ECONOMIC GEOLOGY OF McCRACKEN COUNTY, KENTUCKY

Preston McGrain

Prepared as part of the cooperative geologic mapping program with the United States Geological Survey
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COVER PHOTOGRAPH

Bird's-eye view of the Ohio River at Paducah. The mouth of the Tennessee River is visible at the upper left of the photograph. From the air, Paducah's waterfront presents dramatic evidence of the importance of water to the economy and development of the area. These streams provide water supply, transportation, and recreation. Barges of sand, dredged from the Ohio River, await unloading at the left-center of the picture. Other barge facilities and river terminals are also present. Photograph courtesy of Tennessee Valley Authority.
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LETTER OF TRANSMITTAL

February 20, 1978

Dr. Wimberly C. Royster
Dean of Graduate School and
Coordinator of Research
University of Kentucky

Dear Dean Royster:

This report, Economic Geology of McCracken County, Kentucky, contains much geologic information fundamental to many engineering and environmental studies useful for land-use planning in this county. Natural resources of gravel, sand, ceramic clay, fuller’s earth, and water supplies are available in this area for use in its growth. The report indicates by geologic and resource maps the surface distribution of the mineral deposits.

Sincerely,

Wallace W. Hagan

Wallace W. Hagan
Director and State Geologist
Kentucky Geological Survey
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ECONOMIC GEOLOGY
OF McCracken County, Kentucky
Preston McGrain

ABSTRACT

Gravel, sand, ceramic clay, fuller's earth, and water supplies are the principal geologic resources of McCracken County. Reserves of some of these minerals are indicated. Geologic resource maps included in this report indicate the distribution of rock formations and mineral resources.

An outstanding transportation network of rail, water, and highway facilities with favorable terrain for plant sites and the proximity to sources of supplies of bituminous coal, fluorspar, limestone, silica, and electric power should focus attention on Paducah and McCracken County as an area of potential industrial growth.

Much geologic information fundamental to many engineering and environmental studies is available and would be useful for land-use planning in this part of Kentucky. Because of the growth in the suburban areas in McCracken County, the greatest application of geological data may be in the evaluation of sites for roads, bridges, industrial parks, shopping centers, homes, and reservoirs and the design of various structures associated with such facilities.

INTRODUCTION

Natural resources are needed as never before for the development and growth of a community, a state, or a nation. A knowledge of the geologic resources of a region is an important aspect of the total picture. Geologic resources, though hidden for the most part, have an important impact on the development program of an area. Geology is destined to play a greater role in the future.

Kentucky's statewide areal geologic mapping project, conducted cooperatively by the Kentucky Geological Survey and the United States Geological Survey, has produced a series of new, 7.5-minute geologic quadrangle maps which depict the geologic framework of their respective areas. Eleven maps are required to cover McCracken County (Amos and Wolfe, 1966; Finch, 1964, 1966, 1967, 1968a; Olive, 1963, 1966a, 1966b, 1969; and Swanson, 1970, 1978). The new geologic maps are particularly useful to those interested in the exploration for and development of needed mineral resources. The maps are printed on single sheets at a scale of 1:24,000 (1 inch map distance represents 2000 feet on the ground). They contain geologic diagrams, explanations, structural information, and discussion of potential mineral wealth. In addition to being used as guides for prospecting for possible mineral resources, the new geologic maps can be used as aids for evaluating foundation conditions for buildings, highways, bridges, and other structures; sites for disposal of solid and liquid wastes; design and location of impoundments for surface-water supplies; and problems relating to excavations.

Modern topographic maps and ground-water availability maps (hydrologic investigations atlases), both at a scale of 1:24,000, have also been published for McCracken County. These topographic and water resources programs, like the geologic mapping program, were conducted cooperatively by the Kentucky Geological Survey and the United States Geological Survey, with both State and Federal governments sharing the financial responsibility. The resulting geologic, ground-water, and topographic maps provide the basis for much of the geologic interpretation in this report (Fig. 1).
For more than a century, publications by State and Federal agencies have called attention to mineral deposits and underground water resources in McCracken County. In recording his observations made during 1854 and 1855, David Dale Owen, the first State Geologist of Kentucky, noted the presence of ferruginous conglomerate along Clarks River and Perkins Creek; wrote about chalybeate springs issuing beneath ferruginous gravel beds, particularly along Massac Creek; and published the chemical analysis of a limonite deposit 5 miles from Paducah (Owen, 1856). Since that time numerous maps and bulletins have been issued on the geology, minerals, and important water resources of the county. They are too numerous to summarize here, but a list of pertinent and useful technical references is included at the end of this report.

In the late 1940's, the construction of Kentucky Dam on the Tennessee River about 20 miles east of Paducah with its attendant water supply, navigation and recreational facilities, and electric power, revived interest in this part of western Kentucky as a possible industrial-site and mineral-producing area. Investigations by both government agencies and private industries were stepped up and resulted in a more complete evaluation of the potential of this strategically located region.

This economic geology report summarizes and synthesizes information relative to the geologic resources of McCracken County, drawing on data gathered as parts of the several programs cited above as well as original field work. To date similar reports have been published for Allen, Calloway, Hancock, Marshall, Simpson, and Warren Counties.

The writer gratefully acknowledges the cooperation and counsel of many citizens of McCracken County and several professional associates during the course of this investigation.
GEOLOGIC AND GEOGRAPHIC SETTING

McCracken County is in the extreme western portion of Kentucky (Fig. 2). It is one of eight counties located in that part of the Commonwealth commonly referred to as the Jackson Purchase region. Geologically, the Jackson Purchase has been described as the part of Kentucky lying in the northern tip of the Mississippi embayment, the area of outcrop of the unconsolidated Cretaceous and Tertiary sediments (McFarlan, 1943, p. 204). The eastern margin of the embayment is frequently taken as Kentucky Lake, but the area between Kentucky Lake and Lake Barkley and the area immediately north of the Tennessee River also contain numerous deposits of Cretaceous sediments. No deposits of Paleozoic rocks are known to be exposed at the surface of the ground in McCracken County, but they have been encountered beneath the embayment sediments in drilling activities (Fig. 3).

McCracken County covers a 251-square-mile area in the north-central part of the Purchase. It is bounded on the north by the navigable Ohio and Tennessee Rivers, on the east by Marshall County, on the south by Graves County, and on the west by Ballard County. Paducah, the county seat of McCracken County, is the largest city; McCracken County is the most populous county in the Jackson Purchase region. The population of McCracken County was estimated to be 60,200 in 1976; in 1975 Paducah had an estimated population of 30,674 (Kentucky Department of Commerce, 1977). Because of its strategic location at the confluence of the Ohio and Tennessee Rivers and its proximity to the Mississippi and Cumberland Rivers, Paducah has been referred to as the hub of the inland waterway system of the eastern United States.

In addition to the Ohio and Tennessee Rivers, the principal drainage lines in McCracken County are

Figure 2. Regional geologic setting of Kentucky showing area of this report.
Clarks River and Massac and Mayfield Creeks.

Clarks River watershed includes much of the eastern portion of McCracken County. Clarks River enters the Tennessee River near the southeast edge of Paducah. Massac Creek watershed covers much of the western half of McCracken County; Massac Creek flows into the Ohio River west of Paducah. Mayfield Creek traverses a portion of southwestern McCracken County just north of the Graves County line; it enters the Mississippi River near Wickliffe in southwestern Ballard County.

McCraken County is served by the Illinois Central; Louisville and Nashville; Chicago, Burlington, and Quincy; and Paducah and Illinois railroads.

Barkley Field, located 8 miles west of Paducah, has two paved runways of 4,000 and 6,500 feet and is served by commercial flights. There are several water terminals in Paducah on the Ohio and Tennessee Rivers. A 9-foot channel stage is maintained on both streams. Paducah and McCracken County are served by U. S. Highway routes 45, 60, 62, and 68, and numerous State routes. The new Interstate Highway 24, which will connect St. Louis, Missouri, and Nashville, Tennessee, passes near the southern border of Paducah.

Topographically, McCracken County is a gently rolling plain. The surface of the upland is rolling, but large areas of level land are present between some

Figure 3. Topography of Paleozoic surface in McCracken County. Contour interval is 100 feet. Because the depth to indurated limestones, sandstones, and similar hard rocks is generally more than 100 to 200 feet beneath the surface in McCracken County, bridges, buildings, houses, and other structures will necessarily have their foundations on unconsolidated sands, gravels, and clays. Data adapted from Davis and others (1973).
of the streams and their headwaters, particularly in the western part of the county, and along the flood plains of the Ohio, Tennessee, and Clarks Rivers. Highest elevations occur along the Tennessee Valley divide near St. Johns in the southern part of the county where ridgetops have elevations in excess of 500 feet above sea level (Fig. 4). Other high elevations are present in the uplands between Mayfield Creek and West Fork of Massac Creek in the southwestern part of the county where ridges and knolls attain elevations in excess of 490 feet, and near the headwaters of Massac Creek where similar elevations occur. Lowest elevations are on the Ohio River. Normal pool elevation at Paducah on the upstream side of navigation dam No. 52 is 302 feet; the normal pool elevation below the dam is 290 feet. Greatest relief occurs in the vicinity of Clarks River and Mayfield Creek where hills commonly rise 100 feet or more above the broad valley flats. There are no bluffs on the McCracken County shore of the Ohio River. Elevations of general interest are: downtown Paducah at the McCracken County courthouse, 341 feet; Lone Oak, 475 feet; Reidland, 400 feet; and Barkley Field, 400 feet.

Rocks exposed in McCracken County include unconsolidated sands and clays of Cretaceous and Tertiary ages, and gravel, sand, silt, and clay of Tertiary and Quaternary ages. Exposures are poor; most of the strata are hidden by soil, loess, and alluvial cover. Best opportunities to view the rocks are in man-made exposures and in the steeper gullies and ravines.

Recent geological work suggests that a lake occupied the valleys of the Ohio, Tennessee, and Clarks Rivers in parts of Kentucky and Illinois near Paducah during part of Pleistocene time (Finch, Olive, and Wolfe, 1964). The upper surface of an extensive silt deposit thought to be lacustrine in origin is at elevations between 330 and 350 feet. Olive (1966) named the feature Lake Paducah and dated it by the radiocarbon method as late Pleistocene (Wisconsin), 21,080 plus or minus 400 years.

Plate 1 (in pocket) is a generalized geologic map compiled from the recently published geologic quadrangle map series (Amos and Wolfe, 1966; Finch, 1964, 1966, 1967, 1968a; Olive, 1963, 1966a, 1966b, 1969; and Swanson, 1970). It shows the location and distribution of the rock units, and thus indicates the distribution of some of the mineral resources of the county.

**ENVIRONMENT AND PLANNING**

City, county, and other public officials frequently must make decisions about land use where various aspects of geology, hydrology, and topography should be taken into consideration. Knowledge and understanding of local geological conditions can be useful in land-use planning because geological factors can significantly affect the quality of human environment. These include such things as quantitative and qualitative inventories of mineral resources; sources of construction materials; geology as it influences sources and quality of surface and underground water supplies; ability of land to support man-made structures; and the suitability for and capacity of the earth to receive wastes.

Fortunately there is a large amount of geological information on McCracken County which can materially aid officials in making wise decisions regarding city and county planning. Complete coverage by geologic, topographic, and water-availability maps for the county includes the location of natural drainage lines; elevation, size, and shape of landforms; depths to water; rock types; and thickness and attitude of geologic units. With proper recognition of the problems and with the integration of scientific data, it is possible to forestall damage and unnecessary expense which might be associated with road, street, and pipeline construction; urban and suburban development of housing, plant sites, shopping centers, and industrial parks; water impoundments; and waste disposal.

The recognition of the importance of geologic data to land-use planning and development during the course of the geologic mapping activities in the Jackson Purchase in the 1960's led to an engineering study of the Paducah area (Finch, Nichols, 1968). Field and laboratory investigations were conducted to determine the relation of geologic factors to engineering problems. Engineering geologic maps which delineate surface map units based on engineering properties as well as lithology were prepared. Interpretations were made of the probable behavior of rock units when disturbed by normal engineering and construction practices or in response to natural phenomena such as erosion, flooding, and earthquakes. The results of the investigations indicated that the Paducah area potentially has many construction problems related to geologic factors and that specific site investigations are recommended for efficient land use. General engineering properties of the different rock units presented in the Finch (1968b) and Nichols (1968) reports should be the same in other parts of McCracken County where similar geological conditions are present.

Engineering properties of the unconsolidated surficial deposits and the poorly to moderately consolidated sedimentary rocks were studied in northwestern McCracken County by the Tennessee Valley Authority prior to the construction of the Shawnee steam plant. These data, summarized by Finch (1967), are useful in the planning and design of roads, bridges, buildings, excavations, and other construction related to highway and industrial development sites, both in this area and in other parts of the county where similar earth materials are encountered.
Figure 4. Portion of the Melber quadrangle showing the topography in south-central McCracken County. The highest elevations in the county, 500 feet above sea level, are found in this area along and near the drainage divide between Clarks River and Massac Creek. This divide is also the western boundary of the Tennessee Valley watershed. Contour interval is 10 feet.
Surficial silty and clayey materials are unsatisfactory for road subgrade and base and building foundations. Bedrock materials range from poor to good for various engineering uses; the greater the clay content the poorer the conditions. Loess, mixed loess and clay, the Porters Creek Clay, and clayey portions of other formations are notoriously unstable for foundations or for use as fill material. Surficial gravel deposits are good to excellent for fill, road subgrade and base, and building foundations. In upland areas where thin windblown silt (loess) deposits are present, the underlying gravel formation would be much more suitable for foundations for structures than the silt.

In McCracken County springs and seeps are common along the base of porous sand and gravel formations where they are in contact with underlying impervious clay deposits. This situation produces unstable slope and foundation conditions. Such sites should be avoided because roads and other structures built across them may result in failure unless preventive measures are incorporated in the initial construction. Springs and seeps are particularly noticeable at the contact of the continental deposits (gravels and sands) with the Porters Creek Clay and at the Wilcox-Porters Creek boundary.

The water table in low areas, particularly below elevations of 350 feet, is within a few feet of the ground surface during wet seasons. This can lead to wet basements, unstable roadbeds, and similar problems. Construction in such areas should include pumping and drainage systems as well as adequate foundations.

There are large areas on the flood plains of the Ohio and Tennessee River valleys which offer attractive sites for homes or industry during times of normal stream flow, but these areas may be subject to inundation during floods. To prevent unexpected loss of life and property damage, the possibilities of flooding should be considered before any new development takes place in these areas. Flood stage at Paducah is approximately 325 feet above sea level. The 1937 flood on the Ohio River, which was the greatest on record for the area, reached a crest of approximately 347 feet at Paducah. Since that time, flood control measures such as Kentucky Dam on the Tennessee River about 20 miles above Paducah and other similar structures on tributaries of the Ohio River make the recurrence of another flood of this magnitude unlikely. However, flood crests of 325 to 335 feet above sea level are common at Paducah (Finch, 1968, table 3). Paducah is currently protected by a floodwall which rises to an altitude of about 350 feet.

Pursuant to a request from the 89th Congress, the United States Geological Survey prepared a series of maps of the flood-prone areas of the United States. Some of these include areas along the Ohio and Tennessee River valleys in northern McCracken County (Fig. 5). The maps show areas which may be occasionally flooded or areas for which there are records of floods.

Stream gradients of Clarks River and Mayfield Creek are low, and some of the valley areas along these streams are also subject to flooding after periods of heavy rainfall or from backwater from larger streams. Drainage channels have been excavated in portions of these valleys to relieve ponding and increase rates of flow.

The northern part of the Mississippi embayment area, of which McCracken County is a part, has a history of earthquake activity dating back to the New Madrid, Missouri, earthquake of 1811-12. The Paducah area is in a zone of probable seismic activity of 3, indicating that earthquakes in the area are likely to be of a magnitude great enough to cause major damage (Nichols, 1968, A11). The possibility of earthquakes should be a consideration for certain types of construction, particularly tall buildings and bridges. The design should be in accordance with accepted building codes for structures under these conditions.

Geologic and hydrologic factors should be considered in the development of farm ponds and other reservoirs. If the geologic setting of an area includes sand, water may leak out as fast as it is put in.

In addition to the geological information, a recent report by the U. S. Soil Conservation Service (Humphrey, 1976) contains detailed descriptions of the soils found in McCracken County and tables of soil properties significant in engineering.

**GEOLOGIC RESOURCES**

As indicated previously, many reports of the Kentucky Geological Survey and other organizations have recognized the presence of potentially economic geologic resources in this part of Kentucky. These are primarily nonmetallic mineral deposits (also called industrial minerals)—clay, fuller’s earth, gravel, and sand—and water. Geologic and resource maps included in this report indicate the surface distribution of the mineral resources in McCracken County [Plates 2 and 3, in pocket]. They are bulk materials which generally have a low unit price. Factors affecting the value of a mineral deposit are: the type and quality of the deposit; the quantity of material available; the accessibility of the deposit in terms of overburden, topography, transportation and markets; zoning regulations; and cost of land.

Laboratory evaluations are presented or cited for several of the mineral commodities. Locations of deposits sampled and analyzed are shown in Figure 6. It should be kept in mind that only single samples were taken at widely spaced localities and that tests performed may not duplicate an actual plant operation. Detailed analyses or assays of deposits on in-
individual properties for conformity to market specifications, as well as detailed exploration for commercial-size deposits, are the function and responsibility of individual companies and users of specific mineral commodities.

Ground water is one of the most important geologic resources in McCracken County. Industrial growth, municipal expansion, and suburban development are all dependent upon an adequate supply of good-quality water. Water, although not generally considered a mineral resource by the layman, is as dependent upon geological factors as are petroleum and other hydrocarbons. Adequacy of supply, replenishment of underground reservoirs, and water quality are all related to the geologic environment.

**Ceramic Clays**

Clays have long been important in the economy of Paducah and McCracken County, but the area has been used more for the location of clay-products factories than for the production of raw clays. Eocene sediments, strata from which large quantities of ball, refractory, and artware clays have been produced in the Mississippi embayment area, are present in southern McCracken County. Thus, raw materials which should have some possibility for the manufacture of ceramic products should be expected.

Gardner [1905, p. 122] and Burroughs [1930, p. 14-15] reported that at one time there were three plants in Paducah producing common brick. The raw material used was apparently a local fluviolacustrine clay. There are no brick plants in Paducah or elsewhere in McCracken County at this time.

Clay was reportedly mined for pottery in the early 1900’s adjacent to Contest Road near the southern edge of the Paducah West quadrangle (Finch, 1966). In the mid-1920’s clay was mined near Coleman cut on the Illinois Central Railroad near the southern edge of the County (Finch, 1968), and in the early
1920’s it was mined near Massac Creek, also in the southern part of the county (Swanson, 1970).

Gardner (1905, p. 121), Crider (1906, p. 426), Ries (1922, p. 57-58), and Burroughs (1930, p. 19) reported a pottery in Paducah which manufactured stoneware. The raw material reportedly came from Graves County, Kentucky, and Indiana, but possibly some was supplied from one or more of the pits listed above.

Easton (1913, p. 869-873) presented the chemical and physical characteristics, including drying and firing properties, of several samples of clays gathered from McCracken County. A variety of possible uses was suggested.

More recently, detailed geologic mapping by the joint Federal-State program and industrial mineral investigations by the Kentucky Geological Survey have disclosed new deposits and expanded the knowledge of extent and quality of several clay bodies in McCracken County. Locations of known outcrops are shown on Plate 2.

A drill-hole sample of clay from the lower part of the Porters Creek Clay near Shady Grove in the southeastern part of the county possessed bloating characteristics which indicated its possible use as lightweight aggregate (Finch, 1964). A 5-foot drill-hole sample from the Wilcox Formation near St. Mathews Cemetery also indicated lightweight aggregate possibilities (Finch, 1966).

Dark-gray, nearly silt-free Claiborne clay from Coleman cut on the Illinois Central Railroad near the southern edge of the county has potential use as a body component for artware, and in stoneware and glazed structural tile mixtures (Finch, 1968).

Figure 6. Outline map of McCracken County showing locations of deposits sampled and analyzed. C, clay; F, fuller’s earth; G, gravel; Gs, glauconitic sand; S, silica sand.
Tests of auger samples of clays from Claiborne (?) and Wilcox Formations in the vicinity of Camelia in the Heath quadrangle indicated potential for low-duty refractories and art pottery (Olive, 1966). Olive (1969) also reported that tests of a drill-hole sample of argillaceous silt in the upper part of the continental deposits 2 miles south of Ragland in the western part of the county indicated potential use in the manufacture of face brick and drain and structural tile.

Drying and firing tests of a clay from the Wilcox Formation on Contest Road near the northern part of the Melber quadrangle indicated potential for low-duty refractory, chimney-flue tile, decorative brick and tile, and stoneware (McGran and Kendall, 1972, p. 20). Chemical analyses are given in Table 1 of the present report.

Table 1.—Chemical Analyses of Clay from Wilcox Formation About 3 Miles South of Lone Oak. For Location, See Figure 6 in This Report. (Analyses from McGran and Kendall, 1972, Table 2.)

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</tbody>
</table>

Currently there is no clay mining in McCracken County. Ceramic materials for local artware plants are secured from out-of-county sources. High-grade clay in the Claiborne Formation is being mined in adjacent Graves and Carlisle Counties. Lenses of clay in McCracken County appear to be too small or too low in grade to compete with these. However, clays in McCracken County appear to be satisfactory for the manufacture of structural clay and stoneware products if suitable markets could be established.

**Fuller’s Earth**

Fuller’s earth is a naturally absorptive clay which was first used to full, or clean, grease from wool cloth. At the present time the term is more commonly applied to certain natural bleaching clays that possess high absorptive capacity for oil without commercial activation.

This marked absorptive power has caused this type of earth material to be used widely to decolor and filter oils, fats, and greases. More recently, Fuller’s earth has found expanded markets for floor sweep, for litter for household pets and caged chickens, in the manufacture of insecticides and fungicides, in oil-well drilling muds, and as binding material for pelletizing iron ores.

On the basis of tests performed to date, the Porters Creek Clay of Paleocene age contains a Fuller’s-earth-type clay in McCracken County. It crops out in the eastern part of the county near Clarks River valley and near the base of the low, rolling hills in the southern and western parts of Paducah (Plate 2).

**Fuller’s Earth Sample F 1 (Sample 109 of McGran, 1965). Location shown on Figure 6.**

Location: Ravine 0.2 mile west of Ky. Hwy. 131, about 0.5 mile south of Reidland on the Paducah East topographic map in the northeast part of McCracken County, about 4 miles (airline) southeast of Paducah. Carter coordinate location is 10,300 feet from the east line and 3500 feet from the south line of the quadrangle in 23-G-12.

Description: Sample taken from dark-gray to black (when wet) Porters Creek Clay intermittently exposed for 30 feet in a ravine draining into Clarks River. A few narrow sandstone dikes are present in the clay. The clay is capped by brown Plio-Pleistocene chert gravel.

Absorption properties:

<table>
<thead>
<tr>
<th>Sample wt.</th>
<th>CC’s crude oil</th>
<th>CC’s oil per gram of clay</th>
<th>Percent transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>2.0</td>
<td>0.2</td>
<td>67.0</td>
</tr>
<tr>
<td>10.0</td>
<td>4.0</td>
<td>0.4</td>
<td>14.0</td>
</tr>
<tr>
<td>10.0</td>
<td>6.0</td>
<td>0.6</td>
<td>7.0</td>
</tr>
</tbody>
</table>

This clay is slightly better than chemical oil standard (Fig. 7) and could be used as an absorbent and oil-clarifying material.

Fired properties:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1800</td>
<td>Orange buff</td>
<td>soft, crumbly</td>
<td>10.0</td>
<td>25.0</td>
<td>2.53</td>
</tr>
<tr>
<td>2000</td>
<td>Lt. red</td>
<td>soft, crumbly</td>
<td>15.0</td>
<td>13.5</td>
<td>2.49</td>
</tr>
<tr>
<td>2100</td>
<td>Med. red</td>
<td>fairly hard</td>
<td>15.0</td>
<td>5.3</td>
<td>2.33</td>
</tr>
<tr>
<td>2200</td>
<td>Dk. red</td>
<td>very hard</td>
<td>expanded</td>
<td>5.7</td>
<td>2.19</td>
</tr>
<tr>
<td>2300</td>
<td>Dk. red-brown</td>
<td>steel hard</td>
<td>expanded</td>
<td>29.2</td>
<td>1.92</td>
</tr>
<tr>
<td>2400</td>
<td>Brown-black</td>
<td>brittle</td>
<td>expanded</td>
<td>45.7</td>
<td>1.70</td>
</tr>
</tbody>
</table>

Bloating at 2300° F suggests the possible use of this material for heavy aggregate. Futher testing is required to properly evaluate it for this purpose.
Fulcher's Earth Sample F 2 (Sample 150 of McGrain, 1965). Location shown on Figure 6.

Location: In gully immediately downstream from drainage ditch of Keeling Brothers gravel pit off old Mayfield Road near the south edge of Paducah city limits. Carter coordinate location is 12,400 feet from the north line and 9700 feet from the west line of the quadrangle in 14-G-11.

Description: Sample represents 5 feet of gray-tan Porters Creek Clay intermittently exposed along the gully. The material sampled is at least partially weathered, and has a tan coloration resulting from oxidation of iron minerals and/or staining from iron in overlying Plio-Pleistocene gravel.

Absorption properties:

<table>
<thead>
<tr>
<th>Sample wt.</th>
<th>CC's crude oil</th>
<th>CC's oil per gram of clay</th>
<th>Percent transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>2.0</td>
<td>0.2</td>
<td>85.0</td>
</tr>
<tr>
<td>10.0</td>
<td>4.0</td>
<td>0.4</td>
<td>34.0</td>
</tr>
<tr>
<td>10.0</td>
<td>6.0</td>
<td>0.6</td>
<td>11.0</td>
</tr>
</tbody>
</table>

This sample had the best absorbent properties of any clay tested. It is much better than the standard sample (Fig. 7) and has definite commercial possibilities as a fullers earth. The proximity to rail, highway, and river transportation makes this locality outstanding.

Fired properties:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1800</td>
<td>Buff</td>
<td>crumbly, hard</td>
<td>12.5</td>
<td>51.7</td>
<td>2.46</td>
</tr>
<tr>
<td>2000</td>
<td>Tan</td>
<td>fairly hard</td>
<td>15.5</td>
<td>40.9</td>
<td>2.47</td>
</tr>
<tr>
<td>2200</td>
<td>Tan</td>
<td>hard</td>
<td>20.0</td>
<td>25.9</td>
<td>2.47</td>
</tr>
<tr>
<td>2300</td>
<td>Orange-brown</td>
<td>very hard</td>
<td>24.5</td>
<td>14.9</td>
<td>2.44</td>
</tr>
<tr>
<td>2400</td>
<td>Brown</td>
<td>steel hard</td>
<td>25.0</td>
<td>11.4</td>
<td>2.30</td>
</tr>
</tbody>
</table>

Firing tests indicate that this material is not suitable for structural clay products.

Fuller's Earth Sample F 3 (Sample 160 of McGrain, 1965). Location shown on Figure 6.

Location: Bank of short tributary of Massac Creek on west side of Ky. Hwy. 996 (Mt. Olivet Road), approximately 2.25 miles southwest of Paducah city limits. Carter coordinate location is 12,350 feet from the west line and 9800 feet from the north line of the quadrangle in B-G-10.

Description: Sample represents 4 feet of jointed, gray Porters Creek Clay.

Absorption properties:

<table>
<thead>
<tr>
<th>Sample wt.</th>
<th>CC's crude oil</th>
<th>CC's oil per gram of clay</th>
<th>Percent transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0</td>
<td>2.0</td>
<td>0.2</td>
<td>84.3</td>
</tr>
<tr>
<td>10.0</td>
<td>4.0</td>
<td>0.4</td>
<td>21.5</td>
</tr>
<tr>
<td>10.0</td>
<td>6.0</td>
<td>0.6</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Oil-absorbent characteristics are comparable to the standard fullers earth (Fig. 7).

Fired properties:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1800</td>
<td>LL buff</td>
<td>soft, crumbly</td>
<td>12.5</td>
<td>36.9</td>
<td>2.67</td>
</tr>
<tr>
<td>2000</td>
<td>Buff</td>
<td>fairly hard</td>
<td>24.0</td>
<td>13.3</td>
<td>2.45</td>
</tr>
<tr>
<td>2200</td>
<td>Red-brown</td>
<td>steel hard</td>
<td>26.0</td>
<td>2.3</td>
<td>2.39</td>
</tr>
<tr>
<td>2300</td>
<td>Dk. red-brown</td>
<td>steel hard</td>
<td>expanded</td>
<td>12.4</td>
<td>2.04</td>
</tr>
<tr>
<td>2400</td>
<td>Brown</td>
<td>steel hard</td>
<td>expanded</td>
<td>26.6</td>
<td>1.79</td>
</tr>
</tbody>
</table>

Bloating at 2400° suggests the possible use of this material for heavy aggregate. However, this firing temperature is too high for economical manufacturing, and further testing is required to evaluate the deposit properly for this purpose.

Loughridge (1888, p. 251) recognized a black or gray jointed clay or "soapstone" in McCracken County and assigned it to sediments of Porters Creek age. However, he did not suggest any commercial use of this material.

According to Jilson (1930, p. 118-119), the discovery of commercially important quantities of fuller's earth was first made in the Jackson Purchase in 1929. Two deposits were cited: one on the W. M. Coleman property adjacent to the Illinois Central Railroad in southern McCracken County, and the other near Elva in Marshall County. The results of a chemical analysis and bleaching tests of a sample from the McCracken County deposit were reported by Jilson (1930, p. 120).

The regional aspects of this resource and details about its absorption properties were presented by the present writer in an earlier report (McGrain,
Tests of three widely separated samples of Porters Creek Clay from McCracken County presented in that report suggest that the material would be satisfactory for the manufacture of floor sweep, litter, and related uses and are repeated herein. Chemical analyses of an outcrop sample are given in Table 2.

Table 2.—Chemical Analyses of Porters Creek Clay Sample (Fuller’s Earth Sample F3) About 2 Miles Southwest of Paducah. For Location, See Figure 6 in This Report. (Analyses from McManis, 1965, p. 19.)

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiO₂</td>
<td>62.81%</td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>4.77%</td>
</tr>
<tr>
<td>TiO₂</td>
<td>0.68%</td>
</tr>
<tr>
<td>Al₂O₃</td>
<td>18.7%</td>
</tr>
<tr>
<td>CaO</td>
<td>0.27%</td>
</tr>
<tr>
<td>MgO</td>
<td>1.35%</td>
</tr>
<tr>
<td>Ignition loss</td>
<td>7.37%</td>
</tr>
</tbody>
</table>

Olive (1969, Table 2) presented X-ray analyses of three samples of Porters Creek Clay.

In 1939 Porters Creek Clay was mined from a pit located near the southeastern corner of the Paducah West quadrangle for fuller’s earth (Finch, 1969).

Glaucnite

Glaucnite, also called greensand, is a hydrated silicate of iron and potassium. In McCracken County it occurs as sandy zones from 1 to 3 feet thick in the lower part of the Porters Creek Clay. Because of its base-exchange capacity, it has some potential as a water-softerning agent and for agricultural purposes as a soil conditioner. Analyses of an outcrop sample 1 mile south of Hendron are shown in Table 3.

Table 3.—Chemical Analyses of Glaucnitic Sand from Porters Creek Clay 1.1 Miles South of Hendron. For Location, See Figure 6 in This Report. (Analyses by T. A. Kendall.)

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>K₂O</td>
<td>1.60%</td>
</tr>
<tr>
<td>SiO₂</td>
<td>84.71%</td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>7.69%</td>
</tr>
<tr>
<td>TiO₂</td>
<td>0.26%</td>
</tr>
<tr>
<td>Al₂O₃</td>
<td>1.73%</td>
</tr>
<tr>
<td>CaO</td>
<td>0.03%</td>
</tr>
<tr>
<td>MgO</td>
<td>0.90%</td>
</tr>
<tr>
<td>Ignition loss</td>
<td>2.63%</td>
</tr>
</tbody>
</table>

Purer forms of glaucnition contain 6 percent or more potassium oxide (K₂O). Experimental work would be necessary to determine whether or not the glaucnitic clays and sands in McCracken County have any commercial application.

Gravel

The availability of construction materials is an important aspect of the development of any area. McCracken County has large reserves of gravel and sand. More than 160 active, inactive, and abandoned gravel pits have been located in the county (Fig. 8). They have been developed primarily in the extensive deposits of brown Plio-Pleistocene gravels (Plate 3, in pocket), which are present over most of the Jackson Purchase. (The geologic quadrangle maps for the area refer to these deposits as "continental deposits.") Because of the map scale, it is impossible to show the locations of all the abandoned gravel pits on Plate 3. In addition, it is difficult to find some on the ground because they have been converted to other uses such as building sites and landfills. In other cases, land reclamation and highway construction have obliterated the pits.

Physical properties of representative deposits are reported in Table 4. The continental gravels consist largely of chert pebbles from 0.5 to 1 inch in diameter. Most pebbles are coated with a thin layer of limonite (hydrus iron oxide). A local concentration of limonite may cement the pebbles together into a conglomerate, forming a resistant bed or ledge in some places. Locally these ledges may be of such thickness and hardness that they pose problems in recovering gravel from pits or in making excavations for basements, foundations, or other construction projects.

Olive (1966b) presented sieve analyses of a gravel deposit near Forestdale School in the Heath quadrangle, and Finch (1968) reported results of tests made by the Kentucky Department of Highways from two widely separated sample areas in the Lovelaceville quadrangle, one of which is in McCracken County.
Figure 8. Active gravel pit in continental deposits in the Melber quadrangle, southern McCracken County. These materials are usually used without sizing and washing for secondary roads, drives, berms, fill, and similar construction projects.

Table 4.—Analyses of Continental Gravel Deposits in McCracken County. For Locations. See Figure 6 in This Report. (Data from Kentucky Department of Transportation, Bureau of Highways, Division of Materials, Frankfort.)

<table>
<thead>
<tr>
<th>Gravel Sample</th>
<th>% Passed 2-inch Mesh</th>
<th>% Passed No. 4 Mesh</th>
<th>% Passed No. 40 Mesh</th>
<th>% Passed No. 100 Mesh</th>
<th>% Wear Loss</th>
<th>% Soundness Loss</th>
<th>Plasticity Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>100</td>
<td>47.2</td>
<td>16.9</td>
<td>7.2</td>
<td>18.3</td>
<td>1.3</td>
<td>9.7</td>
</tr>
<tr>
<td>G2</td>
<td>100</td>
<td>44.1</td>
<td>18.0</td>
<td>3.9</td>
<td>18.8</td>
<td>8.3</td>
<td>—</td>
</tr>
<tr>
<td>G3</td>
<td>100</td>
<td>41.7</td>
<td>13.0</td>
<td>6.0</td>
<td>17.5</td>
<td>0.8</td>
<td>6.5</td>
</tr>
<tr>
<td>G4</td>
<td>100</td>
<td>52.5</td>
<td>20.0</td>
<td>8.9</td>
<td>22.8</td>
<td>5.3</td>
<td>9.0</td>
</tr>
<tr>
<td>G5</td>
<td>100</td>
<td>39.9</td>
<td>24.5</td>
<td>7.9</td>
<td>18.5</td>
<td>1.7</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Sand composed of quartz and chert is a common constituent of the continental gravel deposits, occurring either as a matrix in the gravel or as distinct beds. It, too, is usually iron stained. Clay may occur disseminated, as pellets in the sand, or, more rarely, as distinct lenses.

Small amounts of gravel are obtained from low, narrow gravel ridges near the margins of lacustrine and fluvio-lacustrine deposits which appear to be restricted to the northern and eastern parts of the county. The gravel of these ridges is also chert and is similar in appearance and composition to the gravels of the continental deposits.

Continental gravels are also present on ridges and uplands but are obscured by a loess cover up to 15 feet in thickness.
The presence of chert in McCracken County and Jackson Purchase gravel deposits may render them unsatisfactory for use as a concrete aggregate, but the gravel has found wide use as aggregate for secondary roads, private roads and drives, berm, fill material, preparation of building sites, and similar construction projects, as can be attested by the large number of pits that have been active at one time or another in this county. During the course of this investigation, the writer noticed that both chert gravels and crushed limestone were being used as aggregate for secondary roads in McCracken County.

Gravels with higher silt and clay contents pack better and are more suited for road metal, whereas roads surfaced with low-silt-and-clay gravel are characterized by excessive loose gravel (Finch, 1966a). Finch (1966a) observed that in the Lovelaceville quadrangle gravels above the 440-foot contour contain more silt and clay than those below.

Most of the gravel pits in McCracken County operate intermittently, or on an “on-call” basis, producing only on demand rather than stockpiling as do most other aggregate producers. Mobile equipment is used in such operations. Thus an active pit one day may be inactive the following day and vice versa.

Urban and suburban development in McCracken County is taking place on top of deposits of gravel similar to those which have been used extensively. Fortunately there are large reserves available elsewhere in the county. However, as producers have to go farther for raw materials, transportation costs go up and this increase is ultimately passed on to the consumer.

The Ohio and Tennessee Rivers have been sources of gravel and sand for many years. At the present time the Ohio River along northern McCracken County yields little gravel. Red-brown gravel and sand are currently recovered by dredge operations on the Tennessee River. Bulk density of Tennessee River gravel near Paducah is approximately 2600 pounds per cubic yard. The high content of deleterious (lightweight) chert renders gravel from the Tennessee River unsatisfactory for most current specifications for cement-concrete aggregate. Gravel from this source is used for roofing gravel and purposes other than cement concrete.

Industrial Sands

Silica sands are common constituents of Cretaceous, Eocene, and Holocene sediments in McCracken County. Locally there are deposits which might be suitable for use in foundries and metallurgical industries, for making molds in which metals are cast or that form cores for hollow parts of castings, for abrasives, for road and other subfound-
Table 5.—Chemical Analyses of Unprocessed Claiborne Sand in McCracken County. Locations of Samples Are Shown on Figure 6.

<table>
<thead>
<tr>
<th>Sample</th>
<th>$\text{SiO}_2$</th>
<th>$\text{Fe}_2\text{O}_3$</th>
<th>$\text{Al}_2\text{O}_3$</th>
<th>$\text{TiO}_2$</th>
<th>CaO</th>
<th>MgO</th>
<th>Ignition loss</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claiborne sand, sample 1</td>
<td>95.06</td>
<td>0.08</td>
<td>1.87</td>
<td>0.12</td>
<td>0.04</td>
<td>0.07</td>
<td>0.98</td>
<td>98.22</td>
</tr>
<tr>
<td>Claiborne sand, sample 2</td>
<td>95.42</td>
<td>0.85</td>
<td>1.53</td>
<td>0.10</td>
<td>0.04</td>
<td>0.02</td>
<td>0.64</td>
<td>98.60</td>
</tr>
<tr>
<td>Claiborne sand, sample 3</td>
<td>96.74</td>
<td>0.69</td>
<td>0.95</td>
<td>0.06</td>
<td>0.01</td>
<td>0.03</td>
<td>0.35</td>
<td>98.83</td>
</tr>
</tbody>
</table>

Figure 9. Grain-size distribution of unprocessed Claiborne sand from abandoned pit approximately 0.5 mile southeast of Fremont in the southern part of McCracken County. Sieve analysis by T. A. Kendall.

Figure 10. Grain-size distribution of unprocessed Claiborne sand from inactive pit on west side of U. S. Highway 45 approximately 0.25 mile north of the McCracken-Graves County line. Sieve analysis by T. A. Kendall.

Figure 11. Grain-size distribution of unprocessed Claiborne sand from Coleman cut on the Illinois Central Railroad approximately 2 miles north of the McCracken-Graves County line. Sieve analysis by T. A. Kendall.

Miscellaneous Minerals

The fluvo-lacustrine deposits of McCracken County are predominantly silt and sand, but Olive (1966a) recognized the presence of mica, coal, magnetite (magnetic iron ore), and authigenic vivianite (hydrous iron phosphate) in these deposits in the Paducah East quadrangle. Probably none occurs in sufficient quantity anywhere in McCracken County to have economic importance.

Olive (1969, Table 1) reported on the heavy-mineral assemblage in a sand bar or levee adjacent to the Ohio River in the Bandana quadrangle. Here also the associated minerals appear to be of such a small quantity as to preclude any economic consideration.

Loughridge (1888, p. 127) recognized vivianite in alluvial clay in the bank of the Ohio River west of Paducah and stated that the amount was insufficient for either pigment or fertilizer. He (Loughridge, 1888, p. 128) identified gypsum in clay south of Paducah in the form of radiating crystals and thin sheets of selenite, and similarly concluded that the quantity was insufficient for commercial or agricultural purposes.
Oil And Gas

McCraecken County has no history of commercial oil and gas production. Mississippi embayment sediments—clays, sands, and gravels—cover Paleozoic rocks over all the county. The embayment sediments are not only too poorly consolidated to trap hydrocarbons, but they also obscure structural features that might be related to possible occurrence of these resources in older rocks.

The Jackson Purchase region of Kentucky, of which McCracken County is a part, has received relatively little attention from oil and gas prospectors. Schwab (1969, p. 17) stated that only 27 wells are known to have been drilled into Paleozoic rocks in the Purchase region. Eight wells (Tables 6-13) are known to have been drilled for oil or gas in McCracken County. The locations of these are shown on Plate 2.

Sargent (1964, 1967) pointed out that the Jackson Purchase region is not lacking in potentially productive oil or gas zones. He stated that the main explora-

Table 6.—Burger Oil Interests No. 1 G. H. Gentry, McCracken County, Kentucky. (From Schwab, 1969, p. 38.)

<table>
<thead>
<tr>
<th>Burger Oil Interests No. 1 G. H. Gentry</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-F-12</td>
</tr>
<tr>
<td>Elevation: 412'</td>
</tr>
<tr>
<td>Total Depth: 1910'</td>
</tr>
<tr>
<td>Results: D &amp; A</td>
</tr>
<tr>
<td>Casing record:</td>
</tr>
<tr>
<td>Published: KGS, ser. 9, Bull. 6, 1951, p. 455-456</td>
</tr>
<tr>
<td>KGS, ser. 9, Inf. Circ. 8, 1956, p. 26-28</td>
</tr>
</tbody>
</table>

Formation tops (by L. B. Freeman):

<table>
<thead>
<tr>
<th>Tertiary</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mississippian</td>
<td>405</td>
</tr>
<tr>
<td>Devonian</td>
<td></td>
</tr>
<tr>
<td>Clear Creek</td>
<td>1050</td>
</tr>
<tr>
<td>Little Saline</td>
<td>1150</td>
</tr>
<tr>
<td>Grassy Knob-Bailey</td>
<td>1350</td>
</tr>
<tr>
<td>Silurian</td>
<td></td>
</tr>
<tr>
<td>Brownsport</td>
<td>1780</td>
</tr>
<tr>
<td>T. D. 1910'</td>
<td></td>
</tr>
</tbody>
</table>
Table 7.—John Seip et al No. 1 Sheppard, McCracken County, Kentucky. (From Schwalb, 1969, p. 38.)

<table>
<thead>
<tr>
<th>Formation tops:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top of Paleozoic</td>
</tr>
<tr>
<td>Mississippian</td>
</tr>
<tr>
<td>335</td>
</tr>
</tbody>
</table>

Driller’s log:
- 0 - 40 Loam, brown, micaceous.
- 40 - 60 Gravel, rounded chert and quartz.
- 60 - 150 Clay, black, and sand.
- 150 - 264 Clay and sand, micaceous, interlaminated.
- 264 - 335 Chert, quartz, and pyrite debris.
- 335 - 425 Limestone, shaly, white, fossils.
- 425 - 470 Limestone, dark, impure, cavernous.
- 470 - 510 Limestone, siliceous, cavernous.
- 510 - 550 Shale, dark, limy, fossils.
- 550 - 735 Shale, white, limy, fossils.
- 735 - 1135 Limestone, blue, pentremtal.
- 1135 - 1250 Limestone, blue, fractured, loose sand.
- T.D. 1250'                          

Table 8.—Dixie Development Co. No. 1 McFadden, McCracken County, Kentucky. (From Schwalb, 1969, p. 38.)

<table>
<thead>
<tr>
<th>Formation tops:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mississippian</td>
</tr>
<tr>
<td>410</td>
</tr>
</tbody>
</table>

Driller’s log:
- 695- Black shale.
- 915- Devonian lime.
- 1065-1075 Sand.
- 1901-1911 Oil show.
- T. D. 300'                           

Table 9.—Dixie Development Co. No. 1-A McFadden, McCracken County, Kentucky. (From Schwalb, 1969, p. 38.)

<table>
<thead>
<tr>
<th>Formation tops:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mississippian</td>
</tr>
<tr>
<td>855</td>
</tr>
</tbody>
</table>

Table 10.—Well at Paducah, McCracken County, Kentucky. (From Schwalb, 1969, p. 38.)

<table>
<thead>
<tr>
<th>Well at Paducah</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-G-11 3700' FSL X 450' FWL of sec.</td>
</tr>
<tr>
<td>Elevation: 340'</td>
</tr>
<tr>
<td>Total depth: 1250'</td>
</tr>
<tr>
<td>Results: D &amp; A</td>
</tr>
<tr>
<td>Casing record:</td>
</tr>
<tr>
<td>Remarks:</td>
</tr>
<tr>
<td>Published: KGS, ser. 6, v. 3, 1922, p. 496</td>
</tr>
<tr>
<td>KGS, ser. 6, v. 6, 1921, p. 217-218</td>
</tr>
</tbody>
</table>
Table 13.—M. K. Dale et al No. 1 Mrs. Tom Reid (J. N. Sanders), McCracken County, Kentucky. (From Schwalb, 1969, p. 39.)

<table>
<thead>
<tr>
<th>T. D.</th>
<th>1360' (in Clear Creek)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driller’s log:</td>
<td></td>
</tr>
<tr>
<td>0 - 25</td>
<td>Clay.</td>
</tr>
<tr>
<td>25 - 100</td>
<td>Sand and gravel.</td>
</tr>
<tr>
<td>100 - 120</td>
<td>Clay, blue, sandy.</td>
</tr>
<tr>
<td>120 - 212</td>
<td>Sand, white, heavy.</td>
</tr>
<tr>
<td>212 - 217</td>
<td>Clay, blue, sandy.</td>
</tr>
<tr>
<td>217 - 351</td>
<td>Sand.</td>
</tr>
<tr>
<td>351 - 360</td>
<td>Sand, limy.</td>
</tr>
<tr>
<td>360 - 387</td>
<td>Sand, black.</td>
</tr>
<tr>
<td>387 - 397</td>
<td>Sand, limy.</td>
</tr>
<tr>
<td>397 - 480</td>
<td>Sand, white and black.</td>
</tr>
<tr>
<td>480 - 485</td>
<td>Clay, black.</td>
</tr>
<tr>
<td>485 - 500</td>
<td>Sand, white.</td>
</tr>
<tr>
<td>500 - 510</td>
<td>Limestone, white.</td>
</tr>
<tr>
<td>510 - 525</td>
<td>Limestone, hard.</td>
</tr>
<tr>
<td>525 - 640</td>
<td>Limestone, blue.</td>
</tr>
<tr>
<td>640 - 660</td>
<td>Limestone, gray and white sand.</td>
</tr>
<tr>
<td>660 - 665</td>
<td>Limestone, blue.</td>
</tr>
<tr>
<td>665 - 670</td>
<td>Limestone, gray.</td>
</tr>
<tr>
<td>670 - 685</td>
<td>Limestone, black.</td>
</tr>
<tr>
<td>685 - 725</td>
<td>Limestone, gray.</td>
</tr>
<tr>
<td>725 - 740</td>
<td>Limestone, gray and broken.</td>
</tr>
<tr>
<td>740 - 982</td>
<td>Shale, black.</td>
</tr>
<tr>
<td>982 - 992</td>
<td>Limestone, brown.</td>
</tr>
<tr>
<td>992 - 1200</td>
<td>Limestone, white, sandy, gas.</td>
</tr>
<tr>
<td>1200 - 1240</td>
<td>Limestone, hard.</td>
</tr>
<tr>
<td>1240 - 1283</td>
<td>Limestone, hard.</td>
</tr>
<tr>
<td>1283 - 1350</td>
<td>Limestone, white, hard and sand.</td>
</tr>
<tr>
<td>1350 - 1360</td>
<td>Limestone, white, hard and sand.</td>
</tr>
<tr>
<td>T. D. 1360'</td>
<td></td>
</tr>
</tbody>
</table>

ECONOMIC GEOLOGY OF MCCRACKEN COUNTY

133 - 138 Sand and water.
138 - 226 Sandy shale.
226 - 300 Sand.
300 - 341 Boulders.
341 - 349 Gravel shale.
349 - 365 Sticky clay.
365 - 410 Black shelly flint.
410 - 455 Broken lime.
455 - 475 Black flint.
475 - 520 Lime and flint.
520 - 525 Hard lime.
525 - 547 Hard lime and flint.
547 - 665 Lime.
665 - 720 Hard lime.
720 - 800 Broken lime.
800 - 830 Lime, pyrite.
830 - 835 Water.
835 - 840 Lime, black shale.
840 - 850 Sandy shale.
850 - 890 Broken shale.
890 - 920 Chattanooga shale.
920 - 955 Broken lime.
955 - 970 Broken shale.
970 - 983 Broken lime.
983 - 1070 Hard lime.
1070 - 1075 Lime and flint.
1075 - 1099 Hard lime.
1099 - 1115 Hard lime and flint.
1115 - 1125 Flint and lime.
1125 - 1165 Sandy lime, flint.
1165 - 1220 Flint, little lime.
1220 - 1365 Lime and flint.
1365 - 1495 Lime and little flint.
1495 - 1506 Gray and brown flint, gray lime.
1506 - 1690 Lime and flint.
1690 - 1693 Sandy lime and flint.
1693 - 1820 Lime and flint, hard.
1820 - 1839 Lime and flint; smell of crude oil.
1839 - 1852 Lime and flint; gas at 1845-50.
1852 - 2044 Lime and flint.

T. D. 2044' | 982

To this list, Schwalb (1969) added Devonian formations which have produced oil and gas for many years in central and eastern Kentucky, but he stated (p. 17) that within the Jackson Purchase the Devonian would be prospective for oil reservoirs only where it is covered by the New Albany Shale. This latter area would include most of central and all of northern McCracken County (see Schwalb, 1969, Fig. 6).

The two deepest wells drilled in the county, John Seip et al No. 1 Sheppard (Table 7) and Burger Oil Interests No. 1 George Allen (Table 12), attained depths of less than 2100 feet, probably reaching rocks of Late Ordovician age. Two tests located in the Heath quadrangle, Dixie Development Co. No. 1 and No. 1-A (Table 8 and 9), attained depths of only 300 feet and 635 feet. The remaining four test holes...
ranged in depths from 1200 to 1910 feet. A show of oil was reported in the John Seip et al No. 1 Sheppard at 1901 to 1911 feet, and gas was reported in the Burger Oil Interests No. 1 George Allen at 1845 to 1850 feet. All wells were reported completed as dry and abandoned.

Eight wells drilled for oil and gas in McCracken County do not condemn the whole county. Most of these wells were drilled in the eastern part of the county, and it is readily apparent that large areas remain untested. Similarly, the potentially productive Cambrian and Lower Ordovician formations have not been penetrated. However, extensive geophysical prospecting and exploratory drilling will be necessary to completely evaluate the possibilities of commercial accumulations of petroleum and natural gas here.

Water Resources

Water is one of the most important natural resources in McCracken County. Agricultural and industrial growth, municipal expansion, suburban development, and many recreational activities are all dependent upon an adequate supply of good-quality water. Although water is not generally considered a mineral resource by the layman, adequacy of supply, replenishment of underground reservoirs, and water quality are all related to the geological environment.

Ground Water

For more than a century, geologists and engineers have noted the existence and abundance of the underground water resources of the Jackson Purchase region of Kentucky. As indicated in the introduction of this report, the earliest geological writings on McCracken County recognized water as a significant resource. Owen (1856, p. 144) noted that waters impregnated with iron oxide appear occasionally in the form of chalybeate springs, issuing beneath the beds of brown gravel. Loughridge (1888, p. 135) also recognized the presence of chalybeate water in the county and mentioned its occurrence in a well at the ice factory in Paducah where he said it had been used as a tonic by local citizens.

The first detailed publication on ground water in McCracken County was the report by Pree, Walker, and MacCary issued in 1957. It gave detailed information on the occurrence, quantity, and quality of ground water in a 155-square-mile area around Paducah, about 120 square miles of which were in McCracken County. Also included were data on 1,972 wells, springs, and test holes which were inventoried between July 1950 and December 1953.

Since that time a detailed inventory of the groundwater resources of all of McCracken County has been made as a joint project between the Kentucky Geological Survey and the U. S. Geological Survey.

Ten maps, printed at the scale of 1:24,000, present the water conditions (Davis, 1965, 1966, 1967; Hansen, 1966, 1967; Lambert, 1966a, 1966b, 1967; and Morgan 1964, 1965). (For map index, see Figure 1 of this report.) These ground-water availability maps, or hydrologic investigations atlases, present nontechnical information about the county, which is useful to well drillers, land owners, and other water users. Each report is on a single sheet which includes a water-availability map that shows well data, depth to water, and chemical components of the water.

Enough water for domestic and livestock use can generally be obtained from shallow wells almost everywhere in the Paducah area, and larger supplies can probably be obtained from deeper wells in sands of Eocene and Cretaceous ages and Paleozoic carbonate rocks (Pree, Walker, and MacCary, 1957). Ohio River gravels and sands of the Claiborne Formation are the most important aquifers in McCracken County (Fig. 13).

Reidland Water District uses ground water from two wells, 320 and 535 feet deep, in sand and limestone aquifers. Yield from the Reidland wells is 150 to 160 gallons per minute (Mull, Cushman, and Lambert, 1971, p. 74-75).

Surface Water

The Ohio and Tennessee Rivers, with their abundant water and navigation facilities, are pronounced assets to McCracken County. The Ohio River is navigable for its full length of 981 miles between Cairo, Illinois, and Pittsburgh, Pennsylvania, with a minimum channel depth of 9 feet. The original system of 43 locks, 100 by 600 feet, is being replaced by 19 locks with 110- by 1200-foot chambers. This will eliminate the present method of double locking larger tows, thereby lowering transportation time and cost.

The Tennessee River, with its extensive system of locks and dams, is navigable for a distance of 652 miles with a project depth (design or maintained depth) of a minimum of 9 feet. Locks, with dimensions of 110 feet by 600 feet, permit navigation from Kentucky Lake to the Ohio River. Barkley-Kentucky Canal, a navigation facility opened in 1966, connects Kentucky Lake (Tennessee River) with Lake Barkley (Cumberland River) at a point 2.9 miles upstream from Kentucky Dam.

Paducah occupies a strategic position with respect to the navigable Ohio and Tennessee Rivers and has three terminals. Elsewhere in McCracken County, industrially owned barge docks are present on both the Ohio and Tennessee Rivers. The Mississippi River is 54 miles downstream from Paducah.

Most of the public and industrial water supplies of McCracken County come from surface sources. Paducah's municipal water system, which serves
Figure 13. Map showing possible yields of water wells in McCracken County. Adapted from Davis, Lambert, and Hansen (1971, Fig. 4).
the city and the Hendron, Lone Oak, and West McCracken water districts, and Tennessee Valley Authority's Shawnee Steam Plant obtain their supplies from the Ohio River (Mull, Cushman, and Lambert, 1971, p. 7-47).

The drainage area of the Ohio River above Paducah encompasses approximately 203,000 square miles. According to official sources (U.S. Geological Survey, 1977, p. 419) the maximum discharge was 1,780,000 cubic feet per second on February 1, 1937; minimum discharge was 15,000 cubic feet per second on July 30, 1930. The average discharge for the 48-year period of record from 1928 to 1976 was 265,100 cubic feet per second. The flow is partially regulated by impoundments on some of the tributary streams. The flow of the Tennessee River is completely regulated.

**SELECTED REFERENCES**


Gardner, J. H., 1905, Clays and sands of the Jackson's Purchase region, in Some Kentucky clays, including kaolinitic, plastic and fire clays: Kentucky Geol. Survey, ser. 3, Bull. 6, p. 80-123.


McGrain, Preston, 1956, Sources of fuller's earth type clay in Kentucky: Kentucky Geol. Survey, ser. 9, Inf. Circ. 6, 4 p.


MINERAL RESOURCES MAP OF McCracken County, Kentucky

Preston McGrain

1978

EXPLANATION

- Principal area of outcrop of industrial sands
- Principal area of outcrop of fuller's earth
- Clay outcrop
- Abandoned clay pit
- Abandoned fuller's earth pit
- Inactive or abandoned sand pit
- Dry oil or gas test

1. Burger Oil Interests No. 1 G. H. Gentry (Total depth, 1910 ft.)
2. John S. et al No. 1 Sheppard (Total depth, 2013 ft.)
3. Dixie Development Co. No. 1 McFadden (Total depth, 360 ft.)
4. Dixie Development Co. No. 4 A. McFadden (Total depth, 635 ft.)
5. Well at Paducah (Total depth, 335 ft.)
6. C. K. White No. 1 W. B. Jackson (Total depth, 1200 ft.)
7. Burger Oil Interests No. 1 George Allen (Total depth, 2044 ft.)
8. M. K. Dole No. 1 Miss. Tom Reid (Total depth, 1360 ft.)

Field investigations 1971-1973
GRAVEL RESOURCES MAP OF McCracken County, Kentucky

Preston McGrain

1978

Field investigations 1971-1973

Center coordinate system letters and numbers used to designate 5-minute divisions of latitude and longitude are shown along margins.