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A Mesolithic bone tool from the Moervaart palaeolake (NW Belgium)

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1. Introduction

In *Notae* 32 we reported the discovery of a bone tool with an oblique cutting edge (Fig. 1), found isolated in the Late Glacial Moervaart palaeolake during the excavation of a Medieval site at Klein-Sinaai (Crombé *et al.*, 2012). The heavily weathered and fragmented tool was determined as a chisel/adze presumably made on a tibia of a large *bovidae*. Stratigraphically it was found in a strongly organic clayey layer at the transition between calcareous lake marl sediments and covering peat. In absence of an absolute date the artifact was tentatively dated on stratigraphical basis between the Final Palaeolithic and the start of the Neolithic. In order to refine this date samples for radiocarbon dating of the bone artifact and the sediments were submitted, the results of which will be presented in this paper.

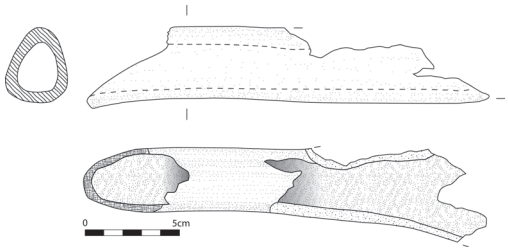

Fig. 1 - Bone artifact from Klein-Sinaai (scale: 1/4).

2. Radiocarbon evidence

2.1. Bone dates

Bone comprises two fractions: a protein fraction (collagen) and an inorganic component (calcium hydroxyapatite). Both contain carbon and in theory both are datable. The hydroxyapatite, however, is an open lattice structure into which carbonates from ground water can be deposited and contaminate the apatite. The preservation state of bone collagen can be evaluated by the C:N ratio reflecting contamination and/or degradation. C:N ratio between 2.9 and 3.6 should result in acceptable ^{14}C dates (De Niro, 1985; Ambrose, 1990). However, collagen extracted from fresh bones have mostly a C:N ratio of 3.1-3.2.

The bone tool found in the Moervaart palaeolake was covered by peat. Peat contains humic acids which can contaminate the bone collagen. During collagen extraction a NaOH-wash was performed to remove most of the humic acids (but not all), which have a higher C:N than bone collagen. Both the purified collagen (RICH-20192) and the

Lab Number	*Dating Material*	*BP-date*	*$\delta^{15}N$*	*$\delta^{13}C$*	*C/N*
RICH-20191	collagen AA (cross flow nanofiltration)	8671 ± 43	+5.2 ‰	-23.0 ‰	3.2
RICH-20192	Collagen	8571 ± 43	+5.3 ‰	-22.7 ‰	3.4
RICH-20190	NaOH-extract collagen	5611 ± 36	+4.9 ‰	-26.8 ‰	9.2
RICH-20193	Apatite	7861 ± 40			

Tab. 1 - List of dates obtained on the bone tool.

NaOH-extract (RICH-20190) were subsequently dated (Tab. 1). The former yielded a date which based on its C:N ratio (3.4) can be considered reliable. But the dated collagen had a light-brownish colour while perfect collagen is normally white. This brown colour can indicate humic acid presence. Therefore, the collagen was hydrolyzed into amino acids and a cross flow nanofiltration was performed. Cross flow nanofiltration is a recent, novel technique improving sample quality of protein-containing samples developed in the Royal Institute for Cultural Heritage (Boudin *et al.*, 2013). The obtained C:N ratio of the collagen AA (RICH-20191) is 3.2 showing better sample quality and hence a more reliable ^{14}C date was obtained. A fourth date (RICH-20193) was performed on the apatite but turned out to be unreliable due to secondary carbonate contamination (Tab. 1).

2.2. Sediment dates

Two samples from organic layers were sampled in order to provide dates *ante quem* and *post quem* for the deposition of the bone artifact (Tab. 2). A first sample was retrieved from a strongly organic layer at the bottom of the lacustrine sediments underlying the bone tool. This sample yielded a date in the first half of the Allerød, which is in accordance with earlier radiocarbon dates from the Moervaart palaeolake (Crombé *et al.*, 2013). The sample of the covering peat yielded a date at the transition between the Atlantic and Subboreal and fits perfectly with the starting dates of peat growth in the nearby Lower Scheldt floodplain.

Lab Number	*Dated Layer*	*BP-date*	*Dating Material*
RICH-20094	Peat base	5760 ± 34	Charcoal and wood fragments
RICH-20089	Organic layer at base lacustrine sediments	11874 ± 53	*Ranunculus flammula* seeds 7 x; *Carex* (trigonous) sp. 4 x fruits; *Schoenoplectus lacustris* 1 x[1]

Tab. 2 - List of sediment dates.

1. Selection and determination of plant macroremains was done by H. Bos from ADC ArcheoProjecten (Amersfoort, the Netherlands).

3. Discussion

The nanofiltration date of the bone artifact, being the most reliable radiocarbon date, is not in conflict with the dates obtained on the underlying and above lying sediments. It situates the bone artifact in the first half of the 8th millennium cal BC, long after the Moervaart lake had dried out (end of Allerød) and ca. three millennia earlier than the start of the peat growth. This indicates that the preservation of this so far unique find within the Moervaart area is most likely due to the highly calcareous composition of the sediment in which it was deposited rather than to waterlogged circumstances. It also demonstrates the potential of the Moervaart palaeolake area for future discovery of organic remains dating to the Final Palaeolithic and Mesolithic.

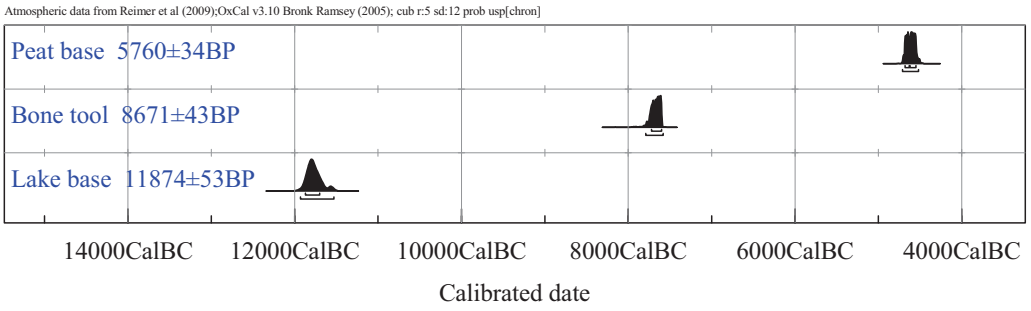

Fig. 2 - Calibrated radiocarbon date of the bone tool in relation to the sediment dates.

The bone tool dates to a period in which the Moervaart area was intensively occupied by (Early) Mesolithic hunter-gatherers, who mainly settled their camp-sites along a meandering channel of the palaeo Durme/Kale (Crombé *et al.*, 2013). However, until now no such site is known in the direct vicinity of the spot where the bone tool was found, suggesting that we are dealing with an isolated artifact which was deliberately deposited or lost.

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Abstract

This short paper reports on the absolute dating of a bone tool found in the Late Glacial Moervaart lake, NW Belgium (Crombé *et al.*, 2012). A collagen sample, which was pretreated by means of a cross flow nanofiltration, yielded a radiocarbon date of 8671 ± 43 BP (RICH-20191). This situates the bone artifact in the first half of the 8th millennium cal BC, when the Moervaart area was densely occupied by Early Mesolithic hunter-gatherers.

Keywords: Moervaart palaeolake, Klein-Sinaai, East Flanders (B), bone tool, Mesolithic, radiocarbon dating.

Samenvatting

In deze korte nota worden de resultaten van enkele koolstofdateringen verricht op een benen werktuig en sedimenten uit de Moervaartdepressie te Klein-Sinaai (Crombé *et al.*, 2012) gepresenteerd. Een directe datering op collageen, onderworpen aan een nanofiltratie, situeert het artefact in de eerste helft van het 8ste millennium v. Chr. (RICH-20191 : 8671 ± 43 BP). Deze datering is niet in tegenspraak met de datering van de onderliggende lacustriene afzettingen (RICH-20089 : 11874 ± 53 BP) en afdekkende veenlaag (RICH-20094 : 5760 ± 34 BP).

Trefwoorden: Moervaart palaeodepressie, Klein-Sinaai, prov. Oost-Vlaanderen (B), benen werktuig, Mesolithicum, koolstofdatering.

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