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Radiocarbon datings at Ringkloster

by Kaare Lund Rasmussen

Radiocarbon datings of samples from Ringkloster have been carried out at The Radiocarbon Dating Laboratory at the National Museum of Denmark. The samples consisted of charcoal and bones of dogs. The charcoal was treated routinely with acid, alkaline, and acid (Mook & Waterbolk 1985), which removes any acid soluble carbon contaminants as well as contamination of humic acid. Collagen was extracted from the bone samples. After conversion into carbon dioxide the samples were further purified, and finally counted in a 3 liters proportional counter equipped with a guard counter for at least one day. It should be borne in mind that the datings from Ringkloster have been produced during a rather long period of time, i.e. from 1970 to 1993.

Most samples were measured for the stable isotope ratio, $\delta^{13}C$, on a mass spectrometer. Besides being highly interesting in itself, the $\delta^{13}C$ was used for correcting the radiocarbon ages for isotopic fractionation. The two dog bone samples K-386 and K-387 were too small to allow dating, and were only measured for stable isotope ratio. One of these (K-387) was definitely affected by marine diet ($\delta^{13}C$ = -11.8 $^{0}/_{00}$ PDB), while the other (K-386) and the two remaining dog bone samples (K-4132 and K-4133) were all clearly terrigenic in isotope ratio ($\delta^{13}C$ = -20.0, -21.3, and -18,8 $^{0}/_{00}$ PDB). Thus all samples dated could be refered to the terrestrial value of $\delta^{13}C$ = -25 $^{0}/_{00}$PDB.

Four samples dated before 1971 were not measured for $\delta^{13}C$. For these have been added extra uncertainty to account for the unknown isotopic fractionation. Fortunately all of these samples were charcoal.

Calibration of the results was performed according to the 20 year average of the atmospheric curves in Stuiver and Pearson (1993) using the Calib V3.0.3c program from University of Washington (Stuiver & Reimer 1993). The most likely calibrated date and the calibrated date at ± 1 standard deviation are listed in Table 1. The full calibrated probability distributions for all the samples were generated by the Oxcal v2.18 program from the Oxford Radiocarbon Laboratory (Ramsey 1995) and are shown in Fig. 1.

It can be speculated whether or not K-1765 (or K-1653) are in fact older than K-4368. A hypothesis that the age of K-1765 is identical with the age of K-4368 is accepted within the 95% confidence limit by a statistical T-test. Thus, seen from a statistical point of view K-1765 are indistinguishable from K-4368, and so is K-1653.

K-1654 is from the same stratigraphical level as K-4370, but seemingly somewhat older. Again a statistical T-test shows that a hypothesis that the date of K-1654 is identical to the date of K-4370 is accepted within the 95% confidence limit.

A hypothesis that K-4132 and K-4133 are of identical age is also accepeted within the 95% confidence limit by a T-test.

None of these statistically derived conclusions are surprising if one contemplates Figure 1, where the distributions of calibrated ages are plotted for all the dates. A significant overlap in the probability distributions are seen for each pair noted above.

However, a hypothesis that K-4371 and K-4372 are of identical age is rejected within the 95% confidence limit by a T-test. There is thus a significant jump in time between the last sample in stratigraphical sequence of Mesolithic age (K-4371) and the first sample of Neolithic age (K-4372). This jump is also clearly seen in Fig. 1.

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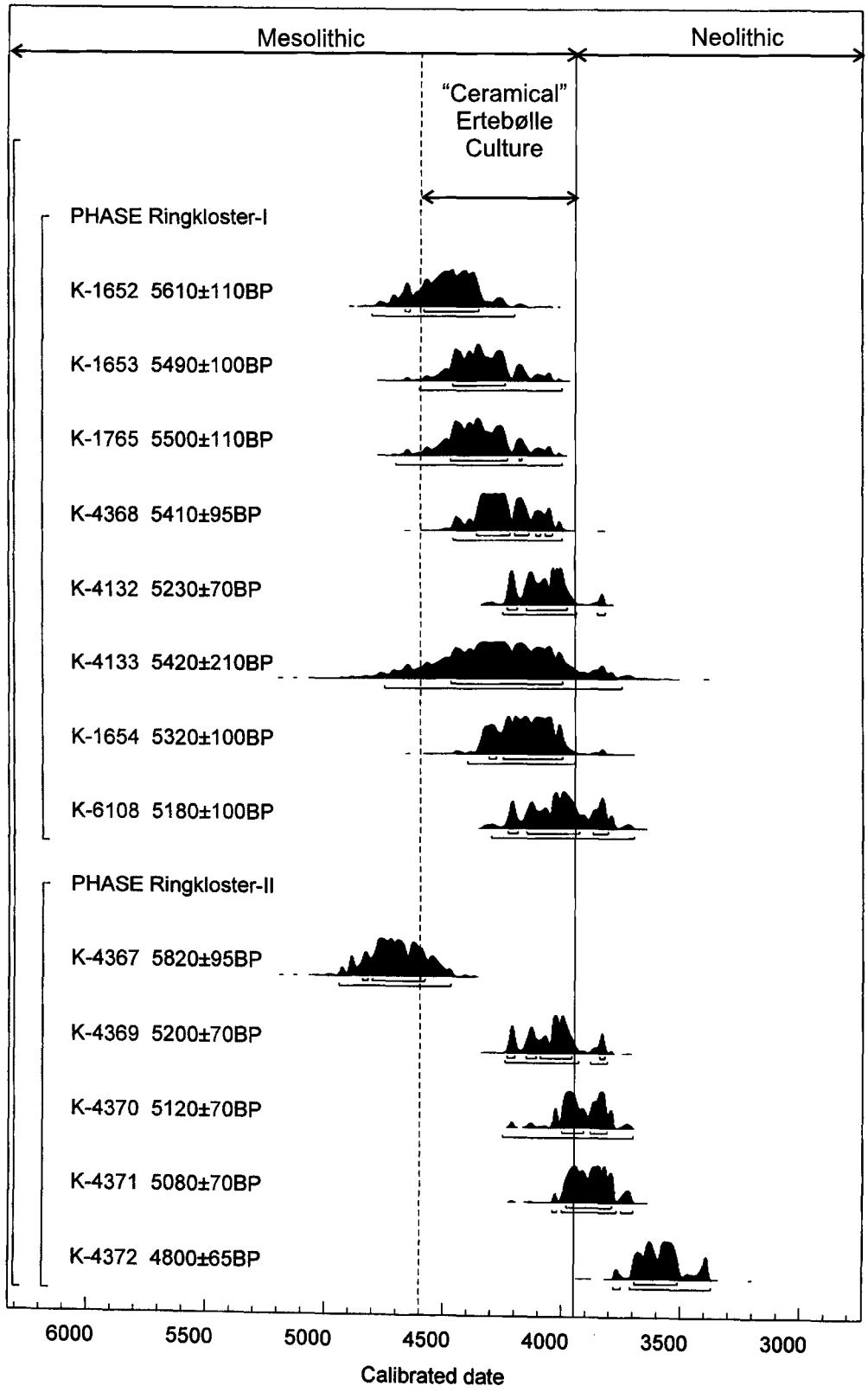
K-no.	Material	Radiocarbon age	Most likely Calibrated age	Calibrated age at ± 1 std.dev.	$\delta^{13}C$ ‰ PDB
K-386	Bones, dog	-			-20.0
K-387	Bones, dog	-			-11.8
K-1652	Charcoal T	5610±110	4460	4540-4350	
K-1653	Charcoal Q	5490±100	4340	4450-4240	
K-1654	Charcoal FR	5320±100	4220-4110	4320-3990	
K-1765	Charcoal Q	5500±110	4350	4460-4240	
K-4132	Bones, dog	5230±70	4030-4000	4220-3970	-21.3
K-4133	Bones, dog	5420±210	4320-4260	4460-3990	-18.8
K-4367	Charcoal Q	5820±95	4710	4790-4540	-25.3
K-4368	Charcoal CO	5410±95	4320-4250	4350-4100	-26.8
K-4369	Charcoal T	5200±70	3990	4080-3960	-26.8
K-4370	Charcoal AL/U	5120±70	3950	3980-3800	-26.2
K-4371	Charcoal CO/-A-L/FR	5080±70	3940-3820	3970-3790	-25.2
K-4372	Charcoal FR/AL	4800±65	3630-3550	3650-3510	-24.7
K-6108	Charcoal AL	5180±100	3980	4210-3820	-26.7

Table 1. Radiocarbon dates from Ringkloster

Fig. 1 Calibrated age distributions of the samples from Ringkloster using Oxcal v2.18. The terminal phase of the Mesolithic, the Ceramical Ertebølle Culture from Cal BC 4600 to 3950, is marked with vertical lines. Only one sample (K-4372) lies exclusively in the Neolithic.


Mesolithic
Neolithic
"Ceramical" Ertebølle Culture
PHASE Ringkloster-I
K-1652 5610±110BP
K-1653 5490±100BP
K-1765 5500±110BP
K-4368 5410±95BP
K-4132 5230±70BP
K-4133 5420±210BP
K-1654 5320±100BP
K-6108 5180±100BP
PHASE Ringkloster-II
K-4367 5820±95BP
K-4369 5200±70BP
K-4370 5120±70BP
K-4371 5080±70BP
K-4372 4800±65BP
6000
5500
5000
4500
4000
3500
3000
Calibrated date