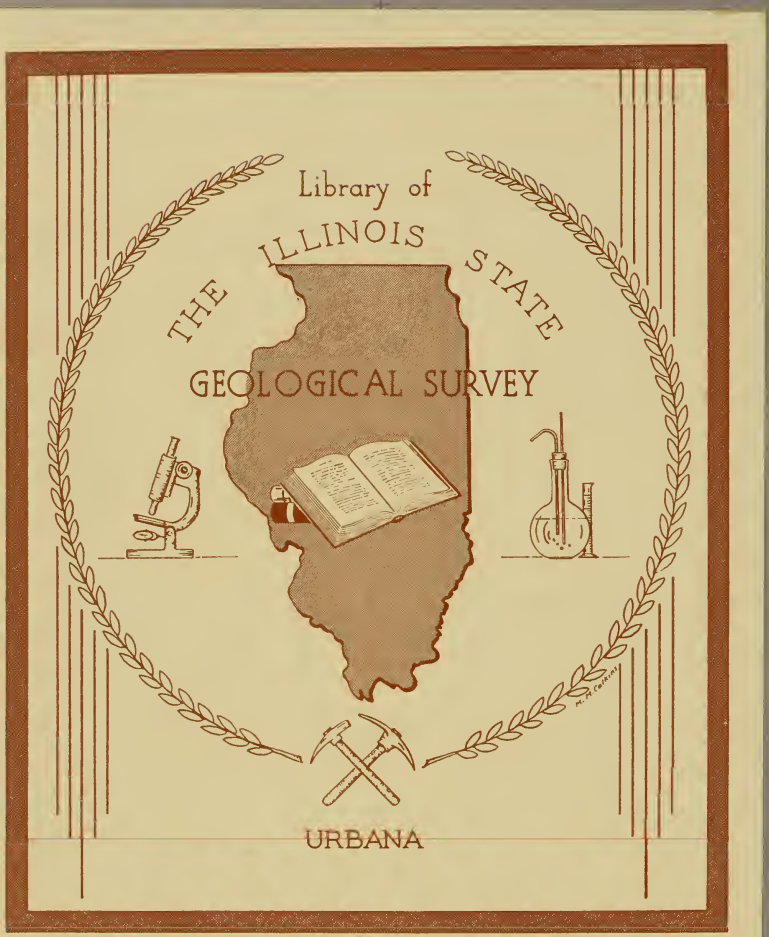

STATE OF ILLINOIS
HENRY HORNER, *Governor*
DEPARTMENT OF REGISTRATION AND EDUCATION
JOHN J. HALLIHAN, *Director*

DIVISION OF THE
STATE GEOLOGICAL SURVEY
M. M. LEIGHTON, *Chief*
URBANA

CIRCULAR NO. 46

NOMENCLATURE OF THE MEGASCOPIC DESCRIPTION OF ILLINOIS COALS

BY

GILBERT H. CADY

Reprinted from Economic Geology,
Vol. 34, No. 5, pp. 475-494, 1939.

PRINTED BY AUTHORITY OF THE STATE OF ILLINOIS

URBANA, ILLINOIS
1939

NOMENCLATURE OF THE MEGASCOPIC DESCRIPTION OF ILLINOIS COALS.[1]

GILBERT H. CADY.

ABSTRACT.

The British names vitrain, clarain, and durain and the more commonly used name fusain have been adopted by the Illinois State Geological Survey as an aid in the megascopic description of the material composing the coal beds of the Illinois coal basin. Expanding activities in our laboratories in matters related to and dependent upon the physical components of our coal beds have made necessary the adoption of a technique of megascopic description that can be readily understood and easily used by both the technician and the layman. This terminology of description has not been widely used in America, but its merits are such as to inspire hope for its general adoption. To the ends that standards of usage may be established as soon as possible, the present explanation of the application of the terms to Illinois coals is advanced. The explanation requires some consideration of the original definitions of the terms and of Continental usage. The Illinois State Geological Survey has endeavored to adhere closely to the denotations of the original definitions.

During the last ten years, the Illinois State Geological Survey has given considerable attention to the physical constitution of Illinois coals. The objectives of these investigations concern (1) the botanical constitution of coal, (2) the physical varieties of coal material, (3) the fundamental chemical constitution of the physical varieties of coal material, (4) the phenomena resulting from the application of pressure to coal under different conditions of time and temperature, (5) coal classification, (6) geological problems relating to the distribution, structure and

[1] Published by permission of the Chief, Illinois State Geological Survey. Presented before the Society of Economic Geologists, New York Meeting, February 16, 1939.

description of the coals, and (7) problems of the preparation and utilization of coal. This emphasis on the physical characteristics of Illinois coal has made essential the adoption of a convenient nomenclature of description useful in presenting the results of the investigations both to the layman and to the scientist.

Two principal schools of descriptive nomenclature of coal exist—the American and the British, that proposed by R. Thiessen[2] (1) and employed by the U. S. Bureau of Mines, and that proposed by Dr. M. C. Stopes (2) of England, both originating about 1919–1920. The Thiessen nomenclature is botanical and genetic and depends for application upon microscopic determinations. The Stopes' nomenclature, on the other hand, is called "petrographic" and is primarily megascopic and hence applicable to hand specimens or to the coal in the bed.

The British system of nomenclature, which has a much wider general use outside America than has the American system, has been the subject of much controversy among European coal technicians. Because of this and the ensuing redefinitions of terms, their meanings have become diverse from country to country, making it necessary for each laboratory to define the terms used. The Illinois State Geological Survey, having adopted the British nomenclature, occupies an unusual position in America in its acceptance of these names. However, it is our belief that the use of this nomenclature will expand in this country; if so desirability of uniformity in usage will not be questioned. To this end, the present explanation of the meaning of the terms used in the megascopic description of Illinois coals is presented.

MEGASCOPIC DESCRIPTION OF ILLINOIS COALS.

In any block of common banded Illinois bituminous coal, ordinary visual inspection reveals three or four varieties of coal material, each having individual and identifying characteristics (Pl. I, Fig. 1). The differences among these megascopic com-

[2] Numbers in parenthesis refer to the bibliography at the end.

Fig. 1. Herrin (No. 6) coal, Orient No. 2 Mine, Chicago, Wilmington and Franklin Coal Co., W. Frankfort, Ill., showing Fusain (F), Vitrain (V), and Clarain (C) bands.

Fig. 2. Top bench coal of Herrin (No. 6) bed, Darmstadt Coal Co., Lenzburg, Washington Co., Ill., composed largely of Clarain; that in upper half is bright and dense with minor micro-Vitrain of microscopic thickness; lower half contains more micro-Vitrain. cf. Fig. 1, 5.

ponents are more or less apparent on any broken surface that crosses them, but they are generally particularly noticeable on freshly broken surfaces such as joint plane or cleat surfaces crossing the bedding more or less at right angles. These components are believed to be the coal "ingredients" of Stopes (2) designated by the names fusain, vitrain, clarain, and durain.

Fusain in Illinois Coals.

Fusain, or mineral charcoal, is most readily discovered on bedding surfaces of Illinois coal (Fig. 4). Not uncommonly,

FIG. 4. A lump of fusain from Herrin (No. 6) coal bed in the mine of the Pyramid Coal Corporation, Pinckneyville, Perry County, Ill.

such surfaces are completely covered with fusain, the coal bed evidently having separated at the position of a thin bed or lens of the material.

Fusain not impregnated with mineral matter is very friable and is the chief component in the finest coal dust. On the other hand, the great porosity of fusain makes it particularly susceptible to mineral deposition, so that it is commonly impregnated with calcite, pyrite, or more rarely kaolinite. Such fusain is hard, but otherwise no different from the soft unmineralized fusain.

In general, fusain offers no particular problem in identification or nomenclature in hand specimens of coal. In certain instances, however, fusain can be seen to grade laterally into vitrain. The intermediate material, which is neither pure fusain nor typical vitrain, has been designated *Halbfusit* (3) (half-fusain or semi-fusain) by certain German writers. Jongmans and Koopmans (4) have named such material fuso-vitrain, fuso-telain, vitro-fusain, or telo-fusain depending upon the proportion of fusain and structureless vitrain and vitrain showing structure (telain) that may be present. These, however, are distinctions based upon microscopic determination. Semifusain is a satisfactory megascopic anglicized name for such transitional material, which, however, is not commonly recognised with the unaided eye.

Vitrain in Illinois Coal.

Banded Vitrain.—A smooth, freshly broken joint or cleat face of a lump of Illinois coal usually displays, in addition to more or less fusain, a succession of thin strips or bands of brilliant glassy looking, jet-like coal, alternating with strips of, or bands of, coal usually broader and having a luster varying from bright to dull (Fig. 5). Even the brightest of the intervening layers does not equal the jet-like coal in brilliance. This jet-like coal is believed to represent the vitrain of the British coals as named by Stopes (2) and the jet of black lignites. Bands of vitrain are a common feature of Illinois coals and represent the cross section of lenses of the material. It is the presence of these lenses of

vitrain that produces the banded appearance or structure of the normal banded bituminous coals such as are most commonly found in Illinois. The horizontal aspect of the material (Figs. 6 and 7) is characterized by a glassy conchoidal fracture so that no horizontal plane surfaces exist.

There is no absolute measure of the brilliance or luster of vitrain, which increases with the rank of the coal. Similarly,

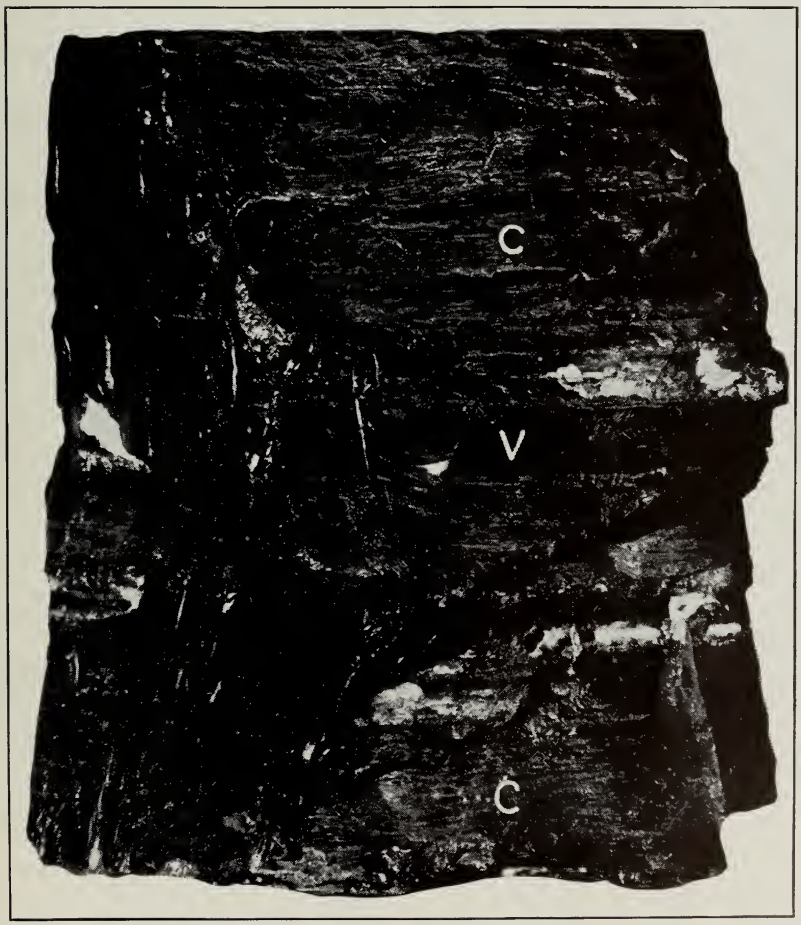

FIG. 5. Coal from Herrin (No. 6) bed in the mine of Valier Coal Co., Valier, Franklin Co., Ill., showing a band of vitrain (*V*) between two thick bands of clarain (*C*).

the brittleness of vitrain increases with its rank. But even in the relatively low-rank, high-volatile coals such as are found in Illinois, the vitrain is much more brittle than other ingredients of the coal bed, so that a disproportionate amount will segregate

FIG. 6. Horizontal broken surface of a band of vitrain in coal from Herrin (No. 6) bed in the mine of the Midland Electric Coal Co., near Farmington, Fulton Co., Ill., illustrating the conchoidal fracture. (Net is 2 inches square.)

in fine sizes other than the fine dust. It may be observed that the brittleness of the vitrain is of a different kind of breakage than the friability of the fusain. The latter when handled will leave the fingers covered with splintery dust; the former is clean to handle.

The Use of the Term Vitrain.

The use of the term vitrain as a name for a variety of coal requires some consideration in view of the lack of agreement among coal technicians and writers concerning the meaning and application of the term.

Vitrain as Defined by Stopes.—In 1919, Dr. M. C. Stopes (2) added the names vitrain, clarain, and durain to the nomenclature of coal description, these materials, with fusain, being the

FIG. 7. Horizontal fracture surface of a band of vitrain in coal from one of the Brazil Block beds in Clay Co., Ind., illustrating the character of the fracture and the characteristic kaolinite-filled shrinkage cracks.

" four distinctive and visibly differing portions forming the mass of an ordinary bituminous coal," which can be recognized and separated from each other " macroscopically by hand and microscopically in thin sections." In the introductory classification,

vitrain is defined as having "conchoidal fracture, brilliant in appearance." In an explanatory paragraph, she says:

> The fourth ingredient, the vitrain or brilliant bands, have been less considered in the past, but are, as a matter of fact, particularly interesting. These brilliant bands in a favorable sample are definitely delimited from the rest of the coal, much more so than either the ordinary bright clarain or the dull durain from each other, which, owing to the finely lamellar nature of the coal in which they are interlarded, are sometimes hard to separate. The true vitrain, however, generally forms a very definite and often sharply straight-cut band, varying from 2 to 6–8 mm. thick. There are, of course, brilliant streaks of smaller size down to almost hair-like flecks. The larger, however, are the more typical vitrain zones.

Her description of vitrain is further amplified on page 475 of the same article as follows:

> *Vitrain* occurs as definite rather narrow bands, in some instances straighter and flatter than other bands of coal, and in some instances more obviously lenticular. True brilliant vitrain bands are often markedly uniform in thickness for considerable distances, and are commonly about 2 mm. to 3 to 4 up to 6–8 mm. thick. The limiting layer between the vitrain and the contiguous clarain and durain is generally sharply marked and is often a clean-cut definite surface (Plate 11, fig. 3). A single brilliant band does not exhibit the fine banding detectable even in the brightest clarain, but is a coherent and uniform whole, brilliantly glossy, indeed vitreous, in its texture.

Certain statements by Stopes relative to the microscopic characteristics of vitrain are now quoted because they contain those remarks that seem to have confused the application of her megascopic terminology (2, p. 481):

> *Vitrain* is, in my experience, unobtainable in *large* sections, as true vitrain occurs almost entirely in thin bands, which tend to break into small segments. In section when pure, its essential characters are its translucency (in which it resembles clarain) and its structureless and uniform texture in which it differs from all other parts of the coal . . . if the purest, most brilliant vitrain is selected, it is essentially homogeneous. . . . There is, consequently, in *pure* vitrain no banding or differentiation of parts in relation to the bedding plane of the deposit, though any individual mass of vitrain generally itself forms a horizontally extended band, lying parallel to the bedding of the coal.

The descriptions of megascopic characteristics of vitrain presented by Stopes in 1919, and the qualifications with respect to the microscopic structure in the last sentence quoted, namely "that there is no banding or differentiation of parts *in relation to the bedding plane of the deposit*" justify the application of

the name vitrain to all bands of jet-like coal found in Illinois coal beds even had there not been the later elucidation of the meaning of the term by Stopes in 1935, (5) as will be explained below. The vitrain of the Illinois coal beds possesses all the

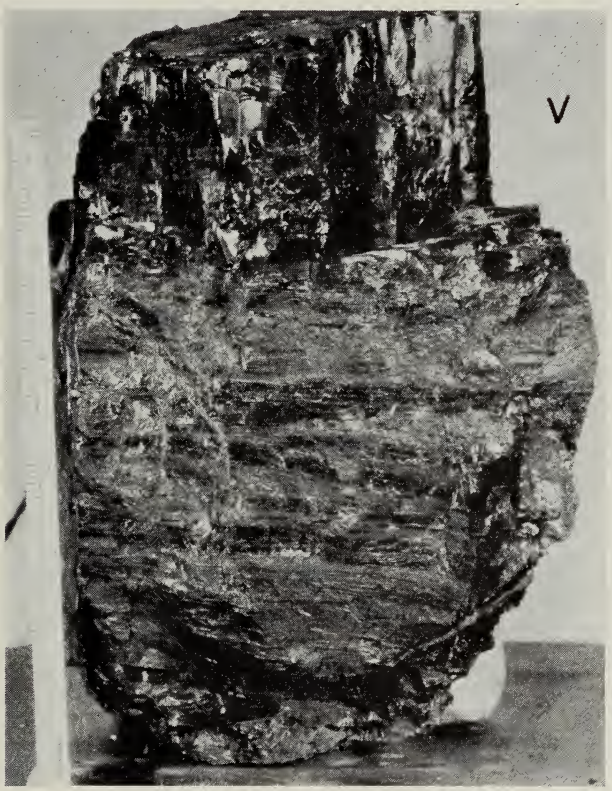

FIG. 8. Coal from Herrin (No. 6) bed in St. Ellen mine of Perry Coal Co., St. Clair Co., Ill., showing a band of vitrain 2 inches (40 mm.) in width.

characteristics assigned to the megascopic appearance of the vitrain of British coals, although the vitrain may occur in bands as much as 2 inches (40 mm.) in thickness (Fig. 8) and be somewhat less brilliant than the vitrain of the British coal beds. The differences in both instances may be due to the fact that Illinois

coals are of somewhat lower rank and hence less compressed than the British coals.

It must be pointed out, moreover, that microscopic criteria are not requisite for megascopic identification and classification. If certain forms of vitrain display plant structure, whereas other vitrain is thought not to do so, subdivision on the basis of such distinction may be possible for the purpose of microscopic classification, but the subdivision should be within the general variety of coal named vitrain on the basis of megascopic criteria.

Vitrain and Anthraxylon.—Stopes' comments on the microscopic characteristics of megascopically differentiated vitrain, and the observations of other investigators on material of this kind, have resulted in the question of the microscopic characteristics becoming controversial, which has hindered the general adoption of the term even for megascopic description. Of special interest to American coal technologists is the use of anthraxylon as a synonym for vitrain.

Thiessen in 1920 (1), after defining "bright coal" as one having "jet-black pitchy appearance, more compact (than dull or matte coal) and breaking with conchoidal fracture," states that:

> *Bright coal is anthraxylon.*—It is not difficult to show that the so-called "bright coal" are components that are derived from the woody parts of plants, parts that at one time were largely composed of wood. Thin sections were cut, both cross-wise and parallel to the bedding planes, from a considerable number of different beds and were examined with a view of determining their origin. Every one examined proved to be derived from some woody plant tissue either of stem, branch, or roots. In every one the cell structure was well enough preserved so as to leave no doubt as to its origin. "Bright coal" has yet to be found in which no trace of cell structure is observable.

In later contributions, Thiessen continued to use the name anthraxylon for coal material referred to in the preceding quotation as "bright coal." Thus, in 1937 he says (6): "Let us first turn to the larger or thicker bands, the strands or bands generally called vitrain, chiefly by Europeans, and anthraxylon by us"; thereby indicating his continued adherence to the belief that the material megascopically identified as vitrain is coalified

woody material and always displays microscopic evidence of its origin.

The identification of anthraxylon is based entirely on microscopic criteria. The declaration that all vitrain is anthraxylon makes unnecessary the use of the longer word at least for bituminous coals. Preference for the shorter name also rests upon the possibility that application of microscopic technique to megascopically identified vitrain may discover the existence of both anthraxylous and non-anthraxylous vitrain.

In 1935, Stopes revised her classification of the petrographic components of coal (5) and defined the megascopic appearance of vitrain in the following summary:

> Thin horizontal bands visible to the naked eye up to 20 mm. thick, though may be in thicker lenticles. Brilliant gloss, strong rectangular fracture perpendicular to the bedding, conchoidal fracture in other directions. Clean specular reflection. Very friable in small cubes with curved sides; quite clean to the touch. Not intrinsically stratified parallel to the bedding plane, but may show striations due to plant structure irrespective of bedding plane.

This modified definition of vitrain, which permits the inclusion of coal that actually shows plant structure arranged irrespective of the bedding plane, dissipates the value of claims such as that of Seyler (7) in 1931 who says, "since Stopes has stated that no coal band which contains recognizable plant structure can justifiably be called vitrain, we must adhere to that definition."

Structureless Vitrain.—Although the identification of coal as vitrain is not dependent upon its possession or lack of possession of plant structure, a considerable group of continental coal technicians and authors have made an issue of this particular criterion as a basis for the identification of vitrain. Working mainly with polished or polished and etched surfaces of coal, and claiming that considerable portions of the brilliant jet-black coal lacks traces of plant structure, this group has proposed and used the name telain (3, 8) (anglicized from Telit) as the name of coal having the general megascopic characteristics of vitrain but exhibiting microscopic traces of plant tissues (Fig. 9), the term vitrain (Vitrit) being restricted to material showing no

structure.[3] Not only is vitrain required by this definition to be without structure, but it constitutes a penetrating substance and binding agent. These definitions make it impossible to identify either vitrain or telain megascopically.

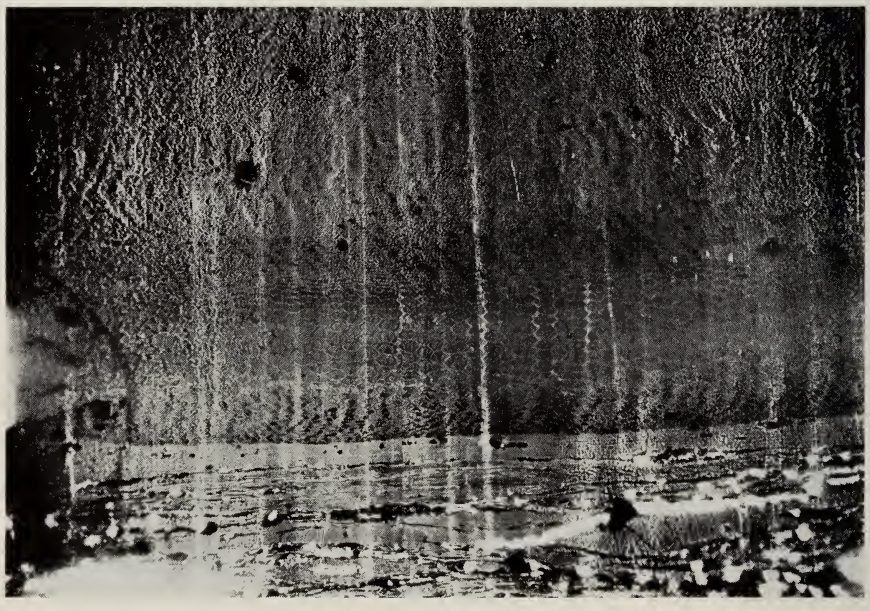

FIG. 9. A portion of a thin section of a block of Herrin (No. 6) coal from a mine at Winkle, Perry Co., Ill. The upper two thirds represents part of a vitrain band of which the lower half shows definite cell structure and the upper half is apparently structureless at the magnification used (200 ×). The bottom part represents clarain.

Microscopic Subdivision of Vitrain.—In 1935 (5) Stopes proposed a subdivision of vitrain on the basis of microscopic criteria primarily in recognition of the fact that certain vitrain bands show traces of plant tissues. The division of vitrain into structureless Eu-vitrain and Pro-vitrain that shows structure is,

[3] Vitrit: (3) Ganz structurlose Grundmasse, von welche die Kohle durchzogen ist and die als Bindmittel dient.

Telit: Grösser Gewebefragmente welche ganz von Vitrit durchzogen sind und deren Zellraume ganz damit ausgefullt sind.

however, based entirely upon microscopic criteria and is impossible of application in megascopic classification.

Clarain.

Megascopic identification.—Within the general group of bright coals all bands, lenses, or benches of coal that are bright, but are not classified as vitrain or fusain, are clarain (Pl. I, Fig. 2). The brightness of clarain is one of its identifying characteristics; the silkiness of its luster is another. One searches vainly in Stopes' original description (2) of the banded ingredients for a precise description of the megascopic characteristics of clarain. She describes it definitely as "bright" (2, p. 272) and differentiates it from vitrain by the brilliance and conchoidal fracture of the vitrain and the "streakiness" (2, p. 274) of the clarain. The description of the luster as silky is believed to be a more precise denotation of the appearance than the term streaky. Both streakiness and the sub-laminations producing silkiness of luster arise from the parallelism of the particles of the coal material. This silkiness of luster is distinctly different from the smooth brilliant luster of a band of vitrain in the same coal.

It should be understood that comparison of brilliance of luster of different ingredients should be made between vitrain and clarain in the same coal and not between heterogeneous vitrains and clarains. The difference is a relative one only, the relation being one that exists in the same coal bed or in the same block of coal after removal from the bed. The relative brightness of vitrain and clarain in the same coal is likely to depend upon the amount of fine or micro-vitrain present in the clarain. At any rate a clarain composed of a large proportion of such micro-vitrain will be bright. On the other hand, even without megascopic evidence of the presence of vitrain, clarain is bright. The explanation in microscopic terminology is that clarain is composed of a predominating proportion of translucent material, whether this material consists of anthraxylon or of attritus. This is a fundamental cause of their megascopic appearance, but is of course not discoverable megascopically.

Stopes' brief description of the physical characteristics of clarain states (2, p. 474) that

> Clarain occurs generally in bands of variable thickness, and when seen in a face at right angles to the bedding plane, they appear parallel to it. Like durain, they are ultimately widely extended lenticular masses. Clarain, even where streaked with durain, has a definite and smooth surface when broken at right angles to the bedding plane, and these faces have a pronounced gloss or shine. This surface luster is seen to be inherently banded, as well as to have bands of durain intercalated between its own bands.

The reference of all Illinois coals with silky luster to clarain does not appear to be contrary to the significance of the original description of this ingredient by Stopes.

Durain.

Megascopic Identification.—Durain is dull coal characterized by lack of luster, matte or earthy appearance and black to lead-gray color (Fig. 10). It is characterized by notably greater hardness than is possessed by the other ingredients. All durain is dull, hence its appearance in this respect is similar in all coal beds. However, since the degree of brightness of clarain and of vitrain varies from coal to coal, particularly with the rank of the coal and the amount of exposure it has suffered, there is no absolute measure of contrast between bright and dull coals. In general, the contrast is greater the higher the rank of the coal, that is, within the bituminous classes. Whether a dull coal appears black or grayish is unimportant in the identification of the coal as durain. Two persons will rarely agree as to the amount of grayness present. The contrast between the brilliant black of vitrain and the dull black of durain is commonly such as to give the impression of grayness to the duller coal, when the two ingredients are in relatively close association.

Stopes' description of the megascopic appearance of durain is as follows (2, p. 474):

> Durain is hard, with a close firm texture, which appears rather granular even to the naked eye. However straight the break across it, the broken face is never truly smooth, but, if looked at closely, always has a finely lumpy or matte surface. Generally, even in the dullest of durain bands, a few (or many) flecks or hair-like streaks of bright coal are to be seen.

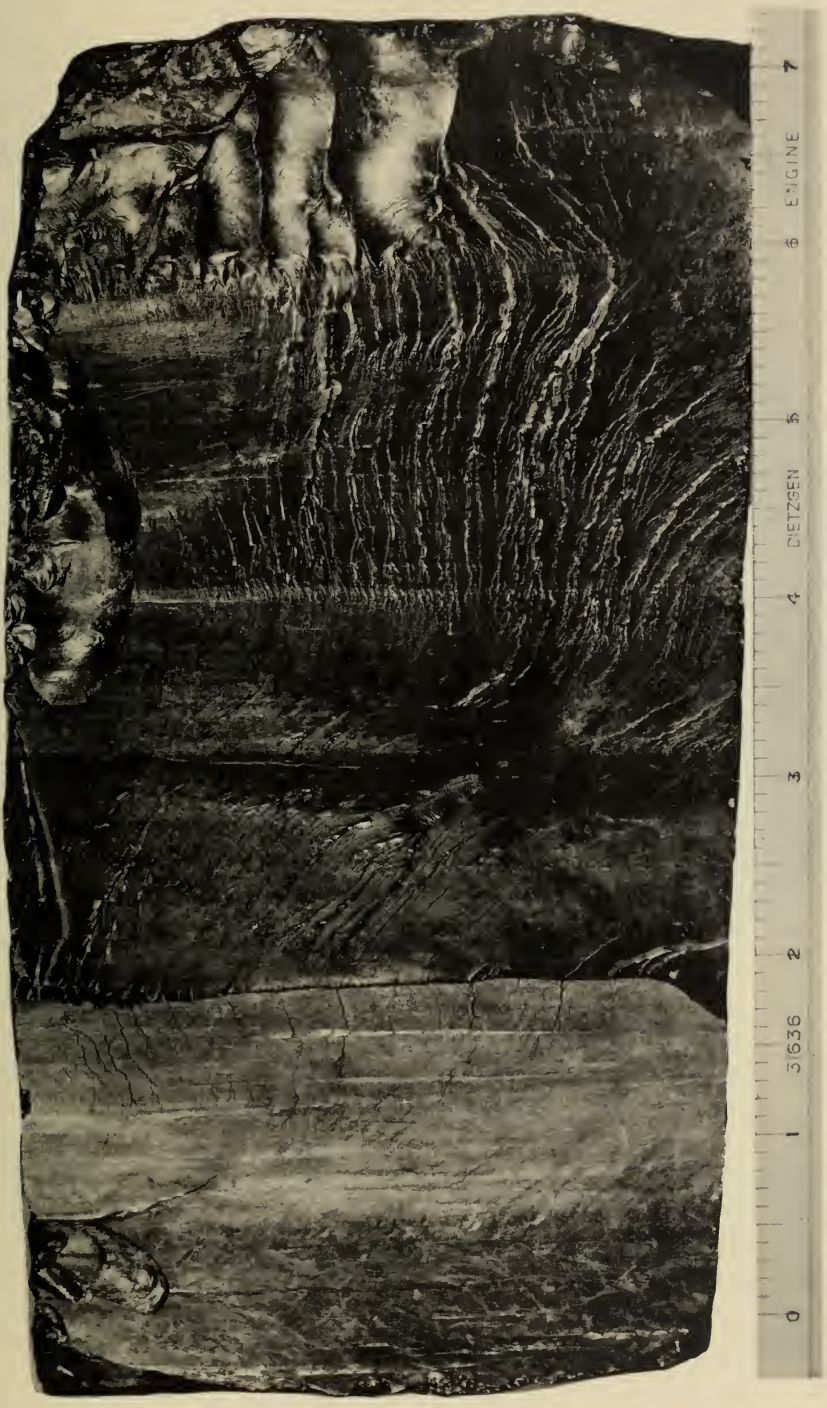

FIG. 3. Typical cannel coal from Lackey, Kentucky, Elkhorn Coal Bed.

It needs to be emphasized that the original descriptions of clarain and durain definitely differentiated between the two. Megascopically distinguishable thin bands of durain in clarain are definitely mentioned (2, p. 475).

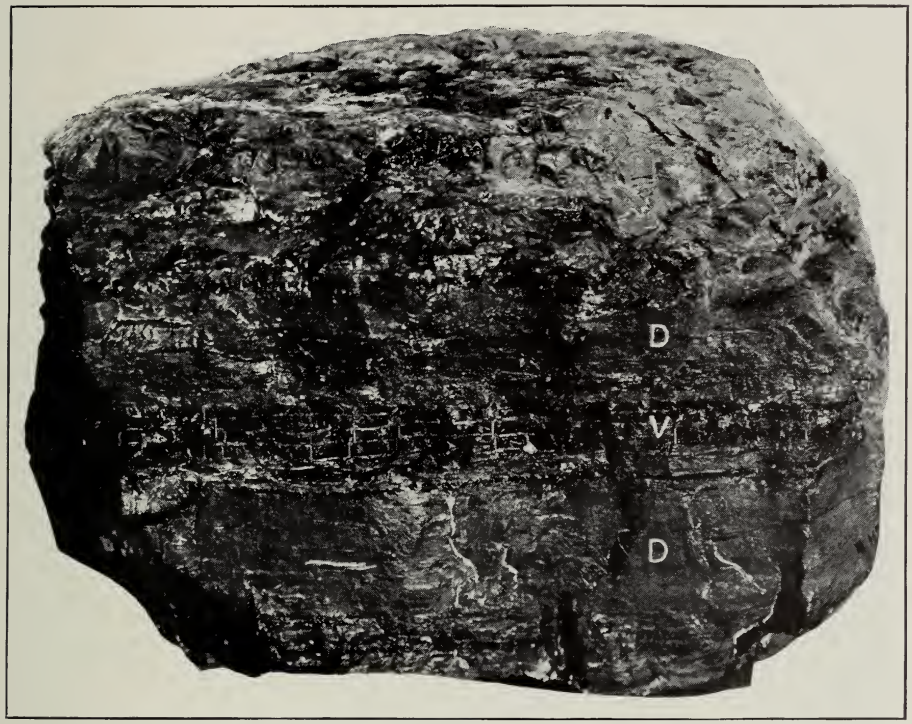

FIG. 10. Coal from Herrin (No. 6) bed in the Orient No. 2 mine of the Chicago, Wilmington and Franklin Coal Co., West Frankfort, Franklin Co., Ill., consisting largely of durain (*D*), but with four narrow bands of vitrain (*V*) in the middle of the block.

This position is opposed to that of certain European authors, particularly E. Stach (11), who holds that clarain is a mixture of vitrain and durain, the vitrain in clarain being distributed as fine shreds in a ground mass of durain. The so-called Humodurit of Stach (11, p. 149) is regarded by him as synonymous with clarain and is translucent throughout except for occasional fragments of fusain.

Opacity of Durain.

Just as the sheen characteristic of clarain is believed to be definitely related to and the result of the translucency of its constituents, as observed in thin sections, so the dullness of durain results from the predominant opacity (Fig. 11) of its components. Although Stopes did not definitely list opacity as one of the criteria for the identification of durain, since this could not be

FIG. 11. A portion of a thin section of a block of Herrin (No. 6) coal in the mine of the Clarkson Coal and Mining Co., Nashville, Washington Co., Ill., illustrating the opacity of the groundmass of durain. The section is sufficiently translucent so that the coal represents semi-splint rather than true splint or durain.

determined without the microscope, she observes that material classified megascopically as durain when viewed microscopically is found to be composed predominantly of opaque material in which the majority of the " roundish or polyhedral fragments " of which it is composed are blackish or opaque. She further says (2, p. 479):

> The granules are closely packed and form a coherent mass, but mixed with them are the most characteristic spore exines. These may be whole or in fragments. The microspores are most conspicuous, and their very thick exines are clear and brilliantly colored, almost red, though when thinner they are reddish gold to pale gold or amber colored.

With the effect of making more definite the contrast between durain and clarain, she says:

> Throughout the texture of the less pure, streaked durain are seen in section small, clear, generally lenticular bands or flecks of more golden color. These are the streaks of clarain which so commonly lie embedded with the durain. . . . One may say that, on the whole, durain is essentially composed of a high proportion of opaque, fine, granules with many macro- and microspore exines scattered through it like currants in a pre-war pudding.

Attritus.

Thiessen referred to all material that he does not identify as anthraxylon and fusain as attritus. Vitrain and fusain in general represent coalified tissues that are, and the only ones that are, naturally preserved in large units, whereas the attritus represents all of the other parts of the plants as well as degradation products, which are naturally preserved in small units.

Opaque and Translucent Attritus.—Attritus is classified by Thiessen as translucent and opaque. The attritus of clarain is predominantly translucent. Clarain is composed of more or less translucent attritus and thin shreds of anthraxylon. The shreds of anthraxylon may be recognized, however, only by the microscope, so that the differentiation of anthraxylon and attritus is impossible megascopically. The fact that the coal is composed of translucent material gives it the silky luster diagnostic of clarain.

Durain consists predominantly of opaque attritus. This is equivalent to saying that pure durain is the same as the coal known in America as splint coal. In general, Illinois dull coals contain

enough translucent attritus to modify materially their character from that of true splints, and generally are more correctly designated semi-splints. However, since the fact of opacity cannot be determined megascopically, all dull coals are grouped together as durain.

Cannel Coal.

Cannel coal constitutes a special variety of coal not included by Stopes among the common varieties of coal occurring as banded ingredients of British bituminous coal beds. Thiessen treats it as essentially non-banded coal. In coal beds found in Illinois, bands and benches of coal having characteristics more or less resembling those of cannel coal are not unknown, and they may contribute to the banded appearance of the coal beds. The identification of cannel coal is at the present a matter of megascopic determination. The criteria for identification consist of its black color, greasy to sub-greasy luster (Plate II, Fig. 3), evenness and extreme fineness of grain, absence of or poorly developed horizontal laminations, and conchoidal fracture on a fairly large scale. The coal is relatively brittle.

Cannel, like durain and clarain, is an attrital coal. Microscopic examination shows that some cannels contain much opaque matter and others (probably less common) contain relatively little. Undoubtedly there will be some difficulty in identifying certain coals that are transitional between cannel coal and durain. As long as the criteria for the microscopic differentiation of cannel coal is more or less indefinite, exact megascopic identification can scarcely be expected. In general, only those bands or benches of coal possessing the common megascopic characteristics listed above should be identified as cannel coal.

Elimination of the Term Clarain.—Certain groups of European technologists, particularly represented by E. Stach (11) and Jongmans (4), who adhere to the technique that employs polished or polished and etched surfaces for the study of coal have discarded the name clarain from their descriptive vocabulary, believing that clarain is only a mixed variety of coal composed of durain and more or less vitrain in units of small dimension. The difference

between translucent and opaque material is not regarded by them as of sufficient fundamental importance to justify the differentiation of clarain as a variety of coal coordinate with vitrain and durain. The present writer and his colleagues believe that the original British system of nomenclature is more useful.

SUMMARY AND CONCLUSIONS.

Illinois coal as seen in the bed, the lump, or the hand specimen is composed of the same four varieties or ingredients of coal recognized by Stopes in British bituminous coal beds, namely vitrain, clarain, durain, and fusain. In addition, bands or benches of cannel or canneloid coal are also found in Illinois coal beds. The term fusain enjoys general usage. Vitrain is the relatively brilliant coal in a bed that largely imparts the banded structure to banded bituminous coals. It corresponds to the thicker strands of anthraxylon as identified by Thiessen. Clarain is relatively bright coal with a silky luster. It is composed more or less of fine strands of anthraxylon and of translucent attritus. The translucency of the material in thin section is characteristic. Durain is coal with a predominant matte or dull texture, and black to lead gray in color. The general opaqueness of this coal in thin section is characteristic. It is composed largely of opaque attritus. Cannel coal, like clarain and durain, is predominantly an attrital coal. It is black, but tends to have a greasy luster, an exceedingly fine texture, and a conchoidal fracture. In thin sections some cannels are largely translucent but probably more cannels are largely opaque.

In establishing a system of megascopic nomenclature for Illinois coals, a simple but fundamentally accurate method is provided for field description and for the occasional hand specimen that reaches the laboratory. The facts provided by such a megascopic description will provide a basis for the megascopic classification of the coals found in Illinois and neighboring states in the Eastern Interior Coal Basin. Such description will make intelligent comparison possible and will provide a means of estimating from the description the probable susceptibility of a coal to

various preparation procedures and its adaptability to many varieties of utilization.

BIBLIOGRAPHY.

1. Thiessen, R.: Compilation and composition of bituminous coals. Jour. of Geol. 28: 185–209, 1920.
2. Stopes, Marie C.: On the four visible ingredients in banded bituminous coal. Studies in the composition of coal. Proc. Royal Soc. Lond., Ser. B, 90: 470–487, 1919.
3. Kühlwein, F. L., Hoffman, E., and Krüpe, E.: Durchfuhrung und praktische Bedeutung planmässig Kohlenpetrographischer Flozprofiluntersuchungen. Glückauf, 70: 1–28, 32–41, 1934.
4. Jongmans, W. J., and Koopmans, R. G.: Kohlenpetrographische Nomenklatur Jaarverslag, 1933: 49–63; Geol. Bur. Nederland. Mungebied Heerlen, 1934.
5. Stopes, M. C.: On the petrology of banded bituminous coals. Fuel, 14 (1): 4–13, 1935.
6. Thiessen, R.: What is coal? Appalachian Coals: (Mimeographed) 38 pp., and illus., Jan. 11, 1937.
7. Seyler, C. A.: Petrography and classification of coal: Proc. Soc. S. W. Inst. Eng., 47, 3, (2): 547–555, 1932.
8. Roos, Gerritt: Comparative researches on the variation of the constituents of coal of one seam from South Limburg (the Netherlands). Deux. Cong. L'Avancement Des Etudes de Stratigraphie Carbonifere, 1935, C. R. II: 1056–1161, 1937.
9. Thiessen, R.: Splint coal: A. I. M. E. Coal Div. Trans. 88: 644–671.
10. Wandless, A. M., and Macrae, J. C.: The banded constituents of coal. Fuel 8 (1): 4–15, 1934.
11. Stach, E.: Lehrbuch der Kohlenpetrographie. Berlin, 1935.

Illinois Geological Survey,
Urbana, Ill.,
March 20, 1939.