

THE LITHOLOGY OF COAL NO. 6*

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The most striking characteristic of the coals of the Illinois basin is their banded appearance. A megascopic analysis of twenty-one columns of coal No. 6, each of which represents the entire seam and which average 6 feet 8 inches in length, shows an average composition of 75.88 per cent clarain¹ (glossy), 13.83 per cent vitrain² (vitreous), 5.58 per cent fusain ("mineral charcoal"), 2.56 per cent clay, and 2.15 per cent pyrite.

The vitrain bands, which vary in thickness from a maximum of 5½ cm. to an arbitrary lower limit of ½ mm. (for practical measurement), are uniform and sharply defined. These bands are brilliant in appearance and usually show conchoidal fracture although cubical structure is sometimes induced by minute vertical fractures within the band. Vitrain continues for some distance through the bed although its lenticular nature can be demonstrated. Commonly the bands are in pairs which rarely can be traced along the bed until they merge and terminate. A thin section through such bands show them to be opposite walls of a cylinder in which the poorly organized central tissue has collapsed.

Vitrain may exhibit a number of forms in thin section depending upon (1) the direction in which the cylinder is oriented with relation to the plane of the cut—single, double, continuous, or lenticular bands are possible; (2) the anatomy of the plant, whether a pithy, hollow, or solid cylinder; (3) the presence of branches at the point sectioned; (4) the stage of growth at the time of preservation—a young succulent stem would find

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¹ Stopes, M. C. Proc. Royal Soc., vol. 90, series B, pp. 470-487, 1919.

² Evans, M. M., Slater, L., and Wheeler, R. V., On Vitrain: Fuel, Vol. VIII, pp. 30-36, 1929.

expression as a single band; and (5) the state of preservation of the material—some trees were undoubtedly split in falling or were partially decayed before burial.

Cell structure is most readily seen in a well prepared cross-section of a stem because the cell walls in such a section exhibit a greater contrast to the material filling the lumens than they do in radial or tangential section. A single vitrain band sometimes shows two zones of well preserved cells in the position of the secondary cortex on either side of the cylinder. The cells in vitrain are but little distorted when filled with infiltrated material. The inference that the filling was largely of secondary origin follows from the fact that the protoplasm in actively growing cells is not capable of filling the lumens when it has suffered extreme dessication and from the fact that in the living plant the cells of older tissues are void of protoplasm or it is of negligible quantity. Occasionally thickened cells in the vitrain are not filled and many such cells have collapsed. This *bogenstruktur* frequently passes into fusain which it resembles except for its translucency.

Clarain, the most heterogeneous of the banded constituents is markedly striped and glossy in appearance. It is closely knit but does not maintain the uniform thickness and definition so characteristic of vitrain. Thin sections show it to be composed of spore exines, cuticles, resins, and the degradation products of plants. In it are enclosed vitrain bands of megascopic and microscopic dimensions.

Resins in the form of rodlets or globules and in zones three to four millimeters wide are common in both the clarain and the vitrain. Such zones are made up chiefly of many small ellipsoidal wine-red bodies, although a pale yellow variety rarely occurs.

Fusain is present as dull black powdery or shiny lenses, fragments, or bands. It is flattened and striated parallel to the bedding, the striated appearance being due to the fibrous nature of the original wood, resin rodlets, or both. The fragments and lenses are distributed through the clarain as microscopic groups of thick-walled xylem cells. The cells are not filled with humic material but a secondary filling of mineral matter may be present³.

Fusain is sometimes associated with vitrain; in such instances it represents the outer cortex of the plant and the vitrain the enclosed tissues of the cylinder. A radial section of a Calamites stem from the Kathleen mine at Dowell, Jackson County, shows fusain forming the cortex and passing progressively inward to vitrain in which the pitting of the cell walls may be faintly seen. The fusainized cortex of *Lepidodendron* and *Stigmaria* have been found to extend for some distance along partings in the bed.

³ McCabe, Louis C., Some plant structures of coal: Trans. Illinois State Acad. Sci. Vol. 24, p. 325, 1931.