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BROGGER ON THE POSITION OF RAISED BEACHES  
IN SOUTHEASTERN NORWAY

BY

DR. GEORGE GRANT MACCURDY

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*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-

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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 *Serobicularia* 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 post-glacial 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,<sup>1</sup> 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.

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<sup>1</sup> *Nordische Altertumskunde.*



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