controls on the occurrence and distribution of polycyclic aromatic compounds (PACs) in coals, *Earth-Science Reviews* (2017). DOI: 10.1016/j.earscirev.2017.06.011

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