

Proceedings of the Iowa Academy of Science

Volume 69 | Annual Issue

Article 7

1962

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Recommended Citation

Graham, Ben F. Jr. (1962) "A Post-Kansan Peat at Grinnell, Iowa: A Preliminary Report," *Proceedings of the Iowa Academy of Science*, 69(1), 39-44.

Available at: <https://scholarworks.uni.edu/pias/vol69/iss1/7>

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A Post-Kansan Peat at Grinnell, Iowa: A Preliminary Report¹

BEN F. GRAHAM, JR.²

Abstract. In June, 1960, a 2-ft. post-Kansan peat deposit was exposed in a building excavation in Grinnell (Poweshiek Co.), Iowa. A Kansan gumbotil lies beneath the peat, and approximately 16 ft. of loess lies above it. Well-preserved wood and pollen of coniferous forest species are abundant. Because there is no overlying till, the deposit is tentatively classified as of Buchanan age.

During the spring of 1960, excavation was begun on the Grinnell College Campus for the new Fine Arts Center. Always strongly attracted to a freshly exposed soil profile, the writer was rewarded in this instance with the discovery that there existed, at from 15 to 18 ft. below grade, a deep and apparently extensive peat deposit. It is the purpose of this paper to place the Grinnell peat in the Pleistocene chronology, and to record the circumstances surrounding its discovery. It is hoped that during the projected major building program now being initiated on the campus, opportunities for further and more detailed study will occur.

LOCATION

Grinnell College is in Poweshiek County in central Iowa. A U. S. Geological Survey bench mark at the front entrance to Goodnow Hall, marks an elevation of 1,025 ft. above mean sea level, and the exposure discussed here lies approximately 100 ft. southeast of the bench mark. The specific study site is now beneath the Roberts Theater. The peat horizon was approximately 2.5 ft. below the floor of the excavation, and so was exposed only for deeper footings and in borings for some 65 deep concrete piers. The top of one such pier, about under the center of the Roberts Theater, was at an elevation of 1,004' 1½", and coincided with the upper limit of the organic layer. In this same area the normal excavation floor was at 1,006' 7½" elevation. The log of a test boring, made in the same general area before the excavation was started, records at a depth of 16 ft. (below a grade level of 1,019 ft. elev.), "silt; some clay; trace sand; dark brown; loose (organic)". Water content analyses made in connection with this boring showed: at 12 ft. 26% W.C.; at 16 ft. 82.4% W.C.; and, at 22 ft., 28% W.C., thence decreasing gradually to less than 15% W.C. at depths greater than 45 ft. It is clear

¹ Supported in part by National Science Foundation Grant 14911.

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from these data that the organic layer is very wet, a fact which has lead to some engineering problems on the campus.

GEOLOGY OF GRINNELL

The surficial geology of the Grinnell area reveals a little over 200 ft. of alternating strata of soil, drift, and loess, underlaid by the St. Louis limestone formation of the Mississippian Period (Stookey, 1909). In this deep mantle is found drift from the first two Pleistocene ages, the Nebraskan and the Kansan. The subsequent Illinoian age left drift in Iowa only in the southeastern corner, and the extensive Wisconsin drift, the most recent, reaches to within 8 miles of Grinnell (in the northwest corner of Poweshiek County), and extends slightly south of Grinnell in a lobe approximately 28 miles to the west (Kay, *et al.*, 1944). (Figure 1)

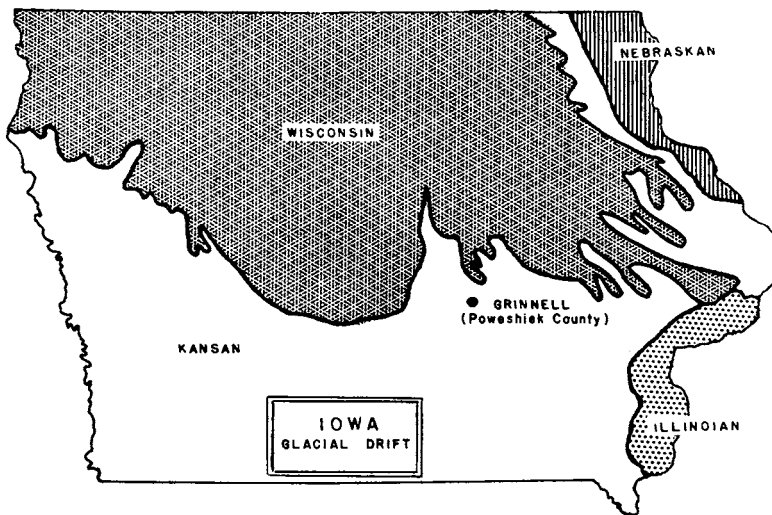


Figure 1. Distribution in Iowa of Pleistocene drift. Grinnell lies on Kansan drift which in turn overlies Nebraska drift from the oldest Pleistocene age. Most of the state has been subsequently covered with a mantle of loess which varies in thickness to a maximum of approximately 100 ft. (Adapted from a sketch map, *Glacial Geology of Iowa*, Iowa Geological Survey, 1955).

Of particular interest to geologists and palynologists are the interbedded non-glacial deposits which separate the glacial till sheets and provide evidence, direct and/or indirect, of interglacial biota and climates. The great bulk of this material is the loess, wind-deposited soil most of which, in the Grinnell area, probably has been carried from the Missouri River outwash to the west (Flint, 1953).

While certain climatological inferences may be drawn from mineralogical characteristics of the loess deposits, and the fossil fauna therein has been very enlightening (Kay, *et al.*, 1944),

the richest source of paleoecological and paleoclimatological information lies in the peat deposits characteristic of the Aftonian (post-Nebraskan), Yarmouth (post-Kansan), and Sangamon (post-Illinoian) interglacial ages. From macroscopic remains in the peat, including leaf-parts, fruits, seeds and wood, much has been learned of interglacial ecology; while, at the microscopic level, pollen analysis has enabled us to reconstruct, on a qualitative basis, a picture of interglacial vegetation. From cyclic variations therein, sequential climatic fluctuations have been inferred.

THE PEAT EXPOSURE

Throughout the excavation, the peat stratum lay approximately 2.5 ft. below floor-level. Some, the first to come to the writer's attention, was brought up in digging for footings under the north side of the Fine Arts Building. This material was very woody, and pieces ranging to approximately 1 in. in diameter were seen. All were very much flattened from above, and the peat had a generally laminar structure (Figure 2). Although



Figure 2. Wood fragments and a dried piece of peat from the Grinnell exposure.

some mineral replacement is evident in the wood, much of it is well preserved in cellulosic form. Mrs. L. W. Colbert (Judith Griffith '61) under the direction of Dr. W. S. Walker, prepared histological sections of one piece of the wood, and readily identified it as Tamarack, *Larix laricina*.

The peat horizon was examined directly by the writer early in June, 1960, when it became accessible above a caisson during excavation for one of the deep concrete piers mentioned pre-

viously. Here was seen the interface between the overlying blue-gray very tough unweathered loess and the top of the peat horizon. The thickness of the peat layer at this point was recorded in field notes as 140 cm., but the poor light down in the hole, and some mixing which must have occurred incident to boring of the hole, make this at best an approximation.

The final and best exposure of the Grinnell peat was made late in June, 1960. In the northeast corner of the excavation for the Roberts Theater the floor-level had to be lowered several feet to accomodate large blower equipment. Here the complete overlying profile was exposed on the north wall of the excavation; and the peat layer was further exposed near floor level, within the pit (Figure 4).

The profile presented strata as follows:

	<i>Thickness</i>
Dark gray very fine topsoil	3.0 ft.
Light brown to yellow-brown heavy silt	9.0 ft.
Peat; dark brown; very wet; varying in texture from very fine to coarse with many small pieces of wood. All wood compressed, with some mineralization. Gross anatomical detail well preserved	1.5 ft.
Dark gray gumbotil	?
From some depth below (i.e., up to approx. 20 ft.) colorful green sandy clays and coarse bright green quartz sands were retrieved (Aftonian?)	

The deep dark-gray topsoil seen here is apparently that of the Muscatine soil series described by P. E. Brown, *et al.* (1935). This is an upland soil, developed on eolian deposits under grass-land vegetation.

In the light of the more or less superficial observations here reported, it would seem appropriate to assign the Grinnell peat to the Buchanan interval as defined by Kay and Apfel (1944). They say, "As a time term Buchanan has come to be used for the interval between the Kansan and Iowan [i.e., the earliest Wisconsin] glacial stages, including the Yarmouth interglacial stage, the Illinoian glacial stage, and the Sangamon interglacial stage". Because there is no Illinoian drift overlying the peat, it cannot definitely be placed in Yarmouth time. The presence of what appears to be deep Kansan gumbotil beneath the peat indicates that it is not early Yarmouth, and may be as much as 300,000 years younger than early Yarmouth, since this is the estimated time required for the Kansan gumbotil development (Flint, loess may be Loveland and/or Peorian. The age span into which the peat must fall is indicated in data presented by Karlstrom (1956). He places the Illinoian glacial age between 130,000 and

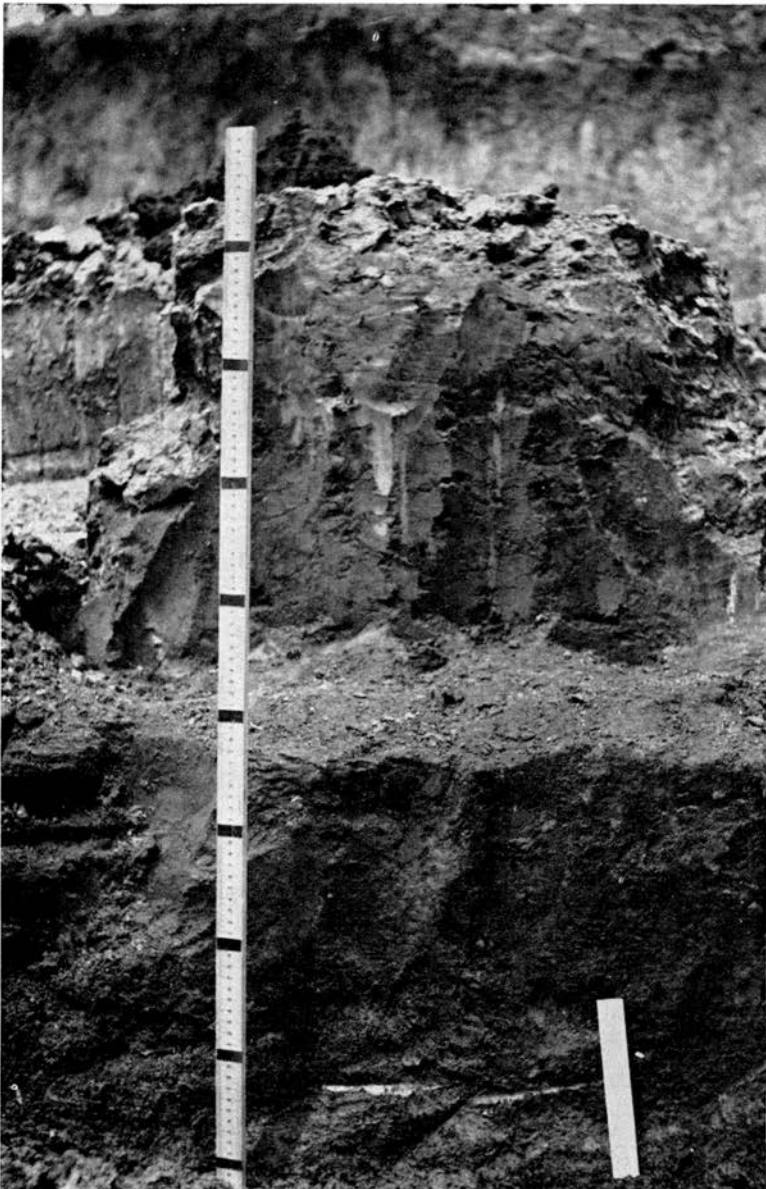


Figure 4. The interface between the peat horizon and the overlying unweathered loess. The light-colored area at the 50 cm. mark is not a stratum as it appears, but is a horizontal shelf marking the top of the peat. The lower limit of the peat lay approximately 10 cm. below the bottom of this photo.

85,000 B.C., a span within which probably falls the maximum possible age of the Grinnell peat; and the greatest southward Published by UNF ScholarWorks, 1962

20,000 B.C., probably delimiting the minimum possible age of the peat.

The earliest reference to Iowa peat of Yarmouth age known to the author is that of Baker (1920). He describes a northern coniferous flora revealed in peat from Davenport. Wilson and Kosanke (1940) made a palynological analysis of a pre-Kansan peat from near Belle Plaine, Iowa. They report, in a 6 in. layer, pollen of *Pinus strobus*, *P. resinosa*, *P. banksiana*, *Picea glauca*, *P. mariana*, *Abies canadensis*, and others. Pollen profiles from 5 Aftonian peats and one Sangamon peat in Iowa were published by Lane (1941). He, too, found conifer pollen predominant in all instances, with some indication in each, of periodic climatic amelioration reflected in increased oak and grass pollen.

Although samples are on hand, pollen analysis of the Grinnell peat has not yet been made. Several slides have been prepared and examined by the writer, however, and all carried abundant pollen. Slides, prepared subsequently by students in Plant Ecology, have shown spruce, fir, pine, alder, maple, numerous "betulaceous" grains, and others characteristic of northern coniferous forest, or transition thereto. More complete analysis is planned.

Grateful acknowledgement is made to Dr. C. N. Brown, of the Iowa Geological Survey, who came to the Grinnell exposure in June of 1960, and was a most helpful consultant. Thanks, too, to Mr. Joseph Neubauer, resident engineer for the Weitz Construction Company, who assisted the writer in gaining access to the peat exposure.

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