

## A NOTE ON CLIMATIC DETERIORATION IN THE FIRST MILLENNIUM BC IN BRITAIN

Stuart Piggott, University of Edinburgh

Recent archaeological investigations in British agrarian prehistory, and the recognition of field systems in Scotland which can only be satisfactorily explained as indicating cultivation during a climatic optimum, and abandonment under worsening conditions, have directed attention afresh to the phenomenon of the Grenzhorizont of palaeobotanists, interpreted as indicating such a change. The concept of post-glacial climatic variations, including one from optimum warm and dry conditions to a wetter and colder phase in Northern Europe some time in the first millennium BC, goes back to the pioneer work of Blytt and Sernander at the beginning of the century. This was continued by geologists and palaeobotanists in the 1920's and 1930's. Gams and Nordhagen made studies individually or in collaboration in Central Europe, Northern Europe and the Alps; in Sweden Granlund and Nilsson pursued the problem in detail for that country. In the British Isles Jessen worked in Ireland in 1934-35 and his work was continued by Mitchell, concurrently with the development of the Cambridge school of palaeobotany under Godwin. The situation has been summarised many times, e.g. in Godwin, 1956; Sawyer, 1966; Lamb, 1968 and Pennington, 1969.

Throughout these studies attention was called, among the other indications of climatic changes in post-glacial times, to a marked feature, the Grenzhorizont or 'boundary horizon', between the phases originally named Sub-boreal and Sub-atlantic, later more usually defined in terms of numbered Zones constructed with minor variants to suit local conditions; in Britain this became the junction of Zones VIIb and VIII, or a transitional Zone VIIb/VIII. Before the advent of radiocarbon dating any time-scale had to be provided by extrapolation from current archaeological chronologies, basically those of Reinecke for West-Central Europe and Montelius for the North, and there has been a tendency to forget that such dates may now need revision, both archaeologically and especially as a result of C-14 determinations, and to continue to use them uncritically.

From the start it was realised that the Grenzhorizont was being drawn within a period of change which was not a relatively sudden episode, but a protracted phenomenon. Gams defined in the Alps a warm dry Sub-boreal around 1200-1000 BC, with deterioration starting by about 900 and reaching its maximum at about 500 BC, marked inter alia by the growth of the local

glaciers. Godwin (1938) defining his VIIb/VIII transitional Zone, ended this in 500 BC, presumably following Gams; Jessen (1949) used the same date, which he thought was confirmed by the finding at Cloonlara, Co. Mayo, of a circular wooden shield of 'U-notch' type lying at the base of a peat-bog which began to form in Zone VIII. We must return to this shield, but should also note that Mitchell (1956) could not accept the 'recurrence-surface' in the peat taken by Jessen to mark his VII/VIII division as necessarily to be equated with that accepted elsewhere as equivalent to the Grenzhorizont, and could not in fact find evidence for any distinction of Zones at this point in Irish bog stratigraphy.

It is not wholly clear why the archaeological terminal date of c. 500 BC has been widely attached to the Grenzhorizont, rather than one earlier. The observations in Switzerland of the flooding of lake-side settlements of the Late Bronze Age had been correlated with Gams's observations of a climatic reversion beginning around 900, and for English readers this had been pointed out by Childe (1929, 358) - 'the rising of the lake waters, consequent upon the onset of the Subatlantic climatic conditions, must have been the main cause of their final desertion', but it seemed to him that one should choose the beginning of the deterioration, not its end, since on archaeological grounds the sites were abandoned c. 900-800 BC. Tansley, writing of the British sequence in 1939, dated the beginning of the Sub-atlantic phase 'from something less than 1000 BC' (Tansley, 1939, 455).

On the other hand, Jessen in 1934 recorded a hoard from Denmark in a peat sequence slightly before the local Grenzhorizont, dated by Broholm to the final phase of the Danish Late Bronze Age, and in absolute chronology to a little before 400 BC: Granlund, however, had dated his Recurrence-Surface III (equated with the Grenzhorizont) to c. 600 BC on the Montelian chronology. In the light of these dates Hyde (1939), when assessing the bog stratigraphy of the Llyn Fawr hoard in connection with that of the Ffos Ton Cenglau bog near by, struck an average at 500 BC for the surface identified by him as the Grenzhorizont there, noting that the Late Bronze Age hoard had been deposited in a pool forming under Sub-atlantic conditions, as it lay in peat well above that surface. On these grounds, Hyde thought the hoard could be as late as c. 350-300 BC; Fox, perhaps not uninfluenced by these conclusions, decided that '500 BC is probably as close as we can get to the date of deposition, on archaeological evidence; I think we should regard 400 BC as an outside limit' (Fox, 1939, 379).

Before turning to the evidence of radiocarbon dates, we should briefly reconsider the Cloonlara shield and the Llyn Fawr hoard in modern terms.

The shield is of a well-known class with 'notches' in its patterning of U or V form, the latter first appearing in the south-east Aegean/Cypriot area, and transmitted westwards along the Mediterranean to Iberia and beyond in circumstances initially 'connected with Phoenician and Oriental activities during the 8th and 7th centuries BC' (Gräslund, 1967). Both U- and V-notch shields are known from Ireland, and the U-notch form is found also in Scandinavia, Germany and Bohemia; the U-type is presumably a northern development which Coles (1962, 163) would put 'within the Late Urnfield period, probably Hallstatt B3 by present chronological schemes', a phase which Müller-Karpe (1959) dates between c. 800-700 BC. If Jessen's recurrence-surface can indeed (*pace* Mitchell) be equated with the Grenzhorizont, it should then date from the end of the ninth century BC. At Llyn Fawr, Godwin (1946, 10) has questioned Hyde's interpretation of the bog stratigraphy, detecting two recurrence-surfaces and not one, but however one correlates the find with palaeobotany, it must be Hallstatt C, the date of the iron sword in the hoard, and around 650-600 BC and not later, so the recurrence-surfaces are no later, and one is earlier, than this date (Piggott, 1953, 184; Hawkes and Smith, 1957, 188).

Clarification has finally come from newly observed bog stratigraphies given a chronological framework by radiocarbon dating. The dates which follow are the 'conventional' C-14 readings, uncorrected by dendrochronological correlations (McKerrell, 1971), but these are considered later. For convenience radiocarbon 'years' are given as dates 'bc'; the calendar years obtained by calibration 'BC'. The palaeobotanical work (summarised by Godwin, 1966, 9-11) began in the bogs of the Somerset Levels, where wooden trackways were built on newly flooded ground at more than one period from the Neolithic onwards, and the group which concerns us comprises eight dated trackways relating to the Zone VIIb/VIII transition, with a range of dates from c. 900 bc to c. 460 bc: there is a pretty even spread, with only two tracks after c. 600 bc. Elsewhere dates from the VIIb/VIII transition have been obtained from other British bogs, as for instance Tregaron in Wales, c. 719 bc and Flanders Moss in Scotland, c. 762 bc. Godwin was able to use twelve dates, which gave a range from the end of Zone VIIb at c. 1009 bc; the trackways already mentioned filled the interval until the beginning of Zone VIII at c. 525 bc.

We have then to reckon with a long period of worsening climate, culminating in the Sub-atlantic (Zone VIII) phase, with all the consequences this may have had for human settlement, and above all agriculture, in northerly latitudes and marginal conditions of soil and altitude. Indeed, we may have to consider other climatic alterations, beyond colder and wetter conditions than in the

Sub-boreal, to which attention has recently been drawn by Wilson and Hendy (1971). Starting from observations on the isotopic composition of ice cores drilled from glaciers, which reflect the temperature differences between the equatorial and polar regions during the glacial and interglacial periods, they point out that the incidence of winds and storms would be greater in times of greater cold, with increased disparity between polar and equatorial mean temperatures, than in climatic optima when this was not so acute. In this context they would see both the Polynesian migrations in the Pacific and the Viking expansion in northern seas as associated with the historical Little Climatic Optimum with its maximum from c. AD 1400 to 1200, and being favoured by a period of comparatively rare storms, and in both instances curtailed by the onset of the Little Ice Age which followed, with its maximum at c. AD 1550 to 1850 (cf Lamb, 1968, 58-112). We may therefore wonder whether the climatic optimum of the Sub-boreal period, the phase of the Neolithic and Beaker colonisations of the British Isles, was a relatively storm-free period favouring long sea voyages, and that with the climatic changes culminating in the Sub-atlantic conditions for seaborne long-range contacts between the British Isles and the Continent, and protracted coasting voyages in Britain and Ireland themselves, were becoming increasingly unsuitable.

Finally, in order to assess the relationship of the climatic reversion under discussion to Continental cultures and chronologies, we must recollect that these, for the period under discussion, have a chronology based on ultimately historical Mediterranean sequences. The corrected C-14 date for the end of Zone VIIb, c. 1000 bc, would be c. 1300 BC. Dates around 550/500 bc present unfortunate alternatives in calibration with c. 600 BC as a likely median date (McKerrell, 1971, 78-9). We have in fact come back to absolute dates not far removed from those assumed 35 years ago. In the generally accepted schemes (Müller-Karpe, 1959; Dehn and Frey, 1962) this would span the centuries from Bronze D (thirteenth century BC) to the end of Hallstatt C (c. 600 BC), and include the whole of the Hallstatt A and B phases which contain the Urnfield cultures. This is indeed a period with evidences of least trade contact between Britain and just these cultures, the re-dated Llyn Fawr find fitting neatly into place in its Hallstatt C context, as do those of the Covesea and Adabrock phases of the Scottish Late Bronze Age (Coles, 1960): if conditions for extended sea travel were worsening over the transition period, they may not be reflected in the archaeological evidence as we see it at present, though they may well have become effective later, once the deterioration climax had been reached.

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