

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

C. L. BIBER, 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.

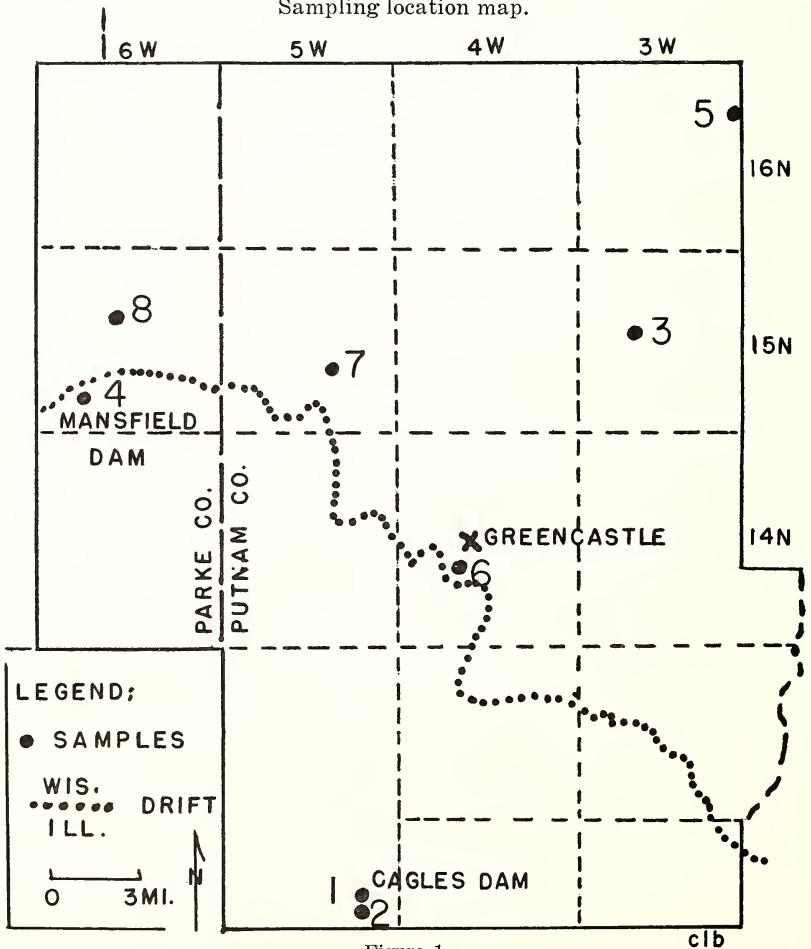


Figure 1

## 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

counts and origin studies show that the ice for both Illinoian and Wisconsin tills came from the same general locality (northeast), though Borden pebbles indicate more of a north-south trend during at least a part of the Wisconsin advance. Some of the similarity in pebble content results from the Wisconsin ice reworking the older Illinoian surface. As might be expected, Devonian black shales are more common in the older tills. An average by age of pebbles from Illinoian and Wisconsin tills show 2% Pennsylvanian, 34% Mississippian, 32% Devonian and Silurian, 29% Precambrian, and 3% unaccounted.

#### Conclusions

1. Pebbles in the tills of Northern Putnam and East Parke Counties were probably derived from nearly the same sources.
2. In southern Putnam County the till samples collected are so close to exposures of Pennsylvanian sandstone and shale, that percentages are locally affected.
3. Over 30% of the till pebbles were not transported over 20 miles; 25 to 30% traveled over 400 miles.
4. Some 30% of the pebbles in the tills are Mississippian limestones and siltstones; nearly 30% are igneous and metamorphic, the balance are middle and lower Paleozoic age.

#### Literature Cited

1. ANDERSON, R. C. 1957. Pebble sand lithology of the major Wisconsin glacial lobes of the Central Lowland Bull. Geol. Soc. America 68 :1418.