

them would be undertaken more appropriately and carried through more effectively by specialists in these subjects, so that this mention is allowed to suffice for the present report.

The commission also discussed the question of geography, political and physical, and was of opinion that conditions are not yet ripe for the union of geography with the natural sciences, but that, nevertheless, the bases of geography in mathematics and the natural sciences should be taken up in connection with the instruction in these subjects in the higher schools.

It is apparent from the above sketch that a movement of the first magnitude is in progress in Germany for the fuller recognition of the value of mathematics and the natural sciences, on the one hand, and for the reorganization within these subjects of the subject matter taught and the method of instruction, on the other, so as to adapt the work more fully both to needs and capacity of the pupil and to the demands of the times. The writer does not presume to classify the movement or estimate its import in any but his own subject; in mathematics, however, the movement is certainly of international significance. It is one in spirit and aim with the movements for the improvement of the teaching of mathematics in France, in England and in the United States, and while the Prussian problems surely differ in detail from those of other nations, the underlying principles are the same. Our American conditions are vastly different from those which the commission could presuppose, and consequently there could be no thought that the commission's results as such would be available in America, still the consideration of the fundamental principles underlying this thoughtful report of some of Germany's most eminent scientists can not fail to lead the American reader to ponder the same

fundamental questions as modified by our environment, and perhaps to stimulate him to evolve some proposal looking towards the accomplishment here of the same end—as sorely needed here as in Germany—the better adaptation of the instruction to the needs and capacity of the pupil and to the spirit and requirements of our twentieth-century civilization.

J. W. A. YOUNG.

THE UNIVERSITY OF CHICAGO,

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SCIENTIFIC BOOKS.

Strandliniens Beliggenhed under Stenalderen I Det Sydøstlige Norge. Af W. C. BRØGGER. Med Tysk Resumé, 11 Plancher, 2 Karter og 9 Figurer i Texten. Norges Geologiske Undersøgelse, No. 41. Kristiania, i Kommission Hos H. Aschehoug & Co. 1905.

The first step in the establishment of a relative chronology for prehistoric times was taken by a Dane, C. J. Thomsen, of Copenhagen, seventy years ago. Much of the subsequent progress along this line has been due to Scandinavians. Professor Brøgger's work on the position of raised beaches in southeastern Norway during the stone and bronze ages is of such a character as to indicate that northern investigators are still among the leaders in the kind of research that tends to render our knowledge of prehistoric archeology more accurate.

That the climate of the kitchen-midden period (first stone age in the north) in Denmark was warmer than at present, is now well known. It has also been established by recent investigations in both Denmark and Sweden that the age of the kitchen middens of southern Scandinavia corresponds to the period of maximum postglacial submergence.

A series of curves are plotted on a map so as to pass through isochronal raised beaches. The general course of these curves through southern Norway, southwestern Sweden and all of Denmark is from northwest to southeast. They show the postglacial submergence to have been greatest around Christiania, where the raised beaches marking the maxi-

imum submergence are 70 meters above the present beaches. To the south, it grew less and less, reaching the zero curve at Nisumfjord, Jutland, and Falster in Laaland. The submergence to the north of Christiania also decreased gradually till it reached the vanishing point in the region of Mjosen Lake. This regional submergence is considered as but an interruption in the general elevation of the land.

The synchronism of the curves representing the maximum of submergence is determined through a study of the fauna in the corresponding shell heaps (with *Tapes decussatus*, etc.).

The period between the maximum postglacial submergence (Littorina-Tapes-Sænkning) and the time when the beaches at Christiania were from 45 to 48 meters higher than at present is called the earlier Tapes period. It corresponds to the latter part of the 'Atlantic period' of Blytt, Sernander, *et al.* The period during which the elevation of the beaches dropped from 45 meters to 19-21 meters at Christiania (from 30 meters to 13-15 at the mouth of Christiania fjord) is called the middle Tapes period. The climate of this period was colder than that of the preceding; perhaps colder, also, than during the following period. The last of the Isocardia clays belong to the middle Tapes period.

The later Tapes period corresponds to a beach elevation of from 19 meters to 8 or 10 meters above the present Christiania beaches (13 meters to 4 or 5 meters at the mouth of the fjord). The climate was comparatively mild, the shell heaps being characterized by a number of southern forms no longer to be found in the fjord. The Scrobicularia clay deposits belong to this epoch.

The recent period goes back to a time when the beach line at Christiania was 8 meters higher than it is now. Only after the elevation was complete did the climate become what it now is and the bivalve *Mya arenaria* make its appearance in the waters of Christiania fjord.

The remainder of the work deals with the relation of archeological finds to the various beach levels. The archeological classification

corresponds in the main to Müller's classification for Denmark. Müller's time scale, however, is somewhat shorter than Brøgger's.

It was long ago observed that the kitchen middens of northern Denmark are well above the present beach lines. They contain the oldest stone industry to be found in Denmark, viz., flint flakes and paring knives (Skive-spalter). But in southern Norway, where flint is scarce, other stone was employed during this early period to produce the so-called Nøstvet industry. Brøgger's researches have established the fact that this old industry occurs at a level corresponding to that of the raised beaches marking the maximum postglacial submergence. It is nowhere found below that level and is, therefore, contemporaneous with the early Tapes period. The Nøstvet industry is, on the other hand, rarely found much above the level of the highest raised beaches. The population must, therefore, have been a coast population, deriving its sustenance largely from the sea.

The axe with pointed pole never occurs at a lower level than that of the beach line marking the close of the early Tapes period. It is a transition form connecting the first northern stone epoch with the second, the latter being the epoch of polished stone axes. The early part of the second stone epoch was characterized by a variety of the axe with pointed pole; the latter part, by a flat-poled axe. During this epoch the habits of the people changed. They were engaged largely in the domestication of animals and in agricultural pursuits. The minimum level of occurrence of this industry is, then, no longer the dominant one. But there is sufficient evidence to prove that, at the close of the second stone epoch, the beaches at Christiania were from 23 to 26 meters above the present beach level.

The third epoch of the stone age is characterized by the thick-poled axe. These are found in Scrobicularia clay deposits as well as in graves. The position of some of these graves is such as to lead to the conclusion that, when they were built, the beach line at Christiania was not more than 13-15 meters higher than it is now.

The bronze age is divided into two epochs. The close of the first corresponds to a former beach elevation of not more than 3.5 meters higher than the present. At the close of the second epoch, the beach line was probably the same as it is now.

In an interesting table, Professor Brøgger gives the results of his attempt to measure the lapse of time since the maximum post-glacial submergence. His basis of reckoning is as follows: (1) The rate of elevation was about the same at the beginning as at the close; (2) the rate during the middle period of elevation was greater than at the beginning or close; (3) the determining of the position of the beach lines at the beginning and end of the bronze age and at the beginning and end of the closing epoch of the stone age, compared with the estimates of archeologists as to the absolute length of the bronze age and the last epoch of stone, gives a standard of measurement for the rate of elevation during the last period of the same. His results are:

(a) For the stone age:

First epoch, 4900-3900 B.C., or 1,000 years.

Second epoch, 3900-2400 B.C., or 1,500 years.

Third epoch, 2400-1900 B.C., or 500 years.

(b) Bronze age, 1900-500 B.C., or 1,400 years.

(c) Iron age, 500 B.C.-1905 A.D., or 2,400 years.

Total of 6,800 years.

According to Sophus Müller,¹ only about 4,900 years have elapsed since the beginning of the stone age in Denmark. He places the duration of the first epoch of the stone age at a minimum of 500 instead of 1,000 years, and the beginning of the bronze age at 1200 B.C. instead of 1900 B.C.

GEORGE GRANT MACCURDY.

YALE UNIVERSITY,
NEW HAVEN, CONN.

Catalogue of the Fossil Plants of the Glosiopteris Flora in the Department of Geology, British Museum (Natural History). By E. A. NEWELL ARBER. London, 1905. Pp. lxxiv + 255; pl. 8; text f. 51.

This book as is indicated by the subtitle is a 'Monograph of the Permo-Carboniferous Floras of India and the Southern Hemis-

phere,' and as such will prove not only a boon to the paleobotanist, but of inestimable value to the student of phyto-geography and the evolution of floras. It will be welcome to the geological workers interested in the correlation of those perplexing series of strata so widely distributed in the southern hemisphere and should also be in the hands of those interested in Paleozoic glaciation. Locally the work will also have a large economic value in the hands of operators and prospectors for coal in the regions of which it treats. It embodies the first comprehensive treatment of this flora, and contains, not only a critical summary of previous knowledge heretofore widely scattered through an immense number of publications, but also embraces considerable additions to our knowledge.

The oldest assemblage of land-plants sufficiently representative to be called a flora is that which appeared during the Devonian and became highly complex in the later Devonian and Lower Carboniferous time. This flora was a cosmopolitan one and discloses a remarkably uniform character wherever plant-remains have been found in the rocks of these periods, from about latitude 75° north (Ellesmere Land and Bear Island) southward to Australia and Argentina. This flora included representatives of the following orders: Equisetales, Lycopodiales, Sphenophyllales, Filicales, Cordiales and Cycadofilicales, the latter possibly including seed-bearing forms (Pteridospermæ). In passing upward into the Upper Carboniferous we find three additional orders, the Cycadales, Ginkgoales and Coniferales; none of these however become of real importance until the dawn of the succeeding Mesozoic era. With the Upper Carboniferous, however, the world-wide uniformity of this ancient flora becomes broken and it is separated into sharply defined northern and southern floras each made up of types belonging to the six dominant Paleozoic orders, which present, nevertheless, an entirely different facies in the two regions. The southern flora, found in strata laid down immediately subsequent to widespread glacial deposits (the Talchir boulder bed of India, the Dwyka con-

¹ *Nordische Altertumskunde.*