SCANDINAVIAN MODELS: RADIOCARBON DATES AND THE ORIGIN AND SPREADING OF PASSAGE GRAVES IN SWEDEN AND DENMARK

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ABSTRACT. Approximately 2700 radiocarbon results are currently available from European megalithic contexts. The interpretation of these ^{14}C dates is often difficult. It is not easy to connect many of them from their archaeological context to the construction or the burial phase of the graves. This paper focuses on the megaliths of Scandinavia—a special megalith region—as it is the only place in Europe with ^{14}C dates directly referable to the construction of the passage graves, the graves have good bone preservation, and new dating sequences are available. Some 188 ^{14}C results are now available from Scandinavian passage graves. In Sweden, new data suggest that these graves were built from the first half of the 35th century BC onwards. The ^{14}C dates from birch bark as filling material between dry walls make it possible to build a sequence for the construction phase of the passage graves in Denmark from the 33rd century BC onward. With an interpretative Bayesian statistical framework, it is possible to untangle the nuances of the differences for the origin and the spreading of the megaliths in the different regions, to define, together with the archaeological remains, possible cultural-historical processes behind these phenomena and to discuss diffusion versus convergence.

INTRODUCTION

Up to the present day, approximately 30,000 megaliths still exist in all of Europe—most of them were constructed in the Neolithic and Copper Age and are located in coastal areas. Radiocarbon dating megalith graves is difficult. The quality of the samples can be a problem, given the old-wood effect or terrestrial or marine reservoir effects, and the treatment of the samples in the laboratory. The problems of biggest concern, however, are the context of the samples and the correlation of the samples to the event to be dated. Consequently, it is important to divide the data into *termini post quos* and *termini ante quos* values. *Termini post quos* regarding the construction of the grave are dating pre-megalithic contexts, i.e settlement layers under the grave, which may be independent from the grave event itself. *Termini ante quos* represent the use of the grave, e.g. human bones, grave goods, and samples from burial activities or other rituals around the grave. Long-lived, often context-less, samples have been used to date the European megaliths for many decades with little source criticism. The result is that many megalith regions are dated too old, since there have been too many *termini post quos* involved in the calculations. These samples were mixed up during building activities and are often found in the cuts of the orthostats (side slabs of the grave), in the filling of the mounds, and also in the chambers. It is difficult to sort out these dates. To get to results as exact as possible, it is necessary—besides the already mentioned accurate sorting of the data—to analyze the dating sequences using Bayesian models. The details and the methodology of Bayesian chronological modeling have been discussed over the last years in different papers and will not be covered here (e.g. Bayliss et al. 2006; Bayliss 2009; Bronk Ramsey 2009). All the models and calibrated data presented in this paper used OxCal v 4.0 (Bronk Ramsey 1995, 2001, 2008, 2009) and the calibration data of Reimer et al. (2004).

Some 269 dates are available from Scandinavian monuments of the Neolithic and Copper Age, which includes dates from dolmen and passage graves and from long barrows (see Appendix for details on dates). This paper focuses on the passage graves, their origin and spreading, and their chronological relationship to the dolmen and long barrows. The finer architectural points of the graves like if they are T-shaped or twin graves (for the passage graves) and round or long (for the dolmens) are hereby secondary. The incorporation of a corridor or passage is important as a differentiation to the dolmen, since they are representing more elaborate burial rites and grave construc-

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tions. It is possible to use both, dolmen and passage graves, as a collective grave for a certain community, but the passage allows the possibility to construct a much larger and more impressive monument, since the inner stone structure, built with slabs or dry walling, was covered by an outer structure such as an earth mound or a stone cairn.

SWEDEN

From Sweden, 154 ^{14}C dates are available from a total of 23 passage graves, 24 dolmens and long dolmens, and 4 long barrows. The first passage graves were built in the 35th century BC in Västergötland and on the Swedish islands Oland and Gotland, both situated in the Baltic Sea. These first passage graves are discussed in more detail and presented in Bayesian models below. On Oland and Gotland, the megaliths are clustered in small "colonies" on the west coasts. These locations are an indication that the passage graves have not developed locally and the passage grave tradition has migrated from elsewhere: either as an innovation from Västergötland or from somewhere to the south.

The Oldest Passage Graves in Sweden

Gökhem 17/Västergötland

The oldest ^{14}C-dated individual from a megalith grave in the Scandinavian Funnel Beaker world is from the passage grave Gökhem 17 in Västergötland in central Sweden. Gökhem 17 is a passage tomb with a very small rectangular chamber that measures 2.7 × 1.0 m with a 3-m-long east-oriented corridor. Today, it has been almost destroyed by plowing (www.raa.se.fornsök). The chamber has 2 niches but no traces of inner compartments or dry walls. The chamber and corridor were completely excavated in 1987 by Lars Bägerfeldt. Six individuals could be separated; each has been dated and the stratigraphy is known. Not many grave goods were found: a small amount of Middle Neolithic pottery, 5 fragments of amber pearls, 2 flint fragments, 2 schist beads, and 3 large animal teeth. Possible ceramic deposits in front of the entrance have most likely been destroyed by plowing (Bägerfeldt 1987).

Nine ^{14}C dates from 6 individuals are available from Gökhem 17 and are here presented within a statistical framework. Three individuals each had 2 dates (individual B, C, and F2): a conventional and an accelerator mass spectrometry (AMS) date, which have been combined in the model to keep the different individuals statistically independent (Figures 1–2). The history of the grave and the burial activities can be reconstructed from this model as follows: the construction of the grave can be placed shortly before the oldest individual E "*Babsan*" (*R_Combine* from the 2 ^{14}C results: Ua-13551, 4700 ± 110 BP; St-11267, 5005 ± 235 BP; 3638–3378 BC, 68% probability; 3760–3340 BC, 95% probability) and thus shortly before the transition to the 35th century BC, at the end of the Early Neolithic. Individual E, a mature woman, was found articulated and nearly complete on the very bottom of the grave, which was built for her. She is the oldest dated individual in a Scandinavian Funnel Beaker megalith context. A second burial phase with the individuals C and D and the combined date for individual F "Emil," which was deposited in the corridor, starts in 3126–2965 BC (68.2%; 3310–2926 BC, 95.4%) and ends in 3009–2865 BC (68.2%; 3082–2662 BC, 95.4%) in the Middle Neolithic in MNII/III. After a break of ~800 yr, individual B was buried in 2403–1881 BC (68.2%; 2576–1634 BC, 95.4%) at the end of the Neolithic. Individual A "Ursula" was found across the corridor and is the highest individual in the stratigraphy. She was buried in the pre-Roman Iron age in 369–43 BC (68.2%; 405–122 BC, 95.4%) in the grave, which was at this time already ~3300 yr old.

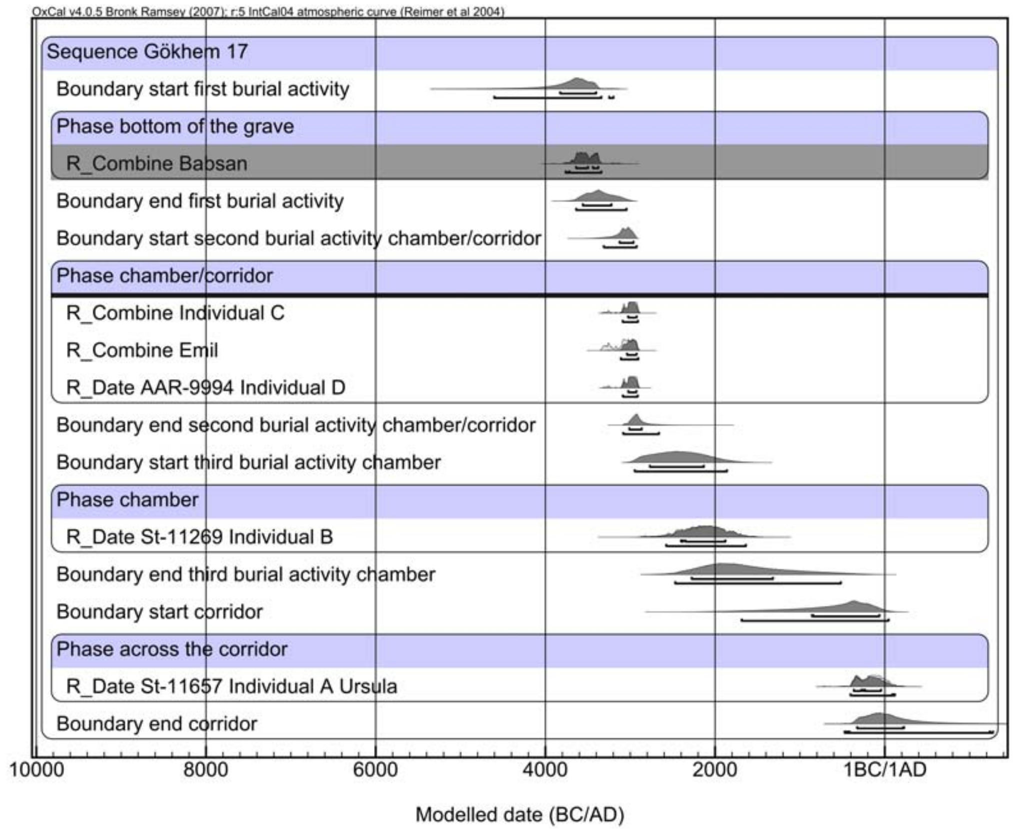

Figure 1 Probability of dates from Gökhem 17 (A_{model} = 117.4%; $A_{overall}$ = 116.6%). The gray bar shows the oldest individual from a megalith context in Scandinavia; the black bar marks the beginning of the grave goods.

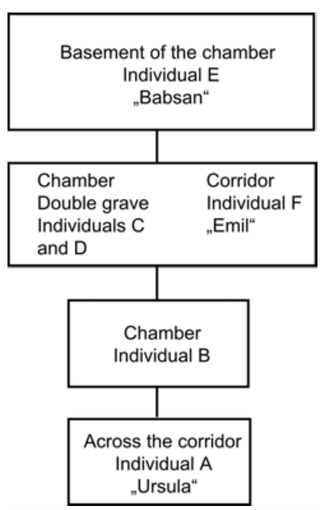

Figure 2 Summary of prior information from Gökhem 17 incorporated in the chronological model.

Figure 3 The passage grave Mysinge 2 with the corridor viewed from the southeast

Mysinge 2/Oland

On Oland in the Baltic Sea, in a quite unique situation, 3 Neolithic cultures are represented: the Funnel Beaker culture, the Pitted Ware culture, and the Battle-axe or Boat-axe culture (Papmehl-Dufay 2006). On the west coast of the island in the parish of Resmo, 4 passage graves are clustered within 3 km, while on the rest of the island only flat mark graves are found. These passage graves, together with a settlement, represent a small Funnel Beaker colony. Only 1 of these graves has been excavated: Mysinge 2, a T-shaped passage tomb with dry walls between the orthostats, a 5 × 3.75 m chamber and a 5.5-m-long corridor (Figures 3–4). The excavation was carried out by T Arne (1909). He described 4 clearly separable layers, from top to bottom: a first filling layer, a second layer with human bones and Bronze Age artifacts, a third layer with human and animal bones and Neolithic finds, and the deepest layer with disarticulated bones and at least 3 articulated individuals and Neolithic finds. Most of the human bones in this last layer were on the short northern side of the chamber. Mounds of 3–4 skulls were lying between the orthostats (Figure 5). All this is evidence that in Mysinge 2, successive deposition of the dead was practiced. Bodies of the recently dead were sequentially interred in the chamber; old decomposed bodies were pushed aside, in this case to the short end of the chamber. Arne estimated there were skeletons of up to 30 or 40 individuals. ^{14}C dates have recently been done on 30 skulls for a stable isotope study; accordingly it is possible to separate the individuals (Eriksson et al. 2008). There does not seem to be any terrestrial or marine reservoir effect in the bones. Interestingly, the study indicated quite different diets for the Mysinge Funnel Beaker people and the people from the Pitted Ware culture. The latter relied heavily on marine resources and certainly have a reservoir effect in their bones. The contemporaneity with the megalith population thus has to be questioned, as the Funnel Beaker diet displays a significant terrestrial input.

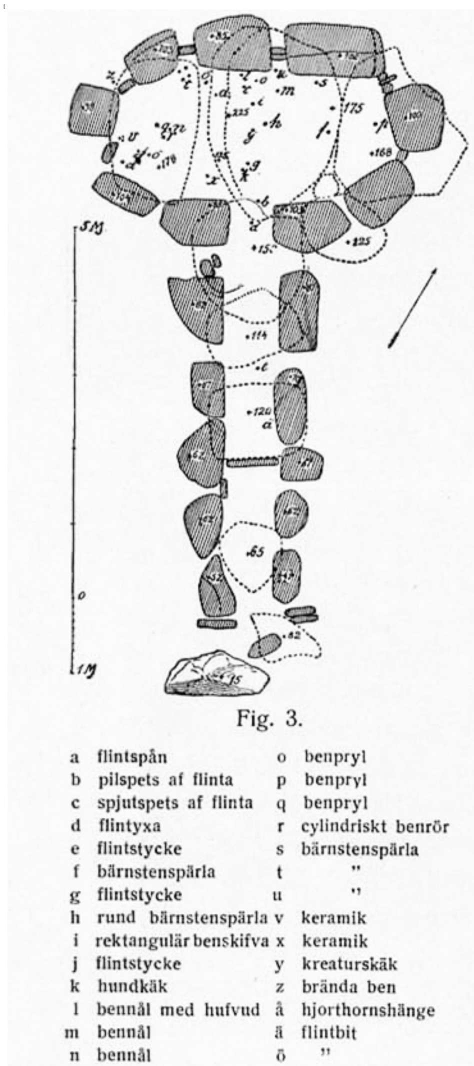

Figure 4 Planum from the excavation of 1908 (Arne 1909:88).

The sparse stratigraphical information reconstructed from the excavation documentation of 1908 only allows us to establish 3 phases (Figure 6). There is 1 main burial phase, during which the grave was regularly frequented. The oldest burial in this first phase was deposited in 3409–3364 BC (GrA-16855, 4685 ± 40 BP; 3409–3364 BC, 68.2%; 3504–3349 BC, 95.4%) in the Early Neolithic. This individual is also one of the 3 oldest dated individuals in Scandinavian megaliths. In the second half of the 33rd century BC, at the beginning of the transition from the Middle Neolithic/MNIa to the Middle Neolithic MNIb, there is a group of individuals buried with quite similar dates. There are no dated individuals from the Middle Neolithic MNII/III, indicating a hiatus. The second phase started in 3015–2916 BC (68.2%; 3092–2899 BC, 95.4%) and ended in the second half of the 26th century BC. During this period, at least 10 individuals were buried. From 2527–2409 BC (68.2%; 2584–2357 BC, 98%) onwards, at the end of the Neolithic and into the Bronze Age, the grave was infrequently used, with 15 individuals buried over a time span of 1360 yr. It is noteworthy that in the

Figure 5 Bone piles along the orthostats—a result of successive burial practice (Arne 1909:90).

immediate surroundings of Mysinge 2, many Bronze Age burial mounds were erected. Thus, the question arises as to what the burials in the megalith grave dating to this period are representing: poor graves or special burials in the grave of the ancestors? Mysinge 2 was in use over a long time, over 2290 yr.

Highly fragmented pottery, attributable only to the Funnel Beaker period, was discovered in the entrance area, which was reopened in 2004. Analysis of the ceramics indicates production using local clay and crushed granite (Papmehl-Dufay 2006). The finds from inside the chamber include at least 17 amber beads, a flint axe, a flint blade, 2 flint arrowheads, a fragment of a flint dagger, and several bone artifacts, including a wrist guard and a number of points. The axe is most probably Middle Neolithic, while most of the other material belongs to the Final Neolithic (Arne 1909; Papmehl-Dufay 2006:72).

Ansarve Hage/Gotland

From Gotland, only 1 megalith grave is known: Ansarve Hage in the Tofta Parish, which is situated on the west-central coast of the island. A few Funnel Beaker settlements are known on Gotland: Grottan, Stora Förvar, and Gumbalde. The rest of the island was occupied by people from the Pitted Ware culture. The grave was excavated in 1984 by Göran Burenhult. It was mostly destroyed, with only 4 orthostats remaining along with the remains of a small passage. The chamber must have been measuring originally around 1.5 × 3 m, and was surrounded by a rectangular frame of smaller stones, probably representing a younger construction. The osteological examination gave a minimum of 29 individuals: 16 adults, 3 juvenile, 8 infants II, and 2 infants I. Altogether, 4 adult females and 3 adult males could be constituted (Wallin and Martinson-Wallin 1997:23–8). Only 5 ^{14}C dates are available from Ansarve Hage. δ^{13}C values vary between –19.3 and –18.6‰ and show a predominately terrestrial diet. There does not seem to be any reservoir effect in the bones. Even if the δ^{15}N values of these specific individuals are unknown, a terrestrial reservoir effect can be excluded, as values are known from other Funnel Beaker sites from the Baltic Sea and they do not represent any problems (Papmehl-Dufay 2006:46).

Three ^{14}C dates (Ua-3783 to -3785) belong to the first burial phase. Burial activity started in the late Early Neolithic with a juvenile individual who was buried ~3350 BC (Ua-3785, 4640 ± 70 BP; 3619–3351 BC, 68.2%; 3635–3112 BC, 95.4%) (Figure 7). The 3 dates are in the time interval

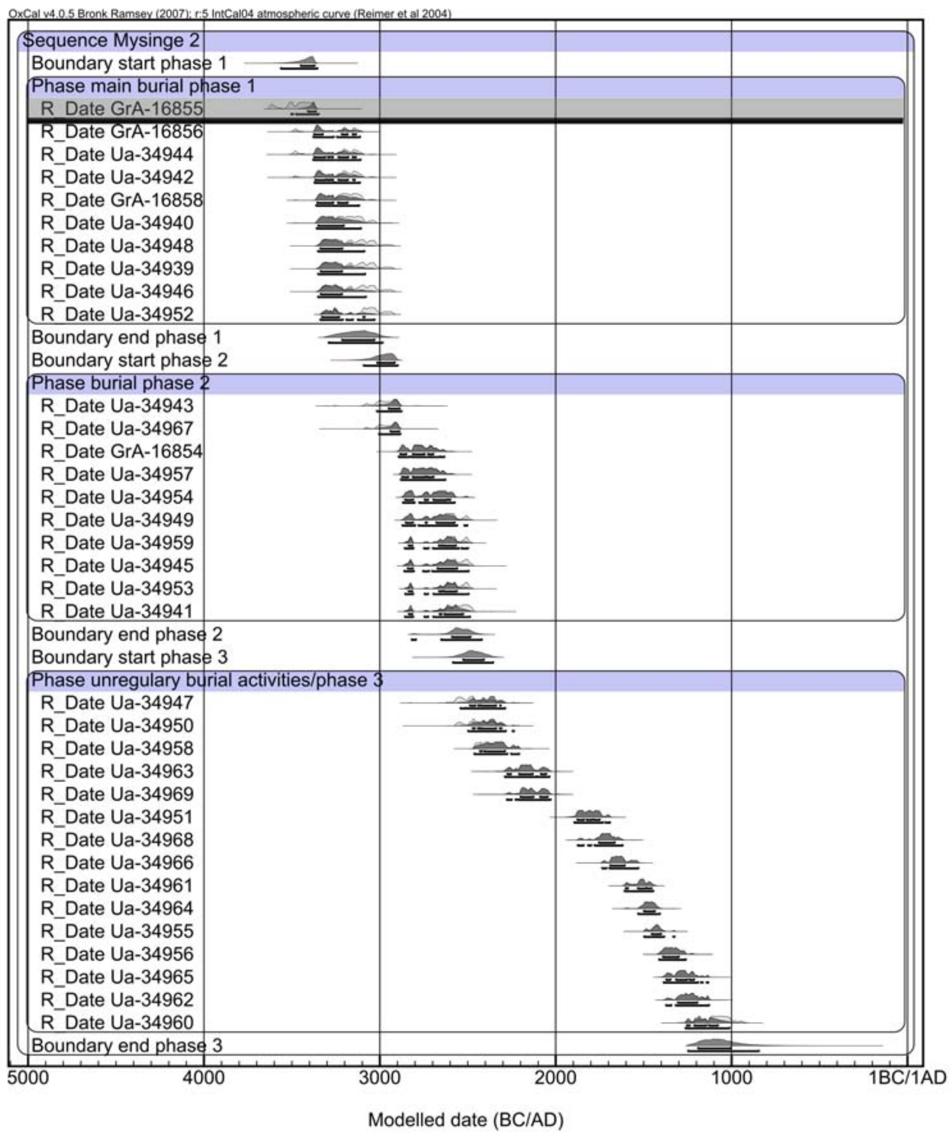

Figure 6 Probability distributions of dates from the passage grave Mysinge 2, A_{model} = 91%, $A_{overall}$ = 90.3%. The sequence shows use of the grave over 2500 yr. The gray bar indicates 1 of the 3 oldest individuals in a megalithic context from Scandinavia; the black bar marks the beginning of the grave goods.

between 3420 and 3250 BC. Two dates show the later use of the grave in the Bronze Age, around 1700 BC (St-10960, 3370 ± 30, 1878–1535 BC, 68.1%; 2026–1421 BC, 95.4%) from a bone depot in the chamber and 720 BC (St-10961, 2530 ± 275 BP; 1046–394 BC, 68.2%; 1391–110 BC, 95.4%) from a burial outside the chamber.

Spreading of the Passage Graves

In Scania, the oldest ^{14}C dates are known from the northeast coast. A bone sample from the chamber of the passage grave Fjälkinge 9 dates around 3300 BC, to the beginning of the Middle Neolithic (GrA-15250, 4465 ± 50 BP; 3494–3129 BC, 68.2%; 3500–3104 BC, 95.4%) (Persson and Sjögren

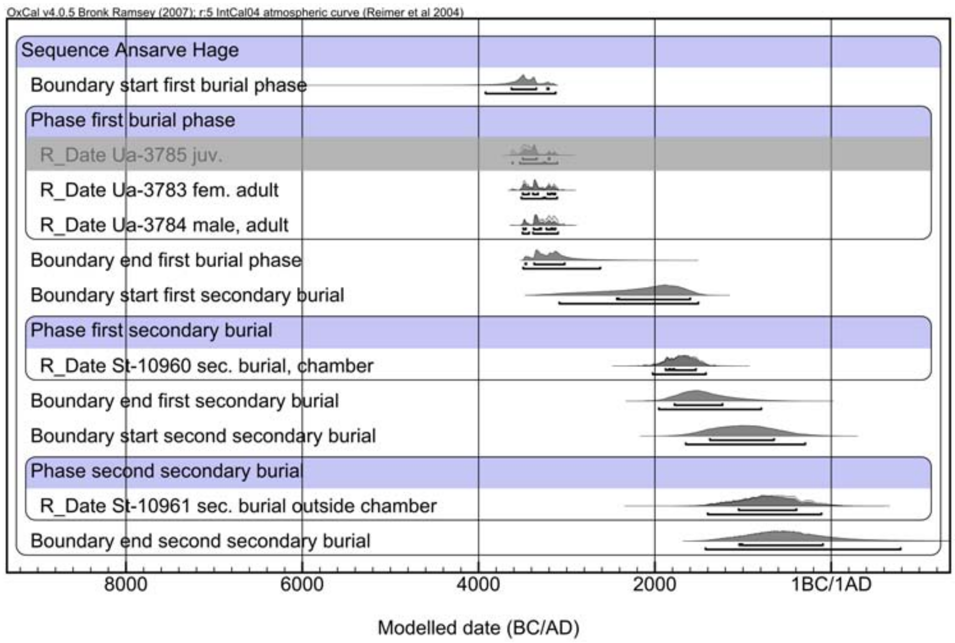

Figure 7 Five ^{14}C dates are available from Gotland's only megalith grave. The oldest individual was buried in the period 3619–3351 cal BC (Ua-3785, 4640 ± 70 BP; 3619–3351 BC, 68.2%; 3635–3112 BC, 95.4%), A_{model} = 102.3%, $A_{overall}$ = 101.6%.

2001:229). The ^{14}C dates from southwest Scania are from the same period. The oldest determination is hereby from food residues inside a ceramic vessel from the passage grave Odarslöv, close to Lund. This date falls in the same time interval, 3489–3117 BC, as the oldest dates from the northeast coast (LUS-7148, 4565 ± 50 BP; 3489–3117 BC, 68.3%; 3499–3097 BC, 95.5%) (Edring 2007:97). In southeast Scania, the development starts even later with a date from a human bone from Ramshög in the time interval 3370–3096 BC (LU-257, 4540 ± 90 BP; 3370–3096 BC, 68.2%; 3518–2933 BC, 95.4%).

Deposition of artifacts in the Swedish passage graves starts in the Middle Neolithic. The material from passage graves in Västergötland has been summarized by Karl-Göran Sjögren (Sjögren 2003: 102, Table 6.12), beginning with small amounts in the Middle Neolithic MNI. Most of the graves have material from the Middle Neolithic MNI-MNII (Falkinge stad 3, Gökhem 31, Gökhem 71, Karleby, Torbjörntorp, Valstad, Valtorp). Around the coast of Bohüslan, Middle Neolithic ceramics have been found in small amounts from Alvastra and Skjeberg. In Scania, also small amounts of Middle Neolithic MNI pottery have been found (Bagge and Kaelas 1950–1952; Strömberg 1971).

Chronological Relationship of Dolmen and Long Barrows to the Passage Graves in Sweden

Some 24 ^{14}C dates are available from a total of 11 dolmen and long dolmens in Scania, Västergötland, Bohüslan, and Smaland. At least 7 of these dates are certain *termini post quos* values. The oldest possible construction or use is placed around 3490 BC based on a charcoal sample from the chamber of the dolmen Holtenes III in Västergötland (T-5828, 4660 ± 80 BP; 3626–3359 BC, 68.2%; 3640–3113 BC, 95.5%) (Sjögren 2003:99). Reliable dates for dolmen use start around 3300 BC with the bone sequence from Kinneved 21 (GrA-15135, 4570 ± 50 BP; 3492–3118 BC, 68.2%; 3500–3097 BC, 95.4%) (Sjögren 2003:98) and Falköping västra 7 (GrA-15142, 4560 ± 60 BP;

3486–3110 BC, 68.1%; 3505–3031 BC, 95.4%) (Cullberg 1961). From Scania, 6 dates exist from Sarup Molle, Trollasten, and Hindbydösen (Strömberg 1971; Burenhult 1981). The oldest ^{14}C date is from Hindbydösen from about 2690 BC (GrA-12735, 2872–2505 BC, 68.2%; 2919–2348 BC, 95.4%). It is not possible to determine the beginning of the dolmens in Scania from the ^{14}C dates because there are too few dates and those are from unsure contexts.

From the Swedish west coast around Bohüslan, Early Neolithic material is known from 3 graves: Tanum 579, Säve 57, and Årstad 88. However, according to Sjögren (2003:101), after critical consideration of the structures, the context of the ceramics is not clear and the ceramics represent a *terminus post quem*. The same is true for most of the dolmens in Scania. There is some evidence for Early Neolithic material in dolmens, for example, at Skögsdaladösen, Hoby 3a, St. Köpinge, and Trollasten (Strömberg 1968; Sjögren 2003:101), but these seem to represent *termini post quos* dating as well. The ceramics were not found inside the chambers, but mainly in the mound. Fuchsberg-like pottery—a late Early Neolithic ceramic style—is only known from Skogsdaladösen, most probably the oldest Scanian dolmen. The traditional picture of the development from dolmen to passage grave in Scandinavia has been questioned for some years now (Persson and Sjögren 1995, 2001; Sjögren 2003:98), but the chronological relationship between dolmens and passage graves is not yet clear.

Only 5 ^{14}C dates exist from 4 Swedish long barrows: Örnakülla, Heberg, Jättegräven, and Gladsax. (Strömberg 1971; Burenhult 1981; Larsson L 1992; Larsson M 2002). They are nearly all typical *termini post quos* from layers under the barrow. Just 1 date from Örnakülla, of ~3500 BC, could date actual use (Ua-13607, 4695 ± 80 BP; 3628–3372 BC, 68.2%; 3651–3138 BC, 95.5%). This determination is on a charcoal sample from an inner structure, which is most probably a grave.

DENMARK

In Denmark, not many ^{14}C dates from megalith structures are available: 35 dates from a total of 14 passage graves and 12 dates from dolmens and long dolmens, while from long barrows 39 dates are available. Yet, Denmark is nearly the only place in Europe where it is possible to date the construction of the passage graves via birch bark. Moreover, even if the ^{14}C dates are limited in number, it is possible to get from them an indication of the chronological relationship between the different monument types—passage graves, dolmen, and long barrows—and, from the spatial distribution of the ^{14}C dates, on their origin and their spread.

Birch Dates and the Construction of the Passage Graves

Ten ^{14}C dates on birch bark are available from 8 Danish passage graves. The bark was used as filling material in the dry walls between the orthostats (Dehn and Hansen 2006) (Figure 8). The oldest birch bark dates—the oldest dates currently known from Danish passage graves—are from Hvalshøje and Snibhøj on the north and northeast coast of Jutland and maybe also within the same period from Raevehøj on the west coast of Sjaeland. The model shows that the construction of passage graves starts in these regions in 3503–3206 BC (68.2%; 3599–3145, 95.4%) and spreads out from there (Figure 9). The latest construction date from Jutland is at Jordhøj in 3289–3035 BC (68.2%; 3356–3012, 95.4%). It seems that on Sjaeland the passage graves were built over a longer period of time; the youngest birch bark date is from Olshøj and the construction of the passage graves in Denmark ends, according to the present data, around 2900 BC (2911–2874 BC, 68.2%; 3018–2763 BC, 95.4%).

Figure 8 Birch bark as filling material between the dry walls of the passage grave Maglehøj. The bark is directly connected to the construction of the graves and provides the opportunity for a more precise dating of these monuments. Photo courtesy T Dehn.

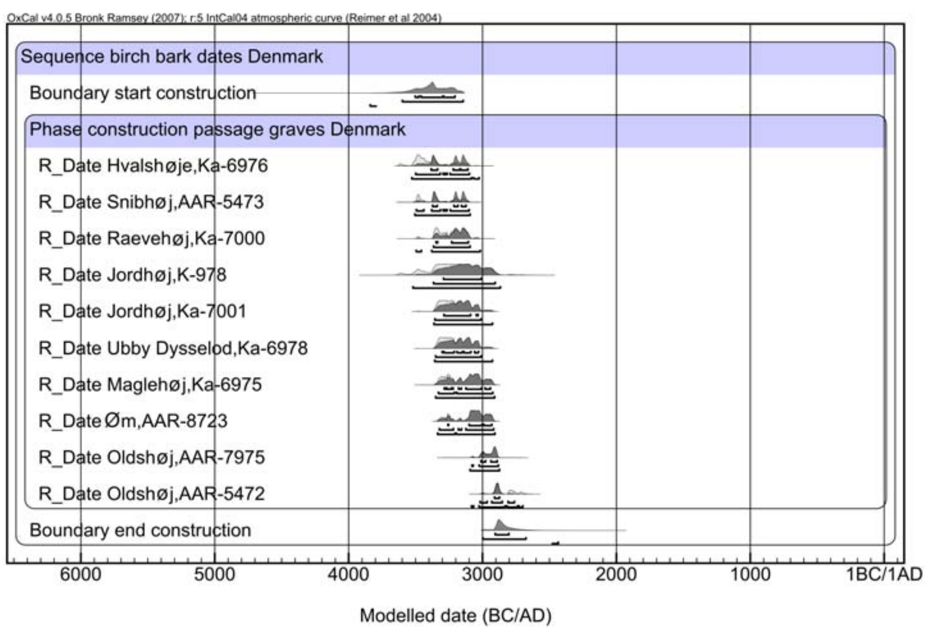

Figure 9 Sequence for construction of passage graves from birch bark dates (A_{model} = 89.8%, $A_{overall}$ = 84.8%)

The passage grave phase thus lasted around 500 yr, between 3350 and 2850 BC. Seven of the passage tombs were built within the first 300 yr. Only Olshøj was built later, around 2900 BC. The location of the first passage graves in Denmark on the north and the northeast coasts, close to the Swedish mainland, could be evidence for a migration or the transport of an idea from Sweden, where the passage graves had already been in use 200 yr prior.

The second model of the birch bark sequence assumes that the graves were built within a short time period, within a couple of weeks, and that the bark was harvested in the same year. There are no traces of restoration works inside the monument. In this case, it is possible to combine the dates within the graves Jordhøj and Olshøj (Figure 10). The dates combine unproblematically. The passage graves start in this model somewhat later with Hvalshøje and Snibhøj on north and northeast Jutland and with Raevehøj on Sjaeland in 3487–3117 BC (68.2%; 3506–3111 BC, 95.4%) and end with Olshøj around 2900 BC (2916–2886 BC, 68%; 3019–2876 BC, 95.4%). This model shortens the period during which the passage graves were built by 100 yr, down to 400 yr. The second model is to be preferred, as the possibility is high that the birch bark relates to a single act of construction. Seven of the 8 dated graves were erected within the time span around 3300–3100 BC.

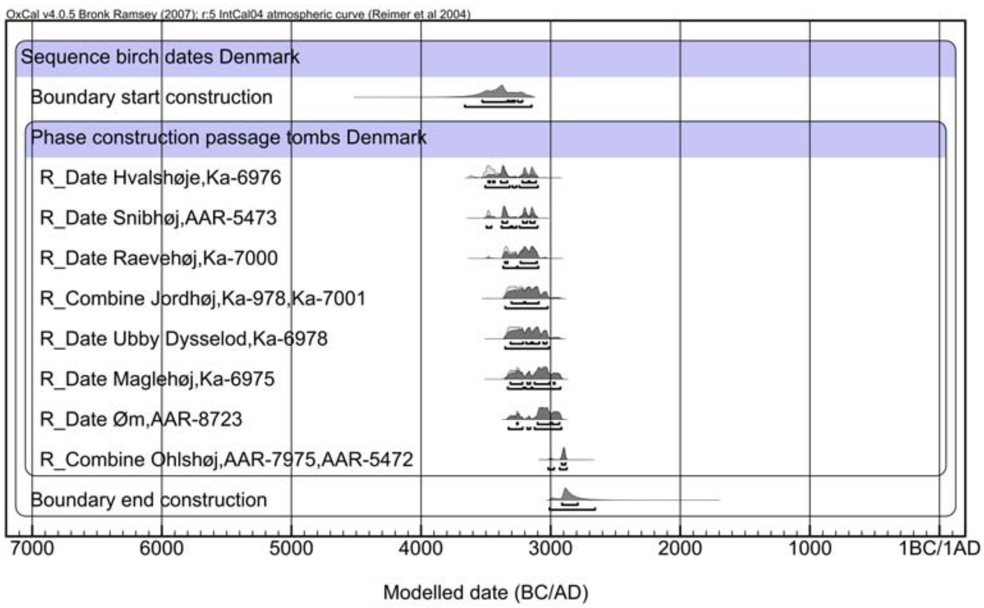

Figure 10 The same sequence with the *R_Combine* function under the presumption that the graves were built within a short span of a couple of weeks (A_{model} = 82.7%; $A_{overall}$ = 78.6%). Most of the passage graves were constructed between 3300 and 3100 BC. Only Olshøj is younger and was constructed around 2900 BC.

Judging from the archaeological material, the oldest ceramics from passage graves belong to the Middle Neolithic Ib. The passage graves have been constructed mostly during this phase or even in the following Middle Neolithic II (Berg 1951; Kjaerum 1967; Gebauer 1978; Skaarup 1985; Sjögren 2003). This is compatible with the birch bark dates.

Chronological Relationship of Dolmen and Long Barrows to Passage Graves in Denmark

Twelve ^{14}C dates are available from dolmens in Denmark. The dates with secure prior information, which can be connected with the construction and the burial activity, are contemporary with the passage graves: from Klokkehoj, 4 dates from bone depots are all from a time interval between 3370 and 3100 BC (K-2954/K-3015, 4550 ± 65 BP; K-3012, 4250 ± 90 BP; K-3013, 4140 ± 90 BP; K-3014, 4200 ± 90 BP); from Trekoner, a bone date is available of ~3220 BC (LU-1952, 4500 ± 55 BP; 3339–3102 BC, 68.3%; 3365–3022 BC, 95.4%) (Persson and Sjögren 2001:229–30). The 5 older ^{14}C dates derive from typical *terminus post quem* contexts. The samples from the long dolmen of Vroude Hede are from under the stone pavement (~3300 BC, K-1566, 4570 ± 100 BP; 3498–3101 BC, 68.2%; 3630–2941, 95.5%) and between the stone pavement and dry wall (~3500 BC, K-2424, 4660 ± 100 BP; 3632–3350 BC, 68.2%; 3645–3101 BC, 95.4%) (Jørgensen 1977). For Ølstykke (~3490 BC, K-2356, 4710 ± 100 BP; 3632–3374 BC, 68.2%; 3704–3116 BC, 95.5%) (Midgeley 1992:497), the context is not known, and for Kjeldbäckgård, the charcoal samples were taken from a pit outside the grave (~3370 BC, AAR-678, 4610 ± 140 BP; 3625–3105 BC, 68.2%; 3645–2930 BC, 95.4%) and from under the orthostat (~3510 BC, AAR-168, 4730 ± 130 BP; 3642–3368 BC, 68.2%; 3786–3098 BC, 95.4%). There is evidence from the material found in Danish dolmens that some were built before the passage graves. From a study in Sydfyn, it is known that in 22 of 201 megalith graves, Early Neolithic material (including Fuchsberg material) was discovered (Skaarup 1985; Sjögren 2003).

Thirty-nine ^{14}C dates are available from Danish long barrows. In the following model, only the 17 ^{14}C dates with secure prior information have been used (Figure 11). It is possible to sort out the safe *terminus post quem* dates. The very old ^{14}C dates from Barkaer (Liversage 1992:102) are from charcoal and mussel shell from a post-hole. The samples from Lindebjerg, Mosegården, and Konens Høj (Nielsen 1984:385; Midgeley 1985:222) are from settlement layers under the barrows, and those from Bjørnsholm, Rustrup I, and Rustrup II are charcoal dates from pits (Midgeley 1985:297; Müller 1998:91). Konens Høj is the youngest date of the *terminus post quem* sequence, which ends in this model in 3654–3511 BC (68.2%; 3701–3437 BC, 95.4%). The model calculates the beginning of the construction and use of the long barrows as 3543–3412 BC (68.2%; 3652–3387 BC, 95.4%). All the dates inserted in the use-phase are from the chamber and are charcoal dates, with the exception of the date from Kellerod, which is the only known date from a human bone from a Danish long barrow and, at the same time, the youngest date of the series (Midgeley 1992:497). It is interesting that all the dates, which are possible dates of use, are within a short time interval, the modeled dates as well as the unmodeled. They are all within the time interval of the second half of the 35th century BC. The exception is again the bone sample from Kellerod that dates to ~4400 BC (K-3515, 4490 ± 65 BP). This is an indication that in Denmark, the long barrows were constructed and used within a short time period, as is the case with this kind of mortuary monuments in England (e.g. Bayliss et al. 2006). The long barrows in Denmark are constructed probably contemporary with the dolmens and before the passage graves.

CONCLUSION

The oldest dated individuals from Scandinavian megalithic graves are known from the passage grave of Gökhem 17 in Västergötland and from the west coasts of the Swedish islands of Oland and Gotland in the Baltic Sea. These individuals were deposited at the end of the Early Neolithic, in the 35th century BC. In Sweden, 2 scenarios are possible: either the passage graves were developed convergent around 3500 BC in Västergötland and spread from there over Oland and Gotland in Scandinavia, or this innovation reached the Scandinavian countries from somewhere to the south. The fact that the ^{14}C-dated individuals are older than the material in the graves could be evidence that the Middle Neolithic started in these areas earlier and the passage graves are an appearance restricted to the Middle Neolithic or that the burial rites changed. The chronological relationship between the passage graves and the dolmen and long barrows in Sweden is not yet clear.

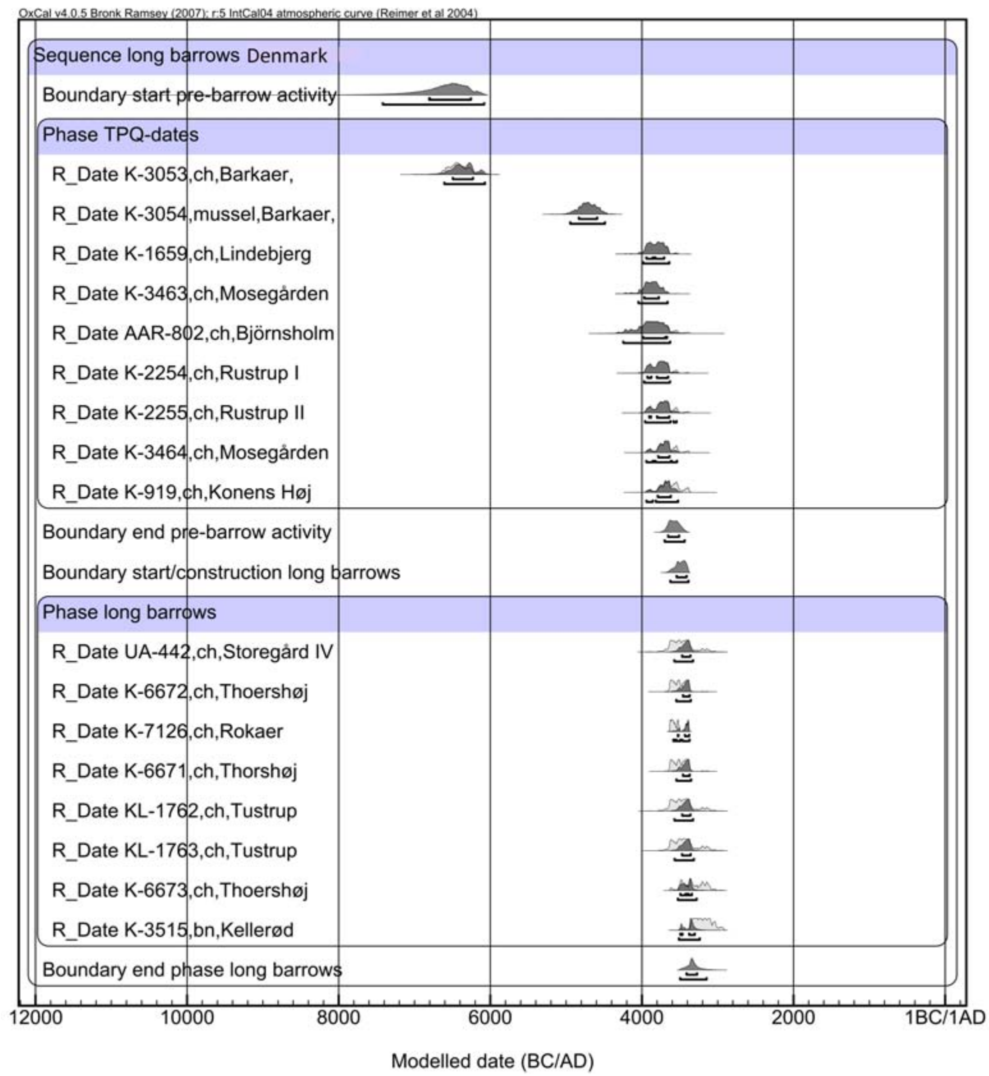

Figure 11 The Danish long barrows and their relationship to the passage graves. In this model, all the available ^{14}C dates with known context are divided into secure *termini post quos* and *termini ante quos* dates. The latter are all in the time interval of the second half of the 35rd century BC, and so the Danish long barrows were constructed most likely shortly before the passage graves (A_{model} = 101.5%; $A_{overall}$ = 102.5%).

The beginning of the passage graves in Denmark with Hvalshøje and Snibhøj on the north and northeast coast of Jutland and with Raevehøj on Sjaelland in 3487–3117 BC is an indicator that this innovation in architecture and funeral customs has been inspired from the nearby Swedish coast and by the Swedish megalith tradition, which started ~200 yr earlier. The long barrows in Denmark were erected probably contemporary with the dolmens in the first half of the 35th century, and before the appearance of passage graves. The only debatable Swedish ^{14}C date for the use of a long barrow falls in the same time interval as the Danish dates.

The dates for Scandinavia are limited. Even so, it is possible to see from the existing ^{14}C results indications on the "way" of the passage graves and the chronological relation between the different monument types. In the future, it will be necessary to produce larger series of ^{14}C dates for individual monuments to establish more reliable Bayesian models.

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APPENDIX

Dates used for the Bayesian modeling in this paper.

Grave	Lab ID	Material	Element, individual	^{14}C age BP	±	Reference
Gökhem 17	Ua-1894	human bone	individual E "Babsan"	4700	110	Sjögren 2003:98
Gökhem 17	St-11267	human bone	individual E "Babsan"	5005	235	Sjögren 2003:98
Gökhem 17	Ua-13551	human bone	individual C	4450	70	Sjögren 2003:98
Gökhem 17	AAR-9993	human bone	individual C	4305	65	Sjögren 2003:98
Gökhem 17	St-11658	human bone	individual F "Emil"	4200	300	Sjögren 2003:98
Gökhem 17	AAR-9991	human bone	individual F "Emil"	4415	55	Sjögren 2003:98
Gökhem 17	AAR-9994	human bone	individual D	4375	43	Sjögren 2003:98
Gökhem 17	St-11266	human bone	individual B	3415	445	Sjögren 2003:98
Gökhem 17	St-11657	human bone	individual A "Ursula"	2105	115	Sjögren 2003:98
Ansarve Hage	Ua-3785	human bone	tooth, individual juvenile-adult	4640	70	Lindqvist 1997:365
Ansarve Hage	Ua-3783	human bone	tooth, individual adult woman	4595	65	Lindqvist 1997:365
Ansarve Hage	Ua-3784	human bone	tooth, individual mature man	4555	60	Lindqvist 1997:365
Ansarve Hage	St-10960	human bone	bone deposit	3370	130	Blomqvist 1989
Ansarve Hage	St-10961	human bone	grave outside the chamber	2530	275	Blomqvist 1989
Mysinge 2	GrA-16855	human bone	Gbg nr 51, ulna	4685	40	Papmehl-Dufay 2006:75
Mysinge 2	GrA-16856	human bone	Gbg nr 52, ulna	4570	40	Papmehl-Dufay 2006:75
Mysinge 2	GrA-16858	human bone	Gbg nr 53 ulna	4520	40	Papmehl-Dufay 2006:75
Mysinge 2	GrA-16854	human bone	Gbg nr 50 ulna	4185	40	Papmehl-Dufay 2006:75
Mysinge 2	Ua-34939	human bone	mandibula, subj. 1, RES	4460	45	Eriksson et al. 2008:532
Mysinge 2	Ua-34940	human bone	mandibula, subj. 2, RES	4500	45	Eriksson et al. 2008:532
Mysinge 2	Ua-34941	human bone	mandibula, subj. 3, RES	4030	45	Eriksson et al. 2008:532
Mysinge 2	Ua-34942	human bone	mandibula, subj. 4, RES	4545	45	Eriksson et al. 2008:532
Mysinge 2	Ua-34943	human bone	mandibula, subj. 5, RES	4330	50	Eriksson et al. 2008:532
Mysinge 2	Ua-34944	human bone	mandibula, subj. 6, RES	4565	50	Eriksson et al. 2008:532
Mysinge 2	Ua-34945	human bone	mandibula, subj. 7, RES	4055	45	Eriksson et al. 2008:532
Mysinge 2	Ua-34946	human bone	mandibula, subj. 8, RES	4455	45	Eriksson et al. 2008:532
Mysinge 2	Ua-34947	human bone	mandibula, subj. 9, RES	3965	50	Eriksson et al. 2008:532
Mysinge 2	Ua-34948	human bone	mandibula, subj. 10, RES	4465	45	Eriksson et al. 2008:532
Mysinge 2	Ua-34949	human bone	mandibula, subj. 11, RES	4085	45	Eriksson et al. 2008:532
Mysinge 2	Ua-34950	human bone	mandibula, subj. 12, RES	3940	45	Eriksson et al. 2008:532
Mysinge 2	Ua-34951	human bone	mandibula, subj. 13, RES	3480	35	Eriksson et al. 2008:532

Dates used for the Bayesian modeling in this paper. *(Continued)*

Grave	Lab ID	Material	Element, individual	^{14}C age BP	±	Reference
Mysinge 2	Ua-34952	human bone	mandibula, subj. 14, RES	4430	35	Eriksson et al. 2008:532
Mysinge 2	Ua-34953	human bone	mandibula, subj. 15, RES	4055	35	Eriksson et al. 2008:532
Mysinge 2	Ua-34954	human bone	mandibula, subj. 16, RES	4110	35	Eriksson et al. 2008:532
Mysinge 2	Ua-34955	human bone	mandibula, subj. 17, RES	3150	30	Eriksson et al. 2008:532
Mysinge 2	Ua-34956	human bone	mandibula, subj. 18, RES	3060	30	Eriksson et al. 2008:532
Mysinge 2	Ua-34957	human bone	mandibula, subj. 19, RES	4160	35	Eriksson et al. 2008:532
Mysinge 2	Ua-34958	human bone	mandibula, subj. 20, RES	3870	35	Eriksson et al. 2008:532
Mysinge 2	Ua-34959	human bone	mandibula, subj. 21, RES	4065	35	Eriksson et al. 2008:532
Mysinge 2	Ua-34960	human bone	mandibula, subj. 22, RES	2890	40	Eriksson et al. 2008:532
Mysinge 2	Ua-34961	human bone	mandibula, subj. 23, RES	3245	30	Eriksson et al. 2008:532
Mysinge 2	Ua-34962	human bone	mandibula, subj. 24, RES	2995	30	Eriksson et al. 2008:532
Mysinge 2	Ua-34963	human bone	mandibula, subj. 25, RES	3755	40	Eriksson et al. 2008:532
Mysinge 2	Ua-34964	human bone	mandibula, subj. 26, RES	3200	35	Eriksson et al. 2008:532
Mysinge 2	Ua-34965	human bone	mandibula, subj. 27, RES	3015	30	Eriksson et al. 2008:532
Mysinge 2	Ua-34966	human bone	mandibula, subj. 28, RES	3350	30	Eriksson et al. 2008:532
Mysinge 2	Ua-34967	human bone	mandibula, subj. 29, RES	4325	40	Eriksson et al. 2008:532
Mysinge 2	Ua-34968	human bone	mandibula, subj. 30, RES	3414	35	Eriksson et al. 2008:532
Maglehøj	Ka-6975	birch bark		4440	50	Dehn & Hansen 2006:32
Hvalshøje	Ka-6976	birch bark		4620	55	Dehn & Hansen 2006:32
Ubby Dysselød	Ka-6978	birch bark		4475	45	Dehn & Hansen 2006:32
Raevehøj	Ka-7000	birch bark		4540	45	Dehn & Hansen 2006:32
Jordhøj	K-978	birch bark		4490	120	Dehn & Hansen 2006:32
Jordhøj	Ka-7001	birch bark		4485	50	Dehn & Hansen 2006:32
Olshøj	AAR-7975	birch bark		4315	40	Dehn & Hansen 2006:32
Olshøj	AAR-5472	birch bark		4245	40	Dehn & Hansen 2006:32
Øm	AAR-8723	birch bark		4420	40	Dehn & Hansen 2006:32
Sniphøj	AAR-5473	birch bark		4590	40	Dehn & Hansen 2006:32
Lindebjerg	K-1659	charcoal		5010	100	Müller 1998:91
Thorshøj	K-6671	charcoal		4710	70	Rasmussen 1996:293
Thorshøj	K-6673	charcoal		4590	75	Rasmussen 1996:293
Mosegården	K-3463	charcoal		5080	90	Müller 1998:91
Mosegården	K-3464	charcoal		4890	90	Müller 1998:91
Björnsholm	AAR-802	charcoal		5050	160	Müller 1998:91
Konens Høj	K-919	charcoal		4850	100	Müller 1998:91
Rustrup I	K-2254	charcoal		4960	100	Müller 1998:91
Rustrup II	K-2255	charcoal		4920	100	Müller 1998:91
Storegard IV	UA-442	charcoal		4710	115	Müller 1998:91
Thorshøj	K-6672	charcoal		4720	70	Rasmussen 1996:293
Rokaer	K-7126	charcoal		4740	34	Rasmussen 2000:332
Tustrup	KL-1762	charcoal		4700	110	Sjögren 2003:98
Tustrup	KL-1763	charcoal		4680	110	Sjögren 2003:98
Barkaer	K-3054	mussel		5850	95	Liversage 1992:102
Barkaer	K-3053	charcoal		7580	130	Liversage 1992:102
Kellerød	K-3515	human bone		4490	65	Müller 1998:94