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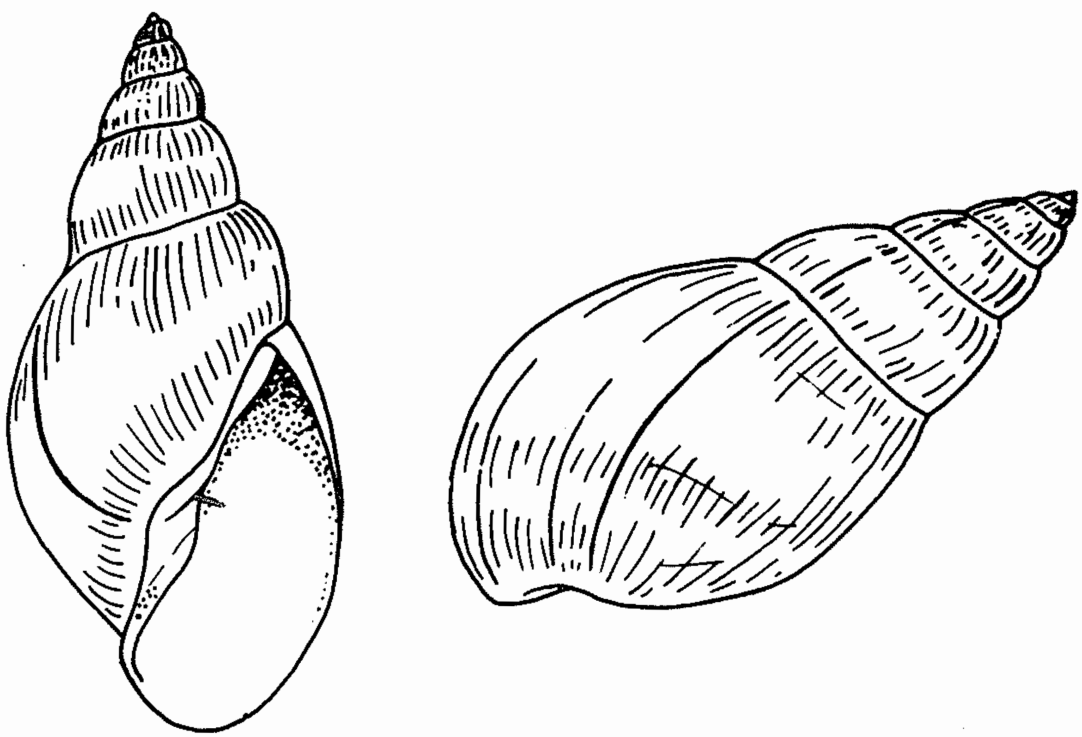

by Fred V. Steece, 1966

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LATE WISCONSIN ICE-PERCHED LAKE DEPOSIT, LINCOLN COUNTY, SOUTH DAKOTA [1]

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INTRODUCTION

In the summer of 1964 a new road cut revealed fossiliferous lacustrine sediments filling a depression in late Wisconsin till. This locality is on State Highway 11, about 2 miles southeast of Harrisburg, SW¼ NW¼ sec. 9, T. 99 N., R. 49 W., Lincoln County, South Dakota. The locality is here referred to as the Harrisburg fauna.

STRATIGRAPHY

Studies of the surface drift in the James lobe in South Dakota have placed the age of the main part of this drift as late Wisconsin (Chamberlain, 1883). This late Wisconsin drift continues eastward from the study area for about 5 miles to the Big Sioux River. The Big Sioux in this part of the State is an ice-marginal channel of the late Wisconsin ice sheet, and therefore marks the maximum eastward extent of late Wisconsin ice in Lincoln County. To the east of the Big Sioux are deposits of Illinoian age (Steece, 1965). Radiocarbon dates from the late Wisconsin drift south and west of the Harrisburg fauna locality (Fig. 1) range from 12,050 to 12,760 years B. P. (before present). Gastropod shells from this locality were dated at 11,770 ± 500 (sample W-1755; Dr. Meyer Rubin, U. S. Geological Survey Isotope Geology Laboratory; unpublished).

At the Harrisburg locality, as much as 7 feet of fossiliferous marl or marly silt underlies 7½ feet of gray, brown, and black clay, and overlies till and as much as 5 feet of gravel. Figure 2 shows a generalized section of the lake deposit.

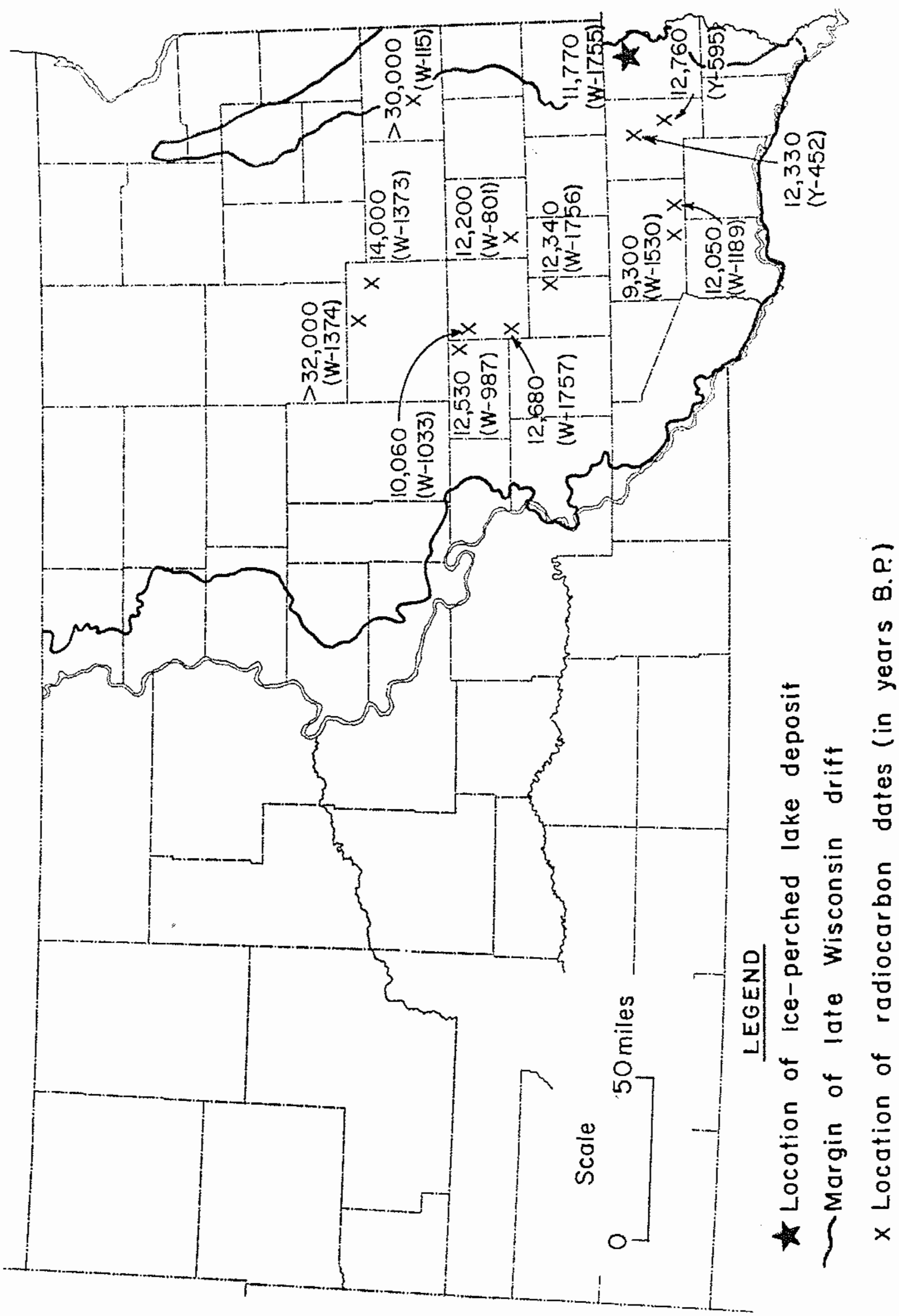
PALEONTOLOGY

The marl and marly silt layers contain an abundant fauna and flora, including molluscs, charophytes, and ostracodes. Relatively few species are present, however, and are as follows:

Mollusca
- Pelecypoda
  - *Pisidium* cf. *nitidum* Jenyns
- Gastropoda
  - *Gyraulus parvus* (Say)
  - *Armiger crista* (Linnaeus)

[1] Publication authorized by the Director, South Dakota Geological Survey.

Figure I. – Location of ice-perched lake deposit, late Wisconsin drift border, and radiocarbon dates



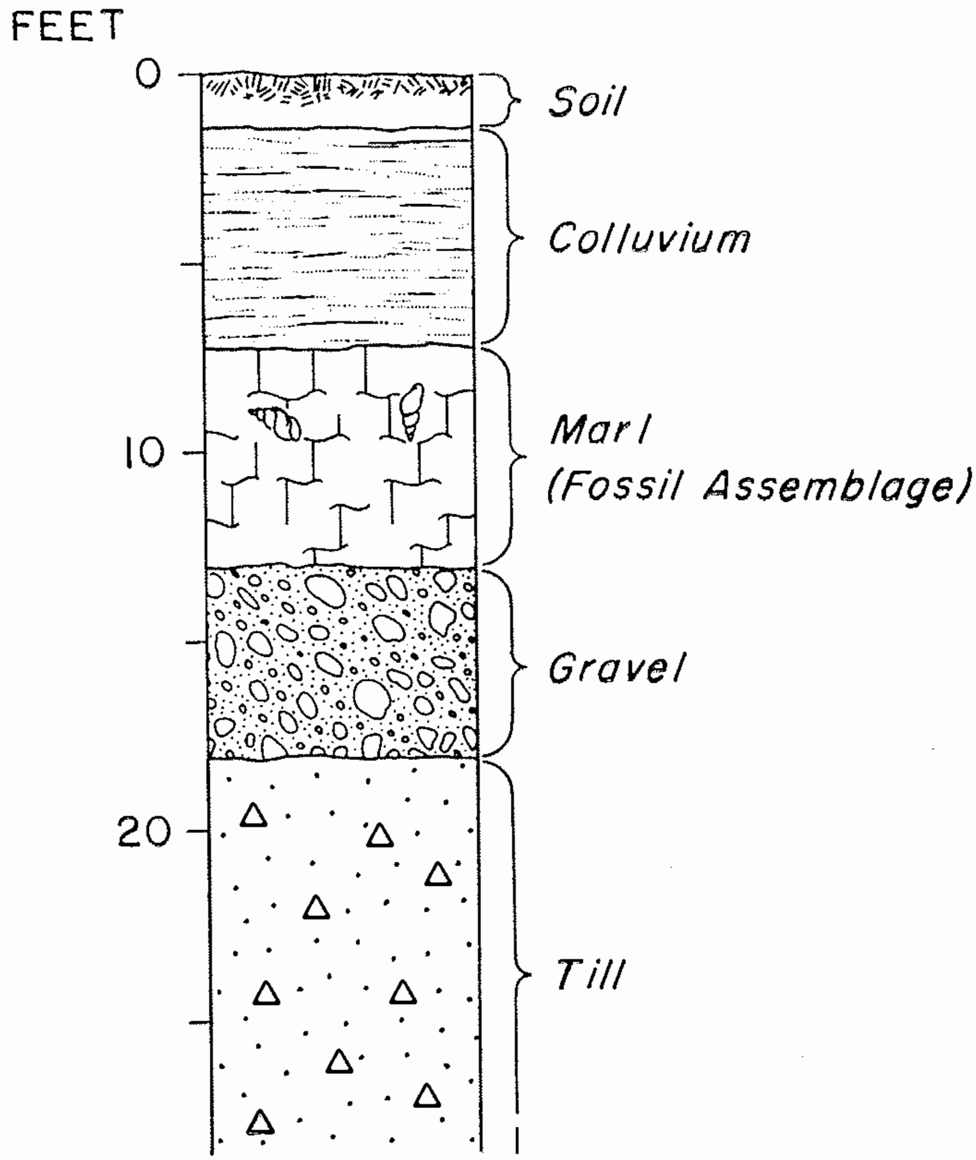


Figure 2. Generalized Section of ice-perched lake deposit.

Gastropoda (continued)
- *Stagnicola palustris elodes* (Say)[1]
- *S. reflexa* (Say)
- *Physa* sp.
- *Vertigo* sp.

Ostracoda
- *Candona* cf. *ohioensis* Furtos
- *Cyclocypris* cf. *forbesi* Sharpe

Charophyta
- ? *Clavatorites* sp.
- ? *Chara* sp.

Certain aspects of the depositional environment of the sediments enclosing these species can be inferred from a knowledge of existing and fossil forms (for example see Baker, 1928, and Taylor, 1960). Most of the snails indicate a shallow temporary water body. *Gyraulus parvus, Armiger crista, Stagnicola palustris elodes,* and *S. reflexa* all prefer quiet or very slowly moving water, and all survive in localities that undergo periodic desiccation. If the *Physas* are of the species *gyrina,* these too inhabit temporary water bodies. If they are *anatina,* however, they would indicate permanent water. *Vertigo* lives in nearly any moist situation near streams, lakes, or ponds. The pelecypod *Pisidium nitidum* inhabits quiet or slowly moving permanent water. If this pelecypod is, however, *P. casertanum,* a less permanent environment would be suggested; *P. casertanum* is able to survive seasonal drying (Taylor, 1960, p. 47). The two species are very similar and difficult to distinguish.

Gyraulus parvus prefers habitations that are rich in vegetation. The very abundant calcareous remains of at least two species of Charophytes *(Clavatorites*? and *Chara*?) would seem to provide the vegetation required by *G. Parvus.* The ostracodes, *Candona* cf. *ohioensis* and *Cyclocypris* cf. *forbesi,* also require abundant aquatic vegetation for survival. *Candona* normally occupies weedy marginal positions adjacent to water.

Because they require permanent, relatively clear water, the absence of such gill-breathing snails from the Harrisburg assemblage, as *Valvata tricarinata* and *Amnicola limosa,* is not surprising. These two snails, as well as *Helisoma anceps* which requires permanent water, are some of the most common snails in glacio-fluvial deposits in eastern South Dakota.

Further evidence that the environment of the Harrisburg fauna was transitory is presented by "rest marks" on the shells of *Pisidium* cf. *nitidum, Stagnicola palustris elodes,* and *Gyraulus parvus.* These features are considered to indicate temporary water bodies that may become dry seasonally (Miller, 1964, p. 114).

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[1] Large **S. palustris elodes** shells were used to obtain radiocarbon date for the Harrisburg locality (Sample W-1755).

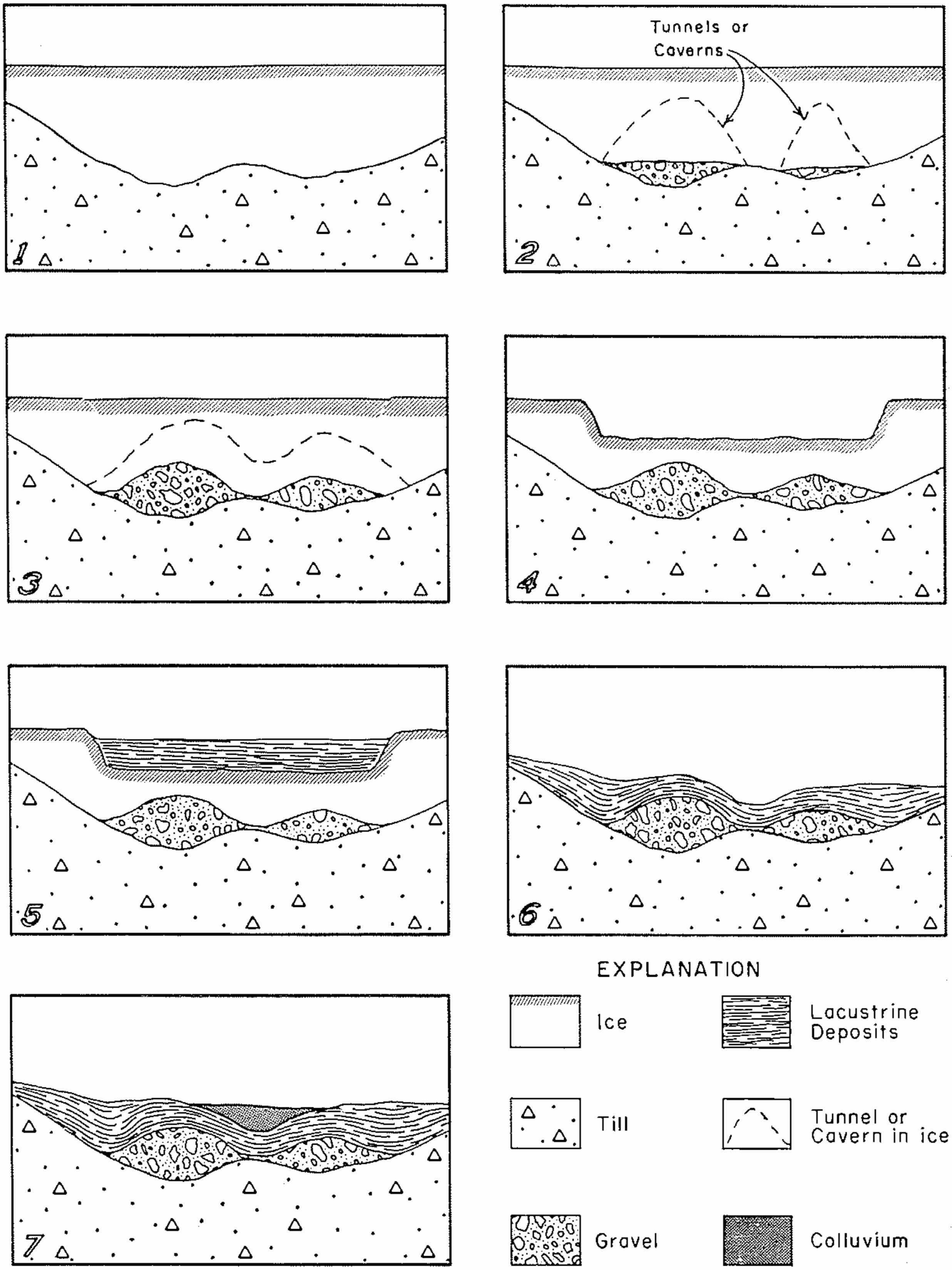

Figure 3. Idealized diagram showing stages in development of ice-perched lake deposit.

ORIGIN

The late Wisconsin ice advanced into the area sometime before 12,760 years ago. The ice margin was only about 5 miles to the east of this locality. Climatic warming caused the thin marginal ice to stagnate and waste away slowly. The marginal late Wisconsin ice must have been thin as shown by the absence of terminal moraine adjacent to the Big Sioux River in Lincoln County. Debris-laden streams followed the low areas on the drift surface beneath the stagnant ice. Such a setting probably existed in Lincoln County at the site of the lake deposit described. The hypothetical stages in the development of this lake deposit are shown in Figure 3, and listed as follows:

1) Thin ice began to stagnate over the glacial till which had already been lodged by the ice.

2) Several small streams flowed beneath the ice, depositing poorly-sorted cobbly gravel.

3) The running water beneath the ice melted the ice outward and upward, causing it to be weakened over the streams.

4) A large block of ice collapsed into the depression containing the gravel deposits.

5) Into the new depression on the ice surface silt and clay were slowly washed by ice meltwater. Thus insulated from the ice by a blanket of sediment, aquatic life began to inhabit the lake and flourish.

6) Gradual climatic moderation caused the buried ice block—surrounding ice had long since melted away because it was not insulated by a sediment cover—to melt beneath the lacustrine deposits. The lake deposits were thus let down and draped over the irregular surface beneath the ice. This draping is shown by contorted bedding in the thinly laminated lake sediments.

7) The depression that remained after collapsing was gradually filled in with colluvial material supplied by slope wash into the low area, until it was completely filled.

8) Modern soil has formed across the depression.

CONCLUSIONS

The radiocarbon age of 11,770 years B. P. for this deposit on late Wisconsin drift dates for the first time the end of Wisconsin glaciation, at least in Lincoln County. An additional C-14 age determination of 10,060 ± 300 years B. P. (Sample W-1033, Ives, and others, 1964, p. 48) from snail shells in a lake deposit overlying late Wisconsin outwash in Sanborn County near the center of the James lobe (Fig. 1), strongly suggests that glacial ice was absent from the latter locality by 10,060 years ago (Steece and Howells, 1965). Thus the southeast part of the State was deglaciated by about 11,700 years ago, and the central part by about 10,000 years ago.

The climate of southeastern South Dakota at the close of the Wisconsin glacial stage was very similar to that in South Dakota at present. All of the fossil mollusks, and probably most of the other species as well found in the Harrisburg fauna, are present-day inhabitants of the State.

Because of the wide geographic distribution and geologic range of the fossil forms in the Harrisburg fauna, these species cannot be used as index fossils. The gastropods, for example, nearly all have a geologic range from either late Pliocene or early Pleistocene to Recent, and all of them have wide distribution in North America.

This paper presents the first known detailed report of superglacial deposits in South Dakota.

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