55

POLLEN ANALYSIS OF PEAT SECTIONS FROM NEAR THE FINLEY SITE, WYOMING

1951

by

Henry P. Hansen

Oregon State College

From: Early man in the Eden Valley, Wyoming
Univ Museum, U of Penn
pp. 111-118-

POLLEN ANALYSIS OF PEAT SECTIONS

SEVERAL SECTIONS were taken from the large swamp formed in Washington Draw, located about one-quarter mile northwest of the Finley Archeological Site, near Eden, Wyoming. The postglacial climatic trends have been interpreted from the pollen profiles of two of the sections which provide a basis for estimating the time of occupation of the nearby Finley Site by Early Man. Five sections were taken across the swamp which vary from 1.3 to 3.0 m. in thickness. Typological succession of the sediments is similar in all sections except one taken near the eastern edge. This section has considerable sand and silt throughout washed from the adjacent slope. The other sections show the upper meter consisting of a high per cent of organic matter, which grades downward into pure sand at the bottom. In fact the lower meter consists of more than 50 per cent sand. No definite layers of interbedded sand were found that might be correlated with any of the three layers of sand revealed in sections through the dunes in the vicinity of the archeological site. The stratigraphic relationships of the three sands at the margin of the swamp indicate that the underlying swamp sand is contemporaneous with the lowest dune sand and directly overlies the Farson gravel laid down as outwash from the Late Wisconsin ice sheet. Drainage from the springs that feed and maintain the water level in the swamp was blocked by sand dunes a few hundred yards south and hydrarch succession was initiated with concurrent deposition and preservation of pollen from adjacent vegetation. The pollen profiles, then, represent perhaps 15,000 to 18,000 years, or the time since meltwater ceased flowing through Washington Draw.

Vegetation existed within range of pollen dispersal to the site of the sediments before sedimentation began, as is shown by the presence of pollen grains in the underlying sand in the sections. There is no reason to assume that vegetation did not exist during the Late Wisconsin glaciation or at least the latter part when the periglacial climate had become somewhat ameliorated. In fact, the pollen profiles denote that forests thrived nearer to the site of the sediments in early postglacial time than they have at any time since, as will be shown later.

Methods

Sections were taken from the swamp with a Hiller peat borer at decimeter intervals. Careful observation was made as each section was taken, to note any significant variation from normal typological succession of the sediments. Especial care was exercised to note any layers of sand that might be correlative with the three superimposed layers of the dune field to the east. As mentioned above, no break in the sedimentary column was noted that might suggest an interruption in the normal hydrarch succession and continuous deposition of the pollen-bearing sediments. In preparing the sediments for microscopic analysis, the large amount of sand was removed by decanting. In the lower meter of the sections, this left little organic material, because of the high per cent of sand. About 4 cc. of sediments were boiled in 200 cc. of a 2% solution of KOH, with a few drops of gentian violet stain, for about 10 minutes. The sediments were then thoroughly washed through a fine mesh strainer, centrifuged, and warm glycerin jelly added to the sediments in the tube. In the lower levels, pollen grains were not abundant, and less than 100 pollens were identified in some of the levels. In other horizons, from 100 to 200 pollen grains were identified. It is not known whether the dearth of pollen was due to poor preservation because of the alkaline sediments, or the sparsity of vegetation in adjacent areas. Sedge pollen was the only hydrophytic pollen recognized. Decrease in the number of sedge pollen during the upper quarter of the sections is contemporaneous with increase of drouth-enduring plants pollen, suggesting lowering of the water table in the swamp itself during a dry period.

Vegetation in Adjacent Areas

Only a general observation was made of the vegetation in areas adjacent to the swamp. As the field work was done early in September, very little herbaceous vegetation was in evidence except on the swamp. In general, most of the area about the swamp and as far as the eye could see, was covered largely by species of sagebrush (*Artemisia* spp.), rabbitbrush (*Chrysothamnus* spp.), other species of

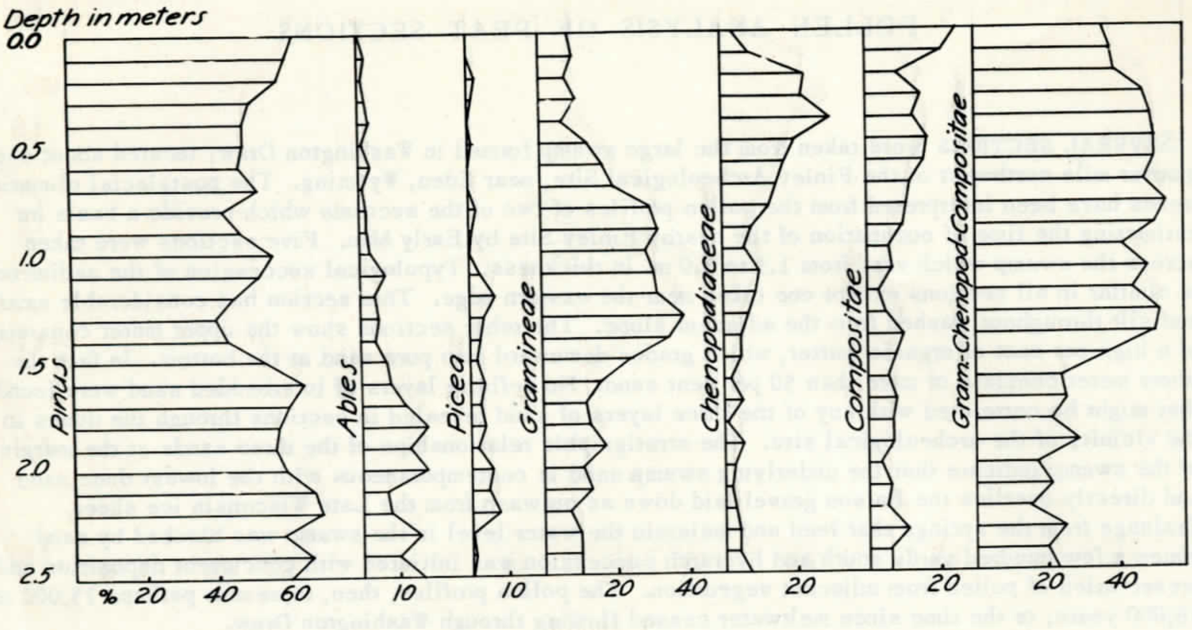

Figure 1

Pollen profiles from swamp near Finley Site. The grass maximum is estimated at about 10,000 years.

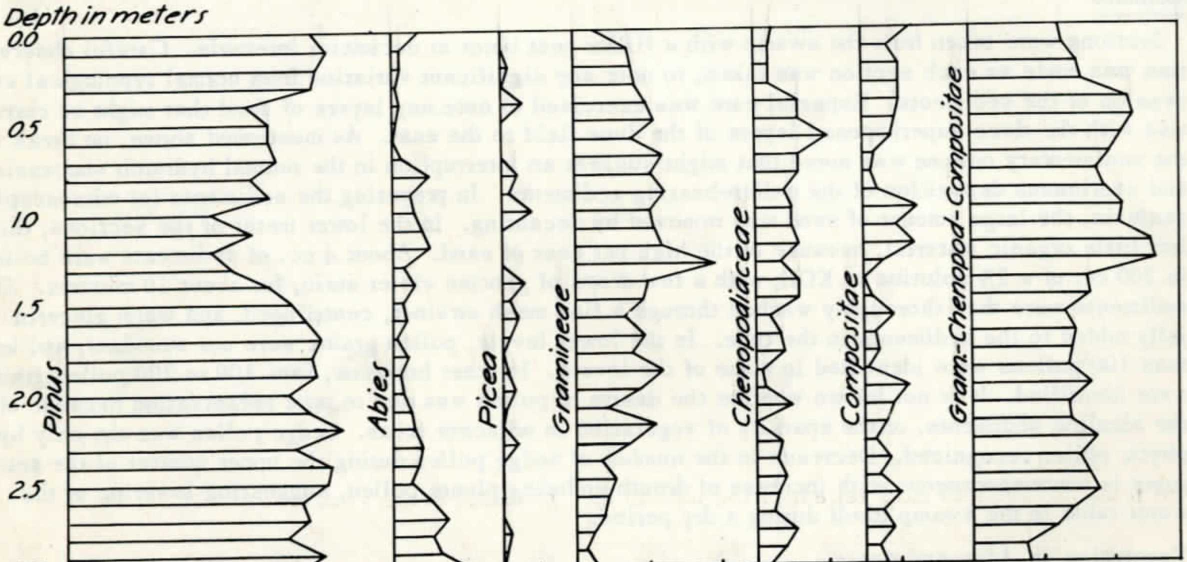

Figure 2

Pollen profiles of second section taken from swamp near Finley Site. The grass maximum is estimated at about 10,000 years.

composites, and species of grasses and chenopods. In alkaline areas, greasewood (*Sarcobatus, vermiculatus*) is common, as well as other halophytic species of grasses, composites, and chenopods. These families contain many anemophilous species and include the principal pollen contributors to the sediments with the exception of pine. On the swamp surface grow several species of sedges, grasses, rushes, and composites, water buttercups, water plantain, knotweed, pondweed, and yet other plants. Cattle, horses, and antelope have grazed and trodden most of the plants to the substratum. The animals have also churned up the top sediments as indicated by the countless hoof prints in the wetter spots, six inches or more deep. This churning of the upper levels had undoubtedly caused some distortion of the pollen profiles. To what extent the mixing of the upper strata has been going on for centuries by bison, deer, and antelope would be hard to say, but undoubtedly this swamp, thirty or forty acres in extent, was a favorable spot for grazing, especially in the summer when much of the forage had dried up and become unpalatable.

The influence of coniferous forests is well shown in the pollen profiles by the high proportions of conifer pollens in the sections (Figs. 1, 2). Although these forests are many miles away at present, and probably have never been much closer during postglacial time, their pollen constitutes more than 50 per cent of the total throughout most of the sections. This over-representation of conifer pollen is caused by the efficiency of pollen dissemination and the enormous amount of pollen produced, especially by pine, fir, and spruce.

According to distribution maps by Munns (1938) and Harlow and Harrar (1941), the following coniferous species are probably within range of pollen dispersal to the swamp: lodgepole pine (*Pinus contorta*), limber pine (*P. flexilis*), whitebark pine (*P. albicaulis*), yellow pine (*P. ponderosa*), Engelmann spruce (*Picea engelmanni*), blue spruce (*P. pungens*), Douglas fir (*Pseudotsuga taxifolia*), subalpine fir (*Abies lasiocarpa*), and white fir (*A. concolor*). The most abundant and widespread of these species would seem to be lodgepole pine, limber pine, Engelmann spruce, Douglas fir, and subalpine fir, all of which occur within 50 miles of the swamp, largely in the Wind River range to the north. They also occur in small local areas in mountains to the west and south. With the exception of Douglas fir, these species are also best represented in the sedimentary columns. Two species of pine pollen were identified. One is considered to be lodgepole and is more abundant. The other species of pine pollen probably include limber pine and/or whitebark pine. Fir pollen is not well preserved, but most of it was identified as subalpine fir. No attempt was made to separate spruce pollen, and it may represent both Engelmann and blue spruce. As the prevailing winds in this region are from the west, location of the forests as discussed above is favorable for their maximum representation. The high proportions of conifer pollen in relation to the distance at which the forests lie, illustrate well that conifers are highly over-represented in postglacial sediments located in non-forested areas of the west.

Postglacial Vegetation

Although pine is predominantly represented throughout both sections, it probably has never existed immediately adjacent to the site of the sediments during postglacial times. The present location of pine forests in relation to their representation at the top suggests that they have been strongly over-represented throughout. The pine complex, which is undoubtedly dominated by lodgepole, is recorded at the top within 10 per cent of its maximum in both profiles. In section I, pine is recorded to a maximum of 76 per cent near the bottom and 68 per cent at the surface, while in section II it attains a peak of 69 per cent and is recorded to 62 per cent at the uppermost horizon (Figs. 1, 2). In view of the fact that present-day forests do not occur within 30 miles of the swamp, it is hardly conceivable that they have existed much nearer during postglacial time unless prevailing winds were different than today. In both profiles, pine declines to a minimum of 40 per cent, which may portray retreat of the forests up the mountain slopes and to greater distance as postglacial climate became warmer, or it may constitute a relative decline resulting from an increase in grass adjacent to the swamp. The latter explanation seems the more feasible, because mere retreat of the forests up a mountain slope would not materially increase the distance for pollen to be disseminated. Undoubtedly the climate became ameliorated as postglacial time progressed, but it seems probable that increasing warmth with some increase in moisture favored grass expansion as will be shown later. A cooler period early in the record of sedimentation is indicated by an abundance of fir pollen in the lower meter with maxima of 22 and 17 per cent (Figs. 1, 2). A decline of fir upward in the profiles probably expresses warming, although a return to cooler climate is not denoted by fir expansion in more recent time. Spruce pollen was identified in most of the horizons, but its low representation provides little evidence of a trend. In both sections, spruce is recorded to a maximum of 8 per cent, but only in section II does higher representation near the bottom reflect early postglacial coolness.

When the pollen proportions of grasses, chenopods, and composites are considered collectively in a single profile, they reveal a sustained maximum in the upper half of both sections (Figs. 1, 2). Although the period represented by this maximum might be interpreted as depicting the postglacial xerothermic interval, consideration of individual pollen profiles of each of the three families suggests that it is more complicated than it would seem at first sight. The lower part of the maximum is effected by a sharp increase in grass to its maximum of 39 per cent in both sections (Figs. 1, 2). From this maximum, grass declines upward to the top, but holds to higher proportions in section II, although the maximum of each profile occurs at approximately the same relative stratigraphic position. The recorded expansion of grass denotes amelioration of climatic conditions, particularly temperature. As the influence of glaciation became more remote, temperatures rose, but a favorable water balance was maintained which permitted grass to increase. If temperatures rose, evaporation increased; so increase in precipitation must have also taken place. This view is supported by the fact that grass is recorded to only 6 and 8 per cent at the top with a mean annual precipitation at Eden, a few miles to the west, of only about 7 inches. Although the prehistoric grasslands in this region probably consisted largely of short and midgrasses, the same as today, they must have been of much greater density. There is always the alternative explanation, however, that grass increase is merely relative because of decimation of forests by fire and/or disease. The decline of pine in the middle third of both sections is largely correlative with the recorded expansion of grass.

With a decline of grass came an expansion of composites and chenopods which is better shown in section II (Figs. 1, 2). Composites expanded first, attaining maxima of 15 and 17 per cent, although section II reveals a maximum of 25 per cent at the top for composites. Chenopods attain maxima of 20 and 30 per cent and then decline to the top. The expansion of chenopods and composites, apparently at the expense of grass, reflects desiccation of the climate and/or continued warming. It is possible that with decreasing precipitation, decimation of grass was accelerated by bison grazing and burning by Early Man, as well as edaphic instability brought about by shifting sand. Grazing and burning were probably especially prevalent in the vicinity of the swamp, which certainly must have been an area of concentration for both man and beast. The combined profiles of grasses, chenopods, and composites show a decline in the upper levels correlative with an increase in pine. This may reflect a cooler climate in more recent time, but not an increase in moisture, as grass declines from its maximum upward to the top (Figs. 1, 2).

Climate and Chronology

Pollen profiles from 70 sedimentary columns throughout the Pacific Northwest reveal consistent and systematic evidence for a warm, dry climatic maximum during the Postglacial (Hansen, 1947). Evidence for this xerothermic stage is also revealed in peat sections from Glacier Park in northwestern Montana and in south central Alberta (Hansen, 1948, 1949) indicating that a climatic maximum was felt as far east as the Rocky Mountain region. The pollen profiles from eastern Washington and Oregon especially bear out evidence for the warm, dry interval, where it is also manifested by expansion of grasses, chenopods, and composites. As in the pollen profiles of this study, those of eastern Washington and Oregon show expansion of grass before chenopods and composites, which is chronologically correlated in the several sections by a layer of volcanic ash of common source. The warm, dry interval in the Pacific Northwest is dated between 8,000 and 4,000 years ago, which is supported by evidence from several other sources (Allison, 1945; Antevs, 1945, 1948). The grass maximum is set early in the xerothermic interval, and it is possible that it represents a period of maximum favorability of water balance for grasses before a decline in precipitation, the same as has been interpreted in this study. In eastern Washington and Oregon, the influence of a marine climate may have provided moister conditions longer than in the more continental climate of Wyoming. The grass maximum in Bridger Basin, then, may have occurred between 10,000 and 8,000 years ago. The grass maximum may well have been contemporaneous with the Temple Lake late-glacial substage in the Wind River range (Moss, p. 56). Apparently the increased precipitation which nourished the Temple Lake glacier was general over the Bridger Basin and favored grass expansion. Although temperature continued to rise or remained stable during the grass predominance, there was sufficient snowfall in the mountains to survive summer melting and thus nourish the glacial substage. Since then, decreased precipitation and an unfavorable water balance brought about by continued warming, as well as other conditions, caused grass to be partially replaced by chenopods and composites.

In applying the interpretations of the pollen profiles to the occupation of the Finley Site by Early

Man, the grass maximum seems to be the most significant. Unless the soil profiles overlying and underlying the Middle Sand are only local expressions of small moist depressions, they may represent a sod produced during the grass maximum. In fact, the abundance of grass in this area may have been responsible for a concentration of both bison and Early Man. The availability of water at the nearby Washington Springs was further conducement for this community. If the grass maximum occurred between 10,000 and 8,000 years ago, then the Finley Site was occupied by Early Man during or perhaps soon after the grass maximum.

There is strong evidence that Early Man was in the northern Great Basin of south central Oregon before the eruption of Mount Mazama, which formed Crater Lake (Cressman, 1942). Pollen analysis, lake sediment stratigraphy, and lake level fluctuations indicate that this eruption occurred about 10,000 years ago (Hansen, 1947). If Early Man crossed the Bering Straits, migrated southward early in postglacial time through the ice-free corridor in Alberta and then followed up the Missouri River drainage over the continental divide, there is no reason to assume he did not reach the Bridger Basin of Wyoming as soon as the northern Great Basin.

BIBLIOGRAPHY

Allison, I. S. (1945) *Pumice Beds at Summer Lake, Oregon,* Geol. Soc. Amer., Bull. 56, pp. 789–808.

Antevs, E. (1945) *Correlation of Wisconsin Glacial Maxima,* Amer. Jour. Sci. 2430A, pp. 1–39.

Antevs, E. (1948) *The Great Basin, with Emphasis on Glacial and Postglacial Times, III. Climatic Changes and Pre-White Man,* Univ. Utah Bull. 38, pp. 168–191.

Cressman, L. S. (1942) *Archaeological Researches in the Northern Great Basin,* Carnegie Inst. Wash. Publ., no. 158, pp. 1–155.

Hansen, H. P. (1947) *Postglacial Forest Succession, Climate and Chronology in the Pacific Northwest,* Amer. Philos. Soc. 37, pp. 1–130.

Hansen, H. P. (1948) *Postglacial Forests of the Glacier National Park Region,* Ecology 29, pp. 146–153.

Hansen, H. P. (1949) *Postglacial Forests in South Central Alberta, Canada,* Amer. Jour. Bot. 36, pp. 54–65.

Harlow, W. M. and Harrar, E. S. (1941) *Textbook of Dendrology,* New York.

Moss, J. H. (1949) *Glaciation in the Southern Wind River Mountains and Its Relation to Early Man in the Eden Valley, Wyoming,* Doctoral Dissertation, Harvard University.

Munns, E. N. (1938) *The Distribution of Important Forest Trees of the United States,* U. S. Dept. Agric. Misc. Bull. 287, pp. 1–176.