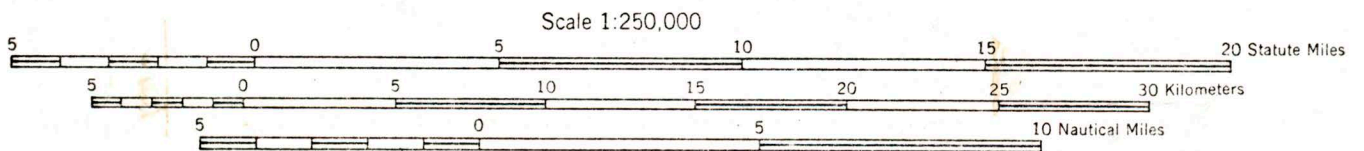
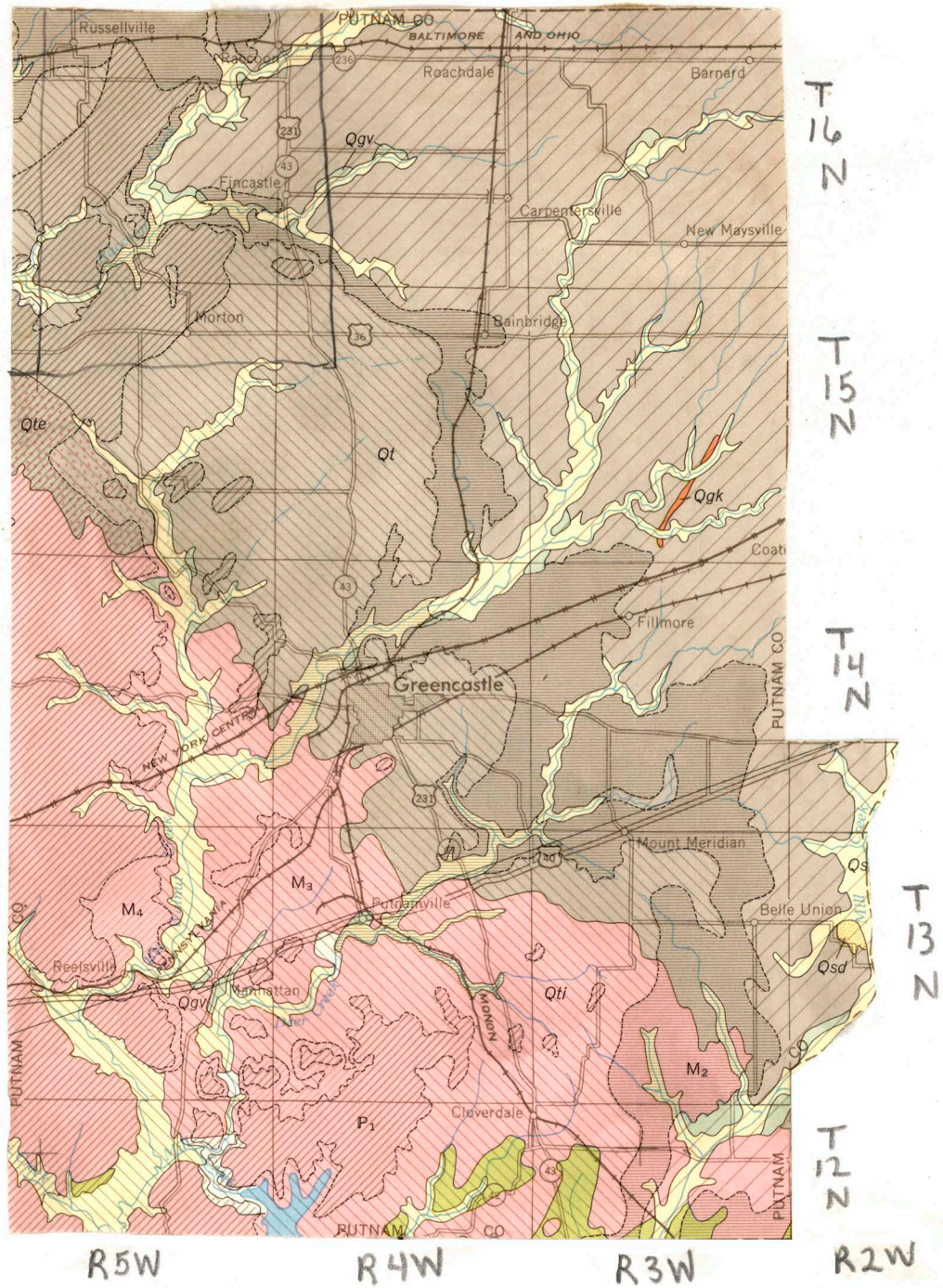


- A. Geologic Map
- B. Pebble counts in the glacial till of Parke and Putnam counties
- C. The pleistocene section near Greenca stle
- D. Memorandum Report: A&C Enterprises
- E. Drift Thickness RP7
- F. Memorandum Report: Bainbridge Sand and Gravel
- G. Bedrock Geology from Weathers after Bieber
- H. Isopach of Quaternary Regolith from Weathers
- I. Depth to Static Water Level from Weathers 1975 A.M. Thesis, Depauw



Pebble Counts in the Glacial Till of Parke and Putnam Counties, Indiana

C. L. BIEBER, DePauw University

Introduction

Unweathered and unoxidized tills of west-central Indiana are difficult to differentiate. The present study is progress reported on a long range statistical approach to the age-recognition problem. Pebbles from the tills have been collected and classified in the hope that statistical differences would appear. Eight areas were selected for sampling, 6 of which are from Putnam County and 2 from eastern Parke County. One Kansan?, 3 Illinoian, and 4 Wisconsin till sites are included in the group.

Sampling Procedure

Sampling location map.

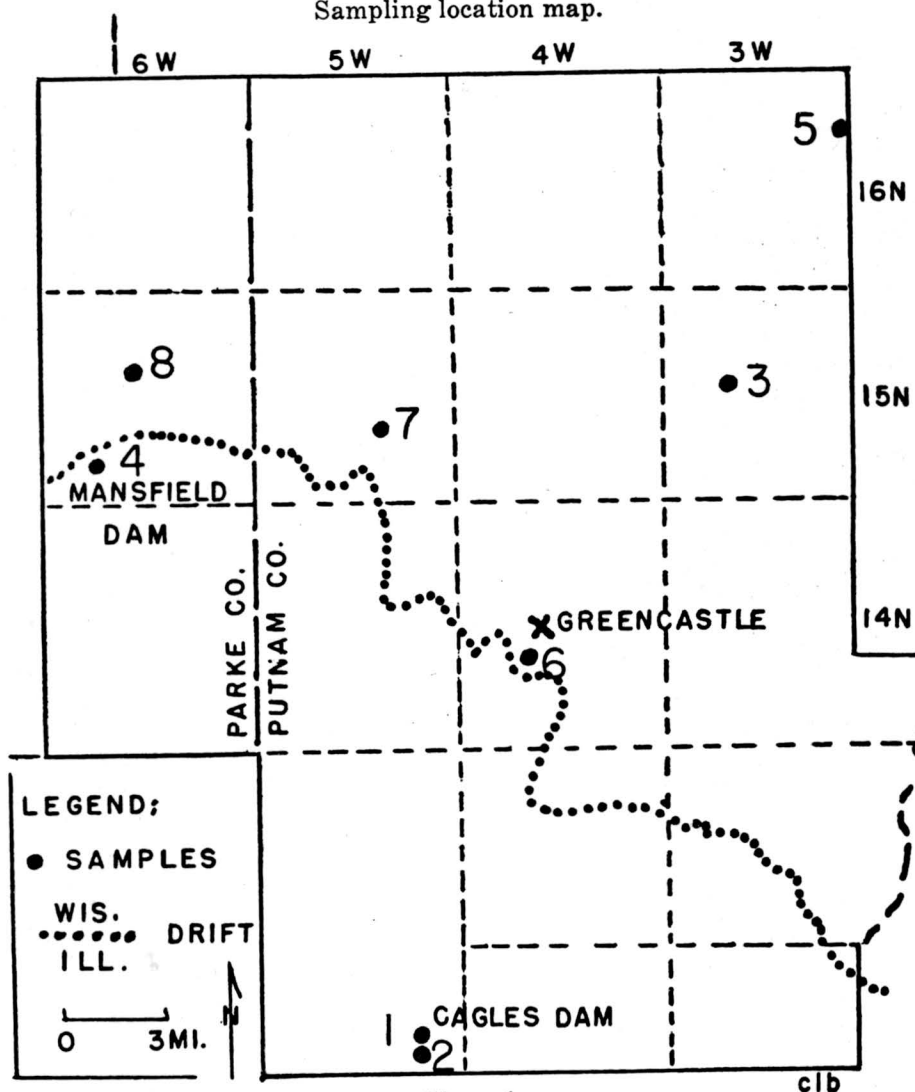


Figure 1

Sampling locations:

1. Kansan? NW $\frac{1}{4}$ sec. 13, T. 12 N., R. 5 W.
2. Illinoian NW $\frac{1}{4}$ sec. 13, T. 12 N., R. 5 W.
3. " SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 16, T. 15 N., R. 3 W.
4. " NW $\frac{1}{4}$ sec. 27, T. 15 N., R. 6 W.
5. Wisconsin SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 13, T. 16 N., R. 3 W.
6. " NW $\frac{1}{4}$ sec. 29, T. 14 N., R. 4 W.
7. " NE $\frac{1}{4}$ sec. 22, T. 15 N., R. 5 W.
8. " NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 10, T. 15 N., R. 6 W.

Sampling sites were selected which exposed at least 10 feet of unoxidized till. If the bank was stable, pebbles were collected from in place. One hundred pebbles were taken as a representative sample. Pebbles approximately one-half to one inch in diameter were chosen. On most sites, a vertical path was taken up the bank, picking all pebbles of the selected size. In two cases of cuts made by man, pebbles were collected after each step from a circle 2 feet in diameter with the collector's foot as the center. A hand screening device was tried at the outcrop, but was found to be too slow.

An attempt to sample only igneous and metamorphic pebbles was made. The samples are thought to be fairly representative, though the human tendency to choose certain colors, shapes, or locations undoubtedly influence the results. It is far better to collect all pebbles, and then choose the igneous and metamorphic ones from the entire sample.

Samples were carried to the laboratory and washed. Each pebble was then cracked and examined with a hand lense. Separation into 14 piles was attempted. The carbonate pile and other questionable pebbles were subjected to a test with HCl acid and a rough separation into limestone and dolomite was then made. After the identification, pebbles were moved to age determination piles. This was done mainly by lithology, color, weathering, and experience of the writer in Indiana stratigraphy.

Interpretation

From northeastern Putnam County westward into Parke County the limestone pebbles in the Illinoian till increase in number, while the dolomite pebbles remain about the same. In the same area for Wisconsin till, both the limestone and dolomite pebbles fall off in number westward. Chert pebbles are common in both tills, and increase proportional to other pebbles in the leached zones. The number of chert pebbles is in part dependent upon the locality of outcrop of the St. Louis limestone, the upper part of which is locally cherty. Up to 10% of the pebbles in the eastern part of the sampled area are siltstone and fine sandstone, reflecting the Borden group. Sandstone pebbles with ironstone are common westward in small percentages where tills are in close association with Pennsylvanian sandstone strata. Devonian black shale fragments are common in the eastern part of Putnam County, and even persist into Parke County where Devonian black shale may become confused with Pennsylvanian shale in the tills.

Igneous pebbles in all tills make up about 25% of all pebbles in the unleached tills. Felsic rock types (light) are less than the mafics (dark)

by about one-third. Pebbles in the Illinoian and Wisconsin tills, which constitute the exposures of till in the northeast part of the area, are remarkably similar in composition and in area of accumulation. Greenstone (basalt-like) pebbles stand out modestly in the Illinoian, as do weathered crystalline mafic pebbles and chert. However, in fresh unaltered till pebble differences in the two tills are difficult to distinguish. Pebble

TABLE I. Average area tills.

	Kansan?	Illinoian	Wisconsin	Average Illinoian-Wisconsin
Limestone	22	15	16	16
Dolomite	11	20	20	20
Sandstone	21	1	0	1
Siltstone	5	7	9	8
Shale	2	3	1	2
Chert	4	22	21	21
Iron-stone	0	1	1	1
Granite (& gneiss)	3	7	3	5
Diorite	3	4	4	4
Gabbro	4	2	3	3
Felsite	0	0	0	0
Andesite	8	4	4	4
Basalt	10	8	8	8
Quartzite	7	5	8	6
Slate-Schist	0	0	1	1

TABLE II. Average Igneous and Metamorphic Pebbles (in %)

	Erie Lobe (1)	Kansan?	Illinoian	Wisconsin	Average Local Till
Felsic, granite	20	30	26	16	24
Medium mafic	18	13	21	18	17
Mafic	34	27	37	41	35
Quartzite, quartz	25	25	9	24	19
Other	3	5	7	1	5

TABLE III. Age of Original Pebble Rock (in %)

	Kansan?	Illinoian	Wisconsin	combined Ill.-Wis
Pennsylvanian Ss.	21	0	0	2
Mississippian Ls.	13	11	10	10
Mississippian chert	1	17	16	16
Older chert (weathered)	3	4	6	5
Borden siltstone	5	7	10	8
Devonian shale	2	4	1	2
Dev.-Silurian Ls.	9	4	6	5
Dev.-Silurian dolomite	11	20	20	20
Precambrian	28	29	30	29
Other	7	4	1	3

A Pleistocene Section Near Greencastle, Indiana

C. L. BIEBER, DePauw University

General—Stripping at a limestone quarry in the NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 29, T. 14 N., R. 4 W., 1 $\frac{1}{2}$ miles southwest of Greencastle in Putnam County has revealed an unusual Pleistocene section for the area. The location is near the boundary of the Wisconsin drift where it thins out over Illinoian drift. The two drift sheets are here separated by a silt (loess) interval, averaging several feet thick. In the upper part of the silt interval are small gastropods and wood fragments.

Silt (loess)—Between the two tills is 5 feet of buff to gray silt. The upper two feet is slightly oxidized and slightly calcareous with scattered woody fragments and small gastropod shells near the top. A few small frosted quartz sand grains are scattered in the silt. The lower three feet is gray, noncalcareous, tightly compacted silt. The sand content is higher than in the silt above. The lower contact of the silt with the Illinoian till is well defined by the oxidized gumbotil line. The upper contact between the silt and the Wisconsin till where iron-stained banding is prominent, is less regular and somewhat undulating.

Buried Fossil Wood—In the upper 12 inches of the silt are scattered accumulations of wood and peaty fragments. The wood consists of logs, branches, and roots? up to 6 inches in diameter. A few leaf impressions are in the peaty silt. Some of the specimens are conifers, probably species of spruce. Sections of the wood viewed under the microscope reveal tracheids common to conifers. Though the wood is confined to a definite horizon, no particular orientation of the logs is apparent. Dating by the radiocarbon method has established the age of the wood as $19,500 \pm 800$ years (1).

Fossil Molluscs—The fossil wood layer near the top of the loess carries a land gastropod fauna. The fossil gastropods are localized and not plentiful, but the fragile white shells can easily be seen with the naked eye. A few have been reworked in the lower several inches of the Wisconsin till, but the main layer is closely associated with the wood zone. Hardy species that can withstand considerable change and variation predominate in the gastropod fauna. One of the most common is *Hendersonia*, a gastropod that normally lives in a climate similar to or colder than that of west-central Indiana (2).

The following species are present:

Cionella lubrica
Discus shimaki
Hendersonia occulta
Stenotrema leai
Succinia avara
Succinea groversoni

Correlation—Below the silt are several feet of iron-stained blocky leached gumbotil and till. Locally calcium carbonate concretions are near

the base of the till which rests on the Aux Vases? shale at the top of the quarry rock. Small pebbles of quartz, chert, and igneous rocks are found sparingly in the lowest till. There is some doubt as to the age of the gumbotil, but it is here interpreted as a weathered soil zone at the top of the Illinoian till. The age of the wood ($19,500 \pm 800$ years) in the silt above the gumbotil indicates that the silt interval is Iowan or Late Farmdale age. Farmdale equivalents are not surely recognized in this section, for Farmdale wood samples are dated near 24,000 years old (3).

PLEISTOCENE SECTION, $1\frac{1}{2}$ miles southwest of Greencastle,
Indiana, near east wall of a limestone quarry, NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.
29, T. 14N., R. 4 W., Putnam County.

	Ft.	In.
Wisconsin Stage		
14. Soil, stripped	2	
13. Till, buff, leached; rocks sparse in upper part; iron-stained at base, leached.....	5	2
12. Till, buff, slightly calcareous.....	1	8
11. Till, buff, very calcareous.....	1	7
10. Till, gray, moderately stony, calcareous; a few small gastro- pods at base.....	3	4
9. Silt (loess), gray with iron-stained laminae slightly cal- careous; scattered small gastropods which include <i>Succinea</i> <i>avara</i> , <i>Hendersonia occulta</i>	0	9
8. Silt (loess), gray to dark gray, wood of conifers with limbs and roots up to 6 inches in diameter; a few small scattered gastropods, slightly calcareous.....	1	0
7. Silt (loess), gray, small leaves and twigs, noncalcareous...	0	3
6. Silt (loess), dark gray, wood fragments up to 4 inches in diameter, some near charcoal, noncalcareous.....	0	6
5. Silt (loess), gray, dense.....	1	0
4. Silt, some clay and sand with a few small pebbles, gray above becoming buff downward, a few carbon specks near top, noncalcareous	1	0
Illinoian Stage		
3. Weathered soil (gumbotil), blocky, leached, iron-stained..	3	0
2. Calcareous concretion line.....	0	3
Mississippian Period		
Chester Series		
Aux Vases? formation		
1. Shale, gray with blue-green cast, thin bedded, noncalcareous, overlying cavernous Ste. Genevieve limestone.....	7	0
Top of quarry		

Literature Cited

1. RUBIN, MEYER. 1954. Laboratory report, U.S.G.S.
2. WAYNE, W. J. 1954. Personal communication.
3. SUESS, H. E. 1954. U. S. Geological Survey radiocarbon dates I. Science, vol. 120, p. 470.

Memorandum Report
by
Michael C. Moore
June 14, 1974

County: Putnam
Company: A & C Enterprises
Mailing Address: Rt. 1, Reelsville, IN 46171
Phone: 317-672-3441
Officer: Emerson Clark, Pres. etc.
No. of Employees: 5
Descriptive Location: 2 mi. south of Reelsville on County Rd. off Rt. 40,
in valley of Big Walnut Creek
U.S.G.S. Location: SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 28, T. 13 N., R. 5 W. Reelsville 7 $\frac{1}{2}$ ' quad
Products: Screened and washed sand and gravel
Shipped by: own trucks
Capacity: 100 tpd

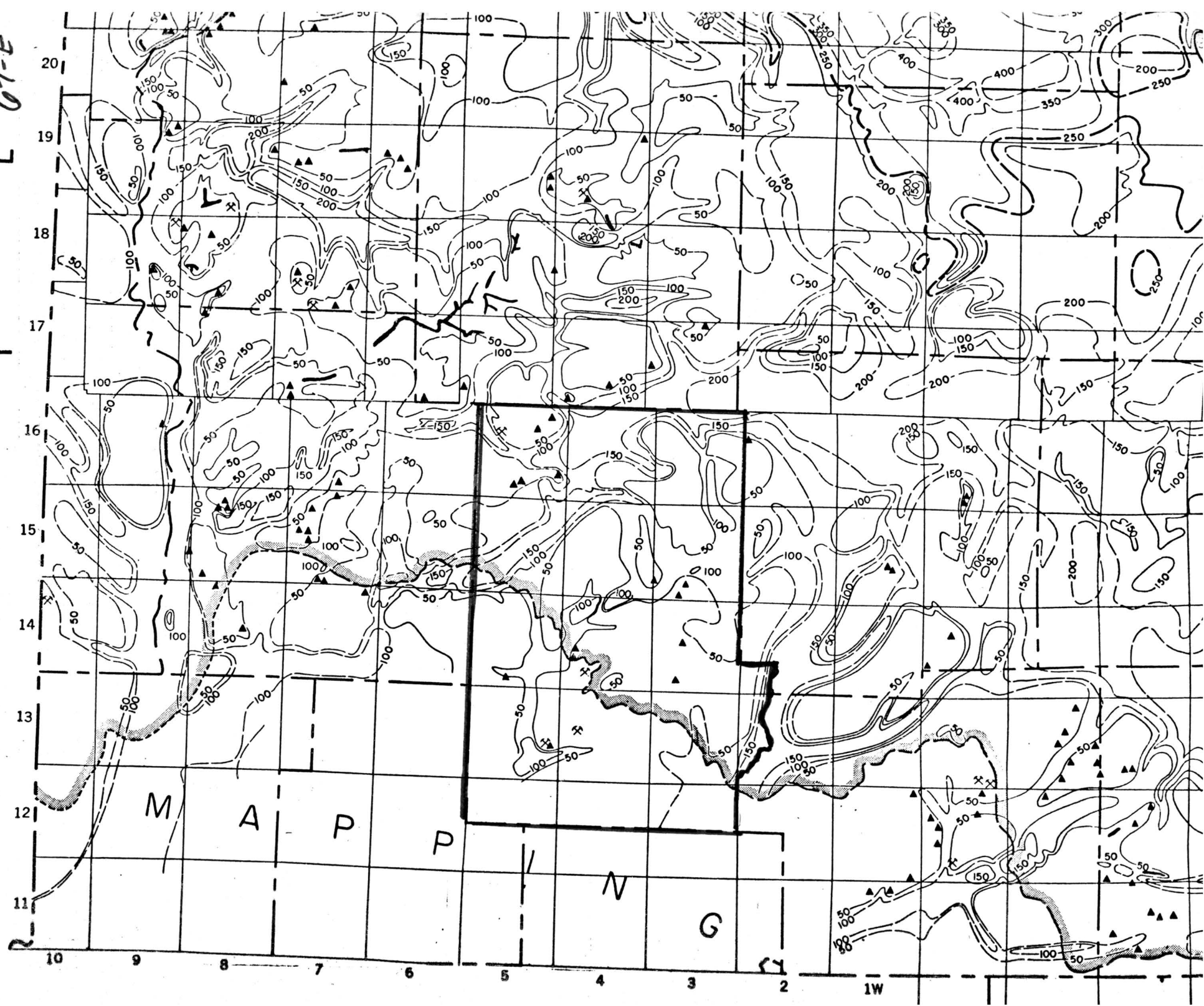
Approximately 8' of overburden must be stripped from this valley-train deposit. Limestone or till are encountered after 50 feet and shale ? was noted along the northeast side of the valley (perhaps this is Bethel or it might be till). The sand to gravel ratio runs about 50/50 and approximately 2% of the material is from 1 $\frac{1}{2}$ " to 3" in diameter and is crushed. No unusual geologic problems plague this operation, but logs are often encountered by the 8 x 10 dredge. The dredge pumps from depths up to 55 feet.

This company has been in business here for 18 years and plans to operate the present pit for another 7 to 8 years. They will then move northwest, possibly in the NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 28. This plant has a market area with a radius of about 25 miles. It is the only sand and gravel processing plant in Putnam County at this time. There are, however, a few pit-run operations: Hassler Sand and Gravel, phone 672-3700, located near Manhattan; Hoskins sand and gravel, NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 19, T. 13 N., R. 5 W.; 672-3483, Bowman Gravel on Route 42, east of Poland.

Date of field visit: June 13, 1974
Informants: Emerson Clark, Steve Clark

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Memorandum Report
by
Michael C. Moore
March 19, 1976

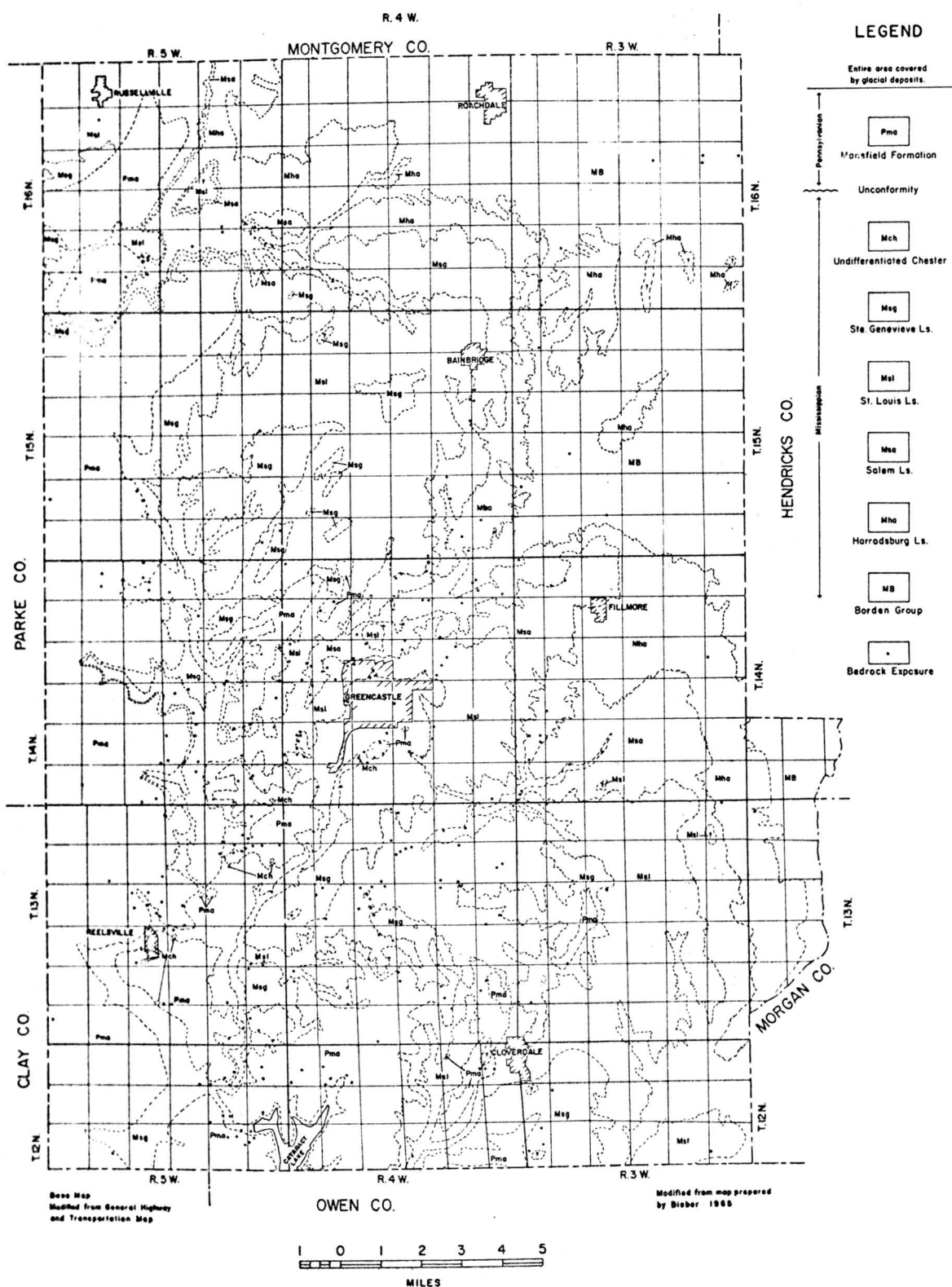
County: Putnam
Company: Bainbridge Sand and Gravel Co.
Mailing Address: P.O. Box 183, Bainbridge, IN 46105
Phone: 317-522-3545
Officer: Dan Detro, President
Descriptive Location: 1 mi. E. of Bainbridge water tower on U.S. 36, then
SE on county road for 1 mi.
U.S.G.S. Location: NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 7, T. 15 N., R. 3 W., Roachdale 7 $\frac{1}{2}$ ' quad.
No. of Employees: 1+
Products: screened sand and gravel
Date of Field Visit: March 18, 1976
Informant: Mr. Dan Detro

This small gravel pit was opened by Mr. Detro in May of 1975 on a 33 acre lease on a terrace along Big Walnut Creek. A pit had been operated here in the 1920's but there was no active sand and gravel operation when Mr. Detro took over. He uses a 3 $\frac{1}{2}$ yd. end loader to mine 24 feet of gravel above the water table. Mr. Detro had been in the stone business, and had a sand pit to the south, near Greencastle. He does not wash the gravel and has no immediate plans for installing a wash plant. The prices (per ton) advertised at the time of this visit were as follows: #63 - \$1.40; #4 - 1.65; #2 - 1.65; oversize - 1.65; dirty oversize - 1.40; pit run - 1.15; concrete mix - 2.00; fill sand - 1.40; concrete sand - 2.00; mason sand - 3.00; fill dirt - .75; top soil - 1.65; he requests a minimum order of \$3.00. The gravel is hauled in customer's trucks.

The deposit is in one of a very few terrace remnants of ice-age outwash along this section of Big Walnut Creek. The material is moderately coarse, with many fist-size cobbles and boulders up to 1 foot across, but there is a high percentage of greenish, slabby Borden Gp. siltstone present. The siltstone in fact, crops out in the southeast corner of the pit. Approximately 5 to 8 feet of soil must be stripped to reach 20 to 24 feet of horizontally bedded gravel. Mr. Detro mines only to the water table, which sometimes rises. Although he reached bedrock in one portion of the pit, it is possible that he could go substantially deeper beneath the water table in other parts of the pit. Ten acres appear to be underlain by gravel and Mr. Detro estimates his reserves at a quarter of a million tons. He estimates the sand to gravel ratio at 25/75. No crushing is done.

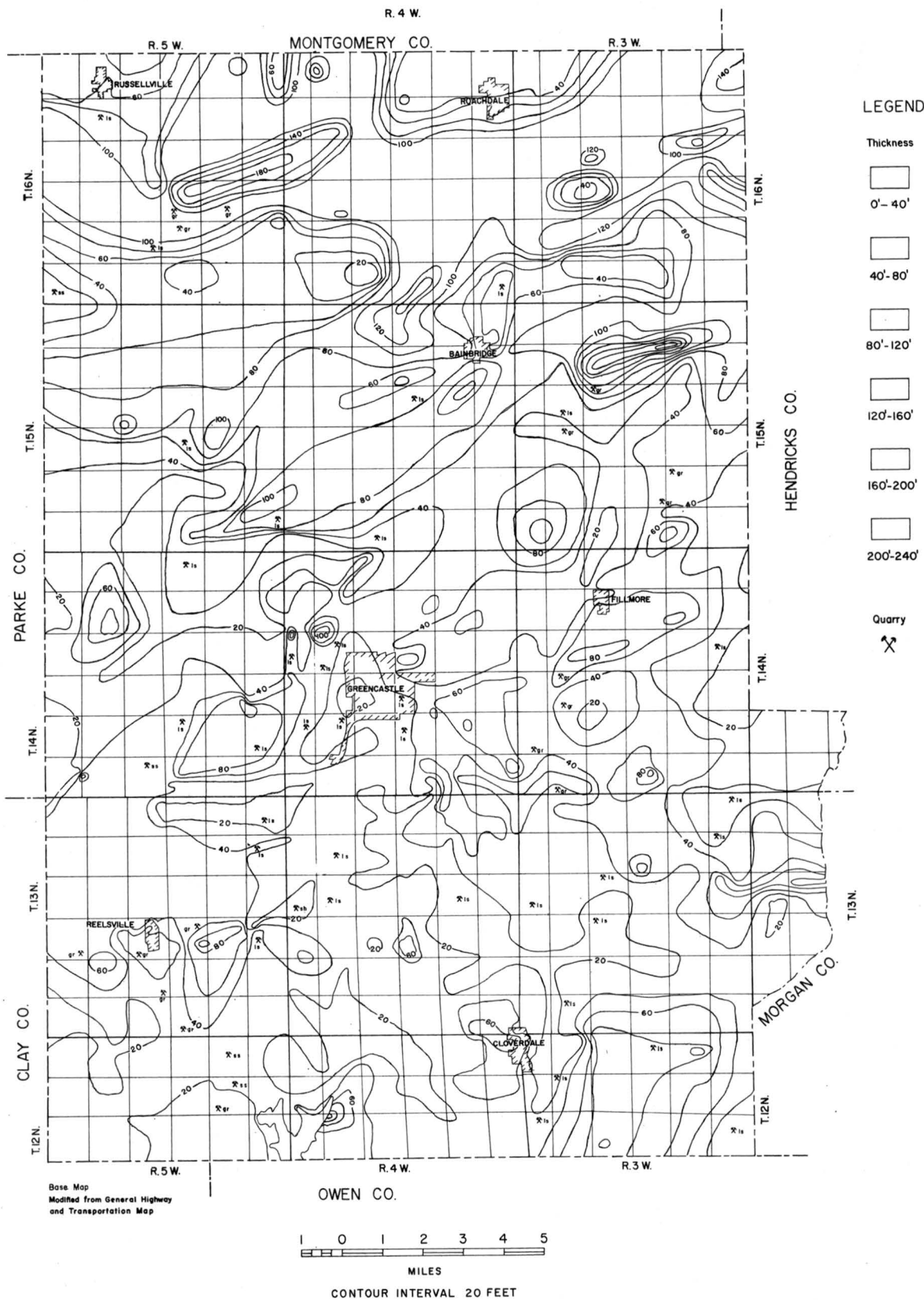
PUTNAM COUNTY, INDIANA

Areal Geology



PUTNAM COUNTY, INDIANA

Isopach Map of Quaternary Regolith,
Primarily Glacial Drift



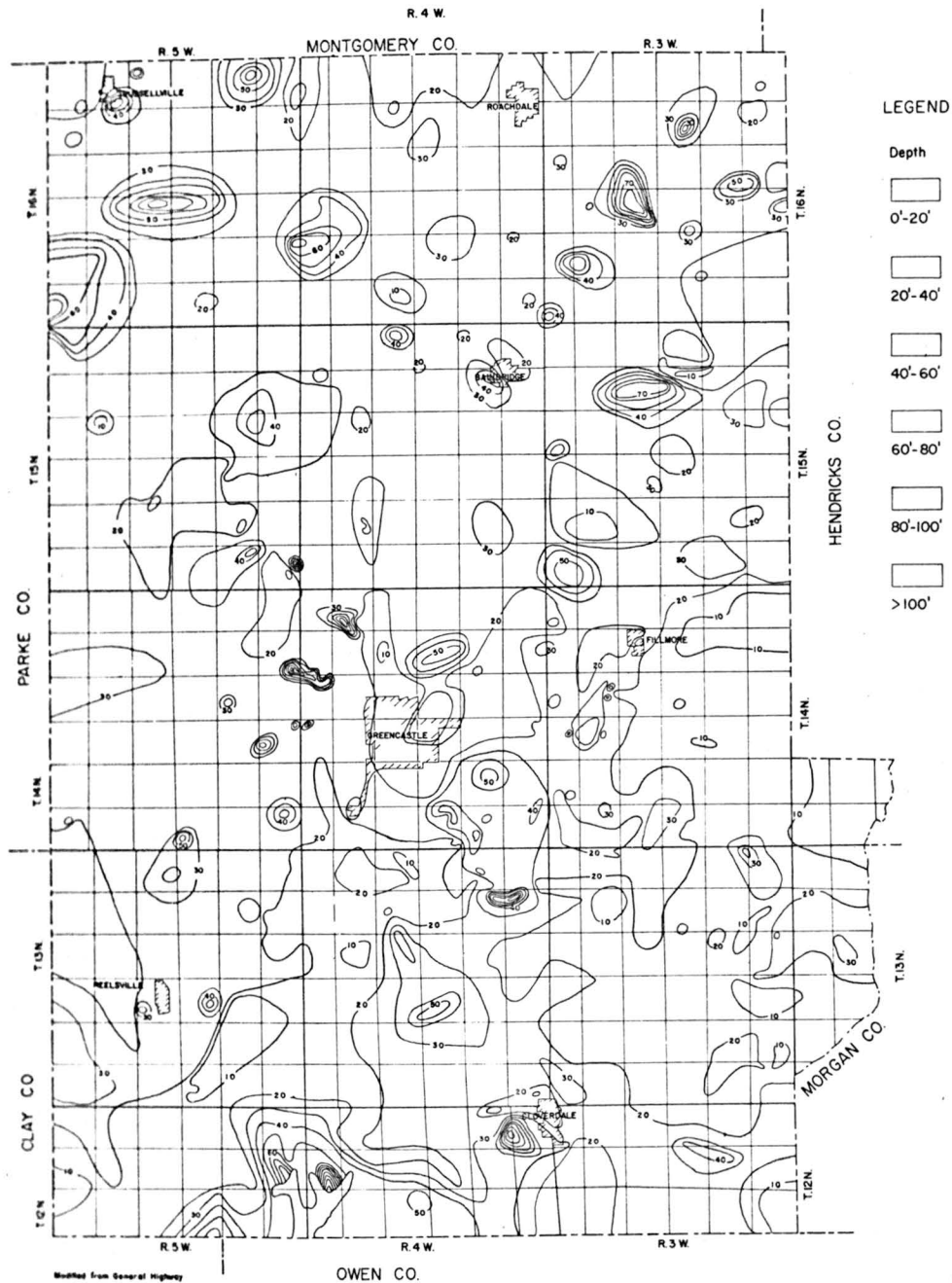
Michael L. Weathers

DePauw University

1975

PUTNAM COUNTY, INDIANA

Depth to Static Water Level



Modified from General Highway and Transportation Map



Michael L. Weathers

DePauw University

1975

GEOLOGICAL SURVEY COMMUNICATION
INDIANA DEPARTMENT OF NATURAL RESOURCES

TO: Gordon Fraser

DATE: 11/28/79

FROM: John Hill

SUBJ: Gravel pit in Putnam County

There is a small, privately owned and operated gravel pit in the SE $\frac{1}{4}$, SW $\frac{1}{4}$, SE $\frac{1}{4}$, Sec. 17, T.15N., R.3W. (Greencastle Quad.). Sand and gravel is being removed from valley train deposits of probable Wisconsinan age.

Operator: Dallas Pearsons
Phones: 522-3300 and 522-3404

Equipment: Front-end-loader and backhoe

Sand and Gravel Deposits of Indiana

SUMMARY REPORT OF PUTNAM COUNTY

Date of Field Examination: A reconnaissance survey of the county was made on August 24 and 25, 1949.

Activity: There are 5 active and more than 36 inactive or abandoned operations in the county.

Geology: Valley train material is present along most of the stream courses in the county. These streams include Eel River and Big Walnut, ^{Big} Raccoon, Henry, ^{Big} Clear, Deer, Ramp and Mill Creeks. Terrace deposits are present in all of the valleys, disappearing in places where active erosional forces have been greatest. In some limited localities, the terraces attain great elevations above the floodplains. Along Big Walnut Creek near the center of Sec. 34, T 13 N, R 5 W, the terrace remnant stands about 90 feet above the floodplain. There is about 3 feet of red sand above the sand and gravel exposure. However, in most places the terraces are from 10 to 15 feet above the elevation of the floodplain. There is some good material in the beds of these streams and one operation is active at the present time in the bed of Big Walnut Creek, where U. S. Highway 40 crosses it.

An esker about 4 miles long and trending northeast-southwest runs through Secs. 22, 23, 27, and 34, T 15 N, R 3 W. It is a long narrow ridge, called Sand Ridge by the local people, about 120 feet wide and is totally sand and gravel. There is little overburden on the ridge. There is one active operation on the esker at present but great quantities of material have been removed in the past.

Kames occur in Secs. 11, 23, 26, 27, 29, 31, and 32, T 15 N

R 5 W, Sec. 7, T 15 N, R 5 W, and Sec. 30, T 15 N, R 4 W. There is no activity in these deposits at the present time.

Reserves: The valley train material along the stream courses and the kame and esker deposits are the reserves for the county.

Remarks: The operations producing crushed limestone in this county have their effect on the sand and gravel industry. Many of the roads are improved with crushed stone.

Bibliography: Cable, E. J. (1906), The Roads and Road Materials of a Portion of Central Indiana, Indiana Dept. Geol. and Nat. Res., 30th Ann. Rept., pp. 658-680.

Fowler, Earl D., et. al. (1925), Soil Survey of Putnam County, Indiana.

Respectfully submitted,

Harry W. Kugler

Harry W. Kugler
Geologist
August 28, 1949

August 6, 1950

MEMORANDUM REPORT BY ROBERT E. SARGENT

SKELTON GRAVEL CO., PUTNAM COUNTY

Date of field examination -- July 29, 1950.

Location -- The Skelton Gravel Pit is located 3 miles south of Pleasant Gardens, in Putnam County, in the NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 34, T.13N., R.5W..

Ownership -- Clarence and William Skelton own 52 acres of land on which the pit is located. The pit is managed by Lem Skelton.

Information for this report was furnished by Lem Skelton.

Geology -- The pit is located in a Pleistocene terrace remnant along the glacial sluiceway now occupied by Big Walnut Creek (See Leverett and Taylor, 1915, Pl. 6). The deposit is well stratified and well sorted. It is characterized by block faulting. The throw of these faults ranges from 0.5 foot to over 2 feet. Much of the deposit is cemented, probably with calcium carbonate, and this cementing material has healed the faults. The deposit contains lignitic material in some horizons and scattered limonitic concretions.

The overburden of the pit area is the Cincinnati silt loam, eroded phase (See Fowler et al, 1925, Soil Map).

In measuring the section described below, the east face was measured with an aneroid barometer and found to be 92 feet high. The overburden was measured on the south face, where it was accessible, with a steel tape, and subtracted from the 92 feet of the east face to give the thickness of sand and gravel.

<u>Unit</u>	<u>Description</u>	<u>Thickness in feet</u>
3.	Overburden:- Light brown gravelly fine sand.	2.1
2.	Overburden:- Red-brown gravelly sand.	2.7

Unit	Description	Thickness in feet
1.	Sand and gravel:- Well stratified and well sorted. Cross bedded. Cemented, probably with calcium carbonate. Block faulted, throw ranges from 0.5 feet to over 2 feet. Faults healed. Contains lignitic material in some horizons, and scattered limonitic concretions.	86.8
Total thickness of measured section		92.0

Samples -- Sample S5047 was taken from the center of the east face. The sample represents the face from 13 feet to 55 feet above the bottom. Below 13 feet and above 55 feet the face was inaccessible. The sample should be quite representative of the deposit.

Operations -- The Skeltons own no equipment and do no removal of the gravel. The gravel is removed by the purchasers.

Production -- No production figures for the pit are available.

Reserves -- There are no available figures on reserves of the pit.

Respectfully submitted,

Robert E. Sargent
Robert E. Sargent
Party Chief

Fowler, E. B. et al (1925) Soil Survey of Putnam County, Indiana,
U. S. Dept. of Agriculture, Series 1925, No. 27, 55 pp., 1 fig.,
2 Pls., map.

Leverett, F. and Taylor, F. B. (1915) The Pleistocene of Indiana and Michigan and the history of the Great Lakes, U. S. Geol. Sur.,
Monograph vol. 53, 529 pp., 32 Pls., 11 figs..