

PALEOECOLOGY OF AN ALKALINE PEATLAND IN ELKHART COUNTY, INDIANA

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Abstract: Investigation of a wetland in Section 26 of Washington Township, Elkhart County, Indiana, revealed a significant peat deposit. The interstitial waters of the peat were alkaline, high in pH, and slightly lotic. Analysis of the sub-fossils extracted from the peat yielded remains of *Picea mariana*, *P. glauca*, *Nuphar* sp., *Najas* sp., and *Drepanocladus* sp. Nine species of gastropod and two species of bivalve were also recovered: *Amnicola limosa*, *A. lustrica*, *Gyraulus parvus*, *Helisoma antrosa*, *Lymnaea palustris*, *L. stagnalis*, *Planorbis campanulatus*, *Valvata sincera*, *V. tricarinata*, *Pisidium* sp., and *Sphaerium* sp. Radiocarbon dating placed the oldest *Picea* sub-fossils at approximately 11,500 C-14 years BP. Peat stratigraphy suggests that the basin may have been a palustrine flood-plain associated with an historic stretch of the Little Elkhart River. Aerial photographs indicate that the surface of the peatland is patterned.

KEYWORDS: *Drepanocladus*, fen, macrofossil, Mollusca, paleoecology, peatland, and *Picea*.

INTRODUCTION

Studies of Indiana peatlands are few. Many of the existing ecological investigations relate to acid or circumneutral peatlands (e.g., Potzger, 1934; Hull, 1937; Wilcox, 1982; Wilcox, *et al.*, 1986; Wilcox and Simonin, 1988) as opposed to alkaline deposits. Although many pollen analyses (e.g., Potzger, 1942; Engelhardt, 1959; Bryant and Halloway, 1985) and a few stratigraphic studies (e.g., Wilcox, *et al.*, 1986; Wilcox and Simonin, 1988) exist, little or no reference is made to the organic sub-fossils embedded in Indiana's peat deposits. An alkaline peatland (fen) occurring in the northeast quarter of Section 26, Washington Township, Elkhart County, Indiana, is described in this paper. The peatland is recorded in the Indiana Natural Heritage Database as Bristol Fen. Substantial organic sub-fossils characterize the peat. These remains and their relationship to the development of the peatland are also discussed.

MATERIALS AND METHODS

Three 15-cm diameter columns of peat were excavated to a depth of 140 cm in Bristol Fen. Blocks of peat from each depth interval (15 cm) were rinsed on a screen (1 mm mesh) with water, and the remaining contents were placed into plastic bags for sorting. Rinsed samples were sorted by hand, and organic sub-fossils were preserved in formalyn. Voucher specimens of the macrofossils are held by the author.

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Two fossil *Picea mariana* cones from the 140 cm depth (earliest peat-forming stratum) were radiocarbon dated by Krueger Enterprises in Cambridge, Massachusetts. The samples were cleaned of dirt and other foreign material and then split into small pieces. Next, they were treated with hot, dilute HCl to remove any carbonates and with hot, dilute NaOH to remove humic acids and other organic contaminants. After washing and drying, the samples were combusted to recover carbon dioxide for the analysis.

RESULTS AND DISCUSSION

Cores from Bristol Fen reveal three distinct strata: a marl layer, a peat layer, and a humified layer. The oldest sediments, between 1.5 and 3 m below the surface, are composed almost entirely of marl and do not represent peat-forming conditions. Aquatic gastropod shells and organic plant remains, including alkaliphilic aquatic mosses, are present, but they are uncommon constituents of the marl.

Immediately superseding the marl is a dense, thin layer of *Drepanocladus* sp. This alkaliphilic moss marks the beginning of the peat layer, which extends upwards to within 50 cm of the surface. The material above the peat layer is humified. Both the marl layer and the peat layer react moderately with acid, suggesting an alkaline environment throughout the history of the peatland. Abundant preserved remains of mosses, conifers, aquatic plants, insects, crustaceans, and mollusks characterize only the peat layer.

The peat layer, which occurs between 50 and 150 cm from the surface of the wetland, contains the most diverse and well-preserved sub-fossils. *Picea mariana* (black spruce) and *P. glauca* (white spruce) are represented by twigs, leaves, seeds, and cones. These remains occur at the marl/peat interface and extend to within 75 cm of the surface. Radiocarbon dating of black spruce cones taken from a depth of 140 cm placed their age at $11,460 \pm 450$ C-14 years BP. The habitats of black and white spruce differ. Black spruce is common in poorly drained wetlands, whereas white spruce is more common on well-drained upland soils. The fossil presence of both species in Bristol Fen suggests that two distinct habitats occurred near the collection site. White spruce may have dominated the upland periphery of the wetland, while black spruce grew on peat deposits within the wetland basin. Charred remains of wood, present throughout the peat layer, suggest occasional disturbance of the ecosystem by fire.

In addition to spruce, other sub-fossils also occur. The most abundant is an achene of *Najas* sp., a submergent aquatic plant. This achene is found throughout the marl and peat layers. *Nuphar* sp., represented by tubers and seeds, is also common. Animals in the marl and peat layers are represented by the spicules of a freshwater sponge (*Heteromeyenia* sp.), coleopteran elytra, microcrustacean appendages, and the shells of aquatic mollusks. The mollusk fauna includes nine species of gastropod (*Amnicola limosa*, *A. lustrica*, *Gyraulus parvus*, *Helisoma antrosa*, *Lymnaea palustris*, *L. stagnalis*, *Planorbis campanulatus*, *Valvata sincera*, and *V. tricarinata*) and two species of bivalve (*Pisidium* sp. and *Sphaerium* sp.).

The species composition of Bristol Fen, along with the depth and nature of the sediments, suggests a palustrine system, which was relatively permanent (as opposed to ephemeral). Current contour maps, as well as aerial photographs taken in 1991, suggest that the wetland was once in close association with the

Little Elkhart River. The apparent presence of an old channel suggests that Bristol Fen may have developed on the flood-plain of an historic stretch of the river. A change in the course of the river probably isolated the wetland from the lotic system. Stagnation could have reduced oxygen levels sufficiently to bring about the peat-forming conditions represented by the preserved organic remains.

Today, the fen is dominated by sedges, a grass (*Panicum clandestinum*), and shrubs (*Cornus stolonifera* and *Physocarpus opulifolius*) as well as several typical peatland species. The Indiana Department of Natural Resources, Natural Heritage Database reports the occurrence of *Andromeda glaucophylla*, *Tofieldia glutinosa*, and *Menyanthes trifoliata*. The peatland is alkaline with an average pH of 8.0. The surface of the peatland slopes gently south, and run-off from morainal uplands induces the slow movement of water through the surface sediments. An inconspicuous pattern has developed on the surface of the peatland. Unlike the patterned peatlands of the North, where strings and flarks are formed perpendicular to surface flow, the many inconspicuous troughs and hummocks seen in airphotos of Bristol Fen are apparently parallel to the direction of water flow.

CONCLUSIONS

Analysis of the organic sub-fossils facilitates the reconstruction of post-glacial plant communities formed *in situ*. This information not only supplements pollen studies (which often reveal more information about terrestrial plant communities than the aquatic systems in which the pollen is found), but it also contributes to the understanding of paleoclimates, peatland formation, and ecological succession. Since Indiana's peatlands have been exposed from glaciation longer than many of the more well-known bogs of the North, a better understanding of peatland senescence may be obtained from studying Indiana's peatlands.

Hopefully, further macrofossil studies of Indiana's peatlands, including more detailed analyses of the unique deposit provided by Bristol Fen, will be undertaken in the future. Studies of the hydrology and stratigraphy of Bristol Fen, including more detailed chronological studies of the macrofossils and microfossils, would be interesting additions to our knowledge of Indiana's relatively few remaining peatlands.

ACKNOWLEDGMENTS

The author would like to thank Dr. Paul Colinveaux (Ohio State University) for advice concerning radiocarbon dating, Dr. C. Franklin Bishop (Goshen College) for identifying the *Nuphar* tubers and *Panicum clandestinum*, Dr. Larry R. Yoder (Merry Lea Environmental Center of Goshen College) for editing the grant proposal, and Dr. Jonathan N. Roth (Goshen College) for advising. The author wishes to extend special thanks to the Indiana Academy of Science Research Grants Program for funding the study.

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