Variability in mudrocks overlying coal seams of the Carbondale Group (Pennsylvanian) in southwestern Indiana

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Abstract

The mudrock overlying the Springfield Coal is dark gray in color. There are significant amounts of pyrite and chert, and minor amounts of sparite. This mudrock was deposited in a shallow marine environment with occasional freshwater influences. Distribution increases upward from 0.4% to 8.2%. There is a decrease in thickness of the intervals of interest in the equivalent intervals at USI by 75%. Less than 1% of the coal member. The onion shape is a layer of chert fragments of trilobite and crinoid debris (Fig. 1A). In addition, there are pyrite concretions with charcoalization around their margins (Fig. 2). Trace fossils in this interval indicate shallow marine conditions. The Springfield Coal overlying the Springfield Coal was probably deposited in a shallow marine environment with occasional freshwater influences, with oxygen content through deposition supported by increasing bioturbation.

Introduction

The purpose of the exploratory drilling at the University of Southern Indiana in the summer of 2005 was to find coal in the Carbondale Group in southwestern Indiana. The project itself did not produce any methane, but the cores that were recovered from the well provide information about the Middle Pennsylvanian rocks of southwestern Indiana. After analysis by the company drilling the well, the well was cased, and the property of the Department of Geology and Physics at USI. The core intervals contained several coal bearing units and the overlying black mudrocks.

The Pennsylvanian, sedimentation and structures occurred during the western margin of the Illinois Basin. Rapid fluctuations of sea level probably controlled by Milankovitch orbital cycles induced Glacialian glacial cycles and resultant eustatic fluctuations. These eustatic fluctuations resulted in deposition of epeiric sediments referred to as epeiric. Specifically, the mudrocks overlying coal seams are interpreted to have been deposited in a continental sea with passive continental margin.

Figure 1: Paleophycus frondosa from the mudrock above the Seelyville Coal. The specimen is 1 cm in length.

Methods

Intervals of the core directly overlying the Springfield, Seelyville, and Carmi Coals were split using a rock saw. The cores were then polished using undamaged of increasing grit, beginning at 600 and ending at 1200. Subsequently, the cores were examined and fossil content descriptions were completed of the sealed interval. At an Epson 4800 photo scanner was used to digitize digital images of the cores. Further examination was accomplished using an Olympus B005 binocular microscope. Photomicrographs were taken with an auto digital camera mounted to this microscope. Image Capture G Pro software was used to image capture and process photomicrographs. The cores were examined for sedimentary structures, mineral and organic thermals. Taphonomic, lithological, and stratigraphic variations was used to interpret the distribution of their depositional setting.

Results

Mudrock overlying Springfield Coal Figure 2: Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (A) Binocular microscope image pic. of phosphate nodule (B) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (C) BSE image of phosphate nodule showing nodular texture. The phosphate nodule is secondary magnesium oxides and calcite. The (D) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (E) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (F) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (G) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (H) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (I) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (J) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (K) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (L) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (M) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (N) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (O) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (P) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (Q) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (R) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (S) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (T) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (U) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (V) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (W) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (X) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (Y) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal (Z) Photomicrographs of phosphate nodules in a mudrock above the Springfield Coal

Conclusions

• Mudrocks overlying the Carbondale Group show variation in ichnofossil, fossil content, and mineralogy indicating wide ranging depositional settings following coal deposition.

• Black shales overlying the Springfield and Seelyville Coals are interpreted to represent deposition during a transgressive marine setting. These black shales contain disseminated pyrite, phosphate nodules, and abundant bioturbation.

• The sulfur content of coal is directly related to the depositional setting that existed after coal deposition. Low sulfur coals are overlain by marine black shales that prevented accumulation of sulfur by reduction of sulfate from marine waters.

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