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PALYNOLOGY OF A BOG IN EASTERN NORWAY

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SUMMARY

Pollen analysis of a 6.4-m peat section from a bog near Magnor, a few miles from the Swedish border, reveals a vegetation history quite similar to that depicted by pollen profiles in the inner Oslofjord region. Some of the differences suggest that: (*1*) the Magnor profile is slightly older than those in the west, as shown by appreciable grass pollen in the lower levels; (*2*) a preponderance of pine during the Preboreal rather than birch; (*3*) the appearance of spruce in the lowest levels at Magnor, while to the west, it is not recorded before the beginning of the Subboreal; (*4*) the predominance of birch and pine throughout the profile with the exception of the Subatlantic; (*5*) the weaker representation of the mixed oak forest during the Atlantic and Subboreal. It should be pointed out, that these differences are based on one profile as compared to the average of 26 profiles in the inner Oslofjord region. The writer has not referred to other pollen which sporadically appear in the section, such as composites, *Typha*, *Myrica*, *Drosera*, and *Nuphar*, nor has he made interpretations of the many lesser fluctuations, as he still is uncertain as to the ecological requirements of the species involved.

INTRODUCTION

During August 1964, the writer collected nineteen peat sections in eastern Norway in a transect of some 300 miles from Røros in the north to Sarpsborg in the south. It is expected that pollen profiles of these and other sections to be obtained will provide a picture of Post-glacial vegetation history in eastern Norway and its general chronology. Especial attention will be directed toward the migration of spruce *(Picea abies)*, its direction and time of movement, its fluctuation, as well as other factors of its paleoecology. Apparently spruce did not make its appearance in southern Norway in any great extent until late in the Subboreal period, and in the inner Oslofjord area it did not attain significant proportions as a forest component until the Subatlantic (HAFSTEN, 1956). It seems probable

that spruce migrated into Norway from the east and northeast from Sweden and the Baltic region.

CHARACTERISTICS OF THE BOG

This paper is concerned with a single section obtained from a bog located about 1 mile east of the town of Magnor 2 miles from the Swedish border. Other sections are in the process of being analyzed, but the data are as yet incomplete. This is a preliminary study and the interpretation of the pollen profiles may be modified in the light of data from the other sections and a better knowledge of the interrelations of the species involved. The peat has developed in a small, northwest–southeast oriented stream valley and is about 1 mile wide and about 3 miles long. The upper portion, or the northwest, has the greatest development, with peat thinning out downstream to the southeast. There is a slight ombrogenous development at present at the upper part of the bog, where it is also very wet. The bog dries out appreciably down slope, because of natural drainage and a ditch cut for drainage.

The principal vegetation on the present-day bog surface includes *Sphagnum* spp., *Andromeda polifolia*, *Rubus chamaemorus*, *Calluna vulgaris*, *Vaccinium oxycoccus*, *Drosera rotundifolia*, *Myrica gale*, *Eriophorum* sp., *Cladonia rangerifera*, and *Betula nana*. Both pine *(Pinus sylvestris)* and spruce occur in dryer parts of the bog, largely on the lower end. The adjacent areas are forested with pine and spruce, with scattered groves of birch (*Betula* sp.).

A series of test borings was taken across the upper reaches of the bog, which show that the bottom is flat with a constant depth of 6 m. The typology of the sediments consists of 5 m of well preserved *Sphagnum* peat, overlying about 0.5 m of dark, woody, oxidized peat, which is underlain by 0.5 m of limnic sediments, grading downward into fine clay to a total depth of 6.4 m.

The flatness and eveness of the bottom, the constant depth of the sediments, and the underlying clay may have resulted from the Late Glacial marine transgression, which inundated the stream valley and persisted for several thousands of years before the development of limnic sediments, the latter identified by the presence of *Pediastrum* sp. It should be pointed out, however, that no attempt was made to delineate the marine or brackish-water sediments from the freshwater sediments by means of the presence or absence of marine and brackish forms of diatoms and the tests of Protozoa. The extent and limits of the Late Glacial marine transgression are well shown by ANDERSEN (1960).

Undoubtedly the pollen profiles have a record not older than the Preboreal. The only region in Norway which has been studied to date, where the Late Glacial is recorded, is in the southwestern part, where FAEGRI (1940, 1944, 1953) in pollen analysis in southern Bømlo, Jaeren, and south of Stavanger, has shown that se-

quence of chionophilous tundra, tundra, and park tundra developed during this time (Table I). A deterioration of climate occurred during the Younger *Dryas* Time succeeding the warmer Allerød period. HAFSTEN (1960) on the basis of pollen analysis of 26 sections of organic sediments in the inner Oslofjord area, has shown

TABLE I

POSTGLACIAL VEGETATION OF SOUTHWESTERN AND SOUTHEASTERN NORWAY

Millennia B.P.		*Periods*	*Southwestern Norway*	*Southeastern Norway*	*Magnor Southeastern Norway*	*Millennia B.C.*
1	POSTGLACIAL IX	SUBATLANTIC cool-wet	HEATH pine-birch	SPRUCE pine-birch	SPRUCE pine	IRON 1
2						0
3	VIII	SUBBOREAL warm-dry	PINE-BIRCH oak cultivation	PINE-BIRCH oak-linden-ash cultivation	PINE-BIRCH alder-linden	BRONZE 1
4						NEOLITHIC 2
5						3
6	VII	ATLANTIC warm-wet	PINE-BIRCH alder-elm-oak	PINE-BIRCH alder-elm-linden	PINE-BIRCH alder-mixed oak linden-hazel spruce	MESOLITHIC 4
7	VI	transition				5
8	V	BOREAL	HAZEL-PINE	PINE-HAZEL birch	PINE-HAZEL birch	6
9						7
10	IV	PREBOREAL	BIRCH	BIRCH	PINE grass	8
11	LATE GLACIAL III	YOUNGER *DRYAS*	PARK TUNDRA	GLACIATION	GLACIATION	9
	II	ALLERØD		MARINE TRANSGRESSION	MARINE TRANSGRESSION	PALEOLITHIC 10
12	Ic	OLDER *DRYAS*	TUNDRA			11
13	Ib	BØLLING				12
	Ia	OLDEST *DRYAS*	CHIONOPHILOUS TUNDRA			

that vegetation probably did not invade this area until the Preboreal because of the persistence of glaciers and marine transgression of the Late Glacial. While this is probably also true of this study, the Magnor bog is near the interior limits of the marine transgression and deglaciation may have permitted the invasion of plants somewhat earlier than in the Oslofjord region, as will be suggested later.

AGE OF SEDIMENTS

In the Magnor area, the lowest sediments reveal a record of pine-pollen predominance, with an abundance of pollen grains of birch (*Betula* sp.), and grass, and traces of pollen of *Picea*, *Hippophae*, *Corylus*, *Alnus*, *Ulmus*, *Salix*, Ericaceae, and composites (Fig.1). Perhaps the greatest significance is the high proportion of pollen grains of grasses during this period, which are recorded to 12% at 5.8 m.

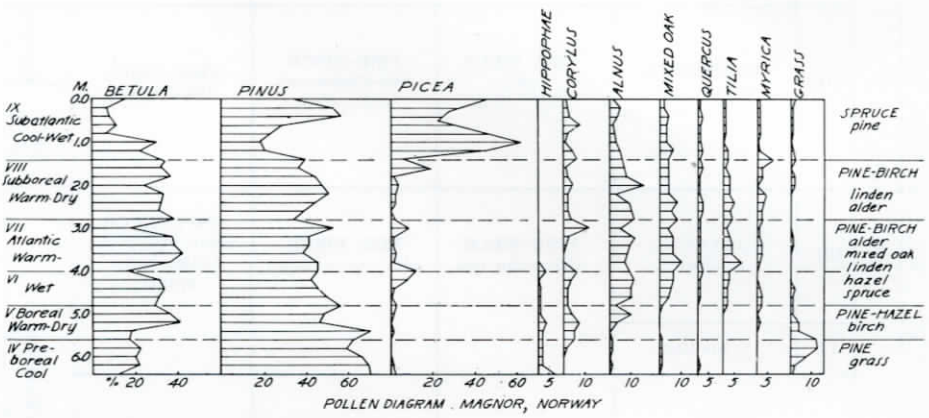

Fig.1. Pollen diagram of Magnor, Norway.

This with the occurrence of willow in the lower levels suggests that the Magnor section may be slightly older than those in the inner Oslofjord area, and that adjacent ice-free uplands had already a flora of pine parkland with grass and *Hippophae* occupying the open sites.

VEGETATION HISTORY

The Boreal period reveals a decline in pine, grass, and *Hippophae*, and expansion of birch, alder, hazel. Spruce pollen is still recorded in small percentages indicating the persistence of spruce, but its inability to compete with pine and birch under this existing environment.

The Atlantic period is recorded by predominance of pollen grains of birch and pine, an increase in spruce and alder pollen, the appearance of *Quercus* and *Tilia*, and almost complete disappearance of grass, as the forest canopy closed. This period is designated as pine–birch, although alder, mixed oak, and linden reach their highest proportions.

The warm, dry Subboreal is also designated as a pine–birch period, with these species remaining stable. Spruce attains its greatest abundance before its expansion during the Subatlantic, with alder and linden predominant in the deciduous forests. Willow practically disappeared during this period, while ericaceous plants show a substantial increase.

The Subatlantic is marked by a tremendous expansion of spruce. Spruce pollen grains increase from 6% at 1.4 m, at the beginning of the period, to over 60% at 1 m. The expansion of spruce takes place at the expense of pine, which declines to its lowest point in the section, while birch pollen records a slight increase at this horizon. The almost equally precipitate decline of spruce pollen to only 22% at 0.4 m and concurrent expansion in pine pollen may reflect warming and/or drying, although a marked expansion of spruce in the upper two levels during a time of known drying is unexplainable. While the increase in spruce during the Subatlantic agrees with Hafsten's work in the inner Oslofjord region, the Magnor pollen records do not show evidence of cultivation with the appearance of weed pollen of *Rumex*, *Plantago*, *Chenopodium*, *Artemisia*, and grasses. A slight increase in grasses, in the uppermost level is hardly sufficient to warrant such an interpretation. The decline of deciduous species during the Subatlantic is consistent with their retraction in the inner Oslofjord area. The Subatlantic in the Magnor area is designated as a spruce–pine period, with little evidence of cultivation.

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