Palaeoenvironmental investigations at Sosteli Iron Age farm (1948-2011)

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Short report by Catherine Jessen and Charlie Christensen

Background

This report expands on a short review into the investigations by J. Troels-Smith and the material held by the National Museum in relation to the environmental and archaeological excavation at Sosteli, Åseral, Vest-Agder fylke, Norge (1946-1954) as reported by Mortensen M.F. and Christensen C, Jernalderbosættelsen Sostelid (Notat, NNU, 1. juni 2010).

All records (correspondence, profiles, photographs, pollen data etc.) relating to Sosteli have been thoroughly examined and the samples stored since 1948/1954 reviewed. This analysis has led to the selection and submission of two of the stored samples from each of the 1948 and the 1954 profiles for radiocarbon dating to establish the relationship between charcoal layers (at 238 and 32 cm depth in the 1948 profile and at ca. 90 cm below surface in the 1954 profile) and the sediment time frame. Additionally, 6 new pollen samples have been prepared and examined from the 1954 profile and the pollen data from the 1948 profile have been digitalized and redrawn. Material has also been sourced and prepared as a contribution to the exhibition opening May 2011 in Åseral.

Radiocarbon ages

Two samples for radiocarbon dating were submitted from each profile and were selected to give an age of charcoal layers in both profiles and an indication of the timespan included (Figures 1 and 2). Results are shown in Table 1 and the ages of the peat just below the upper charcoal layer of 1948 profile (65 BC +/-65) and that of the lower charcoal layer of 1954 profile (75 AD +/-65) strongly suggest that these two charcoal layers correlate. The lower charcoal layer in the 1948 profile yields a radiocarbon age of 6870 +/-190 BC suggesting this represents one of a series of natural fires during boreal forest development as suggested by the pollen analysis completed by Svend Jørgensen in 1952.

It is difficult to confidently assign a timespan for the two profiles without additional dating but it could be expected that the 1948 profile may span from ca. 7000 BC until ca. 100 AD and the 1954 profile from ca. 100 BC until ca. 1400 AD. However it should be noted that changes in sediment type and peat characteristics (from strongly to weakly humified) suggest variable sedimentation rates. The causes of the missing sediment from the top of both profiles is unknown but could be due to a combination of peat cutting (especially in the thickest, 1948 profile) and possibly changes in hydrology as climate began to cool and become more variable after ca. 1300 AD and the beginning of the Little Ice Age (ca. 1300-1800 AD). It is possible that a further borehole survey may locate sediment from the last 5-700 years at the site.

Table 1. Radiocarbon and calibrated radiocarbon ages

Profile		Depth from surface (cm)		Conventional radiocarbon age (BP)	Cal BC/AD	Mid-point Cal BC/AD	+/- (2 sigma)	Cal BP	Mid-point Cal BP	+/- (2 sigma)
1948	ca. 5 cm below upper charcoal layer	35	Peat	2030+/-30	100 BC-30 AD	65 BC	65	2050-1920	1985 BP	65
1948	'Lowest charcoal layer'	238	Charcoal	7970+/-50	7060-6680 BC	6870 BC	190	9010-8630	8820 BP	190
1954	32 cm from surface	32	Peat	880+/-30	1040-1220 AD	1130 AD	90	910-730	820 BP	90
1954	Level'I' *Alnus* (Tellerup)	253	Charcoal	1920+/-40	10-140 AD	75 AD	65	1940-1810	1875 BP	65

Pollen analysis of the 1948 profile and the new 1954 profile pollen samples

The results of the 1948 pollen analysis have been examined, digitalized and a 'Tilia' diagram has been drawn from the data (Figure 2). Two samples from the 1954 profile were scanned immediately after fieldwork and 6 new samples from the 1954 pollen series have been now prepared and found to be well preserved and in good condition. These samples have been scanned for presence of taxon and any strongly noticeable features but *not* counted and therefore they only give an indication of both natural and/or land-use changes within certain age ranges (Table 2). A complete analysis and further radiocarbon dating will be needed to both confirm and supply enhanced detail.

The 1948 pollen profile was discussed by J. Troels-Smith in Anders Hagens' doctoral thesis of 1953 and was suggested to represent natural forest development in the lower part of the

profile around the lower charcoal layer. This is now confirmed by radiocarbon dating (6870 +/-190 BC).

Pollen analysis of the upper part of the 1948 profile, immediately above the charcoal layer at ca. 32 cm below surface, shows distinct vegetational changes with increases in *Calluna*, *Juniperus*, *Pteridium* and reductions in *Pinus*, *Betula* and *Alnus* which together suggest burning and clearance.

Table 2 General observations arising from a scan of 6 new pollen samples together with 2 scanned in 1954.

From base		**General observations 2011**	
80 cm	1130 +/-90 AD	Radiocarbon age	Peat sample
70 cm		High tree pollen frequency, especially birch	
60 cm		General increase in trees/woodland	
50 cm		Generally mossy	
40 cm		Very high grass frequency	
32 cm		Presence of cereal pollen (probably barley)	1954 S. Jørgensen
27 cm		Very high *Dryopteris* frequency	
27 cm	75 +/-65 AD	Radiocarbon age	Charcoal sample
21 cm		Very high *Dryopteris* frequency	
15 cm		Some grazing indicators	1954 S. Jørgensen

The record continues in the 1954 profile where the same charcoal layer now lies at ca. 90 cm below surface (75 AD +/-65) with similar indications of an associated major vegetational disruption. The pollen analysis from both 1948, the single samples from 1954 and the most recent analysis from the 1954 profile all suggest that this charcoal layer is associated with forest clearance i.e. 'landnam' at Sosteli. Additional evidence of disturbance is seen by the presence of large boulders and stones out on the bog in a position which would not be expected due to natural processes. Stratigraphically, these boulders are both associated with the dated charcoal layer and lying beneath it and may suggest some previous human disturbance. Both these indicators of 'landnam' at the site occur prior to the ca. 4-600 AD age of the buildings (Hagen, 1953). Even with only a few pollen samples scanned, cereal pollen is already observed only a few centimeters above the charcoal layer and this may suggest cereal cultivation also began prior to the date of the buildings. Further dating in conjunction with further pollen analysis will be needed to determine this. Other land-use activities are also

observed prior to the charcoal layer in both pollen profiles and in the 1948 profile the first indications appear only 60 cm above the radiocarbon age at 6870 BC. Due to the previously mentioned probable sedimentation rate variability, further dating would be needed to ascertain how long prior to 'landnam' at ca. 75 +/-65 AD the site was being used for, for example, grazing.

The scan of the 6 new samples from the 1954 profile, which together probably span a time period of ca. 100 BC to 1100 AD, also suggest some birch/pine forest regeneration in the upper 40-50 cm but it is not possible to see from scanning the samples, whether there is an associated reduction in grazing indicators. This change occurs more or less half way between the two available radiocarbon dates but as the sedimentation rate is likely to be variable, it is unwise to estimate approximate age at this time.

Summary

- The available radiocarbon ages for the two profiles suggest that the samples stored at the National Museum of Denmark from Sosteli span an estimated time period of at least ca. 7000 BC until 1400 AD.

- The boreal age of the lower charcoal layer in the 1948 profile as suggested by earlier pollen analysis is now confirmed by radiocarbon dating to ca. 6870 +/-190 BC. The upper charcoal layer of this profile is associated with human disturbance of the site and is most likely the same layer as the distinct charcoal layer of the 1954 profile.

- The charcoal layer in the 1954 profile represents forest clearance and disturbance i.e. 'landnam' at ca. 75 +/-65 BC. This is around 400 years earlier than the estimated age of farm buildings. First cereal cultivation may also date prior to the farm buildings.

- A regeneration of the forest prior to 1130 AD is suggested by a scan of the pollen from above the charcoal layer in the 1954 profile.

Main questions raised by this short investigation

- When and how was this 'marginal' site first used for grazing/fodder production prior to the establishment of the fields?

- How does the age of the buildings correspond with the age of the forest clearance and boulder displacement and, importantly, does the first appearance of cereal pollen correlate with the age of the buildings?

- As building occupation does not correlate with the 'landnam' at 75+/-65 AD, what are the vegetational responses to the construction and occupation of the buildings i.e. a second 'landnam'?

- How did the proportion of grazing/haymaking/crop cultivation land-use change both prior to and since first landnam?

- If the suggested regeneration of woodland is confirmed, at what date did this occur and was there a continuation of haymaking/grazing at the site?

- During which time periods did haymaking/grazing at the site continue and how does this type of land-use relate to regional climate change?

- How do the land-use patterns at this marginal site relate and the later lateral expansion of the bog over the Iron Age field layers related to climatic changes in this region?

This short study has shown that the samples collected 1948-1954 and stored at the National Museum of Denmark are well preserved and can be used for both radiocarbon and dating and pollen analysis. Further pollen analysis and radiocarbon dating would undoubtedly shed light on the questions stated above, ideally in conjunction with palaeoclimatic indicators in an attempt to highlight any human responses to climatic change in the last 2000 years.

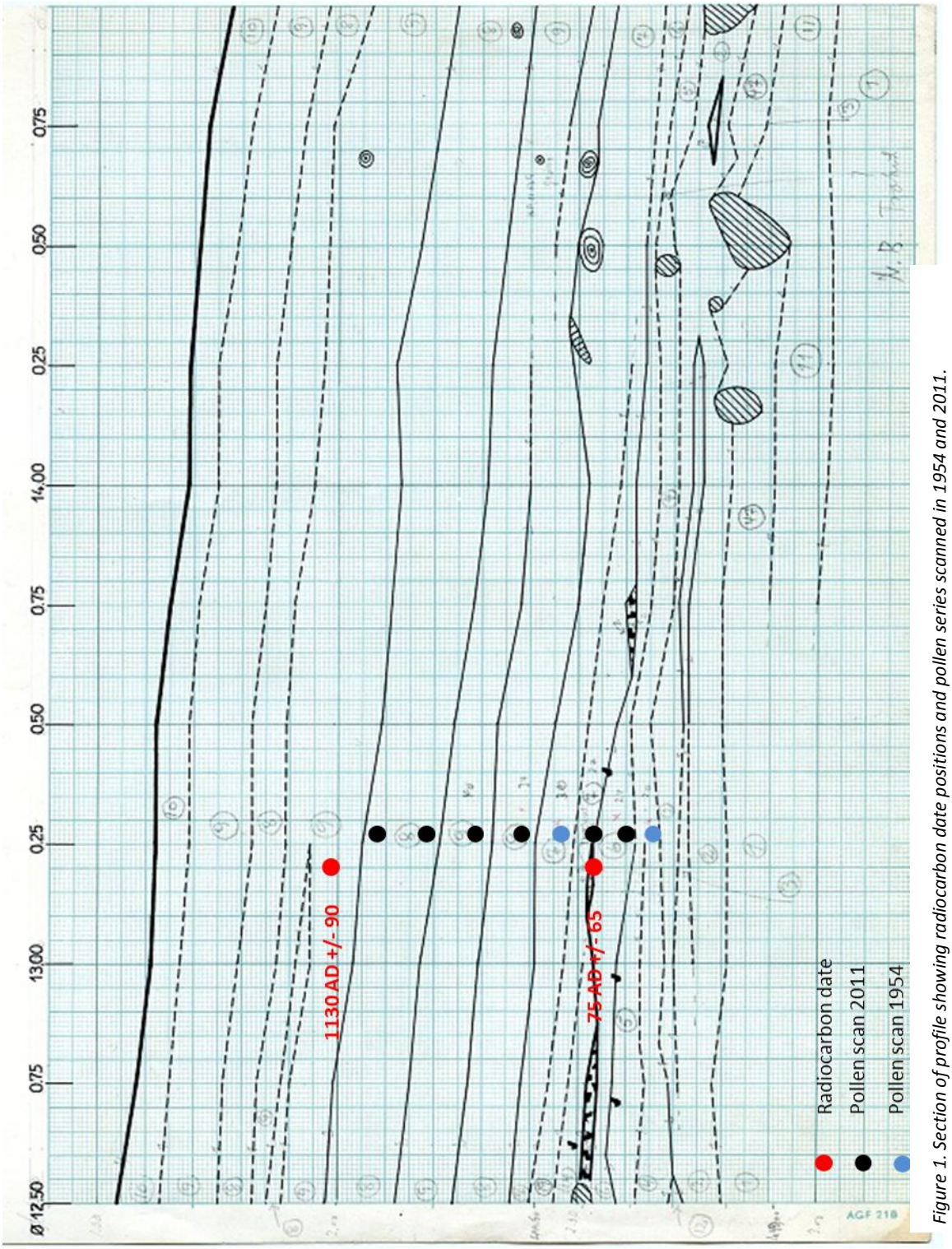

Figure 1. Section of profile showing radiocarbon date positions and pollen series scanned in 1954 and 2011.

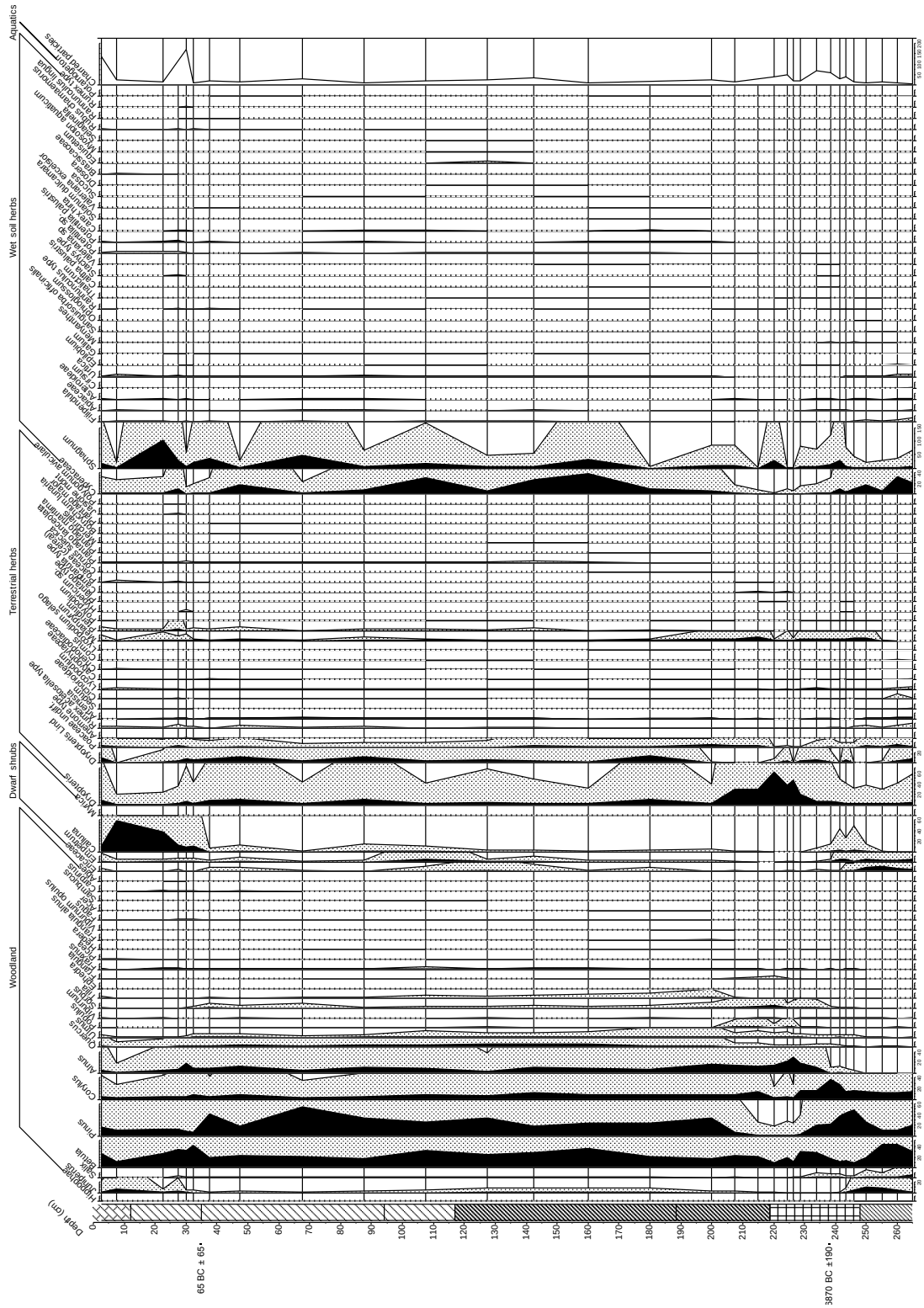

Figure 2 Pollen analysis by Svend Jørgensen from the profile opened in 1954 and including counted number of charred particles. Sediment characteristics and radiocarbon ages obtained in 2011 shown on the extreme left.