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Prehistoric antler and bone tools from the Scheldt basin: new radiocarbon dates from the site of Wintam "Sluis" in the Rupel floodplain (municipality of Bornem, prov. of Antwerp, BE)

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1. Introduction

During the final stage of construction of the "Brussel canal" in the Rupel floodplain, connecting the canal with the Scheldt river at Wintam (Fig. 1), an important assemblage of archaeological finds was collected between 1980 and 1990 from the dredged soil (De Reu, 2001). The assemblage includes finds from different periods, from the Mesolithic and Neolithic (Sergant & Crombé, 2001) over the Bronze Age (Verlaeckt, 2001) till the Roman period (De Clercq, 2001) and Medieval times (Oost, 2001). It contains finds from different categories, such as bone (Pleistocene & Holocene fauna), antler (mattocks), bronze (axes, daggers, lances, pins,...), stone and ceramic. All these finds have been presented in detail in two major publications (Verlaeckt ed., 2001; De Reu ed., 2001). Thanks to a recent funding by the province of Antwerp it was possible to directly date some of the antler and bone tools collected at Wintam. The results of this dating project will be presented in this paper and discussed against the background of earlier dates on similar finds from the Scheldt basin (Crombé *et al.*, 1999).

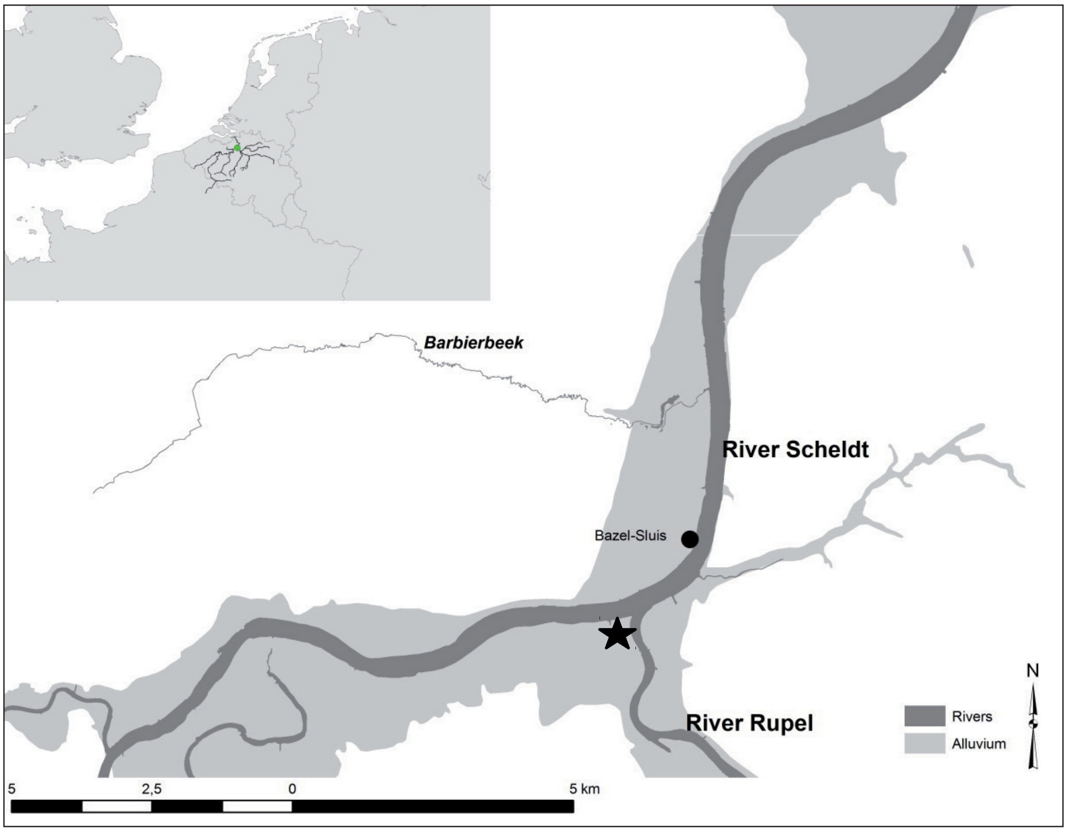

Fig. 1 – Map of the Scheldt and Rupel floodplains (modified from Deforce *et al.*, 2014). The star indicates the position of the Wintam-site at the confluence of both rivers.

2. Classification of the dated mattocks

In a previous paper (Sergant & Crombé, 2001) the antler and bone tools of Wintam have been described in detail from a typological point of view following the classification scheme of V. Hurt (1982). Altogether (Tab. 1) 7 mattocks were identified, next to 6 antler fragments with cut marks and 23 unmodified antler fragments (Fig. 3:2 & 6). Among the mattocks three can be classified as antler beam mattocks, also known as T-shaped axes or *Tüllengeweihäxte*. Two of these mattocks (Fig. 2:4-5) are unperforated (so-called *ontschorsers* or *pelloirs*), although they present an oblique cutting edge. The perforation on the third specimen (Fig. 2:3) is situated next to the removed trez tine. Two basal antler fragments with clear cut marks (Fig. 3:3-4) can be interpreted as waste from the production of beam mattocks.

Next two mattocks are made on the basal section of an antler by removing the brow and bez tines and providing a perforation parallel to the cutting edge (Fig. 2:1-2). A last mattock with oblique cutting edge is made on the distal part of a tine (Fig. 2:6). The last antler tool may be classified as a socket made on the basal part of an unshed antler (Fig. 2-7); the tool is provided with an elliptical to rectangular perforation and a slightly hollowed-out distal end. Six antler fragments with clear cutting marks (Fig. 3:1, 5 & 7-8) can be classified as production waste. Finally, the assemblage also contains a bone tool identified as a chisel made on a split metatarsus most likely from *Bos primigenius* (auroch; Fig. 2:8).

3. Radiocarbon dating

3.1. Sample selection and treatment

Funding allowed us to select all tools and some items from the production waste for radiocarbon dating. Just one mattock did not yield enough collagen in order to obtain a reliable date (Fig. 2:3). Collagen extraction was performed following Longin's (1971) method. A 1 % NaOH-wash step (15 minutes) was introduced between demineralization

Find ID	*Mattock type*	*Hurt type*	*Perforation*	*Lab. code*	*^{14}C date UnCal BP*	*%C*	*%N*	*d13C*	*d15N*	*at C:N*	*Figure*
Antler Tools											
HC-1	Antler beam	Ba	-	RICH-24914	9012 ± 34	33.9	11.99	-21.3	3.6	3.3	2-5
JS-1	Antler beam	Ba	-	RICH-24660	5166 ± 35	25.8	8.8	-21.8	4.6	3.4	2-4
OR-1997-2002	Antler beam	Ba1	+								2-3
RS-1991	Antler base	Aa3	+	RICH-24632	2981 ± 32	39.2	13.9	-23.4	3.4	3.3	2-1
OR 1997-2003	Antler base	Aa3	+	RICH-24633	3428 ± 33	37.5	13.4	-22.5	4.0	3.3	2-2
OR-1997-2001	Antler socket		+	RICH-24634	3901 ± 32	35.9	12.6	-22.9	5.2	3.3	2-7
OR-1997-439	Antler tine	E	-	RICH-24636	8440 ± 40	39.3	14.1	-22.3	3.9	3.3	2-6
Bone tool											
OR-1998-2004	Bone chisel		-	RICH-24659	9513 ± 42	32.5	11.9	-20.6	4.5	3.2	2-8
Production waste (antler)											
JS-2	Basal		-	RICH-24650	5277 ± 34	24.8	8.1	-23.9	5.9	3.6	3-3
JS-3	Basal		-	RICH-24658	5977 ± 36	36.4	12.5	-22.4	3.6	3.4	3-4
HC-3	Basal		-	RICH-24916	3625 ± 30	31.4	10.81	-23.8	6.3	3.4	3-5
HC-2	Crown		-	RICH-24915	6858 ± 32	40.6	14.18	-22.3	5.2	3.3	3-1
?	Crown		-								3-7
?	Crown		-								3-8

Tab. 1 – List of the antler and bone tools and production waste collected at Wintam.

and hydrolization steps. First, all the bone samples were demineralized in 10 ml 8 % HCl for 20 minutes, and rinsed with MilliQ™-water. After that, each sample was immersed for 15 minutes in 1 % NaOH, and again rinsed with MilliQ™-water. Then, after adding 1 % HCl for neutralization, it was washed with MilliQ™-water. For all the steps mentioned

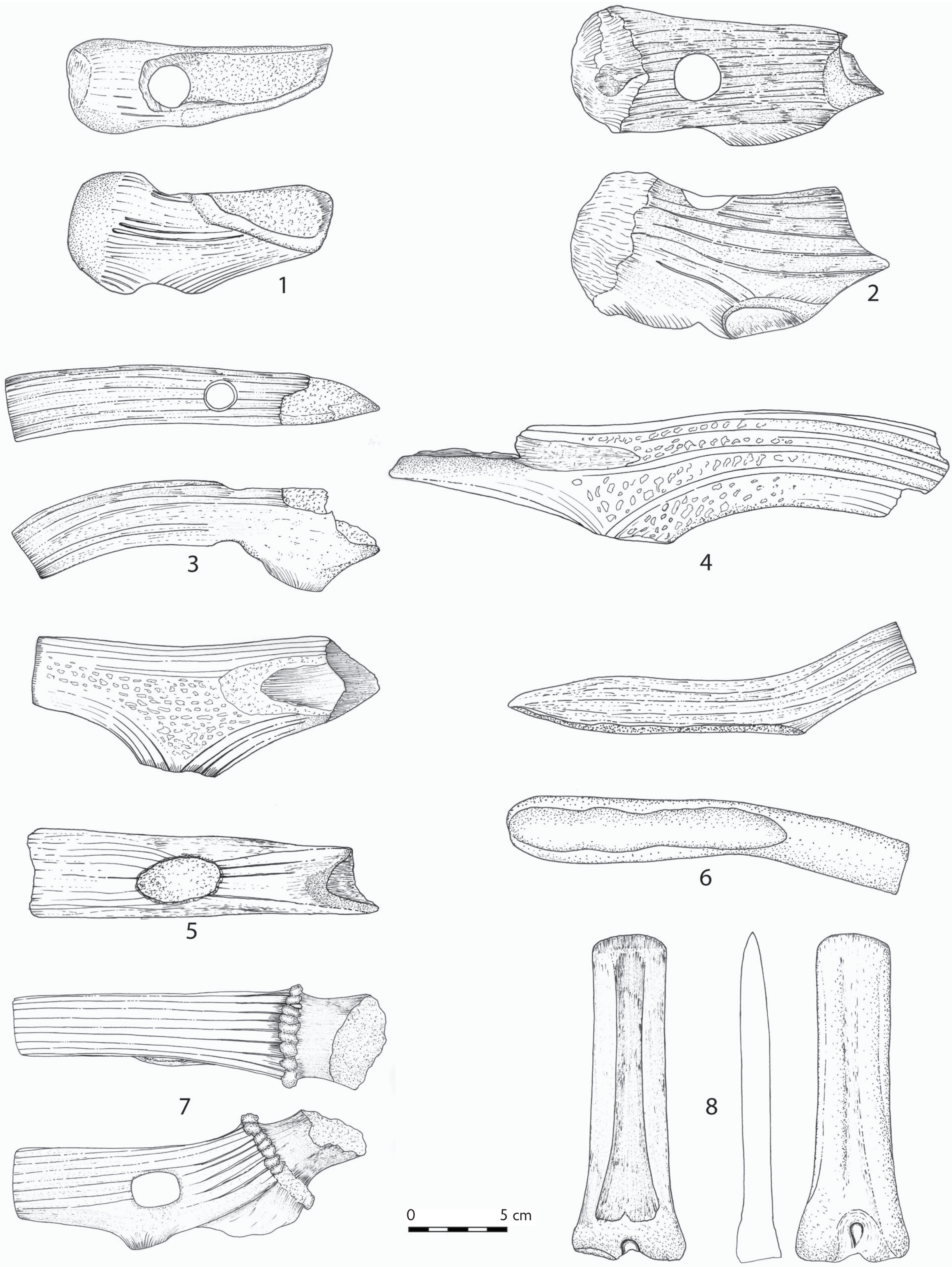

Fig. 2 – Antler and bone tools from Wintam.

above, Ezee-filters were used. Gelatinization of the extract was done in water (pH 3), at 90° C for 12 hours. The resulting gelatin was filtered with a Millipore 7 micrometer glass filter, and freeze-dried. All samples were transformed into graphite using the automatic

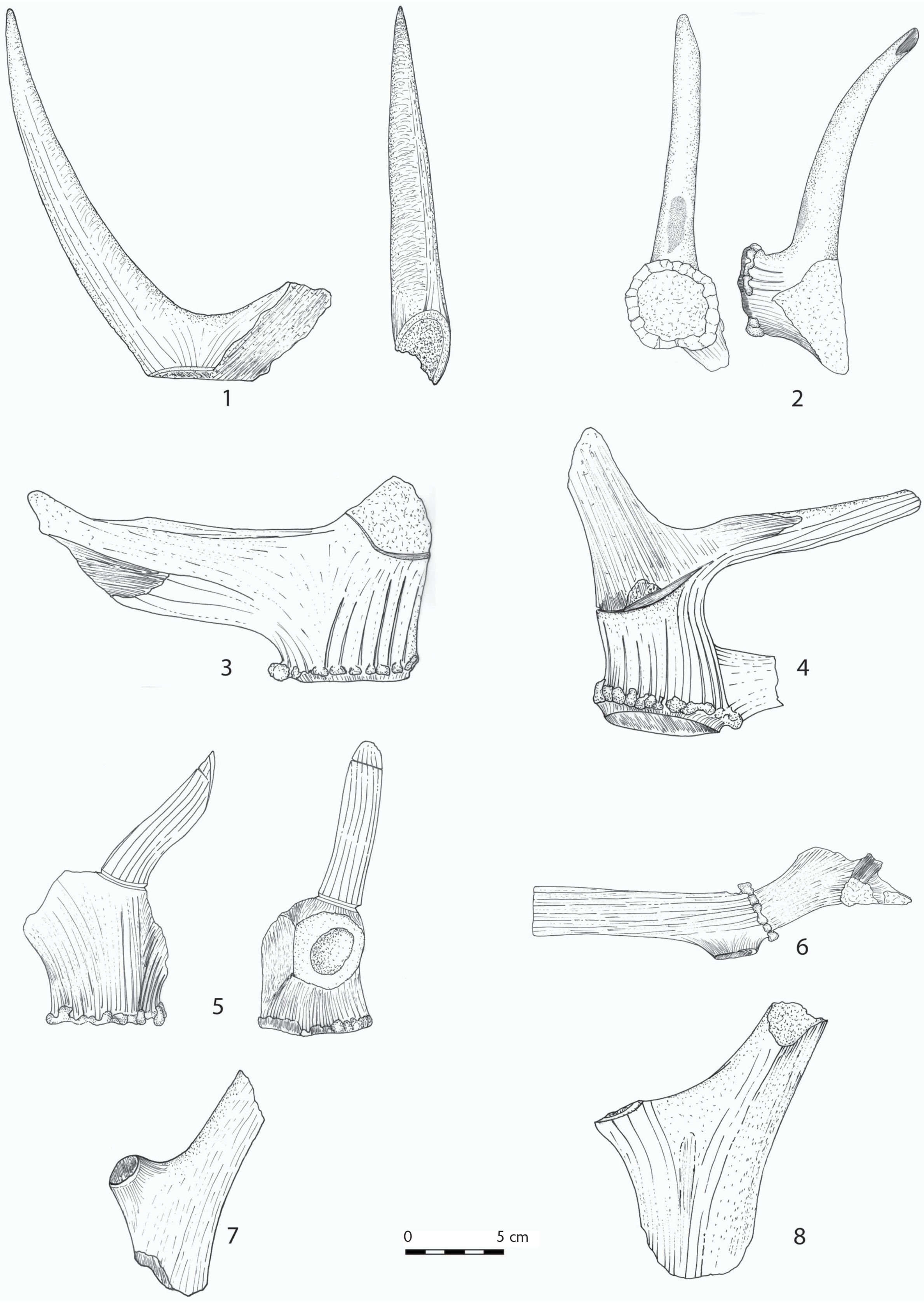

Fig. 3 – Antler production waste and unmodified fragments from Wintam.

graphitization device AGE (N mec *et al*. 2010; Wacker *et al*. 2010; Boudin *et al*., in press). Age determinations (^{14}C analysis) were carried out on the AMS instrument at the Royal Institute for Cultural Heritage (KIRK-IRPA), Brussels (Lab code RICH-; Boudin *et al*., 2015). ^{14}C calibrations were performed using OxCal version 3.1 (Bronk Ramsey, 1995) and the IntCal13 calibration curve date (Reimer *et al*., 2013). The C:N ratio, ^{13}C and ^{15}N analysis were performed on a Thermo Flash EA/HT elemental analyzer, coupled to a Thermo Delta V Advantage Isotope Ratio Mass Spectrometer via ConFlo IV interface (Thermo Fischer Scientific, Bremen, Germany). Standards used were IAEA-N1, IAEA-C6, and internally calibrated acetanilide. Analytical precision was 0.25 ‰ for both ^{13}C and ^{15}N based on multiple measurements of the standard acetanilide.

3.2. Results

The dating results are listed in table 1. The two dated unperforated antler beam mattocks perfectly fall within the chronological range of the T-shaped axes (Crombé *et al*., 1999). However the late date obtained on specimen JS-1 (5166±35BP) is rather surprising, as so far unperforated beam mattocks were dated prior to the appearance of perforated ones. It might indicate that unperforated mattocks with cutting edges continued to be used synchronic with perforated ones, although one cannot fully exclude that the dated specimen from Wintam is an unfinished (not yet perforated) tool. Both basal fragments from the production of antler beam mattocks also confine to the chronological limits of T-shaped antlers. The antler tine with oblique cutting edge is dated to the late Boreal, while the antler socket has a final Neolithic age. Both basal mattocks are amongst the youngest tools from the Wintam assemblage, dating to the middle Bronze Age. The oldest tool from the assemblage is the bone chisel; it dates to the very beginning of the Mesolithic.

4. Discussion

The radiocarbon dates from Wintam combined with some other dates which were obtained after the first dating program of antler mattocks in the 1990s (Crombé *et al*., 1999; Tab. 2) allow a further refinement of the absolute chronology of the different mattock types within the Scheldt basin, using Bayesian statistical modelling (Bronk Ramsey, 2009), OxCal version v4.3.2 and the IntCal13 atmospheric calibration curve (Reimer *et al*., 2013).

Site	*Find ID*	*Mattock type*	*Hurt type*	*Perforation*	*Lab. code*	*^{14}C date UnCal BP*	*Reference*
Bazel-Stuw	21/87/8	Antler beam	Ba1	+	KIA-47402	5835 ± 60	Meylemans *et al*., 2016
Appels-Veer		Antler base	Aa	+	KIA-17982	5600 ± 35	KIK-IRPA datalist
Appels-Veer		Antler base	Aa	+	KIA-17959	3855 ± 25	KIK-IRPA datalist
Ename-Stuw		Antler base	Aa	+	KIA-23328	3660 ± 25	KIK-IRPA datalist
Ename-Stuw		Antler base	Aa	+	KIA-23427	3345 ± 30	KIK-IRPA datalist
Sint-Gillis-Waas	Well 3A	Antler base	Aa	+	RICH-20204	3044 ± 34	Lauwers & Van Strydonck, 2018
Bazel-Stuw	21/83/10	Antler tine	E	+	KIA- 47407	5790 ± 45	Meylemans *et al*., 2016
Bazel-Stuw	12/31/11	Bone chisel		-	KIA-47408	5830 ± 50	Meylemans *et al*., 2016

Tab. 2 – Antler mattocks and a bone chisel from different sites in the Scheldt valley dated after the Crombé *et al*., 1999, publication.

The 21 available dates for antler beam mattocks clearly situate their first appearance at the very beginning of the Mesolithic, between 8923-8064 cal BC (95.4 % prob.) and most likely between 8502-8241 cal BC (68.2 % prob.; Tab. 3; Fig. 4). The newly obtained dates confirm the earlier observation that initially antler beam mattocks were used without perforation (Crombé *et al.*, 1999); three on four dates of unperforated mattocks are older than ca. 7000 cal BC, and are thus of early to middle Mesolithic age. Perforated antler beam mattocks did not appear earlier than the transition from the 6th to the 5th millennium cal BC, i.e. between 5353-4902 cal BC (95.4 % prob.), and most likely between 5150-4962 cal BC (68.2 % prob.). The reason why it took so long before these tools were provided with a perforation so far remains unclear. Perhaps it points at a change in the use of these mattocks, but this is difficult to verify in absence of usewear analysis. Alternatively it was the result of a cultural transfer. One cannot deny the synchronicity between the first appearance of perforated antler beam mattocks in the Scheldt basin and perforated stone chisels in the final LBK of the adjacent löss region. The last few years there is increasing evidence of interaction and exchange between the late hunter-gatherers of the Swifterbant Culture and the LBK/BQY Culture along the Scheldt valley (Crombé *et al.*, 2015) which probably marks the beginning of the neolithization process in the sandy lowlands. It is thus not unlikely that hunter-gatherers started perforating their beam mattocks under influence of the nearby farming communities (Crombé, 2008).

	68.2 % probability Cal BC		*95.4 % probability Cal BC*	
	Start	*End*	*Start*	*End*
Beam mattocks	8502-8241	3541-3239	8923-8064	3585-2821
Perforated beam mattocks	5150-4962	3551-3366	5353-4902	3596-3169
Basal mattocks	4984-4600	1246-871	5624-4545	1320-224
Basal mattocks youngest cluster	2722-2479	1250-998	3068-2387	1349-667

Tab. 3 – Bayesian modelling of the dates presented in this paper in combination with those published in 1999 (Crombé *et al.*, 1999).

Another important question relates to the complete lack of radiocarbon dates between ca. 7000 and ca. 5000 cal BC. One may wonder whether this is an artefact of sampling rather than a "historical reality". Future programs should therefore focus more on dating of unperforated antler beam mattocks, in order to obtain a more robust dataset.

The use of antler beam mattocks apparently came to an abrupt end around the middle of the 4th millennium cal BC, between 3596-3169 cal BC (95.4 % prob.), and most likely between 3551-3366 cal BC (68.2 % prob.). This corresponds well with the "disappearance" of the Michelsberg Culture (Vanmontfort *et al.*, 2008). The fact that perforated beam mattocks persisted over a period of ca. 1.5 millennium in an unchanged way, testifies of an important "cultural" continuity in the Scheldt basin, incorporating the Swifterbant and Michelsberg Cultures. There is indeed increasing evidence (ongoing research Ghent University) that the appearance of the Michelsberg Culture (or Spiere group) in the lower-Scheldt basin is due to an acculturation of local hunter-gatherers rather than an expansion of farmers/herders from the southern löss area of the upper-Scheldt.

Until recently the chronology of the mattocks made on the proximal portion of antlers remained vague (Crombé *et al.*, 1999). With 7 new dates it is now possible to elaborate a chronological framework. Although clearly younger than the antler beam mattocks, there is some chronological overlap between both types. The chronological distribution of the

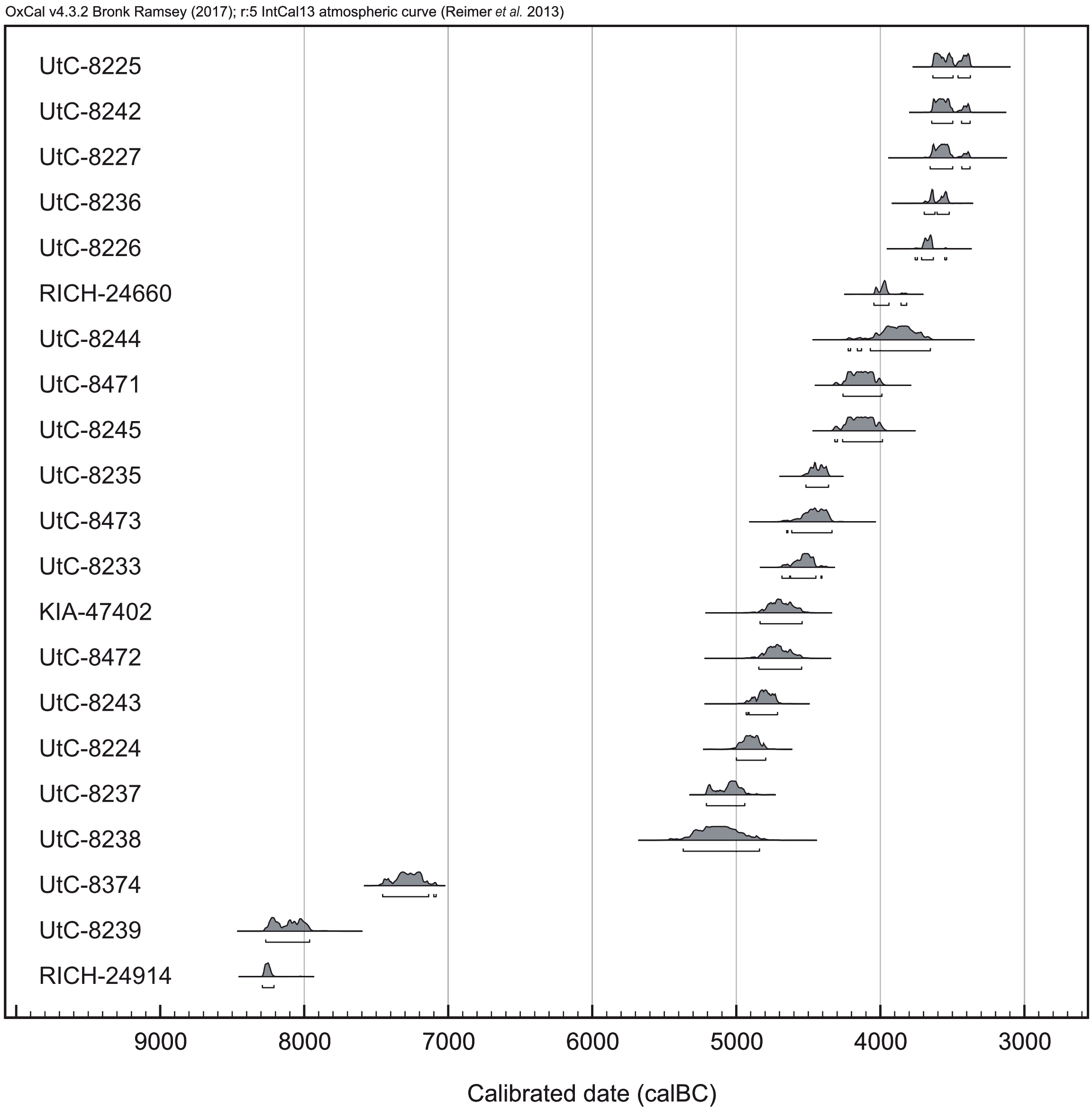

Fig. 4 – Calibrated chronological range of antler beam mattocks from the Scheldt basin.

antler base mattocks falls apart into two clusters separated by a hiatus (Fig. 5). Here too it is unclear whether the lack of dates from the middle of the 5th till the middle of the 3rd millennium is an artefact of sampling or a "historical reality". The oldest cluster, consisting of just two dates, is contemporaneous with the bulk of beam mattocks. However, the largest cluster represented by 9 dates, is much younger. It starts between 3068-2387 cal BC (95.4 % prob.), or more likely 2722-2479 cal BC (68.2 % prob.) and ends between 1349-667 cal BC (95.4 % prob.), or more likely 1250-998 cal BC (68.2 % prob.). This corresponds to the final Neolithic (Bell Beaker Culture) up to the middle Bronze Age. Hence this type of tool seems "culturally" more tidily linked to the traditions of funeral barrows, well represented in the Scheldt basin (Crombé et *al*., 2011; De Reu *et al*., 2011).

The date of the antler socket from Wintam is in perfect line with two other dates on similar tools, performed earlier (Crombé *et al*., 1999). They all three fall in the chronological gap of the antler base mattocks.

The surprisingly old date for the bone chisel at the initial stage of the Mesolithic confirms

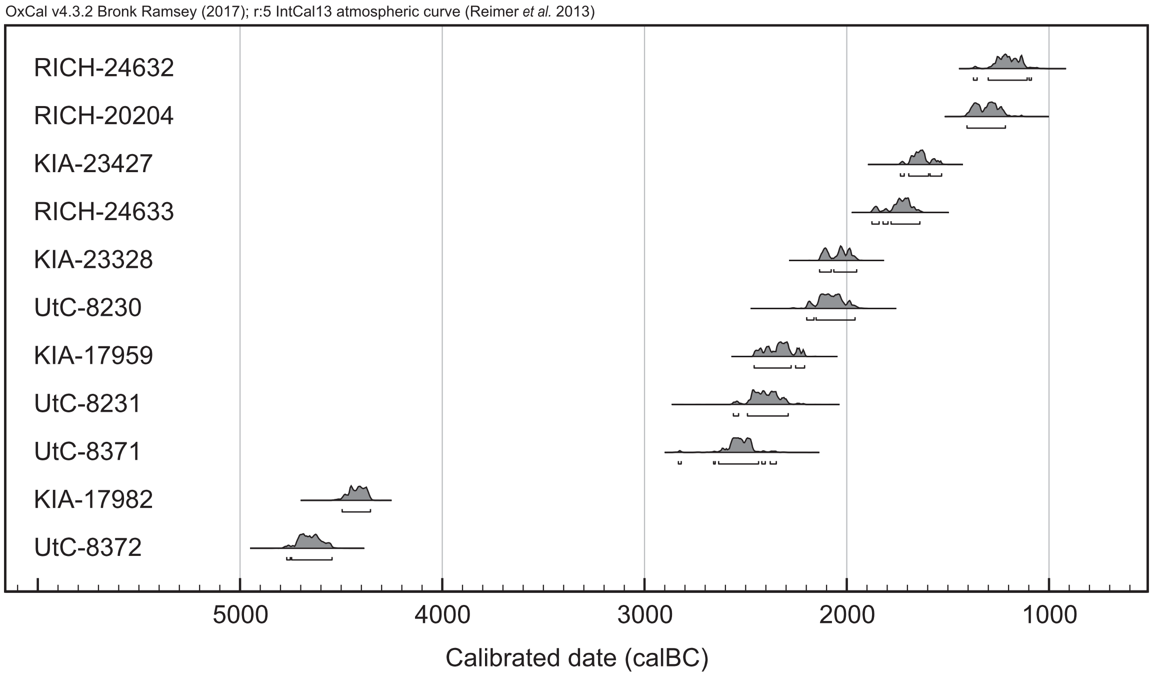

Fig. 5 – Calibrated chronological range of antler base mattocks from the Scheldt basin.

with dates on similar objects in other regions of NW Europe, such as Friesack (Gramsch, 1987) and Star Carr (Clark, 1954). A similar tool found at the wetland site of Bazel demonstrates a survival of this tool type in the Scheldt valley until the 5th millennium cal BC (Tab. 2).

4. Conclusion

The dating of the small antler and bone assemblage of Wintam in the Rupel valley demonstrates the importance of obtaining new radiocarbon dates, even on dredged finds lacking stratigraphical information. By performing large series of dates it is possible to get a better grip on the chronological distribution of different types of organic tools, which are generally missing on dryland settlement site due to unfavorable soil conditions. This can help us in explaining wear traces of bone and antler working found on numerous lithic tools on the latter sites, but also to study cultural changes over extensive time periods, ranging from the beginning of the Mesolithic till the Bronze Age. Future dating projects should preferably focus on unperforated antler-beam mattocks as well as antler base mattocks, in order to check out the current chronological gaps. In addition it is advisable to include also other "smaller" types of antler and bone tools, such as those made on antler tines (Hurt type E) and antler crowns (Hurt type D), fish hooks, barbed points, etc. The few dates currently available, e.g. dates RICH-24636 (Wintam) and KIA-47408 (Bazel), strongly indicate these smaller items were also used over a long period of time starting from the early Mesolithic. Finally there is need for an extensive microwear study of these organic remains.

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Abstract

This paper discusses a series of 11 new radiocarbon dates obtained on antler and bone tools dredged at Wintam from the Rupel River, a tributary of the Scheldt River. Combined with previous dates these allow a further refinement of the chronology of antler beam and base mattocks within the Scheldt basin. The dates confirm the appearance of unperforated beam mattocks at the start of the Mesolithic, as well as the first appearance of perforated examples at the transition from the 6th to 5th millennium cal BC, i.e. at the beginning of the Neolithization process of the Lower Scheldt basin. The dates also demonstrate a predominantly Final Neolithic to Bronze Age chronology for the antler base mattocks. Still important hiatuses exist within the chronology of organic tools from the Scheldt valley, in particular the 7th, 6th and 4th millennium cal BC. It is therefore important to continue dating these dredged river finds.

Keywords: Wintam "Sluis", municipality of Bornem, prov. of Antwerp (BE), Scheldt valley, antler mattocks, bone chisel, radiocarbon dates, Neolithization process.

Samenvatting

In dit artikel worden 11 nieuwe koolstofdateringen, uitgevoerd op hertshoornen en benen werktuigen, verzameld tijdens de aanleg van het Brussels Kanaal in de Rupelvallei te Wintam (gemeente Bornem), besproken. Deze dateringen laten toe de chronologie van organische baggervondsten uit de Schelde en haar bijrivieren verder te verfijnen. Ze bevestigen de vroeg-mesolithische ouderdom van niet-doorboorde volgtakbijlen en het verschijnen van perforaties op de overgang van het 6de naar het 5de millennium cal BC. De dateringen tonen ook aan dat het merendeel van de basisbijlen uit het Scheldebekken uit het finaal-neolithicum tot de bronstijd dateert. Slechts enkele exemplaren blijken gelijktijdig te zijn met de geperforeerde volgtakbijlen. Verder dateringsonderzoek is noodzakelijk om de vastgestelde hiaten in de chronologie van organische werktuigen in de Scheldevallei, in het bijzonder gedurende het 7de, 6de en 4de millennium cal BC, te duiden.

Trefwoorden: Wintam "Sluis", gemeente Bornem, prov. Antwerpen (BE), Scheldevallei, hertshoornen hakken, benen beitel, koolstofdateringen, neolithisatieproces.

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