Seasonal Human Presence at the Late Mesolithic Sites of Tågerup, Segebro, Skateholm I, Bökeberg III and Ageröd V from the Developing Mandibular Dentition of Red Deer (*Cervus elaphus*) and Roe Deer (*Capreolus capreolus*)

BY RICHARD J. CARTER

Abstract

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Important new seasonal evidence has been obtained from five Scanian Late Mesolithic sites based upon tooth development stages in dentally immature Red deer (Cervus elaphus) and Roe deer (Capreolus capreolus). Radiographs of the developing molars and premolars have been used to provide an indication of age at death by comparisons with modern known age specimens. Knowledge of their age when killed indicates at what time of the year humans were present at the sites. Determining whether a site was occupied seasonally or year-round is critical to subsequent interpretations of human economic and social activity. Sample sizes were small and comprised a mix of loose teeth and fragmented mandibles with partial dentition. Based on this new line of enquiry there is evidence that at Tågerup in the early Kongemose (Phase I) Roe deer were killed during the autumn months. At the same site, but later in the Kongemose (Phase II), Roe and possibly Red deer were killed during the summer and winter months. Similar evidence exists at the Kongemose site of Segebro where autumn and winter deaths of Red deer have been recorded. At the Ertebølle coastal site of Skateholm I a single Roe deer mandible provides good evidence for a spring death, whilst at the inland sites of Bökeberg III and Ageröd V contrasting evidence indicates winter and summer/autumn deaths of Red and Roe deer, respectively.

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Introduction

A technique for ageing Fallow deer *(Dama dama)* and Red deer *(Cervus elaphus)* from radiographs of mandibular tooth development (Brown & Chapman 1991a, 1991b) has been used to age archaeological specimens of Red and Roe deer *(Capreolus capreolus)* from five Swedish Late Mesolithic sites. The same methodology was employed as that used in the author's examination of the Roe and Red deer mandibles from the Early and Late Mesolithic sites of Star Carr (Carter 1997; 1998), Thatcham (2001a), Holmegaarde, Mullerup, Tybrind Vig and Ringkloster (Carter 2001b). The number of specimens examined from the Swedish sites was small compared to the British and Danish sites. Nevertheless the results described in this paper are likely to contribute to our understanding of settlement patterns in south Scania during the Late Mesolithic.

The two papers by Brown and Chapman should be referred to for a detailed explanation of the scheme used and to the author's research thesis (Carter 2001c) and aforementioned papers for its successful application to archaeological material. The main criteria for determining which sites could be examined were the availability and preservative state of dentally immature Red and Roe deer mandibles. Despite the low number of specimens it was possible to examine suitable material from inland and coastal sites dating from the Kongemose and Ertebølle culture periods. In order to place any new seasonal evidence into context, the background and existing seasonal assessments at each of the sites has been summarized. Later the results will be presented in a series of site charts illustrating the assessed age range and season of death for each specimen examined.

The Sites

Tågerup

Tågerup was a coastal site and one of the largest Mesolithic settlement sites ever excavated in Scandinavia. It is located in western Scania and has yielded a remarkable amount of flint work, bone and wood (Karsten & Knarrström 1998). Traces of Late Palaeolithic and Early Mesolithic cultures have been found, but the majority of evidence comes from the early phases of the Kongemose and Ertebølle culture periods. The largest area excavated (Phase I), and where the majority of bones were recovered, has been dated between 7800 and 7140 BP. A smaller area, Phase II *c.* 6005–6370 BP, was also examined and spans the late Kongemose/early Ertebølle transition. The volume and range of evidence recovered from the Kongemose through to the Ertebølle provides an insight into the emergence and development of a Mesolithic community.

Finds from the waste deposits include many antlers, wooden poles, osier baskets and implements of wood, bone and flint. Perhaps the most famous has been a highly decorated and polished axe handle made from Red deer antler and radiocarbon dated to *c.* 7600 BP (Karsten *et al.* 1998). Of particular significance to Mesolithic studies was the discovery of the oldest known cemetery in north-west Europe. Grave goods include evidence of food in the form of fish, wild boar and Red deer bones; pendants of antler, bone and teeth from pine marten, Red deer, wild boar and seal are also present (Karsten & Knarrström 1998). Later in the Ertebølle period the western part of the headland was settled, resulting in a very distinct and stratigraphically discrete narrow strip of occupation along the coastline. It is likely that subsistence activities were concentrated on procuring and processing marine resources at this time. Artefacts recovered included hones for sharpening antler axes, a coarse core axe, knives and graving tools. Concentrations of bone material may indicate a specialized activity zone away from the habitation areas.

Despite the recovery of many artefacts and evidence of dwellings and a cemetery, very few seasonal indicators were found. Evidence includes the bones of a diver (*Gavia stellata*), indicating possible winter occupation, and the juvenile Red and Roe deer dentition examined here.

Segebro

This site lies just outside Malmö in south Scania, on the west bank of the River Sege and has dates ranging from the Late Glacial through to the Atlantic periods. The main period of occupation was during the early and middle Kongemose, and all the bone material has been dated between 6970±90 and 7390±80 BP (Larsson 1978a). During this phase it was located at the mouth of the river where it runs into the sea, but would have been sheltered by a headland that formed a lagoon behind it. The strategic location of the settlement ensured proximity to a variety of plants and animals along the river and coast (Salomonsson 1964). The site was excavated in the early seventies by Larsson (1982) and the bone remains were identified and reported on by Lepiksaar (1982).

The covering of the site by gyttja and sand during the marine transgression has resulted in partly good preservation of organic material and artefacts. Based on the number of finds Red deer, Roe deer and wild boar were of the greatest importance to the occupants of Segebro (Lepiksaar 1982). Hundreds of arrowheads have been found at the site and it is likely that these animals were hunted using bows, spears and possibly traps and snares (Larsson 1982). The mixed oak forest provided an ideal habitat for ungulate species which may have been abundant despite predation by man, wolf and bears. Marine resources are not as well represented at Segebro, although $d^{13}C$ analysis of human bone indicates they were very important in the diet (Larsson 1982; Price 1985). This may be due to the fact that fish bones are very fragile and often do not survive well over time. Occupation of the site during the spring has been proposed based mainly on the presence of bones of migratory birds and a large grey seal (Larsson 1982).

Skateholm I

This coastal settlement in south Scania belongs to the Ertebølle culture period. Skateholm I is one of three large sites in the area, with up to ten smaller short-term sites scattered nearby. The dentitions examined in this paper all come from Skateholm I (5790±70–6020±70 BP). The site has been viewed as a large base camp (Larsson 1984; Jonsson 1988) with its famous cemeteries containing many human burials, some of which have rich grave goods possibly indicating a complex social structure.

There are insufficient seasonal indicators at Skateholm to warrant any valid conclusions, according to the excavator Lars Larsson (1984). Despite this Jonsson (1988) thinks the site could have been used at all times of the year. His winter evidence comes from bone measurements of grey seals *(Halichoerus grypus)*, which he compares with known age modern specimens. There is an implicit assumption that body size has not altered since the Mesolithic era and that measurements are directly comparable. He also thinks that burial evidence indicates a degree of social complexity and territoriality normally associated with permanent occupation, and that the rich local environment was capable of supporting year round human presence.

Rowley-Conwy (1998) has reviewed the evidence and thinks that the site was seasonal and visited only during the winter. He employed two approaches, firstly the eruption states of dentally immature Roe deer and wild pig jaws, and secondly measurements of the scapula collum length and phalanges of juvenile and adult wild pig. Using Early Mesolithic and modern data for comparison, Rowley-Conwy (1998) observed gaps in the range of measurements that were interpreted as evidence for seasonal killing of wild pig. But, like Red and Roe deer, the body sizes of wild pig may have changed between the Early Mesolithic and the present day and this may affect his results (Carter 2001c). He also thought that the majority of bird and fish evidence indicated human presence during the colder months of the year. In addition, a single Roe deer jaw was thought to be aged seven or eight months and probably killed in January or February. Based on all the evidence and an absence of summer indicators Rowley-Conwy (1998) proposed an autumn to spring occupation of Skateholm I.

Bökeberg III

This inland site was located on a small peninsular on the shores of a lake in what is now south-west Scania. Thirty other Mesolithic or Neolithic sites are known in the surrounding area, most of which are located on the former shoreline. There appear to have been two settlement phases, associated with low lake levels and a drier climate. The first was from *c.* 6650–6400 BP and the second between *c.* 6150–5800 BP, although the site may have been occupied throughout the entire period of about 850 years. There is also evidence of later human activity at the site between 5300 and 5000 BP, but all the bone material from Bökeberg III has been dated between 6600 and 6200 BP (Ericsson & Lindblad 1995). Site location meant that inhabitants were able to exploit resources from two contrasting biotopes.

The Red deer bones from the site have been examined by Cegielka *et al.* (1995). They were able to provide a broad age structure of the local Red deer population from epiphyseal fusion, tooth eruption and wear. Unfortunately the techniques employed were of insufficient resolution to indicate at what time of the year the calves and younger adults were killed and cannot add to determinations of site seasonality. It was concluded that there was no evidence of selection for age or sex in the hunting of Red deer. Random hunting was proposed with a natural bias towards young animals aged between two and five years, similar to that expected in a resident population. They propose that the site was occupied for most of the year, except perhaps spring and early summer, based on an absence of shed Red deer antlers.

Other seasonal indicators include large numbers of hazelnuts and acorns in the refuse layer, which would have been collected from September to November. Macroremains of dogwood (*Cornus sanguinea*), sloe (*Prunus spinosa*) and rowan (*Sorbus aucuparia*) have been found, the fruits of which may have been collected in the autumn. In contrast the remains of raspberry seeds (*Rubus idaeus*) are unusual amongst Mesolithic sites in Scandinavia and provide good summer evidence (July/August). Regnell *et al.* (1995) think that this seasonal evidence indicates occupation throughout the summer and into early winter.

Ageröd V

The Ageröd complex is located around Ringsjön in central Scania and comprises sites I:B, I:D, I:HC and V. Only the latter site is examined here and has been dated between 6540±75 and 6800±90 BP (Larsson 1983). It is thought to have extended over an area of only about 100 m^2 (Larsson 1978b) with evidence of residential dwellings (Larsson 1983).

Notwithstanding the role of plants and fish in the occupants' diet, Red deer were undoubtedly a major food source at Ageröd V (Larsson 1978b). The deliberate setting of forest fires to create clearings and new growth may have attracted them to the site environs. Larsson thinks that the low representation of Roe deer at the site is due to the wrong type of soils and vegetation in the area. This is doubtful because Roe deer are highly adaptable and the fact that they are present is indicative of a viable local population. It may well be that the abundance and potential calorific return of Red deer and wild boar drove up the cost to benefit ratio of hunting Roe deer to such an extent that it became unnecessary. Occupation during the summer and early autumn has been proposed (Price 1985) based on the presence of hazelnut and water chestnut shells.

Time of birth
Important to the ageing of archaeological specimens is the assessment of birth date. The birth timings of modern Red and Roe deer have been reviewed and discussed in the Star Carr papers and author's thesis (1997, 1998 and 2001c). It has been assumed that the period from the end of May to mid-June would also be the probable birth dates for the majority of Red and Roe deer from Mesolithic south Sweden. It is acknowledged that favourable environmental conditions may bring the mean birth date forward by a few weeks, but this would have minimal impact on subsequent seasonal assessments.

Materials and method

Modern reference sample
Assessment of age at death of archaeological specimens of Red and Roe deer from tooth development relies on the acquisition of modern known age or known kill date specimens for comparative purposes. Roe deer samples from populations in Scotland, England, Denmark, France, Poland and Switzerland have been secured (n = 122). Red deer samples originate from Exmoor & Quantocks, Cumbria, Scotland, Poland and Brown and Chapman's sample from Richmond Park (n = 209).

The system used to age both modern and archaeological specimens identifies ten distinct stages of tooth development common to both species. The progressive development of the crown and root of the mandibular premolars and molars can be readily observed from radiographs. These stage numbers were used for scoring and are summarized in Table 1. The criterion for each stage is described in greater detail by Brown and Chapman (1991a and b). Establishing clear criteria in this way results in objective and relatively unambiguous assessments at each stage of development.

Stage/ Score	Description
1	Evidence of a crypt
2	Evidence of mineralisation
3	All cusps mineralising
4	Infundibulum formation
5	Crown formation complete
6	Early root formation
7	Half root length formed
8	Late root formation
9	Full root length (apex open)
10	Full root length (apex closed)

Table 1. Outline of tooth development scoring system (after Brown & Chapman 1991a).

For mandibles with complete dentition these stage numbers are totalled to provide an overall score. However, incomplete jaws are common archaeologically and the individual premolar or molar scores are of equal significance. Comparisons between the modern known age and archaeological scores provide an accurate indication of kill date. In Red deer dental maturity occurs between 40 and 43 months, but ageing resolution decreases after 30 months of age. Loss of resolution in Roe deer is minimal as dental maturity is completed in 15 months and ageing by this method remains consistently accurate. A high level of ageing accuracy is still possible from loose teeth, due to the fact that the stage at which a tooth passes through can be very diagnostic of a particular age or range. For example, a single lower third molar of a Red deer at Stage 5 (crown formation complete but with no visible root formation) is always between 16 and 18 months of age according to the modern comparative collection.

The ages at which the progressive stages of tooth development appear have been summarized for Red and Roe deer in Tables 2 and 3 respectively. These tables provide a general guide to season of death and are sufficient for this paper. It should be remembered that the

Age (months)	N	Months	Season	Molars 3rd	Molars 2nd	Molars 1st	Premolars 4th	Premolars 3rd	Premolars 2nd	Deciduous premolars *4th*	Deciduous premolars *3rd*	Deciduous premolars *2nd*	Totals
1	1	July	S	0	2	5	0	0	0	(8)	(8)	(9)	7(25)
2	3	Aug.	S	0	2-3	6-7	0	0	0	(9)	(9)	(9)	8(27)-10(27)
3	2	Sept.	A	0	4	7	0	0	0	(9-10)	(9)	(9)	11(27-28)
4	11	Oct.	A	0-2	4-7	8-9	1	0-1	0-1	(10)	(9-10)	(9-10)	13(28)-21
5	20	Nov.	A	1-3	5-8	8-9	1-3	1-3	1-2				17-28
6	14	Dec.	W	2-5	7-9	8-10	2-3	1-3	1-3				22-33
7	17	Jan.	W	3-6	8-9	9-10	2-5	2-5	1-5				25-40
8	8	Feb.	W	4-6	8-9	9-10	5-6	5-6	3-6				34-43
9	6	Mar.	Sp	5-6	9-10	9-10	6	6	5-6				40-44
10	13	Apr.	Sp	6-8	9-10	10	6-8	6-8	6-8				43-52
11	4	May	Sp	6-7	9-10	10	7	7	7-8				46-49
12	6	June	S	7-9	9-10	10	8	8	8-9				50-54
13	4	July	S	8-9	10	10	8-9	9	9-10				54-57
14	6	Aug.	S	7-10	9-10	10	8-10	8-10	8-10				50-60
15	2	Sept.	A	10	10	10	9-10	9-10	10				58-60
16	4	Oct.	A	9-10	10	10	9-10	9-10	10				57-60
17	1	Nov.	A	10	10	10	10	10	10				60

Deciduous premolars: (tooth development complete)

Premolars: (no infundibulum - stage 4)

Table 2. The age which a particular tooth development score may be found for molariform teeth of Roe deer (*Capreolus capreolus*) n = 122 (Sp = Spring, S = Summer, A = Autumn, W = Winter).

site charts have been compiled using the full list of tooth development scores and individual ages. As mentioned above, stages of tooth development can be associated with particular ages. For example, at six months of age the third molar of Roe deer may be between Stages 2 and 5 (Table 2). But the raw data indicates that out of 15 specimens only one is at Stage 2, three at Stage 4 and one at Stage 5. The remaining 10 are at Stage 3.

Archaeological specimens

The archaeological specimens from Tågerup were examined at the offices of the Riksantikvarieämbetet near Lund. The specimens from Segebro, Skateholm I, Bökeberg III and Ageröd V were sorted at the University of Lund archaeological storerooms and radiographed at the Conservation Department, Malmö Museum. The dentitions of many of the archaeological jaws were incomplete and in some cases only single teeth were recovered. Individual tooth development scores for each species at every site have not been listed, but where scores are given in the Results section Tables 2 and 3 can be consulted.

Results

A series of charts has been assembled (Figs. 1–5) clearly indicating the assessed age at death range for all the dentally immature specimens from each site. It should be emphasized that Red and Roe deer were killed at some point within these periods and not throughout the range. The evidence from each site chart is then summarized. Where actual tooth development scores are discussed reference should be made to Tables 2 and 3.

Seasonal age groups *(months)*	N	Months	Season	Molars 3rd	Molars 2nd	Molars 1st	Premolars 4th	Premolars 3rd	Premolars 2nd	Deciduous premolars *4th*	Deciduous premolars *3rd*	Deciduous premolars *2nd*	Totals
1 - 2	3	July-Aug	S	0	0-1	2-5	0	0	0	(7-8)	(7-8)	(7-8)	2(21)-6(24)
3 - 5	12	Sept-Nov	A	0-1	3-4	6-8	0	0-1	0-1	(9-10)	(9)	(9-10)	9(27)-15(29)
6 - 8	32	Dec-Feb	W	0-1	3-6	7-8	0-1	0-1	0-1	(9-10)	(9-10)	(9-10)	10(27)-18
9 - 11	3	Mar-May	Sp	1-2	6	9	0-1	0-1	1	(tooth development complete)			17-20
12 - 14	4	June-Aug	S	2-3	6-7	9	1-3	1-3	1-3				20-28
16 - 17	13	Sept-Nov	A	4-6	7-9	9-10	3-6	3-6	2-7				28-44
18 - 20	30	Dec-Feb	W	5-7	7-9	9-10	6-7	5-7	5-8				37-48
21 - 23	4	Mar-May	Sp	7	9	9-10	7	7	7-8				46-48
24 - 26	4	June-Aug	S	7-8	8-9	10	7-8	7-8	7-8				46-51
27 - 29	31	Sept-Nov	A	7-9	8-10	9-10	8-10	8-9	8-10				48-58
30 - 32	28	Dec-Feb	W	8-9	9-10	10	9-10	8-10	8-10				52-59
33 - 35	19	Mar-May	Sp	8-10	9-10	10	9-10	9-10	9-10				54-60
36 - 38	1	June-Aug	S	10	10	10	10	10	10				60
39 - 41	17	Sept-Nov	A	9-10	10	10	10	9-10	9-10				57-60
42 - 44	5	Dec-Feb	W	9-10	10	10	10	10	10				59-60
45 - 46	2	Mar/Apr	Sp	10	10	10	10	10	10				60

(no infundibulum - stage 4)

Table 3. The age range within which a particular tooth development score may be found for molariform teeth of Red deer (*Cervus elaphus*) n = 209 (Sp = Spring, S = Summer, A = Autumn, W = Winter).

Tågerup

It was not necessary to radiograph any of the Tågerup specimens as they were all loose teeth and their stages of root development were clearly visible. The sample consisted of teeth from seven Roe deer and one Red deer. Despite the poor size and composition of the sample the results provide general indicators that assist in clarifying seasonality at the site.

Phase I

Roe deer specimens TG6846CC/5L and TG14076CC/9L are second molars at Stage 4. There can be confusion distinguishing between M_1 and M_2, but in this case this has been resolved as Roe deer are born with M_1 already at Stage 5. Autumn deaths are proposed based on age estimations of three or four months.

Phase II

The remaining teeth are from the Kongemose/Ertebølle transition period. The stages of development on the slightly older premolars P_2 (TG264CC/7L) and P_4 (TG5077CC/3R) indicate deaths in mid-winter. The sole Red deer specimen, a loose third molar (TG22353CE/2L), is at Stage 8 and indicates an autumn to spring death.

Segebro

Three of the four Red deer specimens examined were loose teeth; the other was a "mandible" with complete dentition. The ageing resolution on the latter specimen (SB212CE/L8) is good, with root development stages indicating death occurring between 27 and 34 months (September–April). It has been compared with a mandible from a modern Red deer killed in March, aged approximately 33 months in Figures 3 and 4.

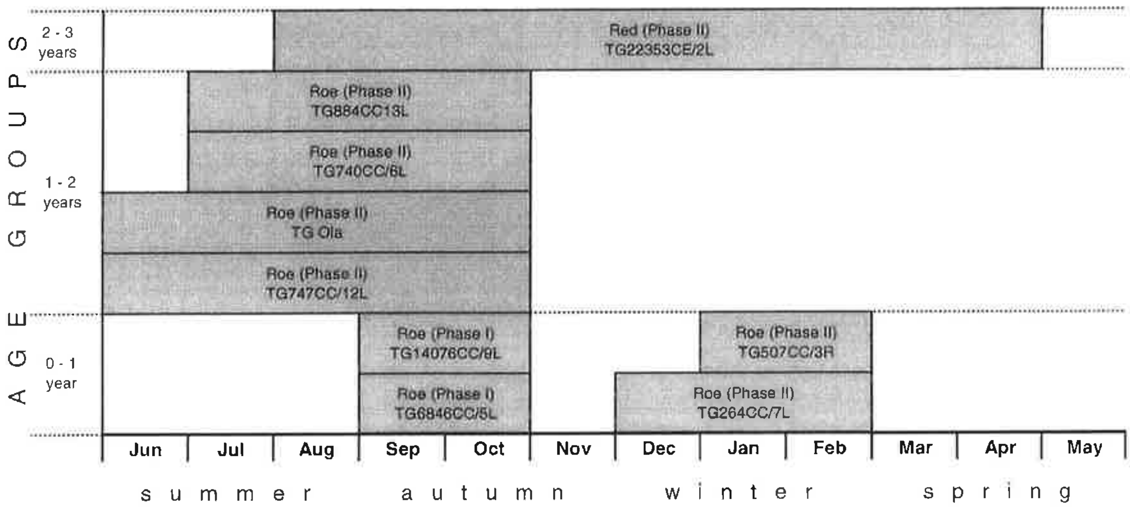

Figure 1. Age and season of death of dentally immature Red and Roe deer from Phases I and II at Tågerup (Red: n = 1 Roe: n = 8).

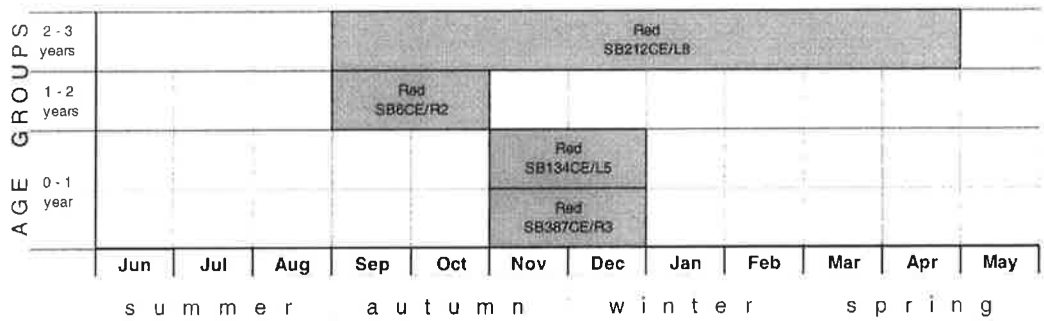

Figure. 2. Age and season of death of dentally immature Red deer (*Cervus elaphus*) from Segebro (n = 4).

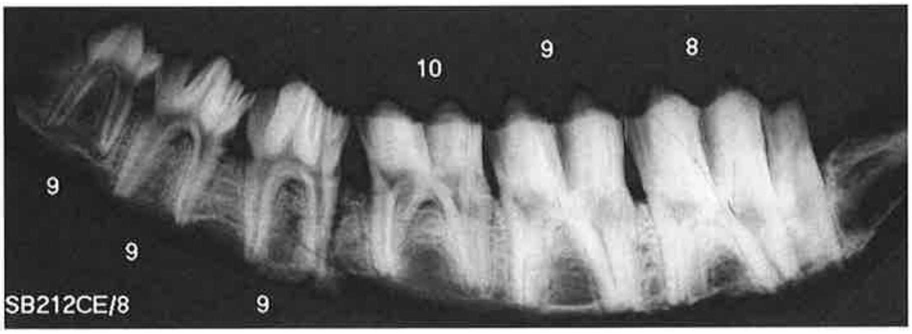

Figure 3. Radiograph of Red deer mandible SB212CE/8 from Segebro, with a proposed age at death of 27-34 months.

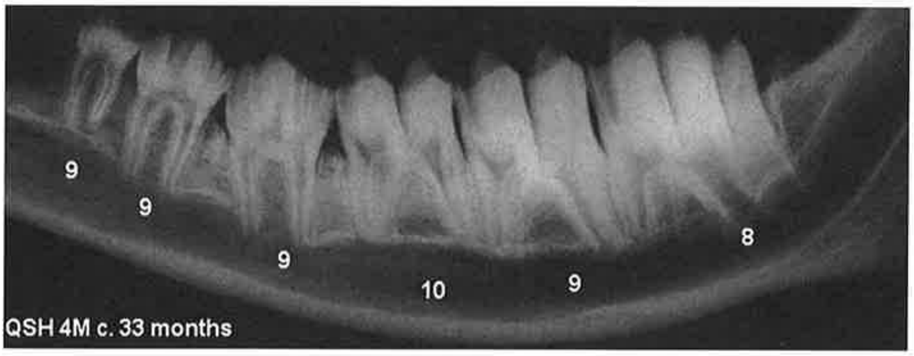

Figure 4. Radiograph of Red deer mandible QSH 4M, aged ca. 33 months, from the Quantocks, S. England.

AGE GROUP												
0-1 years											Roe SK1739CC/1L	
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
	summer			autumn			winter			spring		

Figure 5. Age and season of death of a dentally immature Roe deer (*Capreolus capreolus*) from Skateholm I.

The base of the Segebro mandible is fractured and larger than the modern specimen, but otherwise they are remarkably similar.

It was possible to identify two of the loose teeth as second molars, based on their early stage of development and by comparisons with the aforementioned complete mandible. Both teeth are at Stage 4 with no evidence of root development, indicating a November–December death. The other loose specimen

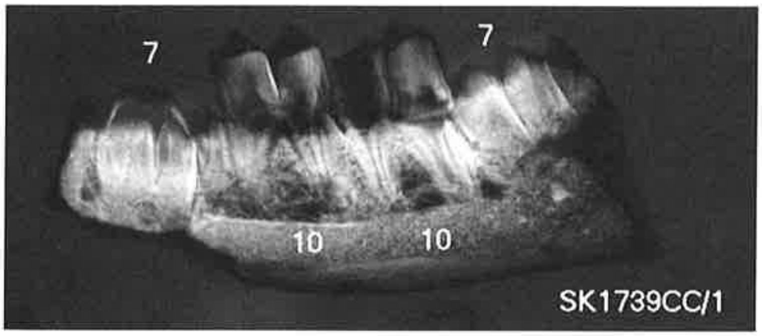

Figure 6. Radiograph of Roe deer mandible SK1739CC/1L from Skateholm I, with a proposed age at death of 10-11 months.

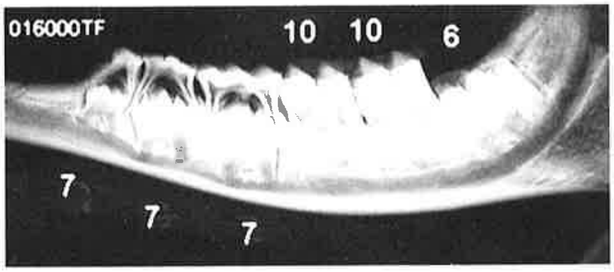

Figure 7. Radiograph of Roe deer mandible 016000TF, aged approximately ten months, from the Dourdan Forest, N. France

is a third molar also at Stage 4, and could only have come from a yearling aged 15 or 16 months (September–October). In this small assemblage there is evidence to suggest that all the deer were killed during the cooler months of the year.

Skateholm I

The single specimen examined is very friable and was difficult to X-ray. Despite fragmentation, it is thought that two of the teeth are at stages of development diagnostic of the age range 10–11 months. This specimen has been compared with a modern mandible in Figures 6 and 7.

The roots of P_4 are difficult to see from the reproduction in Figure 6, but close examination reveals that they are either at, or close to, being half-formed (Stage 7). They have certainly progressed beyond early root formation (Stage 6) and their development is virtually identical to P_4 in the modern specimen 016000TF (Figure 7). The roots of the shed dp_4 remain trapped between the erupting tooth and surrounding bone. Root development on M_3 is unclear on the radiograph, although the early root formation was visible through the broken basal border of the mandible. It has been observed that M_3 tooth development progresses at similar rates to premolars (Carter 2001c) and Stage 7 has been assigned to the Skateholm third molar. Should the third molar in fact be at Stage 6 then this would increase the age at death range from nine to eleven months (March to May).

Bökeberg III

The mandible B1448CE/19L is from a young calf and badly fragmented. Nevertheless the stages of tooth development on M_2, M_1 and P_2 are visible and at Stages 5, 8 and 1, respectively. The roots of dp_4 are visible on the radiograph and the apices are not fully closed. It has been possible to estimate an age at death of seven or eight months occurring

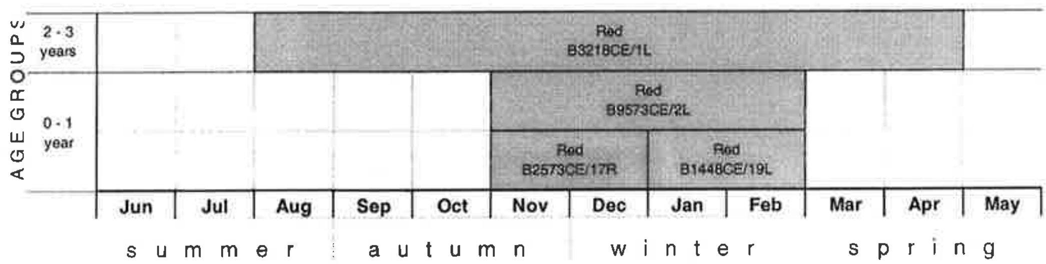

Figure 8. Age and season of death of dentally immature Red deer (*Cervus elaphus*) from Bökeberg III (n = 4).

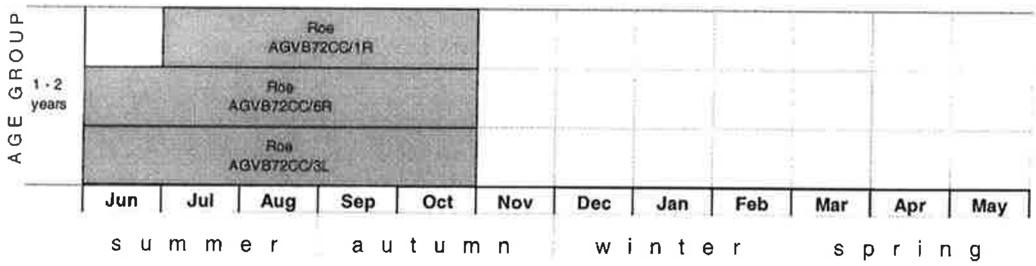

Figure 9. Age and season of death of dentally immature Roe deer (*Capreolus capreolus)* from Ageröd V (n = 3).

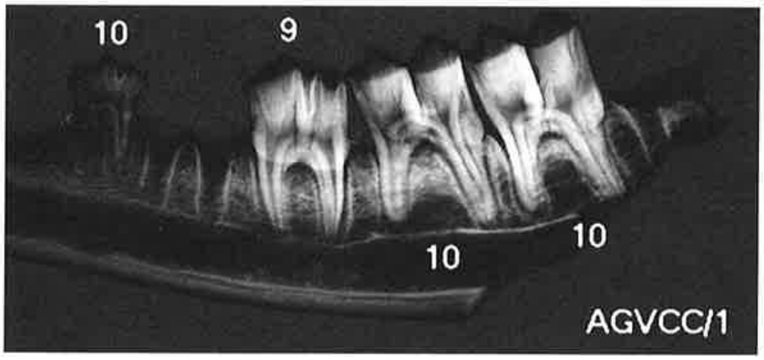

Figure 10. Radiograph of Roe deer mandible AGVCC/1R from Ageröd V, with a proposed age at death of 13–16 months.

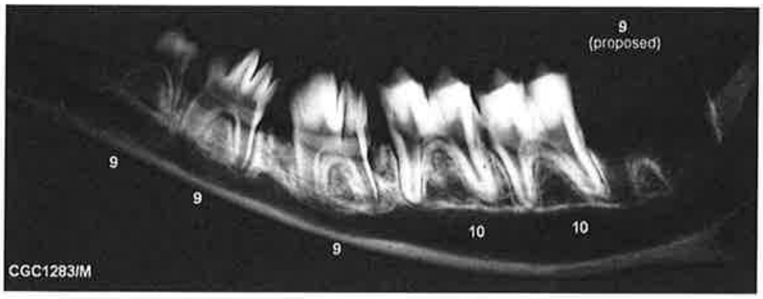

Figure 11. Radiograph of Roe deer mandible CGC1283 aged approximately 14 months, from Craigellachie, Scotland.

during the winter. The molars of this specimen helped in determining whether or not two of the other specimens were either M_1 or M_2. Because the stages of development on the loose molars are similar to the two permanent *in situ* molars, it was straightforward to determine which was which.

Root development on M_1 of B1448CE/19L and the single M_1 (B597CE/2L) is identical, whilst the development of M_2 on B1448CE/19L was only slightly more advanced than on the single M_2 (B2573CE/17R). All this indicates ages at death that are very close to one another, i.e. sometime between five and eight months during the winter period (November to February). B3218CE/1L is a third molar at Stage 8 and may also have been killed in the winter, but autumn and spring cannot be discounted.

Ageröd V

AGVB72CC/1R has been compared to a mandible from a Roe deer killed aged *c.* 14 months from Scotland in Figures 10 and 11. P_4 from the Ageröd specimen looks slightly closer to Stage 10 than its modern comparison. The remaining two specimens are loose third molars with root apices open at Stage 9, indicating that death occurred sometime between 12 and 16 months of age. It is likely that all the Ageröd specimens come from yearlings killed during the warmer months of the year (June–October).

The implications of these results for assessing local settlement patterns will now be discussed.

Discussion

The new seasonal evidence described above has been summarized and compared with existing seasonal assessments at the five sites in Figure 12.

During the early Kongemose Phase I of occupation at **Tågerup** the evidence is quite limited but of high resolution. There is clear evidence that roe deer kids were killed in the autumn. Later during the Kongemose/Ertebølle transition (Phase II) killing appears to have occurred in both warmer and colder months of the year. An older Red deer may have been killed sometime between August and April. From this evidence it would appear that springtime is the only period of the year when deer were not being hunted and killed. The problems of locating and procuring resources during late winter/early spring (Jacobi 1987) may have forced the occupants of the site to move elsewhere. But this is thought unlikely due to the other types of evidence found at the site and discussed earlier. The evidence seems to suggest year-round human presence during Phase II occupation. This is likely to have continued into the Ertebølle period when structural evidence increases along the promontory and coastal resources become increasingly important.

The site of **Segebro** evolved over a long period of time at a prime location enabling successive occupants to exploit a variety of marine and terrestrial resources. The proximity and diversity of edible resources may have made residential movement unnecessary. An absence of fishing-related equipment and marine animal bones is surprising given the high $d^{13}C$ levels in human bone found at the site. Coastal resources may have been exploited from temporary special purpose camps dotted along the coastal strip. If Segebro was a base camp and more permanently occupied then these resources are likely to have been transported back to the site. The most reasonable explanation for the lack of direct evidence is that it has simply not survived. It is possible the site was a seasonal hunting camp, but finds of highly decorated flint, bone and antler indicate activities often associated with a base camp. The seasonal evidence may indicate abandonment of the site and a residential move elsewhere during the summer months. Movement inland, possibly via the numerous watercourses, may have occurred.

At **Skateholm** the only seasonal evidence comes from the spring death of a Roe deer kid aged 10 or 11 months. This conflicts with

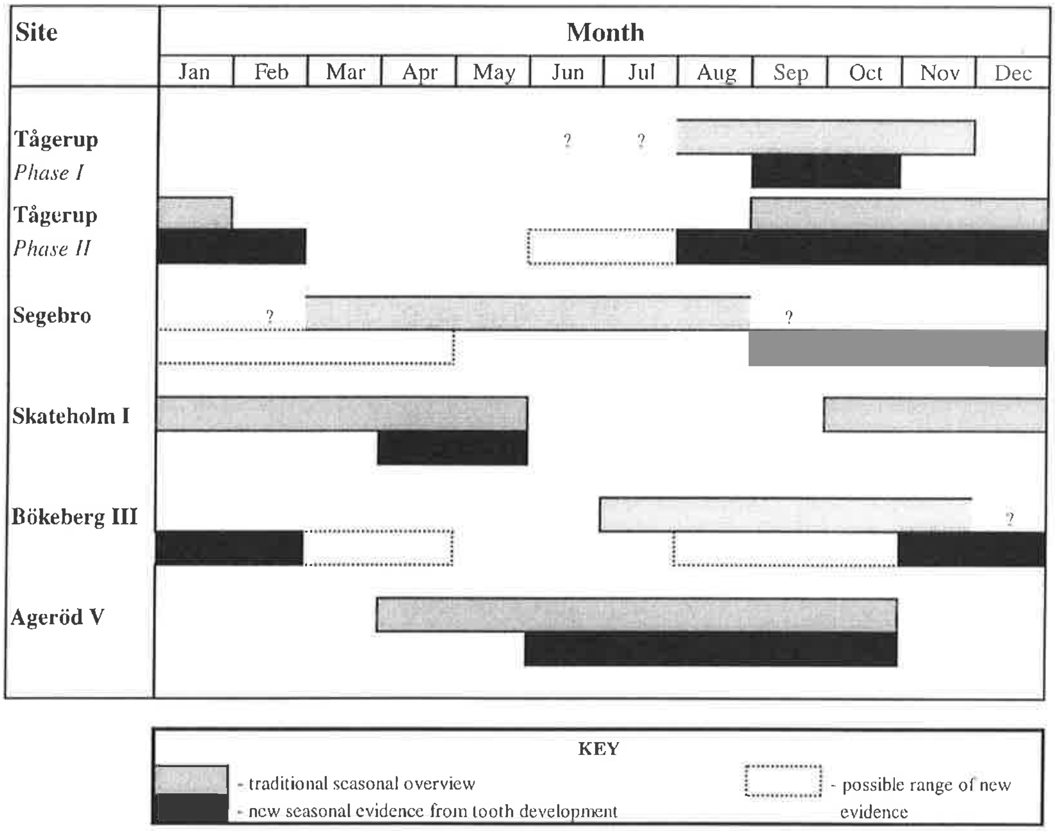

Figure 12. Traditional and new assessments of seasonal human presence at Tågerup, Segebro, Skateholm I, Bökeberg III and Ageröd V. (The traditional assessments are a consensus of views based on evidence discussed in the site reviews. Question marks indicate more ambiguous seasonal evidence acknowledged by the authors.)

the age assessment of the same animal (seven or eight months) by Rowley-Conwy (1998) from tooth eruption. Although justified in questioning the proposed year-round occupation by Jonsson (1988), Rowley-Conwy's proposal that Skateholm I was only occupied in the winter months may be incorrect. This revised age estimation does not necessarily contradict other winter indicators and supports the autumn to spring bird and fish evidence (Rowley-Conwy 1998). The April or May death of the Roe deer kid is at the end of this range and, in the absence of direct summer indicators, autumn to spring may be the period of occupation. According to Rowley-Conwy (1998) Skateholm I was probably occupied only in the winter by a "non-sedentary territorial group". The revised ageing of the Roe deer mandible questions this proposal by extending human presence into the spring. This seems to be confirmed by other seasonal indicators and, if so, may indicate a degree of sedentism greater than that envisaged by Rowley-Conwy.

The age at death of three Red deer calves at **Bökeberg III** has provided the best seasonal information spanning the winter period November to February. This winter evidence supports some of the conclusions drawn by Regnell *et al.* (1995) and Cegielka (1995). The site was virtually equidistant between the shores of the Baltic Sea to the south and the Oresund Strait to the west. A more permanent settlement may have existed at the coast with excursions inland during the winter months to exploit resources in and around the lake, particularly Red deer. This does not account for the "summer" raspberry seed evidence and it may be that the site was semi- or permanently occupied for most of the year. This proposal accords well with that suggested by Regnell *et al.* (1995), who think that the diversity and number of artefacts, debris and constructions indicates something more than a hunting camp. They also think the site fits into a settlement model based on differentiated use of coastal and inland resources and was occupied during the warmer months of the year. The new seasonal evidence presented here appears to indicate human presence at the site during mid-winter and the proposal that the site was abandoned at this time in favour of the coast may now be too simplistic.

The seasonal evidence presented here from **Ageröd V** is similar to Holmegaard and Mullerup Syd (Carter 2001b) with summer the preferred season of occupation. Like Holmegaard, water levels during the winter may have restricted occupation to the drier and warmer months of the year. The sites were closer to the coast than Holmegaard, but further away than Mullerup. Other evidence from the Ageröd complex includes presence of seal bones at Ageröd I:HC (7770–7970 bp) and coastal flint has also been found (Larsson 1978b). If the suggestion that the Ageröd sites were only occupied during the warmer months of the year is correct, then movement to more permanent coastal camps in order to exploit other resources may make strategic sense. Unfortunately these inferred coastal sites are now underwater and it may be some years before clarification of this interaction becomes possible.

Conclusion

The amount of new seasonal evidence from the Swedish sites is small, but nevertheless significant. Taken together with more substantial evidence from other north-west European Mesolithic sites (Carter 1997, 1998, 2001a, 2001b) it is possible to re-examine traditional models of Early and Late Mesolithic settlement (Carter 2001c). For example, in south Scania during the Kongemose culture period there is evidence to suggest that both coastal and inland sites may have been more permanently occupied than previously thought. This pattern of settlement appears to have continued into the Ertebølle, and the relegation of some inland sites to temporary seasonal camps acting in support of permanent coastal base camps (cf. Paludan-Müller 1978; Rowley-Conwy 1983, 1993, 1999; Andersen & Johansen 1986) may be too simplistic.

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