Characteristics of coal petrology and its genesis of Jurassic coal in Ordos Basin in China

HUANG WENHUI[1], XIAO XIULIN[1], TANG XIUYI[2], CHEN PIN[2], ZHAO ZHIGEN[2], WAN HUAN[1], AO WEIHUA[1] AND B. FINKELMAN[3]

[1]School of Energy Resources, China University of Geosciences, Beijing, 100083
[2]Anhui University of Science and Technology, Huainan, 232001
[3]The University of Texas at Dallas, Richardson,TX 75083-0688

Multiple thick coal beds occur in Jurassic, Ordos Basin. They have good coal qualities, huge reserves, simple structures, and relatively shallow burial depth. As a result, they possess large exploitation values. Their genetic swamp environment was mainly a series of high-stand swamps on the upper fluvial system that was related with the development of typical large inland lakes, in which the sandstones take an high portion in the deposit. The peat, therefore after the burial, continued to undergo oxidation conditions more or less. The vitrinite component has extensively undergone specific-degree fusainization and became semi vitrinite. The Jurassic coal in this basin is mainly semi-dull coal and dull coal. The depositional environment and coal-generating swamp environment have the major controlling effects on the coal components. The fusinite content is higher in coal macerals with thicker sandstone and coarser grain sizes, moreover, its texture is clear, especially in lower coal beds. The semi vitrinite has the same regularity. The cell texture of plants becomes more complete and regular. After burial, the lithology of roof and floor rocks can continue to affect the evolution of coal petrology. The sand bodies in the roof and the floor of coal beds have good physical conditions so that the pore water can still be in the state of oxidizing, circulating and connecting in a long term. It makes the coal components stay in the oxidation phase for a long time, which is favorable for the proceeding of fusinitization. On the contrary, the development of lacustrine facies and peat rapidly covered by mudstone after the burial, make the coal beds swiftly in reduction and anoxic environment. Exinite often accumulates in a specific position of coal bed. It has great contribution to the total hydrocarbon generated capacity of coal beds.

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Self potential – In search of the biogeobattery

C.G. HUBBARD[1]*, L.J. WEST[1], B. KULESSA[2], K. MORRIS[3] AND S. SHAW[1]

[1]Earth Surface Science Institute, School of Earth and Environment, University of Leeds, Leeds, LS2 9JT, UK (*correspondence: c.g.hubbard@leeds.ac.uk)
[2]School of Environment and Society, University of Swansea, Singleton Park, Swansea, SA2 8PP, UK
[3]Research Centre for Radwaste Disposal, School of Earth, Atmospheric and Environmental Sciences, The University of Manchester, Manchester, M13 9PL, UK

An array of geophysical approaches including induced polarisation, electrical conductivity, current generation from graphite electrodes and self potential are showing promise as tools for detecting and quantifying microbial activity in subsurface environments resulting from biostimulation treatments. Self potential is particularly attractive as it could offer a mechanism for remotely sensing changing redox conditions, giving valuable information on the spatiotemperal success of the biostimulation treatment. Self potential anomalies have led to the theoretical development of a biogeobattery model. This model requires zones of different redox potential connected by a physical conductor, where the conductor is postulated to be a biofilm and/or a precipitated mineral phase. However, laboratory validation of the model, ideally under different biostimulation conditions, is still required.

We performed flow-through column experiments designed to investigate the biogeobattery hypothesis. Columns were divided into an oxic section (clean quartz sand) and an anoxic, iron-reducing section (ferrihydrite-coated sand). Iron reduction was achieved by either (i) mixing the sand with a natural, silty sediment containing iron-reducers or (ii) injecting a pure culture of *Shewanella oneidensis* MR-1.

No anomalous self potential signal was detected in the column inoculated with natural sediment as the bacteria source, despite operating the column for 132 days. Bulk electrical conductivity values at day 132 were elevated by 28-54%. Iron reducing conditions developed and were maintained after 21 days and dissolved Fe (II) reached a peak of 520 μM. SEM images showed the transformation of ferrihydrite to goethite but no biofilm development. The implication is that effective biostimulation treatments will not necessarily result in the generation of self potential signals. We will also report the results of ongoing work with *Shewanella* column experiments.