

76.

STEUBEN COUNTY

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## STEUBEN COUNTY

A summary of sand and gravel deposits.

Date of field examination: July 6, 8, 9, 18, 1949

Geologist: Donald R. Coates

Number of sand and gravel pits:

- 6 active
- 5 active on demand
- 3 inactive, and 2 with a demand status
- 150 abandoned

Size of operations: There are three moderately large gravel companies operating in the county with yearly productions that run between 30,000 and 60,000 tons. The Stonestreet Gravel Company west of Angola is the only operating pit equipped with a washing and crushing plant that screens to state sizes and specifications. The Stonestreet plant southeast of Angola maintains a washing plant. The County Highway Department operates and maintains several of the active on demand pits.

Origin of deposits and pit characteristics: Steuben County contains more sand and gravel than any other county in the state. The deposits are extremely variable in size, character, composition, and origin.

The glacial geology of the county is somewhat complex. Leverett and Malott differ on the glacial interpretation of the county. It is known that both the Saginaw and Erie lobes are represented by their corresponding moraines, in this case the Sturgis and Mississinewa-Salamonie moraines respectively. There is disagreement, however, on the extent of coverage by each, as Malott believes the Erie moraines to be more prominent while the Saginaw has produced features only in the extreme northwestern part of the county, while Leverett believes the Saginaw lobe produced features throughout most of the county excepting in the southeast. The writer believes that Malott has the better of the argument.

The county is largely morainal, but also contains several

## STEUBEN COUNTY REPORT

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important channels of glacial drainage with associated outwash. As the ice in the Erie lobe retreated eastward at least four important lines of glacial drainage formed and flowed westward, destroying much of the moraines, None of these channels are at present occupied by streams that flow in the same courses but the southern two valley train-sluciceways are occupied in part by Pigeon Creek and by Misner Creek.

The following is a brief discussion of the different type origins of the sand and gravel deposits:

(1) Glacial drainage deposits, consisting of valley train terraces and outwash, have produced many of the gravel veins that have been worked in the past. Fish Creek in the southeast has produced many such deposits, most of which are small and now abandoned. Pigeon Creek has produced more gravel deposits, with greater reserves than perhaps any other sluiceway in the county. A typical pit is the Stonestreet deposit 3 miles east of Angola. The workings encompass an area 1000' x 300' with a gravel vein more than 30' thick. The material is good, though somewhat sandy (70%). The Foulk pit east of Otter Lake ( NW $\frac{1}{4}$  sec. 11, 37 N, 13 E), is located in a sluicway that is the northernmost in the county. It is partly valley train terrace and in part valley train outwash. The gravel vein is reputed to be 75' thick. A pit is operated by the Angola Sand and Gravel Company, (NW $\frac{1}{4}$  sec. 11, 37 N, 13 E), that is located in the next sluiceway south, of which Crooked Creek flows in the northwest extension. This deposit is largely valley train outwash, is very sandy (85%) and contains a sand and gravel vein 40' thick. An extensive pit area has been developed in the vicinity of Pleasant Lake in Steuben township. These pits are predominantly outwash and outwash plains. The pits being worked at present are dry and contain gravel veins at least 20' thick. The material is of good quality,

STEBEN COUNTY REPORT

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with approximately equal amounts of sand and gravel. Abandoned workings in this area cover many acres.

(2) Kames and eskers abound in Steuben County and the gravel is practically limitless. There is no section of the county that does not contain several such deposits. The Stonestreet pit north of Silver Lake, (SE $\frac{1}{4}$  sec. 19, 37 N, 12 E), is an excellent example of deposits with this genetic classification. The pit is located in an esker and contains an excellent sand and gravel vein with a dry bank of more than 40'. The sand and gravel is present in a 50-50 ratio. Kame and esker areas are very extensive in the vicinity of Lake James, Hogback Lake, Salem Center, and many localities too numerous for mention. The gravel veins are much thicker than meets the eye as all pits are abandoned as soon as the water level is reached, indicative of the tremendous resources present throughout the county. In general the material is excellent in all deposits, although some pits do contain much shale. The materials are predominantly crystallines and limestone, with the latter sometimes subordinate to the former.

(3) Morainal deposits are present throughout the county and are worked to some extent where streams have aided in eroding the till overburden. There are innumerable small knolls containing a few feet of till overburden with sand and gravel below. York and Scott township depend in part on deposits of such nature, although probably adequate deposits exist in kames and valley train terraces. These deposits are shallow but contain good road gravel.

Future possibilities: Steuben County has much more sand and gravel than will be used. The outlook in quality and quantity is excellent. The deposits are all readily accessible and there is no part of the county without large

## STEUBEN COUNTY REPORT

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sand and gravel reserves. Indeed, Steuben is a sand and gravel county.

Best information sources: Robert Cary, County Highway Dept. employee;  
Paul Duguid, County Supervisor; Kenneth Gary, George Julian, and Mrs.  
George Foulk.

References: Leverett and Taylor, The Pleistocene of Indiana and Michigan,  
USGS Monograph 53, 1915  
30th Annual Report of Indiana Dept of Geology and Natural  
Resources, 1905  
Malott, C.A., Handbook of Indiana Geology, "The Physiography  
of Indiana", 1922  
Smith, L.R., Soil Survey of Steuben County, U.S. Dept. of Agri.  
Series 1933, No. 35, October 1940

August 11, 1950

STONESTREET GRAVEL COMPANY, STEUBEN COUNTY

RESAMPLING

Date of resampling -- July 6, 1950.

Resampling procedure -- Steep, crumbling gravel faces made direct sampling of the pit impossible. Sample S5020 was taken from the southeast face of the pit with a crescent scraper. This sample should be quite representative of the deposit.

Respectfully submitted,

*Robert E. Sargent*

Robert E. Sargent  
Party Chief

# STEBEN COUNTY FIELD TRIP 76-C

1

Nearly all of the topography and geologic features of Steuben County have resulted from glacial and glacio-fluviatile deposition. Bedrock, Lower Mississippian shale, lies buried beneath glacial drift that ranges in thickness from 195 to at least 500 feet. All glacial features are Cary (Late Wisconsin) in age.

The dominant geologic features are two massive end moraines of the Erie lobe that cross the county from southwest to northeast and the outwash plains that spread, apron-like, to the west from them. The more westerly of these ridges is the Mississinewa moraine, outermost of the end moraines left by the Erie lobe in the Cary subage. At the western edge of the Mississinewa moraine several large kames form a prominent, though not continuous, ridge. These kames have been called the Saginaw-Erie interlobate moraine and Dryer (1894, p. 89) thought they were deposited by the Saginaw lobe. Leverett regarded them as part of the Erie lobe deposits (1915, p. 159). Pokagon State Park is situated on one of these areas of kame moraine. A broad, pitted outwash plain extends northwestward from these kames and the large ice-block basins at their bases.

A belt of ground moraine about 3 miles wide separates the Mississinewa moraine from the next distinct moraine to the east, which Dryer (1894, p.88) stated was part of the Salemonie moraine. Malott (1922, p. 123, pl. 3) followed Dryer's interpretation. By use of modern topographic maps where available, and aerial photograph study, this belt seems to be continuous with the Wabash moraine in Allen County and southward. Further, the Wabash moraine is massive throughout much of its length whereas the Salemonie moraine is generally narrow and discontinuous. Some of the features in Allen, DeKalb, and Steuben Counties indicate that the Wabash moraine represents a retreat and readvance of the ice.

The Wabash moraine contains fewer kames along its frontal margin than does the Mississinewa moraine, although kames become more common from northern Allen County northward. One distinctive area of kame moraine exists for a few miles north and northwest from Hamilton Lake in the southeastern part of the county. Elsewhere, most of the kames are scattered. Two large outwash plains as well as smaller outwash plains are associated with this moraine. The larger of these includes Pleasant, Long, and Golden Lakes and is the head-water area of Pigeon Creek. The second is north of Clear Lake. Meltwater from the ice that constructed the Wabash moraine swept out the trough of Pigeon Creek through the older outwash plain of the Mississinewa moraine.

A few areas of Saginaw lobe till plain lie between outwash plains of the Mississinewa moraine in the northwestern part of Steuben County. Saginaw lobe till is generally silty and sandy, in contrast to a blocky clay lithology of Erie lobe till.

Mineable deposits of economic value in the drift of northeastern Indiana are gravel and sand, used for concrete aggregate, road metal, and fill; marl, used for agricultural lime; and peat.

Boulders derived from igneous and metamorphic rocks of the Canadian Shield are abundant and in years past provided a usable field stone for foundation masonry. These boulders are also an excellent source of specimens for mineral and rock collectors.

## Route Log and Descriptions of Stops

Mileage  
between stops

- 0.0      Parking lot beside Potawatomi Inn. Park is shown on Angola West quadrangle.
- 0.3      Gatehouse. The road passes through a kame moraine at the west (forward) edge of the Mississinewa moraine between the gatehouse and park entrance. Most of the hills are gravel.
- 1.3      Turn south (right) on U. S. Highway 27.
- 1.9      Turn east (left) along county gravel road. Road cuts expose a sandy and gravelly till.
- 2.0      Enter Angola East quadrangle.
- 3.0      Descend east (back) slope of end moraine.
- 4.3      Cross New York Central Railroad.
- 4.5      Turn northeast (left) on Indiana Highway 827. The road crosses gently rolling ground moraine or till plain for the next few miles. The Mississinewa end moraine can be seen to the west.
- 5.8      Park on berm along east side of road. Please do not block cemetery entrance.

STOP 1. Road cut exposure of till. NE $\frac{1}{4}$  NE $\frac{1}{4}$  sec. 32, T. 38 N., R.14 E.; one mile south of Fremont.

A total thickness of 15 feet of till and soil are exposed in this road cut. The till is a moderately sandy and silty clay that contains a few pebbles. The entire unit exposed is oxidized brown, and carbonates have been leached from the upper 32 inches. This till was deposited by the Erie lobe during the Cary subage. The soil is Miami silty clay loam (Smith, et al, 1940, map).

Mileage  
between stops

- 0.0      Leave stop 1.
- 0.7      Cross New York Central Railroad and enter Fremont.
- 1.2      Turn east (right) on Indiana Highway 120 in Fremont.
- 1.7      Leave Fremont; cross railroad.
- 2.3      Low road cut exposes 6 feet of heavy clay till along west edge of Wabash moraine.



- 2.6 Note glacio-outwash-lacustrine plain on both sides of road.
- 4.3 Enter Clear Lake quadrangle.
- 5.5 Turn south (right) at cross roads 0.1 mile east of white church.
- 5.8 Some boulders can be seen along the road; they become much more abundant a few miles farther south in this moraine.
- 6.4 Turn west (right) at crossroads.
- 7.2 Turn south at T road intersection.
- 8.1 Cross Bruce Ryan Ditch. Materials exposed in the banks are mostly silt and sand in thin beds although it is gravelly in places.
- 8.3 CAUTION: yield right of way at crossroads.  
The route passes over a reentrant in the outwash plain that was deposited in front of the ice; the moraine can be seen to the east.
- 9.1 Climb forward edge of moraine.
- 9.3 Turn west (right) at T road.
- 9.7 Enter Angola East quadrangle.
- 9.8 Turn north (right) at crossroads; CAUTION: yield right of way to north-south traffic.
- 10.3 Park on shoulder of road; allow room for traffic to pass.

STOP 2. Late Wisconsin fossiliferous peat and marl. Location: NE corner SE $\frac{1}{4}$ -sec. 2, T. 37 N., R. 14 E.; 3 miles southeast of Fremont.

A ditch was dug about three years ago to drain the shallow, muck-filled slough in the outwash plain. The flat plain at this stop is part of an outwash plain which extends west and north from the Wabash moraine. The moraine rises to the south and east. Tough, lacustrine clay underlies a few feet of gravel and sand outwash in a ditch bank exposure about 1000 feet northwest of the road. Nearer the road a thin unit of marl and peat overlies unweathered till and is capped with thin calcareous gravel. This peaty layer, unit 3 in the measured section, can be found at several places and seems fairly continuous. Wood fragments from the peat were determined recently by radiocarbon analysis to be 13,000 years old. (Suess, personal communication) This indicates that glacial sediments associated with the dated bed must be Late Cary.

The following section was measured in the north bank of the ditch.

<u>Unit</u>	<u>Thickness in feet</u>
7. Muck: non-calcareous	1.0
6. Clay: grayish-brown, non-calcareous	2.0
5. Clay: grayish-brown, calcareous	0.5

Thickness in feet

- |   |            |
|---|------------|
| 4. Sand: light tan, gravelly, highly calcareous;<br>shows minor cross-bedding in a few places         | 1.5 to 2.0 |
| 3. Peat: dark brown, fibrous; contains abundant<br>wood fragments and <u>Picea</u> cones              | 0.1 to 0.3 |
| 2. Marl: gray, peaty, clayey and slightly pebbly,<br>molluscs common, a little woody material at base | 0.5 to 0.8 |
| 1. Till: gray, silty, sandy, calcareous; exposed  | 1.0        |

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Total	7.0
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The following pollen percentages were obtained from identification of 200 pollen grains from each of the two fossiliferous beds in the above section by G. K. Guennel.

	Abies	Picea glauca	Picea mariana	Pinus	Larix	Quercus
Peat	1.5%	27.5%	50.0%	15.5	5.0%	0.5%
Marl	6.0%	36.0%	42.0%	14.5%	1.5%	----

The following molluscs from the marl have been identified:

Valveta sincera Say c

Valveta tricerinata (Say) c

Amnicola limosa porata Say r

Gyraulus altissimus (Baker) c

Gyraulus deflectus (Say) r

Fossaria obrussa decampi (Streng) r-c

Helisoma sp - r. (broken)

Pisidium spp. e

All of these molluscs inhabit small, shallow lakes and have a northern range. No terrestrial gastropods were found in the samples studied. One species, Gyraulus altissimus, is known only from Pleistocene deposits and may be extinct.

Mileage  
Between Stops

- 0.0      Cross part of outwash plain.
- 1.2      Re-enter forward edge of Wabash moraine.
- 1.9      Note abandoned gravel pit in small kame 500 feet west of road.
- 2.7      Turn west (left) on Indiana Highway 120. CAUTION: yield right of way to west- and east-bound traffic.
- 4.0      Note boulders.
- 4.9      Leave moraine.
- 5.2      Enter Fremont.
- 5.6      Junction with Indiana Highway 827; continue westward on 120.
- 6.9      Park on north shoulder of road between marl pits. Do not block entrance to pit.

STOP 3. Schaeffer Marl Pit. Location: SW corner sec. 20, T. 38 N., R. 14 E., one mile west of Fremont.

Marl is a soft, earthy lake sediment composed mainly of calcium carbonate. It frequently contains the remains of molluscs and Characae. This marl pit is typical of many that have been opened in northern Indiana to provide a local source of agricultural lime. This pit was first opened about 1941. During the past three years, 4,000 to 5,000 cubic yards have been removed annually.

Along the fence at the west side of the pit the marl thins rapidly and is underlain by both till and gravelly sand. At the east side of the pit, however, a core sample showed marl to a depth of 15.5 feet, where gyttja was encountered. The depression occurs in an outwash plain and exposures of the gravel can be seen in a road cut 150 feet west of the pit.

The following analyses were determined spectrographically by R. K. Leininger, Indiana Geological Survey. They are calculated on estimates of the combustible organic matter present and thus will be subject to slight modification when the analysis is complete.

Sample File No.	Thickness of unit	CaCO <sub>3</sub>	MgCO <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	TiO <sub>2</sub>	MnO	SiO <sub>2</sub>	Organic (est.)
WJW-53-57	6.5 ft.	85.0	3.2	1.2	0.7	0.06	0.03	5.9	4%
WJW-53-58	15.0 ft.	93.0	3.7	0.3	0.2	--	0.01	1.0	1.5%

Molluscs--were--present--throughout both cores.

Mileage  
Between Stops

- 0.0      Leave Stop 3
- 0.8      SLOW DOWN. Note outwash plain gravels exposed in cuts where proposed tollroad will join Indiana Highway 120.
- 1.7      This hummocky topography is part of a pitted outwash plain. Note kames and moraine to south.
- 2.5      Turn south (left) on U. S. Highway 20. Gravel pit at intersection exposes materials which underlie this outwash plain.
- 3.5      Turn west (right) on county gravel road.
- 4.0      Park in wide place in road at crest of hill. Please keep at least one traffic lane open.

STOP 4. Hells Point overlook. Location: SE $\frac{1}{4}$  SE $\frac{1}{4}$  sec. 27, T. 38 N., R. 13 E., altitude 1123 feet.

Hell's Point is the crest of one of the kames in a rugged kame moraine that was deposited at the forward edge of the Erie lobe of ice during the Cary subage. Southward, in Pokagon State Park, several more of this series of kames can be seen. Lake James, Snow Lake, and many of the other lakes are ice block basins (Zumberge, 1952, pp. 18-20) in the pitted outwash plain that slopes toward the north and west. Some of the silt, sand, and gravel of this kame can be seen in the low cuts along the road near the parking area.

- 0.0      Leave Stop 4 and continue westward.
- 0.3      Turn north.
- 0.4      One can get an excellent view of the pitted front slope of the Hell's Point kame from this place where it merges with a pitted outwash plain. Note coarse gravel and boulders exposed along road.
- 1.4      Turn west (left) on Indiana Highway 120.
- 2.4      The many lake basins in this area of outwash plain probably resulted from the burial and later melting of large blocks of ice.
- 3.0      Note abandoned gravel pit 500 feet north of highway.
- 3.7      The low rise on the south side of the route is underlain by silty and sandy till of the Saginaw lobe.
- 4.4      Park along shoulder of road on west bank of small valley.

STOP 5. Saginaw Lobe till. Location: center S edge SW $\frac{1}{4}$  sec. 17, T. 38 N., R. 13 E.

Sandy and silty till characteristic of that deposited by the Saginaw lobe can be seen in the rather poor exposure in the road cut at this place. The overlying soil type is Miami fine sandy loam. Purpose of this stop is to provide an opportunity to compare this till with the material examined at Stop 1.

Mileage  
Between Stops

- 0.0 Continue westward on Highway 120. The till plain is capped by a few scattered areas of thin windblown sand.
- 2.7 Leave till plain and begin to cross pitted outwash plain.
- 3.3 Enter Orland sheet.
- 3.6 Abandoned gravel pit on south side of highway has a layer of windblown sand at the crest of the exposure.
- 3.7 Note gravel pit 500 feet north of road.
- 5.7 Enter Orland.
- 6.0 Turn south on Indiana Highway 327.
- 7.0 Note shallow depressions in outwash plain.
- 9.4 Ridge visible to the southwest is a series of dunes.
- 10.0 Highway starts over dunes.
- 10.4 Park on berm beside large blowout.

STOP 6. Dune and blowout. Location: NW $\frac{1}{4}$  NE $\frac{1}{4}$  sec. 17, T. 37 N., R. 12 E.

The dune sand which this blowout exposes forms a continuous ridge along the east bluff of Pigeon Creek Valley for about two miles. From its topographic occurrence it would seem to have been derived from outwash of the Erie Lobe that sluiced out the trough through which Pigeon Creek meanders and was blown to the top of the adjacent bluff. The soil here has been mapped as Coloma loamy fine sand.

Mileage  
between stops

- 0.0 Continue southward.
- 0.3 Note the starts of blowouts everywhere that a road cut has been made through dune sand.
- 0.5 Descend into the glacial sluiceway now occupied by Pigeon Creek.

Mileage  
Between Stops

- 1.4 Cross Pigeon Creek
- 1.8 Cross U. S. Highway 20 and continue south on Indiana Highway 327.
- 2.1 Turn west (right) on lane leading into gravel pit.
- 2.3 Park on floor of gravel pit.

STOP 7. Brown Gravel Pit. Location; NW $\frac{1}{4}$  NW $\frac{1}{4}$  sec. 29, T. 37 N., R. 12 E.

This is an active-on-demand gravel pit operated by the Steuben County Highway Department. The following section was measured in the face of the pit.

	Thickness in feet
2. Soil: brown, clayey, a few long tubular pendants	2.5
1. Gravel and sand: yellowish gray, shows cut-and-fill bedding, fairly well-sorted, but with some boulders	<u>18.0</u>
Total exposed	20.5

The cross-bedded gravel exposed in this pit is part of the extensive outwash plain deposited at the same time that the kame moraine at Pokagon State Park was constructed by the ice. The surface of the outwash plain slopes generally northwestward and is pitted with many large depressions.

Some controversy exists regarding the origin of long, tubular pendants of weathered, clay-enriched gravel that penetrate the parent material from the base of the B-zone in Fox soils. According to one hypothesis, these pendants have been formed where taproots of trees permitted a more rapid entry of water. Another hypothesis is that weathering may be accelerated downward as a result of the presence of ice wedges in perennially frozen ground. If this is to be accepted, these would be relict structures indicating former permafrost. Neither of these hypotheses seems entirely satisfactory to explain the structure, however.

- 0.0 Turn north (left) from lane on to Indiana Highway 327.
- 0.3 Turn east (right) on U. S. Highway 20.
- 1.6 Western (forward) margin of Mississinewa moraine. Clayey till is exposed in road cuts.
- 3.1 Enter Angola West Sheet.
- 3.9 Cross bridge over Pigeon Creek. Note width of trough through which this underfit stream flows.
- 5.8 Steep road cuts on south side of highway expose gravel of a large kame.
- 6.1 The slackline towers half a mile north belong to Stonestreet Gravel Co. Part of the low flat area between Silver Lake and the gravel pit is underlain with marl.

Mileage  
Between Stops

- 8.6 Turn north (left) on blacktopped road.
- 9.3 Till is exposed in low road cuts.
- 11.1 Steuben County home. The underlying material is outwash gravel and sand.
- 11.6 Note kame moraine to northeast.
- 12.6 Turn east at T intersection on south side of Lake James.
- 13.0 Enter kame moraine.
- 13.6 Turn north (left) on U. S. Highway 20.
- 15.4 Entrance to Pokagon State Park; turn west (left).
- 16.5 Gatehouse.
- 16.8 Parking lot beside Inn. End of trip.

References

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- Melott, C. A., 1922. The physiography of Indiana, in Handbook of Indiana Geology: Ind. Dept. Cons., Pub. No. 21, pp. 59-256, 3 pls. 51 figs, maps.
- Smith, L. R., Tharp, W. E., Leighty, W. J., Bushnell, T. M., and Ulrich, H. P., 1940. Soil Survey of Steuben County, Indiana: U. S. Dept. Agriculture, Series 1933, No. 35, 63 pages, 1 fig., 7 tables, 1 map.
- Zumberge, J. H., 1952. The lakes of Minnesota, their origin and classification: Minn. Geol. Survey, Bull. 35, 99 pages, 2 pls. 48 figs.

# Baby Mastodon Bones Found

mcm-1972  
76-D

ANGOLA, Ind. (AP) — The upper part of the head of a baby mastodon has been uncovered at a site about three miles west of Angola in Steuben County.

Dr. Jack Sunderman, chairman of the geology department at the Indiana-Purdue University regional campus at Fort Wayne, said Thursday the head was in good shape and some of the teeth still were in the bone.

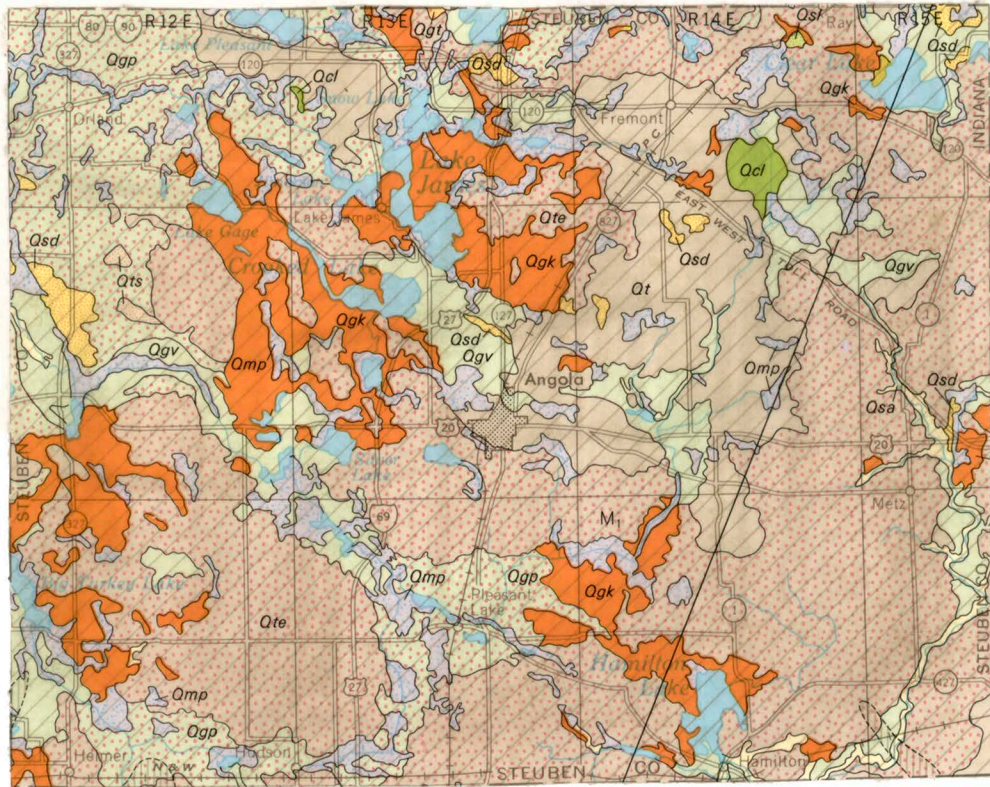
Sunderman, in charge of the excavations, and several geology students had been digging in the area for the remaining bones from another mastodon found in the same area about two years ago. These bones were believed to be about 10,000-15,000 years old.

Sunderman said the diggers had been unsuccessful and had given up when the operator of a crane used in the excavation spotted the head and called them back.

A farmer digging out a farm pond had made the original discovery two years ago and notified the geology department.



76-E



T 38 N

T 37 N

T 36 N

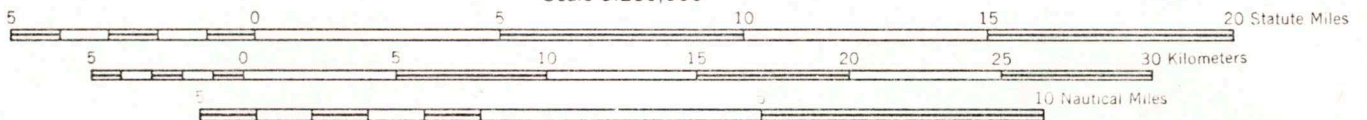
R12E

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R14E

R15E

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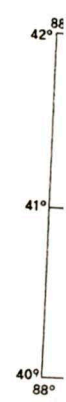




G A N



76-F



SHO



Memorandum Report  
by  
Michael C. Moore  
March 25, 1974

COMPANY: Viking Gravel Co.  
COUNTY: Steuben  
MAILING ADDRESS: R. R. #5, Box 1055, Angola, IN 46703  
DESCRIPTIVE LOCATION: ~~60~~ West on US 20 from Angola 3 3/4 mi.  
Pit is on south side of road.  
U.S.G.S. LOCATION: E $\frac{1}{2}$  SW $\frac{1}{4}$  sec. 30, T. 37N., R. 13E., Angola  
W ~~1/3~~ quad  
OFFICERS: Dean Goranson, Pres. and Supt., Dayton Hake, portable plant  
foreman  
PHONE: 1-219-665-2690  
NO. OF EMPLOYEES: 2  
PRODUCTS: Crushed, washed and screened gravel  
SHIPPED BY: Customer trucks  
CAPACITY: 150 TPH  
GEOLOGY: Kame-esker  
INFORMANT: Dean Goranson  
DATE OF FIELD VISIT: March 11, 1974

There are only a few small boulders in this deposit which has a sand to gravel ratio of 65/35. Approximately 40% of the coarse material is crushed by a 10/36 Jaw crusher and a 36/24 roll crusher. There are no operational problems and Mr. Goranson reports that the material is of very high quality.

He has owned the deposit and operated as Viking Gravel for 4 years. He was formerly President of Stone-Street Gravel of Angola. He reports that he has had great difficulty in getting zoning for the gravel operation. The market area for the pit has a radius of about 30 miles.

Although the Viking pit produces gravel with a very low content of deleterious materials, there are problems in northeastern Indiana with "ochre" or the ironstone crusts surrounding very dense, dark gray dolomite concretions. Mr. Goranson reports that the deposits near Clear Lake, in the very northeasternmost corner of the state may have as much as 17 to 22% ironstone, while the main Stone-Street pit will have, perhaps, 6%. The new north pit of the Stone-Street Company, which was originally bought by Mr. Goranson seems to be out of the streak and like Viking, has only about 3% deleterious material.

High ironstone contents similar to that at Clear Lake are known from near Jonesville in Hillsdale County, Michigan, and especially to the southwest of Jackson. Often the iron oxides of iron-bearing clay are found above the water table while below the water table the content of these contaminants is lower. The reverse may be true for the apparent concentration of chert. Mr. Goranson states that the best way to get rid of ironstone contamination is to try to isolate it in one size fraction, and/or to run it through a hammermill which breaks the brittle crusts and allows them to be eliminated with undersize.



Memorandum Report  
by  
Michael C. Moore  
March 25, 1974

COMPANY: Flegal Sand and Gravel  
COUNTY: Steuben  
MAILING ADDRESS: R. R. #1, Hamilton, IN  
DESCRIPTIVE LOCATION OF PIT: West from Hamilton 1 mi. and north  
1 mi., then east on Russels Point  
Rd.  $\frac{1}{2}$  mi.  
U.S.G.S. LOCATION: SE $\frac{1}{4}$  NW $\frac{1}{4}$  sec. 28, T. 36N., R. 14E., Hamilton  
7 $\frac{1}{2}$ ' quad.  
OFFICERS: Ben Flegal, pres.  
PHONE: 1-219-488-3222  
NO. OF EMPLOYEES: 2  
PRODUCTS: Screened and washed sand and gravel  
SHIPPED BY: Customer trucks  
CAPACITY: 100 TPH  
GEOLOGY: Kame  
REMARKS:

This small sand and gravel company has been operating in the northeastern Indiana area for 10 years, shipping as far as Woodburn in Allen County and 15 miles in other directions. Clay veins are the only operational problem for this company. The property, 160 acres under county zoning, is now owned but was formerly leased. The company also operates an excavating business and McMahon Construction Co. equipment was parked on the grounds.

The deposit is a large kame on the west side of Hamilton Lake. The uppermost 10 to 15 feet consists of fine to medium grained sand which is cross-bedded and laminated with calcareous stringers. It grades down to a stone line with coarse cobbles. Below the stone line medium gravel is found. Both the sand and the gravel dip to the north or northwest, but the sand dips at a greater angle. There is evidence of deformation due to overridding or cryoturbation. Till is found lower in the pit and overlies gray and brown clay. There is perhaps 10 feet of gravel below the till to the floor of the majority of the pit. Just below floor level is a coarse stone line and another 15 feet of gravel beneath. There is a noticeable amount of ochre in the lower gravel.

Date of field visit: March 10, 1974

Memorandum Report  
by  
Michael C. Moore  
May 13, 1974

County: Steuben  
Company: State Line Sand and Gravel  
Mailing Address: R. R. #2, Fremont, Indiana  
U.S.G.S. Location: E $\frac{1}{2}$  NE $\frac{1}{4}$  sec. 22, T. 38 N., R. 13 E., Angola W., 7 $\frac{1}{2}$ ' quad  
Descriptive Location:  $\frac{1}{2}$  mi. east of U.S. 27; northwest of intersection of  
27 and toll road.  
Officers: Wayne Klink, owner  
Phone: (219) 495-3005  
No. of Employees: 2  
Products: Crushed stone and sand, #5, #11, #9, all non-state spec.  
Shipped by: Truck  
Capacity: 500 TPD

Most of the land on this 20 acre lease has been worked and it is not known if the plant will be relocated. The pit is worked as a dry face which in some places, is as high as 50 feet. Three end loaders, a crane and the processing screens make up the equipment used. Over-size material is crushed, but the deposit is quite fine-grained, with a sand to gravel ratio of about 80/20. The only other drawbacks, aside from the fine grain size and limited amount of material remaining, are unctuous clay layers near the bottom of the pit. The pit was first opened in 1957 and enlarged during the construction of I-69 and the huge pile of waste sand that accumulated was used for fill in that project. Another monstrous pile has now accumulated, but Mr. Klink has resisted the urge to push it into a nearby swamp with the hope that he may sell some more.

The deposit is in a kame and has a variable thickness of soil development on its top. Alternating bands of coarse gravel and sand are about 3 and 1 foot thick respectively. The dips are mostly to the west but dips in all directions may be found. The coarse sand often has a shallow dip opposite that of associated gravel, and this may be evidence for upper flow regime transport. Some areas near the center of the deposit show distortion, possibly due to cryoturbation, slumping due to ice block melting, or to overriding. There are few ironstones, and those that do exist seem to be a ferruginous sandstone rather than siderite nodules. A pair of 3 foot boulders of this material were piled at one point, as was a similar boulder of tillite. The deposit may be coarser to the east. On the west several feet of till overlie the sand and gravel.

Date of field visit: May 7, 1974

