THE FIRST RADIOCARBON MEASUREMENTS ON ORGANIC MATERIAL FROM KASTELHOLM AND THEIR INTERPRETATION

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Two samples from the pilework, S.E. of the castle, one charcoal sample from the burned layer A, north-eastern part, two charcoal samples from the hall, eastern part of the castle, and two wooden samples from the excavation immediately to the north of the castle are dated. The pilework samples are the youngest and one wood sample from N. of the castle the oldest. The range is from about 600 to 400 ^{14}C years B.P. All samples have been carefully pretreated and the ^{14}C measurements extended to yield statistical uncertainties of about ± 50 years. The reliability seems good and is discussed. The dates are converted to calendar years using high-precision calibration curves. The results have to be given as ranges, because of the secular short-term variations.

Introduction

The samples from Kastelholm were expected to be of various ages but certainly not earlier than the 12th century. The age is difficult to determine with the ^{14}C method because of the secular variations of the $^{14}C/^{12}C$ ratio. The high-precision curves show wiggles in the actual range. Wiggle matching is only feasible if samples are available from a well defined stratigraphic section or a series of tree rings covering a period longer than a few times the statistical uncertainty of the measurements. The logs available had less than forty rings. Unfortunately wiggle-matching cannot be applied in the present investigation.

Details *re* the dating technique are given by Olsson (1958), and about the calculation of the statistical uncertainty and the meaning of σ by Olsson (1983).

The samples and the results

The samples were selected and submitted by Magnus Elfwendahl as the first seven in a series to be dated during the course of this investigation. The positions of the samples are indicated on the map given by Elfwendahl (this volume).

The pretreatment of the samples included treatment with hot 1 % HCl overnight or longer followed by washing with distilled water, treatment with hot 1 % NaOH (80°C) overnight, washing again and finally an acidification before the combustion.

The results are given as ^{14}C years. A normalization based on the ^{13}C value is thus included. The ^{13}C measurements were performed at the Maringeological Institute,

Table 1. Radiocarbon dating of seven samples from Kastelholm castle.

Sample		Sample material	Dating no.	$\delta^{13}C$ ‰ (PDB)	^{14}C age
3	KS5, C6 4.87 m above sea level North-eastern part Burned layer A	Charcoal	U-6164	—23.6	595 ± 55
1	KS9 Pile construction S.E. of the castle	Innermost 7 rings of pile with 36 rings Dendro sample 7	U-6165	—25.6	375 ± 50
2	KS9 Pile construction S.E. of the castle	Innermost 5 rings of pile with 33 rings Dendro sample 8	U-6166	—26.1	430 ± 50
4	KS2, The hall Eastern entrance Layer 14 5.7 m above sea level	Charcoal	U-6177	—23.8	570 ± 50
5	KS2, The hall Eastern entrance Layer 6 6.0 m above sea level	Charcoal	U-6178	—24.4	570 ± 50
6	KS12 Outside northern part of castle	Innermost 16 rings of about 20 rings	U-6179	—25.1	615 ± 50
7	KS12 Outside northern part of castle	Innermost 8 rings of about 17 rings	U-6180	—26.1	505 ± 50

Gothenburg University and the supervision of Eric Olausson. The results are given in Table 1.

The measurements were spread under a long period — from November 1983 to August 1984. The statistics for the samples, the standard and the background, were checked and proved to be so accurate that the estimation of σ seems reliable (Fig. 1). In the comparison published in *Nature* (1982) vol. 298, p. 619—623, 20 laboratories participated, the Uppsala laboratory being one of them. The Uppsala values proved to differ very little from the mean values and to have given reliable statistical uncertainties. The small bias detected at that time could have been included in the discussion here. Since something was changed in Uppsala when three samples had been measured so that new standard values were adopted for four of the results, the bias measured in 1980 to 1981 may have differed from that for at least the last four measured samples.

Two very similar curves (Stuiver, 1982 and Pearson & Baillie, 1983) were chosen for the calibration to demonstrate that slightly different results can be obtained, although the curves agree rather well. It is seen (Fig. 2) that the youngest samples are probably older than the figure given in ^{14}C years and the two oldest might be younger than indicated by the ^{14}C age. The possibility that they are older is not excluded, however.

For six of the samples σ is ± 50 years and for one ± 55 years. It is obvious that some samples have such an activity that the probability is high that more than one

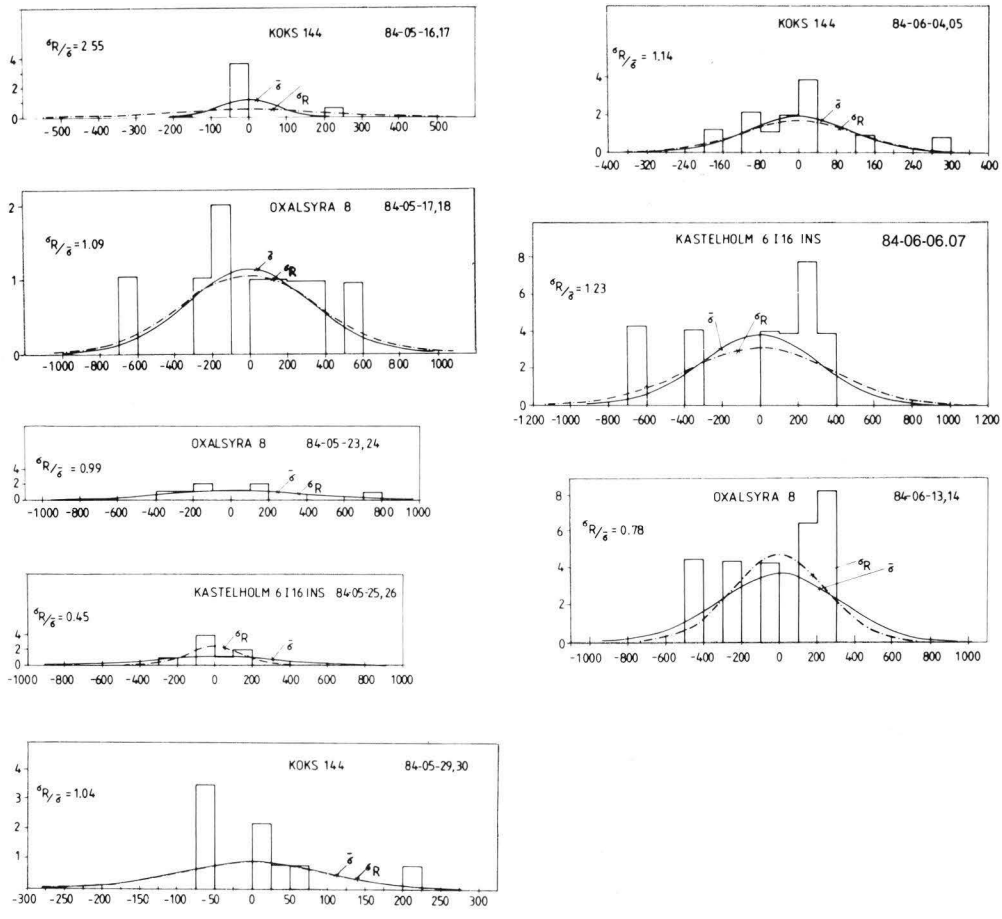

Fig. 1. The distribution of results during a 20-hour period. The weight of each short period (usually 100 min.), calculated from the statistical uncertainty, is plotted along the ordinate. The real distribution is plotted as a histogram and can be depicted by the curve σ_R. The corresponding expected curve $\bar{\sigma}$ is based on the mathematically calculated σ values. If the ratios $\sigma_R/\bar{\sigma}$ for a series of periods cluster around 1.0 the given statistical uncertainties are realistic. Ratios predominantly > 1.0 indicate that the statistical uncertainties are underestimated and < 1.0 that they are overestimated. The 20-hour periods of interest for this investigation are depicted for three weeks.

calibrated value must be considered for one particular ^{14}C year. Moreover it may well happen that the calibrated value does not fall inside a certain span within the total range given at the calibration thereof (the ^{14}C years $\pm$ 2 σ).

Since the inner rings were used for the four wood samples it must be remembered that each sample dates rings a few years older than the outermost ring dating the first possible usage of the wood. The corresponding correction must be applied on the calibrated value.

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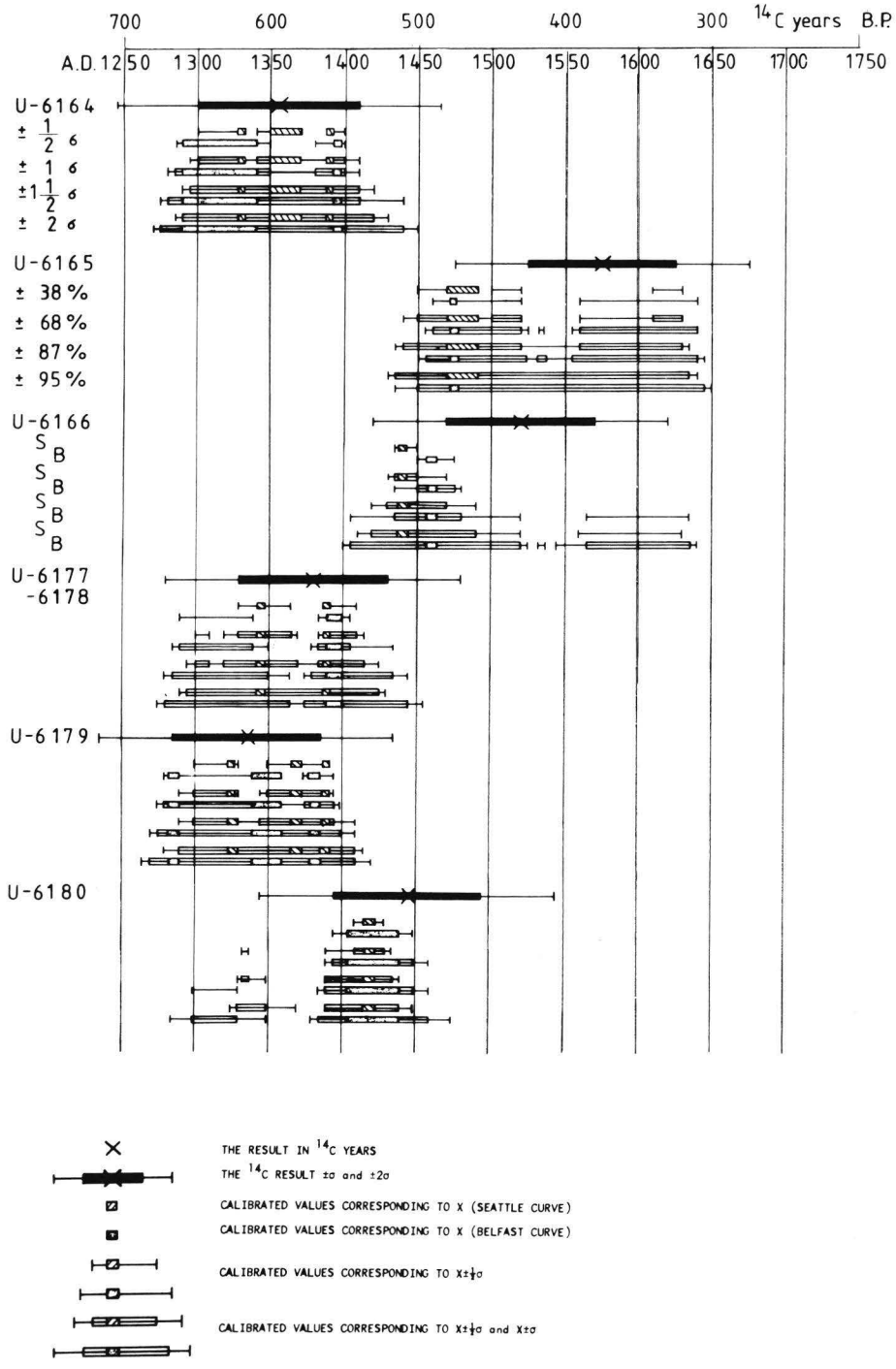

Fig. 2. Calibration of the values: ^{14}C age ± ½ σ corresponding to 38 % probability
± 1 σ corresponding to 68 % probability
± 1½ σ corresponding to 87 % probability
± 2 σ corresponding to 95 % probability
The calibration is made using two curves (Stuiver, 1982 and Pearson & Baillie, 1983). S stands for Seattle and B for Belfast. The B.P. scale should be used for radiocarbon ages and the A.D. scale for calibrated ages (Calendar years).

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