Geophysical Research Abstracts
Vol. 12, EGU2010-4549, 2010
EGU General Assembly 2010

A new look at Pennsylvanian coal-bearing strata of the East Midlands, UK: initial data from the Smalley open pit mine

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Outcrops of Pennsylvanian (Duckmantian) age coal-bearing strata in the East Midlands of England are rare and have become rarer as more of the surface environment has been developed. Much of the stratigraphic correlation and paleoenvironmental interpretation of these strata have thus been based on subsurface data from deep mine workings and coal exploration boreholes. However, in 2009, coal mining commenced at an open pit mine near Smalley, east Derbyshire in the UK East Midlands. The mine provides a unique opportunity to carry out examination of a large-scale outcrop of Pennsylvanian coal-bearing strata in order to undertake detailed palaeoenvironmental reconstructions. The coals that will be exposed during working belong to the Waterloo group of seams of Duckmantian age. Initial examination of the workings has been concentrated on two successive intervals: from the basal Third Waterloo Seam to the Bottom Second Waterloo seam, and the from above the Bottom Second Waterloo seam to the Top Second Waterloo seam. The two inter-seam intervals are approximately 10-12 meters thick. Examination of the coal seams and inter-seam intervals will continue as new faces are exposed, supplemented by exploration drilling data. Initial field observations on the first sections exposed suggest that the two inter-seam intervals represent the infill of lakes formed on a fluvio-lacustrine plain, with negligible marine influence. The strata immediately above the Third Waterloo Seam consist of dark grey fissile shaly mudrocks overlain by an upward coarsening sequence of pale grey siltstones with sandy laminae and current ripples indicating unidirectional tractional flows. These pass upwards into rippled fine sandstones, cut by shallow channels towards the top. The overall inter-seam sequence is interpreted as the deposits of a lacustrine delta system that infilled a shallow lake that was initially anoxic. Once the lake had been infilled, a peat mire was able to form, now represented by the Bottom Second Waterloo Seam. The interval between the Bottom and Top Waterloo Seams contains an upward-coarsening sequence of laminated siltstones, overlain by a series of sharp-based rippled sandstones, each up to about 60 cm thick. The sharp based sandstones are interpreted as being crevasse splay deposits, which would have been fed by a nearby fluvial channel, which has not yet been located. As additional exposures are created during the lifetime of the mine, the temporal, spatial and environmental relationships of the coals and inter-seam strata will be investigated further by recording stratigraphic sections and directional data and producing photo panels. This should enable detailed paleoenvironmental reconstructions for each of the intervals investigated, which will be considered in the light of recent research on analogous ancient and recent environments. Data from adjacent former mines and coal exploration boreholes containing lateral continuations of the intervals examined will then allow the Smalley mine geology to be placed within the regional context of the East Midlands Coalfield, and enable us to consider broad scale paleoenvironmental variation across the area. It is anticipated that by enhancing our understanding of inter-seam deposits, prediction of geological conditions ahead of mining will be improved.