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# New radiocarbon dates of Finnish mammoths (*Mammuthus* sp.)

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Six new radiocarbon dates of Finnish subfossil mammoths (*Mammuthus* sp.) range from c. 32,000 to c. 16,000 yBP. Four of the subfossils found in Late Weichselian minerogenic sediments form a consistent series of dates from 32,000 to 22,500 yBP. They suggest that there was a larger ice-free area in Fennoscandia during a Middle Weichselian nonglacial interval than previously assumed. They also indicate a very fast growth of the Scandinavian Ice Sheet over the northeastern part of Europe to its maximum position during the Late Weichselian. Two bones were found in littoral sediments between Holocene Baltic clays and beach sand. The very young age of one of them (15,950 yBP) can be explained with a different kind of transport, for example by icebergs.

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## INTRODUCTION

Mammoth remains are very scarce in northern Fennoscandia, and only a fraction of these have been radiocarbon dated. In Norway 7 out of total 19 (Heinz *et al*. 1979, Bergersen 1991) and in Sweden 5 out of total 30 (Liljegren & Ekström 1996) finds have been dated. Further south the situation is different: in Denmark altogether 125 localities have been reported with 15 dated finds (Aaris-Sørensen 1990). Lepiksaar (1992) reports 14 localities in Estonia with only one dated find.

Mammoth bones and teeth have been found at nine localities in Finland (Donner 1965). Three of the subfossils were radiocarbon dated earlier (Donner *et al*. 1979). The molar from Espoo, southern Finland (Metzger 1921) gave an infinite age (>43,000 yBP). The humerus found in Helsinki Herttoniemi

(Pearson *et al*. 1965) yielded surprisingly young ages: Pearson et al. (1965) reported an age of 9,030 ± 65 yBP, but later Donner *et al*. (1979) dated the humerus at 15,500 ± 200 yBP. The femur from Lohtaja, western Finland (Okko 1949) gave an age of 25,200 ± 500 yBP. The latter dates have puzzled geologists and paleontologists since such young ages were not in accordance with the traditional glacial history of Fennoscandia. In this paper we introduce the specimens found in Finland as well as the respective dating results. The implications of the results for the glacial history of the area are discussed in more detail elsewhere.

## SPECIMENS

All mammoth bones found in the Finnish territory are shown in Fig. 1. The specimens with details of locality, time of the discovery,

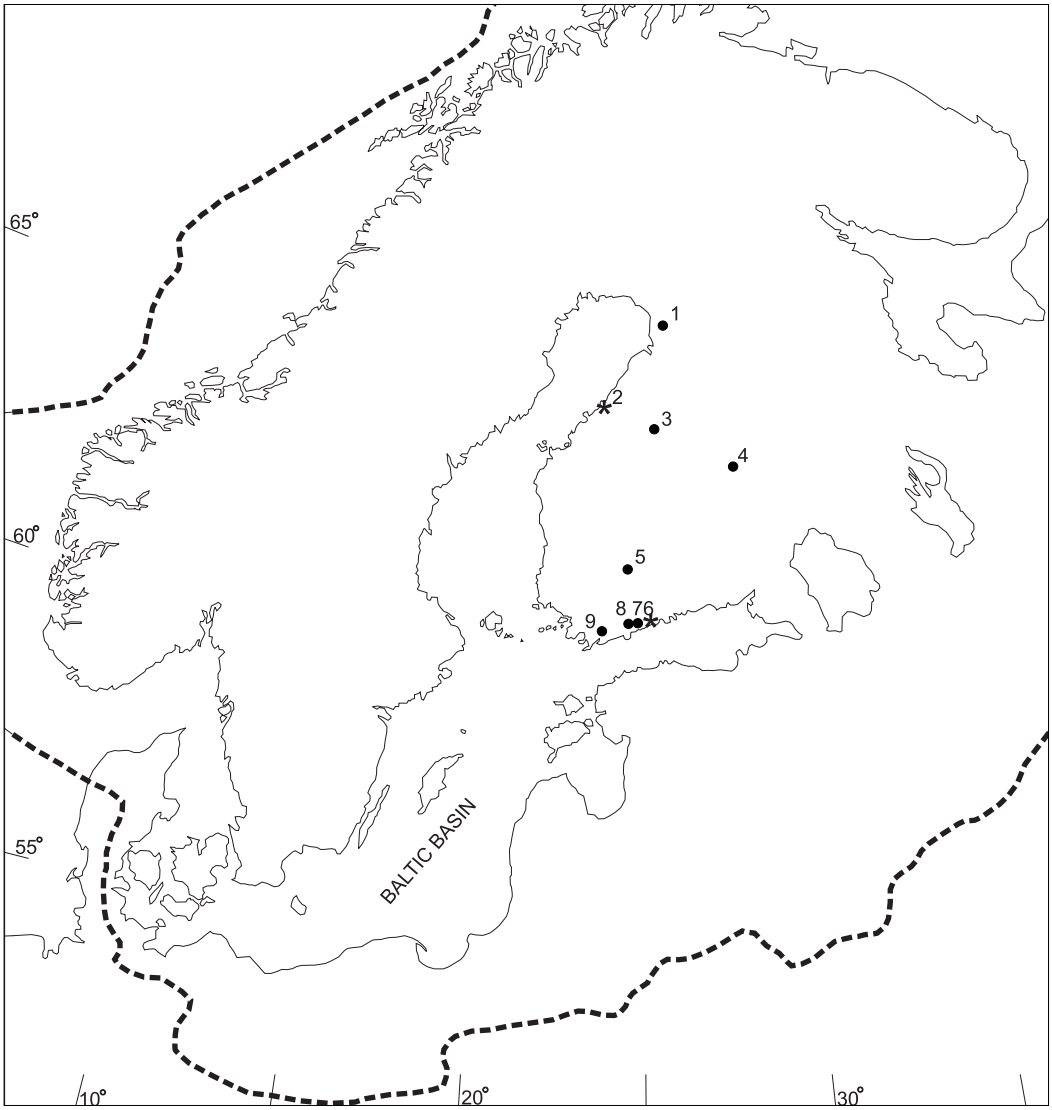


Figure 1 Mammoth bone localities in Finland. Black dots = glacially transported bones, asterisks = bones dropped into Baltic sediments, presumably by icebergs; (**1** = Iijoki, **2** = Lohtaja, **3** = Haapajärvi, **4** = Nilsiä, **5** = Tuulos, **6** = Helsinki Herttoniemi, **7** = Helsinki Töölö, **8** = Espoo, **9** = Pohja). Dashed line = extent of the Scandinavian Ice Sheet at the last glacial maximum.

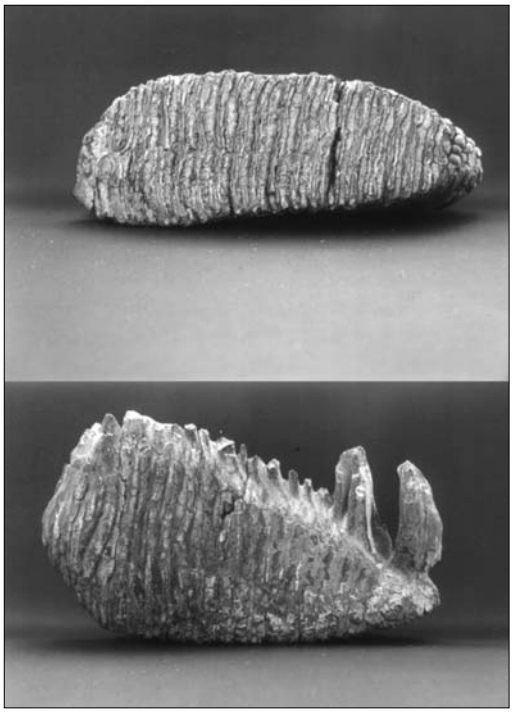

Figure 2 Upper molar from Iijoki. [Photo: Pirkko Ukkonen]

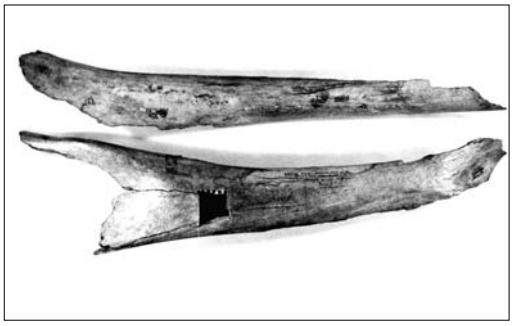

Figure 3 Femur from Lohtaja. [Photo: Ritva Talman]

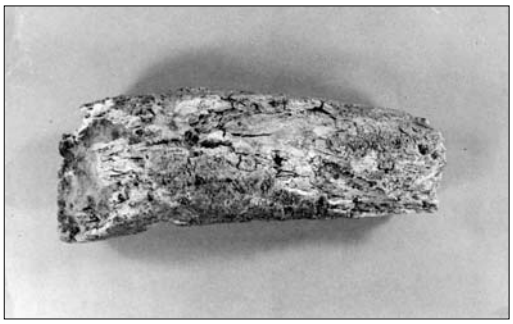

Figure 4 A piece of tusk from Haapajärvi. [Photo: Ritva Talman]

description, context, and the museum where the specimens are currently stored, as well as the relevant references are listed below. Measurements of teeth follow the system described by Maglio (1973; P = plate number, L = length, W = width, H = height, LF = lamellar frequency).

**1**. River Iijoki (*ca*.1750); M3 sin. (P 23, L 230, W 73 mm [7], H 114 mm [17], LF 12) in sand; Swedish Museum of Natural History, Stockholm; Malmgren 1874-75, Holm 1904, Korvenkontio 1915; Fig 2.

**2**. Lohtaja (1930); two pieces of femur (L 700+/670+ mm, bone thickness 25 mm) in clay: Finnish Museum of Natural History, University of Helsinki; Okko 1949; Fig. 3.

**3**. Haapajärvi (1952); tusk (L 200+ mm, diameter 73 mm) between gravel and sand, in 7-8 m depth, 121 m above sealevel; Finnish Museum of Natural History, University of Helsinki; Okko 1953; Fig. 4.

**4**. Nilsiä, shore of Lake Syväri (1873); M3 dex.(P 17+, L 227+ mm, W 82 mm [6], H 163 mm [13], LF 9); washed out from glacigenic sediments; Finnish Museum of Natural History, University of Helsinki; Malmgren 1874-1875, Ramsay 1900, Korvenkontio 1915; Fig. 5.

**5**. Tuulos, Suolijärvi (1923); two small pieces of humerus (L 130/80+ mm, W 130/540+ mm, bone thickness 60/30 mm) in glaciofluvial material, in 4.2 m depth, 83.9 m above sealevel; University collections; not relocated; Rosberg 1924.

**6**. Helsinki, Herttoniemi (1954); two pieces of humerus dex.(the larger piece: L 590+ mm, diameter 160-119-185 mm, bone thickness 25 mm); found between clay and sand under the a bog in 1.2 m depth; Finnish Museum of Natural History, University of Helsinki; Pearson *et al.* 1965, newspaper articles and M. Salmi diary notes; Fig. 6.

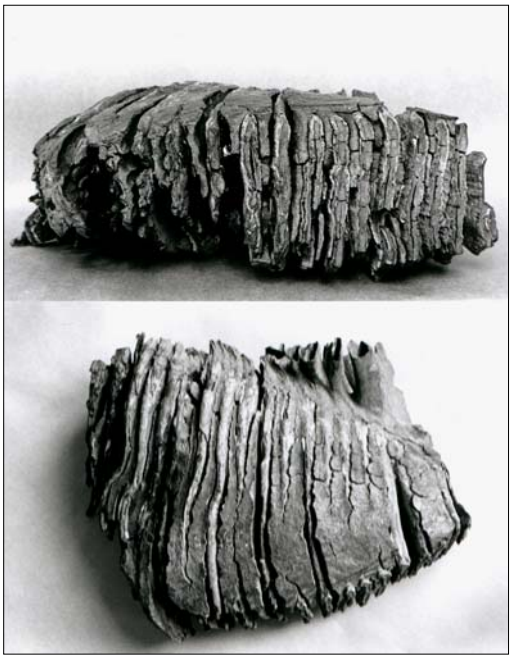

Figure 5 Upper molar from Nilsiä. [Photo: Ritva Talman]

Figure 6 A Piece of humerus from Herttoniemi in Helsinki. [Photo: Ritva Talman]

**7**. Helsinki, Töölö (1911); dp4 sin (P 6+, L 48+ mm, W 53 mm [5], H 12 mm [4], LF 12.5, highly worn); in till, in 1.8 m depth, *ca*. 12 m above sealevel; Finnish Museum of Natural History, University of Helsinki; Korvenkontio 1915; Fig. 7.

**8**. Espoo (*ca*. 1921); molar in till (measurements not available); Finnish Museum of Natural History, University of Helsinki; Metzger 1921; Fig. 8.

**9**. Pohja Brödtorp (1896); a piece of a rib (L150+ mm, W 50 mm) in till, in 4.6 m depth, 48.9 m above sealevel; Zoological Museum in St. Petersburg; not relocated; Ramsay 1897; Rosberg 1901; Korvenkontio 1915.

The mammoth bone localities are relatively evenly dispersed across Finland. The teeth from Iijoki, Haapajärvi, Nilsiä, and Töölö in Helsinki were originally found in Late Weichselian minerogenic sediments. The subfossils from Lohtaja and Herttoniemi in Helsinki were discovered in clay and in littoral sediments of Holocene age, respectively.

## DATING

Six subfossil mammoth bones of the total nine found in Finland were radiocarbon dated using the AMS-technique (Table 1). The molar from Espoo was not redated because of its infinite date obtained by conventional radiocarbon dating (Donner *et al*. 1979). The pieces of humerus from Tuulos and the rib from Pohja have not yet been relocated. Five of the samples were prepared in the Radiocarbon Dating Laboratory in Helsinki. Bone collagen was used for dating, and the collagen extraction used was modified from the combined method described by Berglund *et al*. (1976). Special attention was paid to removal of contaminations and humus absorbed into the bone. One sample was prepared in the dating laboratory of the University of Uppsala, where the AMS measurements were done.

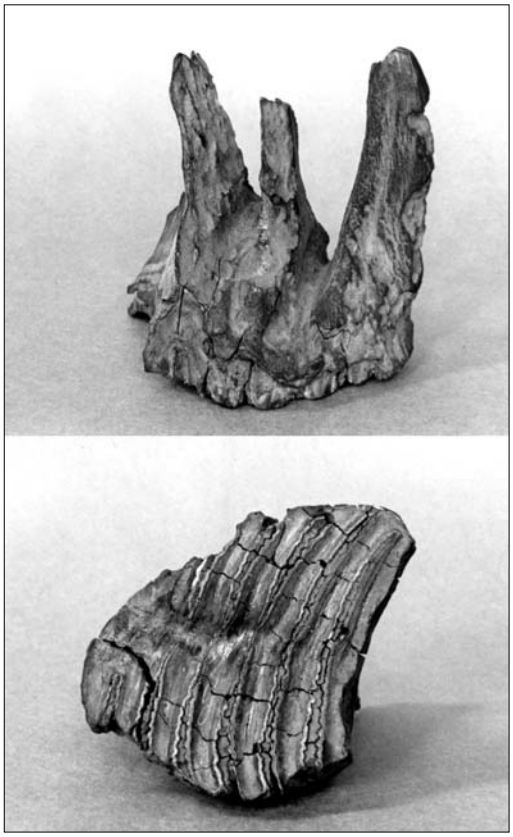

Figure 7 Premolar from Töölö in Helsinki. [Photo: Ritva Talman]

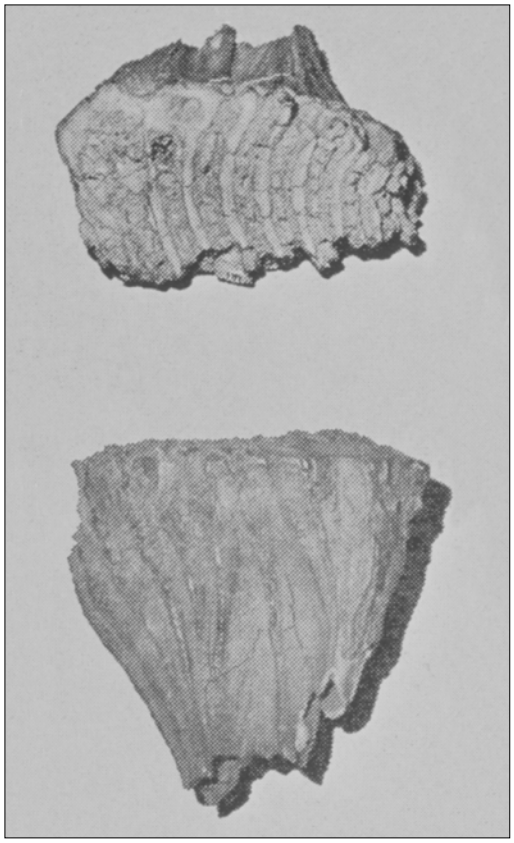

Figure 8 Upper molar from Espoo. [Reproduced with the permission of the Bulletin of The Geological Society of Finland]

## DISCUSSION

The dating results from Iijoki, Haapajärvi, Nilsiä, Töölö in Helsinki, and Espoo range from 32,000 - 22,500 yBP and form a consistent series of dates from the latter part of the Weichselian glaciation. The subfossils were not found *in situ* but were picked up by the Scandinavian Ice Sheet and transported like erratics by the ice for a short distance as the Ice Sheet advanced across Finland. These datings indicate that there were large ice-free areas in Fennoscandia prior to the last glacial maximum c. 18,000 yBP. A conventional radiocarbon date of a reindeer antler from Tornio, northern Finland (34,300 +2,000/-1,450 yBP; Siivonen 1975) is in accordance with this theory. The dates also indicate a very fast growth of the Scandinavian Ice Sheet over the northeastern part of Europe to its maximum position during the Late Weichselian.

The subfossils from Lohtaja (24,450 yBP), and Herttoniemi in Helsinki (15,910 yBP) were found in Baltic clay and could have been transported to their locations for example by icebergs. Therefore they can not be used as evidence of any ice-free areas near the location they were found at. A long distance transport has been suggested for all mammoth subfossils found on both sides of the Gulf of Finland by Lepiksaar (1992). Both finds are bones and not teeth as in case of the other dated subfossils, which is well in accordance with the note of Lepiksaar (1992) about the difference in preservation between interstadial and late-glacial finds.

Similar dates as those obtained in Finland

Table 1 Mammoth bones found in Finland, localities, conventional and AMS datings. The numbers refer to the location map in Figure 1.

| Locality | Bone material | Previous dating (conv.) | New $^{14}$C-Dating (AMS) | Lab.nr. (AMS) |
|---|---|---|---|---|
| 1. Iijoki | Molar | - | 31,970±950 BP | Ua-14190 |
| 2. Lohtaja | Femur | 25,200±500 BP | 24,450±385 BP | Hela-295 |
| 3. Haapajärvi | Tusk | - | 28,740±670 BP | Hela-294 |
| 4. Nilsiä, Syväri | Molar | - | 22,420±315 BP | Hela-281 |
| 5. Tuulos | Humerus | - | - (not relocated) | |
| 6. Helsinki, Herttoniemi | Humerus | 15,500±200 BP | 15,910±155 BP | Hela-321 |
| 7. Helsinki, Töölö | Premolar | - | 23,340±350 BP | Hela-282 |
| 8. Espoo | Molar | >43,000 BP | - | |
| 9. Pohja, Brödtorp | Costa | - | - (not relocated) | |

have been recorded in Denmark (Aaris-Sørensen *et al*. 1990), Sweden (Berglund *et al*. 1976), and Norway (Heintz *et al*. 1979; Follestad & Olsson 1979), but the reliability of the datings has been questioned. This has lead to categorical rejection of all unexpected dating results of Scandinavian mammoth subfossils, although Lepiksaar (1992) has discussed their possible value in reconstructing the history of the Scandinavian Ice Sheet. In our opinion the preparation and dating techniques used here are reliable. We base this on the good accordance between the AMS and conventional datings, the presence of one infinite date, the consistence of the results, and the fact that the results are geologically possible, if not uncontroversial.

## CONCLUSIONS

The radiocarbon dates of Finnish mammoths ranging from 32,000 yBP to 22,500 yBP build a consistent series of geologically possible ages. The dates suggest that there were large ice-free areas in Northern Fennoscandia during the Middle Weichselian. They also indicate a very fast growth of the Scandinavian Ice Sheet to its maximum position. To understand the distribution of mammoths during the Middle and Late Weichselian in countries covered by the Scandinavian Ice Sheet more datings of Swedish, Norwegian, and Estonian finds are needed.

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