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THE INFLUENCE OF VOLCANIC ERUPTIONS UPON POST-PLEISTOCENE FOREST SUCCESSION IN CENTRAL OREGON

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THE INFLUENCE OF VOLCANIC ERUPTIONS UPON POST-PLEISTOCENE FOREST SUCCESSION IN CENTRAL OREGON [1]

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THE DISTRIBUTION and abundance of peat bogs in North America is largely determined by the boundaries of Pleistocene glaciation. The occurrence of innumerable lakes within the glaciated region is responsible for their great number, and sufficient precipitation over much of this region permits the maintenance of a constant lake level or water table in the bog. Apparently most of the environmental conditions have been at an optimum for hydrarch plant succession culminating in the formation of peat deposits. Climate is perhaps one of the chief ecologic factors concerned with the development and continued accumulation of peat and other types of pollen-bearing sediments. The proximity of the Pacific Ocean and the presence of the Coast Range, Olympic Mountains, and the Cascade Range, permit the existence of a great diversity of climates, and hence, many plant formations in the Pacific Northwest. All of Oregon, and most of Washington and Idaho lie south of the boundaries of Pleistocene continental glaciation, and, consequently, peat deposits and other types of sediments suitable for pollen analysis are not common over much of this vast region. Where the climate is not too dry, the absence of ponded water has inhibited the initiation of hydrarch plant succession and subsequent accumulation of peat. The greatest number of peat deposits is in the Puget Lowland of western Washington, which was glaciated and where the climate is favorable for maximum bog development. Peat deposition has also occurred in montane glacial lakes and along the Oregon Coast, where the erosion cycle of a submerged shoreline has resulted in the formation of many lakes (Hansen, 1941c). In the latter region, sand dune lakes also support various stages of hydrarch plant succession, but they are usually recent or of uncertain age. East of the Cascade Range in Oregon and Washington the few existent lakes are usually too alkaline to permit hydrarch succession, or fluctuating water levels do not encourage peat deposition. In other areas the mature topography with its efficient drainage prevents the existence of standing water and subsequent hydrarch plant succession. Tule swamps are rare, and those examined overlie shallow strata of black muck, unsuitable for pollen analysis.

LOCATION AND CHARACTERISTICS OF THE BOG.—The peat deposit of this study is located about 13 miles west of Bend, Oregon, in section 16 of T. 18 S., R. 10 E. on the Three Sisters quadrangle. The elevation of the bog is about 5,240 feet above sea level. The peat and other pollen-bearing sediments have accumulated in Tumalo Lake, a small lake that was apparently ponded by the terminal moraine of a valley glacier in a tributary of Tumalo Creek. The latter empties into the Deschutes River a few miles north of Bend. The Pleistocene mountain glaciers in this region evidently reached lower elevations, but post-Pleistocene volcanic activity has largely obliterated the surface effects of glaciation. In recent years the lake level has been raised by an artificial dam on the moraine at the lower end of the lake. In the autumn of 1940, the lake was drained to remove peat for commercial purposes, and a complete profile was obtained where the surface had not been disturbed. The hydrarch plant succession had reached a sedge-meadow stage with an abundance of Hypnum moss before the lake level was raised artificially. This stage of plant succession is similar to that of a montane bog on the east slope of the Cascades in central Washington, where the climate is also the same (Hansen, 1939c). The area of the peat deposit is about 300 feet wide and 600 feet long. The adjacent valley slopes rise directly from the edge of the bog. Peat samples were obtained with a Swedish-type peat borer. The depth of the sediments in the area of sampling is 7 meters, and test borings made across the bog show that the bottom is flat most of its width. This suggests that the lake was ponded in a U-shaped valley of glacial origin.

Two layers of pumice are present in the peat profile, one at 4.5 and the other at 2.0 meters. The occurrence of the pumice strata is significant, because the change in the edaphic conditions due to the deposition of the pumice in this region evidently had a marked influence upon the forest succession as suggested by the pollen profiles. There are several possible sources of the pumice, there having been considerable volcanic activity in Cascade Range of Oregon during post-Pleistocene time. It is probable that the pumice had its origin from one of the following: Mount Mazama, about 80 miles to the south; Newberry Crater, about 25 miles to the southeast; and Devils Hill,[2] about 11 miles to the west of the peat deposit (Williams, 1935, 1941). The eruption of Mount Mazama, forming the caldera holding Crater Lake, occurred during the post-Pleistocene between 5,000 and 10,000 years ago (Williams, 1941). The pumice mantle from this eruption extends with diminishing thickness to the east and for a distance of about 100 miles to the north. The site of the sediments of this study is located within a zone where the pumice is from 1 foot to 6 inches thick. It seems probable that at least one of the pumice strata had its origin from Mount Mazama. Two peat deposits farther south in the vicinity of Crater Lake, that lie definitely upon Crater Lake pumice, are 2 meters deep as determined by the writer. Assuming that the rate of deposition has been about the same in both

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[2] Personal communication from Dr. Howell Williams, University of California.

TABLE 1. *Percentages of fossil pollen.*

Depth in meters:	6.75	6.5	6.25	6.0	5.75	5.5	5.25	5.0	4.75	4.5[a]	4.25	4.0	3.75	3.5	3.25	3.0	2.75	2.5	2.25	2.0[a]	1.75	1.5	1.25	1.0	0.75	0.50	0.25	0.0
Pinus contorta	30	33	30	47	42	49	32	20	20	19	60	58	53	42	38	36	35	40	38	37	44	48	51	58	60	50	48	50
P. monticola	14	11	20	17	14	24	21	20	26	24	21	18	18	24	21	24	16	20	18	22	20	20	16	16	14	15	15	16
P. ponderosa	14	18	24	16	21	22	40	42	43	44	12	16	20	28	30	26	30	28	32	31	26	21	19	18	20	22	24	21
P. lambertiana	4	1	10	..	1	..	..	4	2	1	1	1	..	..	..	6	4	1	2	..	..	..	..	..	..	..	..	..
Pseudotsuga taxifolia	..	2	1	1	1	..	..	8	..	1	1	1	..	1	2	1	1	1	1	..	..	..	1	..	1	1	1	1
Tsuga heterophylla	..	..	..	1	..	..	1	..	1	1	..	..	..	..	1	1	3	2	1	1	..	1	1	1	..	1	3	1
T. mertensiana	..	5	3	2	3	3	2	1	2	2	1	4	4	2	2	2	6	4	3	3	4	3	3	4	3	6	4	6
Picea engelmanni	2	..	..	2	2	1	1	1	2	1	1	..	1	..	2	2	1	..	1	3	3	2	3	1	1	1	1	2
Larix occidentalis	33	28	10	12	2	..	..	1	..	4	..	1	..	..	..	1	1	..	..	1	..	..	1	..	..	..	..	..
Abies grandis	1	..	..	..	..	..	1	..	2	1	1	1	2	1	1	..	1	2	2	..	1	1	3	1	..	2	..	1
A. concolor	1	2	1	1	4	1	1	2	2	..	1	..	2	2	3	1	1	2	1	2	2	4	2	1	1	1	3	2
A. lasiocarpa	1	..	1	1	..	..	1	1	..	2	1	..	..	..	..	..	1	..	1	..	..	..	..	..	..	1	1	..
Pinus spp.[b]	17	22	17	14	19	26	25	25	12	11	9	15	12	21	15	17	15	18	13	12	10	18	16	18	19	17	15	12
Abies spp.[b]	1	3	2	1	1	1	3	5	1	3	1	1	2	1	1	1	3	4	5	1	1	1	1	1	2	4	3	2
Gramineae[c]	..	2	1	..	1	..	..	..	..	2	..	..	..	..	..	2	..	1	..	..	..	..	..	..	..	..	..	..
Compositae[c]	1	1	..	..	1	1	..	..	..	..	..	..	..	1	..	..	..	..	..	..	1	1	1	..	..	..	..	1
Chenopodiaceae[c]	..	1	..	1	1	..	..	2	..	..	..	1	..	1	..	..	2	..	..	..	..	..	..	1	..	..	..	..
Alnus[c]	4	4	2	2	..	..	1	..	3	1	2	..	2	2	1	4	..	1	1	1	2	2	..	..	..	..	..	..
Betula[c]	3	2	..	1	..	..	1	1	..	2	2	..	..	..	..	1	2	..	1	2	1	1	..	..	2	..	..	..
Acer[c]	6	5	1	2	2	..	2	1	2	2	1	1	1	2	..	..	..	1	..	..	1	..	..	1	1	..	..	1
Salix[c]	..	1	..	..	..	2	..	1	..	..	2	..	..	..	..	1	..	..	1	..	..	..	..	..	..	2	..	1
Ericaceae[c]	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	3	2	..	..
Cyperaceae[c]	1	5	2	8	2	3	6	7	3	7	3	2	3	3	3	4	7	7	6	11	3	7	13	20	2	6	7	9
Nymphozanthus[c]	..	..	2	..	..	..	1	..	1	..	..	1	..	..	..	2	1	1	..	..	..	..	..	..	..	..	..	..

[a] Levels at which pumice occurs

[b] Number of *Abies* and *Pinus* pollen grains discarded, not computed in the percentages.

[c] Number of pollen grains, not computed in the percentages.

areas, it suggests that the pumice at 2 meters came from the Mount Mazama eruption. If 6,000 years have elapsed since its eruption, the rate of peat deposition has been consistent with that of other postglacial bogs in the Pacific Northwest (Hansen, 1942a). Thus, the lower pumice stratum must have come from a much earlier eruption of Mount Mazama or some other volcano. The separation of the two layers by 2.5 meters of fine peat indicates that the first eruption may have occurred about 12,000 years ago. Post-Pleistocene peat profiles in the lower Willamette Valley of western Oregon contain a single layer of pumice, less than 2 meters from the present surface of the sediments (Hansen, 1942b). It is possible that this layer owes its origin to the same volcanic eruption as the upper stratum in the peat profile of this study.

In the preparation of the peat for microscopic study, the potassium hydrate method was used. From 150 to 200 pollen grains of significant species were identified from each level, except the lowest at 7 meters, where no pollen was present. The size-range method, which has been described in several recent papers, was used in separating the species of *Pinus* and *Abies* (Hansen, 1941a, 1941b, 1941c). In this study it should be noted that pollen listed as that of *Pinus monticola* probably includes some of *P. albicaulis* which is present near timberline. Also pollen listed as that of *P. ponderosa* may include small proportions of *P. albicaulis* and *P. lambertiana* due to a slight overlap of their size-ranges. In the firs, pollen identified as *Abies nobilis* may include some of *A. concolor,* although the small proportions of fir pollen present make this source of error negligible. The size-range method in the identification of fossil winged conifer pollen is shown to be feasible by the consistency of pollen profiles in certain peat profiles. In four peat profiles from Lower Klamath Lake of Oregon and California, the pollen profiles of each species of pine are similar in their major and significant trends (Hansen, 1942a). The separation of western yellow and western white pine is important because of the climatic indicator value of these species. The identification of lodgepole pine pollen is also essential, not for the interpretation of climatic trends, but rather for the recorded interruption of forest succession due to changes in edaphic conditions or other non-climatic environmental factors. It is particularly significant in this study. Pollen is abundant at most levels, with more than 1,000 pollen grains present on a single slide at many horizons. This is perhaps due to the fine type of sediments, which require a long period of time for their deposition, resulting in a concentration of pollen of many seasons in a small unit of thickness. The enormous quantity of pollen shed by the various species of pine is also a factor in the abundance of pollen present. Those species recorded by less than 1.5 per cent are listed in the table as 1 per cent.

FORESTS IN ADJACENT AREAS.—The terrain of the region surrounding the bog is extremely rugged with considerable relief. The divide of the Cascade Range is about 15 miles to the west. The South Sister, reaching an elevation of 10,354 feet, rises about 13 miles to the northwest and supports large glaciers. Broken Top peak, about 10 miles to the northwest, also has glaciers, and there are many peaks within several miles that attain a height of over 6,000 feet. The elevation decreases to the east, with the less rugged regions lying at an altitude from 3,000 to 4,000 feet. This great relief permits the existence of several life zones within a few miles of the site of the sediments. The bog lies within the timbered Arid Transition area (Bailey, 1936). The rapid increase in elevation to the west causes this to grade into the Canadian which in turn grades into the Hudsonian zone at still higher altitudes. The Arctic-alpine zone occupies considerable areas on the upper slopes of the Three Sisters. At lower elevations to the east the timbered Arid Transition gives way to the timberless part of the same area, which in turn grades into the Upper Sonoran zone still farther to the east. Much of the timbered Transition is forested with western yellow pine (*Pinus ponderosa*), which forms a zone of varying width along the eastern flank of the Cascade Range in Oregon and Washington. This zone, however, is broken and discontinuous for a distance of about 100 miles from Crater Lake to Bend. Vast forests of lodgepole pine (*Pinus contorta*) occupy the pumice-covered areas that extend north and east of Crater Lake. Forest type maps (1936) show an almost uninterrupted belt of yellow pine east of the lodgepole pine forests where the pumice mantle is not so thick as farther to the west. North of Bend, the lodgepole pine zone tapers to nothing, and is practically absent for the last 100 miles to the Columbia River. This suggests that the prevalence of lodgepole pine in this region is due to the pumice mantle, and that the other ecological conditions are such as normally to support a forest of yellow pine over most or all of the timbered Arid Transition.

At some points the lower limits of the yellow pine zone grade into sparse forests of western juniper (*Juniperus occidentalis*), which occupy a considerable area in central Oregon. In other places the yellow pine forest gives way directly to the bunchgrass prairie. Near the upper boundaries of the yellow pine zone, sugar pine (*P. lambertiana*), Douglas fir (*Pseudotsuga taxifolia*), lowland white fir (*Abies grandis*), white fir (*A. concolor*), western red cedar (*Thuja plicata*), incense cedar (*Libocedrus decurrens*), and western larch (*Larix occidentalis*) may be found on favorable sites. Sudworth (1908) gives the southern limits of the range of western larch as the headwaters of Squaw Creek, 10 miles to the northeast of Tumalo Lake. A few specimens, however, were noted in the vicinity of the lake.

The most common species of conifers in the Canadian zone immediately above the Transition are western white pine (*P. monticola*), western hemlock (*Tsuga heterophylla*), Engelmann spruce (*Picea engelmanni*), noble fir (*Abies nobilis*), silver fir (*A. amabilis*), Douglas fir, lowland white fir, and lodgepole pine. In this zone lodgepole pine also occupies the pumice-covered areas, or areas where fire has been to its advantage. Next to lodgepole, western white pine is perhaps the most abundant species in this zone. The Hudsonian zone is more sparsely forested than the Canadian, and the principal species are mountain hemlock (*Tsuga mertensiana*), white bark pine (*P. albicaulis*), alpine fir (*A. lasiocarpa*), and Alaska cedar (*Chamaecyparis nootkatensis*). The boundaries of these zones are irregular, the forests of each extending upward or downward beyond the general limits where conditions are favorable.

The peat deposit is located within a climatic province designated by Thornthwaite (1931), as being subhumid and microthermal, with adequate precipitation at all seasons. The climatic zones are narrow in this region, because of the steep slope of the Cascades. The precipitation increases at higher elevations to the west and decreases at lower altitudes to the east. The mean annual precipitation at Bend, 13 miles to the east and at an elevation of 3,629 feet, is 13.21 inches, and at Sisters, about 20 miles to the north at an elevation of 3,175 feet, it is 16.65 inches (Climatic Summary, U. S. D. A.). At Bend, about 27 per cent occurs during May to September inclusive, and at Sisters, about 21 per cent falls during the same period.

POST-PLEISTOCENE FOREST SUCCESSION. — The depth of the sediments suggests that they represent the greater part of postglacial time. The fineness of the sediments and the type of vegetation contributing to their deposition indicate that the rate of sedimentation was slow. The average depth of six post-Pleistocene peat deposits studied in eastern Washington and Oregon is 6 meters, which is slightly less than the 7-meter depth of the bog of this study. As previously stated, the eruption of Mount Mazama occurred not less than 5,000 nor more than 10,000 years ago. If the upper layer of pumice at 2 meters owes its origin to this eruption, then the age of the peat profile is perhaps 15,000 years. If the lower stratum at 4.5 meters represents this eruption, then the sediments had their origin somewhat later. The total depth of the sediments, however, suggests the former figure.

The forests recorded in the lowest pollen-bearing level at 6.75 meters consisted chiefly of western larch, lodgepole pine, western white pine, and western yellow pine. The first was apparently the most abundant, and contributed 33 per cent of the pollen (fig. 1). Lodgepole, western white, and western yellow pine are represented by 30, 14, and 14 per cent, respectively. It is probable that larch was predominant by a greater margin than is denoted by the pollen proportions, because this species does not shed nearly so much pollen as the pines, especially lodgepole. Larch pollen percentages decline rather abruptly from the lowest level upward, to show only 2 per cent at 5.75 meters. It is then recorded sporadically in low proportions to the surface. Larch is not recorded by its pollen to any great extent in Pacific Northwest bogs, even though they are located within forests including appreciable proportions of this species (Hansen, 1939a, 1939c, 1940b, 1941e). The highest proportion present is 25 per cent in a bog near Spokane, Washington (Hansen, 1939b). In Wisconsin bogs, tamarack (*Larix laricina*) is only sparsely represented, even though it is the chief tree on bogs in their climax stage (Hansen, 1937, 1939d). Apparently the pollen of species of this genus is not well preserved in peat. The predominance of larch in the lower horizon is significant in that the bog lies near the southernmost limits of its geographic range in Oregon. The sporadic occurrence of its pollen in the upper part of the profile indicates that it was never abundant after its initial predominance. The proportions of larch pollen in the lower four levels suggests the occurrence of repeated fires prior to initial sedimentation. Larch has thick bark and is able to withstand successive severe fires that may destroy first the parent trees of other species, and then their seedlings. The lack of competition for light then permits it to flourish until other species are able to regain a foothold. If undisturbed by fire, these will eventually replace the larch (Sudworth, 1908; Larsen, 1929). Lodgepole pine may also increase in abundance after fire, but this is due to release of seed from the cones as a result of heat, rather than survival of the parent trees. Subsequent fire before seed-bearing age may completely eradicate this species.

The several species of pine show a general increase to 5.5 meters, with lodgepole pine becoming predominant (fig. 1). Yellow pine is then recorded as increasing abruptly to 44 per cent at 4.5 meters, white pine remains constant, and lodgepole pine decreases to 19 per cent. Most of this region is normally forested with a yellow pine climax, and it seems probable that the initial increase in this species depicts a warming and drying of the climate as the effects of recent glaciation were modified. Modification of the conditions left by the hypothetical fires may also have been a factor in its increase. Lodgepole pine shows a sharp increase from 19 per cent at 4.5 meters, whereas yellow pine declines to only 12 per cent at this level. White pine remains more or less constant. It is extremely significant that a stratum of pumice is present at 4.5 meters, indicating that a volcanic eruption occurred at this time, depositing a pumice mantle over this region. This apparently resulted in an increase in lodgepole pine due to the change in the edaphic conditions or possibly because of further fire. The depth of the pumice was probably not sufficient to kill the existing yellow pine forests outright. The changes in the edaphic conditions, however, may have been unfavorable for yellow pine seedlings, and lodgepole was thus able to thrive because of the absence of competition. The general constant trend in the pollen proportions of white and white bark pine during this interval suggests that they were unaffected by the pumice because of their existence at higher elevations to the west, where the pumice mantle is thinner or absent. Lodgepole pine is recorded as generally declining from 4.25 to 2 meters, yellow pine shows a slight increase, and white and white bark pine continue their static trend. The increase in yellow pine suggests a partial return of this species as the pumiceous soil perhaps was gradually modified by climatic and biotic factors. Lodgepole is again indicated as increasing, less gradually than at first, upward from the 2-meter horizon. The occurrence of a second layer of pumice at this level records another volcanic eruption and deposition of volcanic material, with accompanying changes in edaphic conditions favorable for lodgepole pine. Although it seems probable that the source of this pumice was the eruption of Mount Mazama, an increase in erosion may have washed the pumice into the lake from adjacent slopes. Erosion greater than normal may have resulted from deforestation by fire, which in itself would cause edaphic and biotic changes favorable for an increase in lodgepole pine. Lodgepole shows an increase upward to .75 meter, and then it declines slightly to the surface. Yellow pine is recorded as slightly declining from 2 meters for several levels upward, and then it remains constant to the surface. White pine also maintains its static trend to the top. The surface sediments record 50, 21, and 16 per cent for lodgepole, yellow, and white pine, respectively (fig. 1). It seems probable that lodgepole is over-represented because of its extensive existence windward to the site of the sediments. Conversely, yellow pine is under-represented because of its existence largely leeward to the bog.

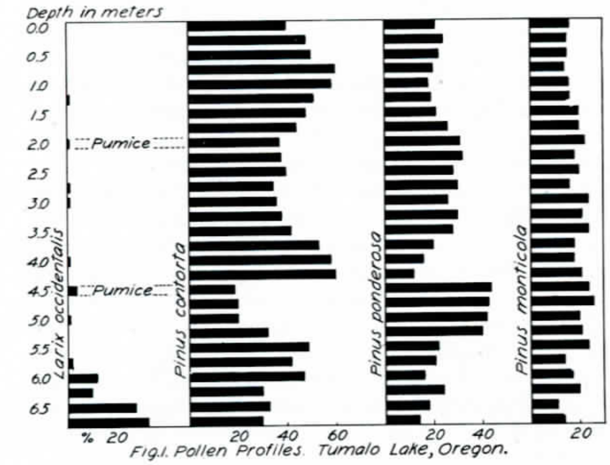

Fig.1. Pollen Profiles. Tumalo Lake, Oregon.

Other coniferous species recorded by their pollen, either consistently or sporadically throughout the peat profile, are sugar pine, western and mountain hemlock, Douglas fir, Engelmann spruce, and lowland white, alpine, and noble fir. Mountain hemlock and noble fir are most abundantly and consistently represented. Sugar pine pollen is present in the lower levels, but is entirely absent in the upper 2 meters. Grass, Composite, and Chenopod pollen occurs sporadically in the profile, but these species were never extensive near the site of the sediments. Broadleaf trees including alder, birch, maple, and willow are sparsely represented. Sedge pollen is present at all horizons and shows a slight increase in the upper levels as the sedge-meadow stage of hydrarch succession progressed (table).

Climatic considerations.—There seems to be little evidence for climatic trends in the pollen profiles of this study. The increase in yellow pine from the bottom to 4.5 meters may mark a drying and warming during the early postglacial, but its continued development was apparently interrupted by the deposition of the pumice mantle. Desiccation of postglacial climate is denoted by pollen profiles of other peat deposits east of the Cascades in Washington and Oregon. Sediments from Lower Klamath Lake record drying and warming by an increase in yellow pine to a maximum from the bottom to about halfway up in the profiles (Hansen, 1942a). This was followed by slightly cooler and moister conditions. A bog near Spokane, Washington, located in a yellow pine climax, records a sharp increase in grasses, Composites, and Chenopods, marking a hot, dry period during the middle third of the post-Pleistocene (Hansen, 1939b). In north central Washington, pollen profiles suggest a gradual drying to a maximum that has persisted to the present (Hansen, 1940b). In the lower Willamette Valley of western Oregon, three peat profiles record an influx of white oak (*Quercus garryana*) of considerable magnitude in the upper levels (Hansen, 1942b). The pollen profiles of this species and a decline in Sitka spruce (*Picea sitchensis*) and lowland white fir from the bottom upward is significant evidence for a dry period during the second half of the post-Pleistocene in the Willamette Valley. Pollen profiles of a peat deposit in the eastern foothills of the Coast Range in west central Oregon also provide evidence for warming and drying during this period (Hansen, 1941b). In other parts of the Pacific Northwest west of the Cascades, precipitation has probably not been a limiting factor in postglacial forest succession (Hansen, 1938, 1940a, 1941a). In a 7-meter profile of lake sediments in the Upper Sonoran life zone of east central Washington, the relative succession of grassland and forest suggests a warming of the climate during the postglacial to a degree persisting to the present (Hansen, 1941d).

Another source of evidence for a dry period during the middle third or latter half of postglacial time is the occurrence of artifacts underlying 6 to 8 feet of fibrous peat in Lower Klamath Lake (Cressman, 1940). The lake was drained in 1917, and wind and fire removed the fibrous peat, exposing an extensive artifact horizon. This signifies that the lake dried up sufficiently to permit early man to build his camp sites upon the exposed bed. A later increase in moisture resulted in inundation of the lake bed and the subsequent deposition of 6 feet of tule peat. Antevs (1940) estimates this period of desiccation to have occurred between 7,500 and 4,000 years ago. This dry period may have been synchronous with that indicated by the pollen profiles mentioned above. The occurrence of a postglacial dry period is further substantiated by the salinity of certain lakes in the Great Basin. The present salinity of these lakes is too low to represent a continuous deposition of salts during the entire post-Pleistocene (Antevs, 1938). Apparently the lakes dried up, and their precipitated salts were removed by wind or buried. The present lakes were reborn in the freshened basins about 4,000 years ago. This is believed to have been synchronous with the reinundation of the Lower Klamath fossil lake bed. Another line of evidence for a dry period is that the remnants of most Pleistocene glaciers in the western mountains entirely disappeared during the postglacial, and the present glaciers were formed only a few thousand years ago (Matthes, 1939). Their wasting and rebirth are thought to have resulted from decreased precipitation followed by an increase in moisture. Pollen profiles in eastern North America also indicate a period of maximum warmth and dryness, succeeded by an increase in moisture and some cooling in recent time. The author hopes to show that all or most of these lines of evidence for a dry postglacial period are chronologically correlated.

SUMMARY

A montane peat deposit on the east slope of the Cascade Range in central Oregon records post-Pleistocene forest succession that was apparently influenced more by the deposition of pumice than by climate. At least two volcanic eruptions are evidenced by the presence of pumice strata in the peat profile. There are four major trends of forest succession as interpreted from the pollen profiles. An initial predominance of western larch suggests the occurrence of repeated fire just prior to the origin of the sediments. When the effects of the hypothetical fires had been modified, lodgepole pine assumed predominance for a short time, only to be superseded by western yellow pine as the climate became warmer and dryer. Yellow pine never reached a maximum, however, because its trend was interrupted by a pumice fall that caused unfavorable edaphic conditions for its continued development. Lodgepole pine once again became predominant.

Lodgepole retained its predominance during the rest of the post-Pleistocene, but yellow pine gained slowly until another pumice fall interrupted its climax trend. Lodgepole pine made a less precipitate gain, but it attained the same proportion as it did after the first eruption. It is believed that the yellow pine forests which lie chiefly leeward to the bog in this region are under-represented by their pollen in the profile. The source of the pumice is not known with certainty, but it seems probable that at least one, probably the upper layer, came from the eruption of Mount Mazama between 5,000 and 10,000 years ago.

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