

THE PRINCIPAL BEDS OF UNDERCLAY IN THE COAL FIELDS OF INDIANA

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Introduction. No single area in Indiana is so rich in ceramic resources as the coal-bearing area located in the western and southwestern part of the state. The underclays and shales found in association with most of the coals of this area are widely used in Indiana for the manufacture of ceramic products. In 1931, forty plants of the 101 ceramic plants in the state were using these materials.

Of the two ceramic materials, the underclays are the most important source of raw materials because of the greater variety of products which can be manufactured from them. In Indiana, the products manufactured from underclays include pottery, structural wares and refractories.

Because of the extensive and varied usages made of underclays in Indiana, it is of scientific as well as commercial interest to know the stratigraphical position and general character of the more important beds of underclay. The various state geological reports contain an abundance of information on clays, but such information is scattered and not readily accessible. In the following pages, the writer presents a summary of the chief underclay-bearing horizons of Indiana with reference to their relationship to the various coal beds. It must be borne in mind, however, that the information presented in the summary is very general and is intended solely as an index for rapid reference work; detailed information must be drawn from other sources.

The writer wishes to acknowledge his debt to the various writers on the subject of Indiana clays for supplementary information obtained from their publications.

Geologic Conditions. The Indiana coal field includes approximately 70,000 square miles or about one-fifth of the total area of the State. The rocks of this area belong chiefly to the Pennsylvanian system and consist of a great series of coals, sandstones, shales and underclays. All of the coals are found in the rocks of this system, except a thin and unimportant bed that occurs in the lowermost group of the Chester (Mississippian) series upon whose eroded surface the Pennsylvanian rocks rest.

The coal beds are interstratified with beds of shale, sandstone, underclay and limestone. The underclays normally underlie beds of coal. The thicknesses of the beds of underclay range from total absence, as in localities where the coal rests on shale or sandstone, to as much as 12 feet.

"The coal beds and their associated strata dip southwest at the rate of about 20 to 35 feet to the mile, except in the extreme north where

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the dip is approximately west, and in the extreme south where the dip is northwest and north. The beds outcrop from east to west in the order of their age; the oldest extend farthest east and pass under younger beds toward the west.

"There are more than 20 beds of coal in the State; 15 have been mined locally and nine over large areas. The principal beds, named in the ascending order of stratigraphical position and age, are: Coal I, Lower Block, Upper Block, Minshall, Coal II, Coal III, Coal IV, Coal V, Coal VI, Coal VII, Coal VIII, Coal IX, Parker, Friendsville, and Aldrich."² All the coals belong to the bituminous class.

The Pennsylvania series of Indiana include the Pottsville, the Allegheny, and the post-Allegheny divisions. The rocks of the Pottsville division, which includes the Mansfield and the Brazil groups, rest unconformably upon the rocks of the Mississippian system. The Mansfield group consists largely of a basal conglomerate or sandstone, but also contains minor beds of shale and underclay and beds of coal.

POTTSVILLE DIVISION

Mansfield group. The principal beds of underclay in this group are found in association with Coal I and two riders of that coal bed. As the coals of this group were deposited in basins of relatively small area, the beds of underclay which occur beneath the coals are not continuous over very wide areas. The coals of the Mansfield group, therefore, have been difficult to correlate; in the southern part of the coal field at least three beds of coal and their associated strata have been recognized, while to the north, in the region of Greene and Martin counties, only one bed is recognizable as belonging to this group. The confusion which exists over this stratigraphical problem is unfortunate and for want of better correlation, the writer simply refers the coals to Coal I horizon. There is, however, a possibility that the Lower Block coal may be represented by one of the rider beds of Coal I in the southern part of the area.

Coal I usually rests upon beds of underclay which vary in thickness from three to six feet, the greater thicknesses being found in the southern part of the area. The underclays are gray to grayish-brown in color, of moderately fine texture, and almost always of good plasticity. Fossil plant imprints are very characteristic of these underclays. Fire tests of the clays from this horizon show that they are buff to tan-burning, are comparatively free of iron, and have an average refractoriness equivalent to Cone 10. Some of the underclays from the southern portion of the area are more refractory, however, and will withstand a temperature equivalent to Cone 20. The principal commercial uses that have been made of the clays from the horizon of Coal I include such products as stoneware, building tile, face brick, sewer pipe, conduits, flue lining, and chimney tops.

Brazil group. The Brazil group contains four mineable beds of coal—the Lower Block, the Upper Block, Minshall and Coal II. The underclay associated with the Lower Block coal is of variable quality. In

² "The Indiana Coal Fields." W. N. Logan, 11th Am. Rpt., Div. Geol., Dept. Cons., page 30, 1929.

the Brazil district (Clay County), the bed of underclay, upon which the Lower Block coal usually rests, is not of very great thickness and consists of a sandy underclay that is frequently of inferior quality; to the south and east of Brazil, in Greene and Martin counties, the thickness of the bed is greater and the clay is found to be fine-grained, plastic, and suitable for the manufacture of various ceramic wares, including terra cotta and pottery. The thicknesses of the bed range from one and one-half to 10 feet with the average thickness being about three to five feet. Commercial development of the underclays of this horizon has been limited.

The bed of underclay that is practically always found beneath the Upper Block coal is the best ceramic material in the state, from the standpoint of the large variety and the uniform quality of the products that are obtained from its use in ceramic manufacture. The underclay of this horizon is used extensively in the ceramic plants of the Brazil district and is shipped to numerous plants in other parts of Indiana and to points outside the state. The bed of underclay is typically developed in Clay and Parke counties. It is usually gray to dark gray in color, fine-grained, very plastic, comparatively free of grit and other impurities, moderately refractory, and buff-burning. The thickness of the bed is not very uniform and varies from two to as much as ten and one-half feet in thickness; the average thickness is about five feet. The underclay is well adapted to the manufacture of terra cotta and pottery and is very satisfactory for making building tile, face brick, conduits, sewer pipe, glazed tile, flue linings, and similar products.

The Minshall coal is underlain usually by a bed of underclay of good quality and of commercial thickness. The most typical development of this bed occurs in the region of Huntingburg (Dubois County). Here, the bed is about six feet in thickness and consists of an upper four-foot layer of buff-burning clay and a basal two-foot layer of red-burning clay. The buff-burning stratum of the bed is light gray in color, fine-textured, very plastic and sufficiently refractory for the manufacture of low-heat duty fire brick. Face brick are also made from this buff-burning layer. The basal, red-burning portion of the bed contains considerable sand, carbonaceous matter, and iron. The latter impurity is in the form of small, oolitic-like concretions. This basal layer is also used for making face brick.

Coal II is a coal of variable thickness and is entirely absent in certain areas, having been removed by erosion preceding the deposition of the rocks of the Allegheny division. A thin bed of underclay is frequently present beneath Coal II but the clay is not of commercial importance.

ALLEGHENY DIVISION

Staunton group. The Allegheny division is divided into three groups—the Staunton, the Petersburg and the Shelburn. The first of these formations contains Coal III, Coal IIIa and Coal IV. Coal III and Coal IIIa are best developed in the northern part of the Indiana coal field. The underclays associated with these coals are important ceramic materials. The underclay of Coal III is five to seven feet in thickness and

is particularly well developed in Parke and Vermillion counties. The physical characters of the clay vary from a dark gray, soft, massive clay to that of a white, hard, massive, very siliceous clay which resembles a friable sandstone. This latter variety of underclay is found in the area between Newport and Montezuma and is used for the manufacture of a good grade of fire brick. The less siliceous deposits of the underclay are suitable for the manufacture of such structural wares as face brick, building tile and floor tile. The underclay of Coal IIIa averages about five feet in thickness. It is a gray, massive, fairly siliceous clay with good plasticity. The clay is moderately refractory and is used in the manufacture of sewer pipe and flue lining.

Coal IV usually rests upon a sandstone or a very hard and sandy shale or underclay. The underclay is not adapted to ceramic purposes. Coal IVa, which lies about 20 feet above Coal IV, is a thin rider vein that frequently rests upon several feet of very plastic, fine-grained, light gray underclay. The underclay merges into a massive, greenish-gray, sandy shale below. The underclay of this rider, although not used commercially at present, is adaptable to the manufacture of such structural wares as brick and tile.

Petersburg group. The Petersburg group contains three important coal beds—Coal V, Coal VI, and Coal VII. Coal V, the most important coal bed in Indiana, normally rests on shale or underclay. The underclay, where tested, has proven unsatisfactory for the manufacture of ceramic products. The thickness of the bed varies from a few feet up to as much as nine feet. The clay is greenish-gray to dark gray in color, is very sandy, and contains much pyrite.

Coal VI usually rests upon an underclay but the presence of shale at the base of the coal has been noted at several points. The thickness of the underclay bed is variable, ranging from a few inches to as much as seven feet; the average thickness, however, is between two and three feet. The clay is gray to dark gray in color, plastic, and often slightly sandy. There has been no commercial development of this bed of underclay, but fire tests which have been made of it show that, in places, the clay is adaptable to the manufacture of structural wares.

Underclay is usually found below Coal VII in commercial thicknesses. The underclay is generally dark brown in color, fine-textured, and plastic. Imprints of fossil plants are frequently very abundant in the upper part of the bed. The thickness of the underclay bed averages about five feet. The quality of the clay is variable, but where sufficiently free of iron, fluxes and other impurities, fire tests have shown that the underclay is adaptable to certain pottery and heavy clay products. As a commercial prospect this bed of underclay is not very good.

Shelburn group. The Shelburn group contains two beds of coal—Coal VIII and Coal IX. These beds of coal usually have some underclays associated with them but they are not of commercial importance.

POST-ALLEGHENY DIVISION

The post-Allegheny division, composed of the Merom and the Wabash groups, does not contain any underclays of commercial importance.