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# The chronology of the Neolithic wetland site of Oudenaarde-Donk NEO 1 revisited (East Flanders, BE)

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## 1. Introduction

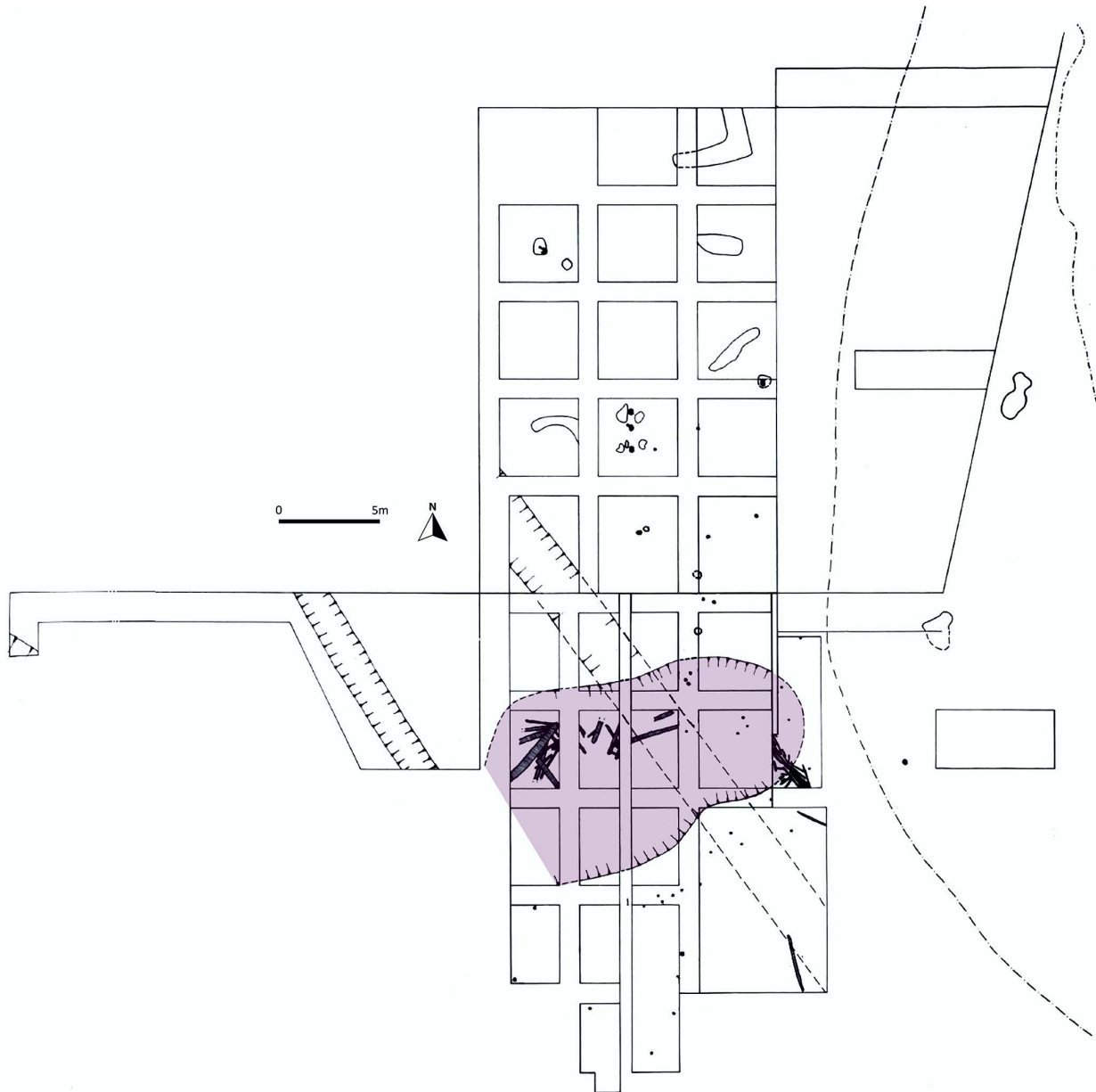
The wetland site of Oudenaarde-Donk (prov. of East Flanders, BE), situated within the former floodplain of the Middle Scheldt, is well-known internationally thanks to the discovery of numerous well-preserved and sealed sites dating the different phases of the Mesolithic and Neolithic (Parent *et al.*, 1987a, 1987b). More specifically, the site of NEO 1 is important as it yielded a unique assemblage of faunal remains mainly dating to the Michelsberg Culture phase. Particularly interesting is the presence of both wild and domesticated animals within this assemblage, demonstrating that the first farmers of the Scheldt basin still had a mixed economy. Unfortunately, the site was excavated in very bad circumstances due to the extensive mechanized sand extraction, impacting the quality of the recovered information. In addition, three of us (J-PP, PvdP, JV) excavated the site without any technical assistance nor expertise in large-scale wetland archaeological research, which was non-existent at that time in Belgium. Nevertheless, the site of Oudenaarde remains exceptional within Neolithic research in Belgium. In order to get a better grip on the formation of this site, an extensive dating project was initiated in 2023, the results of which will be presented in this paper.

## 2. Stratigraphy and features

The main feature at the site of NEO 1 is a large and deep pit of *ca.* 16 x 10 m (context I) reaching a depth of *ca.* 2 m (**Fig. 1**). According to the ground plan, its full extension is not known as the eastern and western sides were not excavated. Little is known about its filling, except that it consists of clayey sediments and yielded most of the archaeological finds, including ceramics, lithic artefacts and numerous animal bones. Although this feature was initially interpreted as anthropogenic, based on its similarities both in dimensions and fill with the deep feature excavated at the nearby site of Ename-Stuw (Crombé *et al.*, 2024) a natural origin cannot be excluded and even seems more likely. This feature was covered by a thick layer of irregularly organized trunks and branches, which was superimposed by a relatively thick “archaeological” layer (context II). Further east, in the lower regions of the site, two pits with a similar clayey infill have been excavated, covered by the same layer. Based on these similarities, it is assumed that they belong to the same occupation phase, attributed to the Michelsberg Culture on the basis of the ceramic and lithic finds (Parent *et al.*, 1987a).

A second occupation phase is supposed in the northern sector of the NEO 1-site. Unfortunately, due to its somewhat higher position in the substrate, organic remains were much less preserved. The settlement features consist of several pits and postholes, some of which may belong to a small rectangular structure (**Fig. 1**). It is thought that most of the numerous pointed posts that were found vertically or obliquely in the lower-positioned zones of the site belong to the same occupation phase, although this cannot be fully proven. Based on the presence of two decorated potsherds this phase is tentatively attributed to the Bell Beaker Culture. Based on the pottery, there might have been an occupational hiatus between both phases (Parent *et al.*, 1987a: 18).





**Fig.1** – Excavation plan of the site of Oudenaarde-Donk NEO 1 (Parent *et al.*, 1987a). The coloured structure is a deep and large pit (context I) filled with archaeological material and sealed by an archaeological layer (context II).

### 3. The radiocarbon evidence

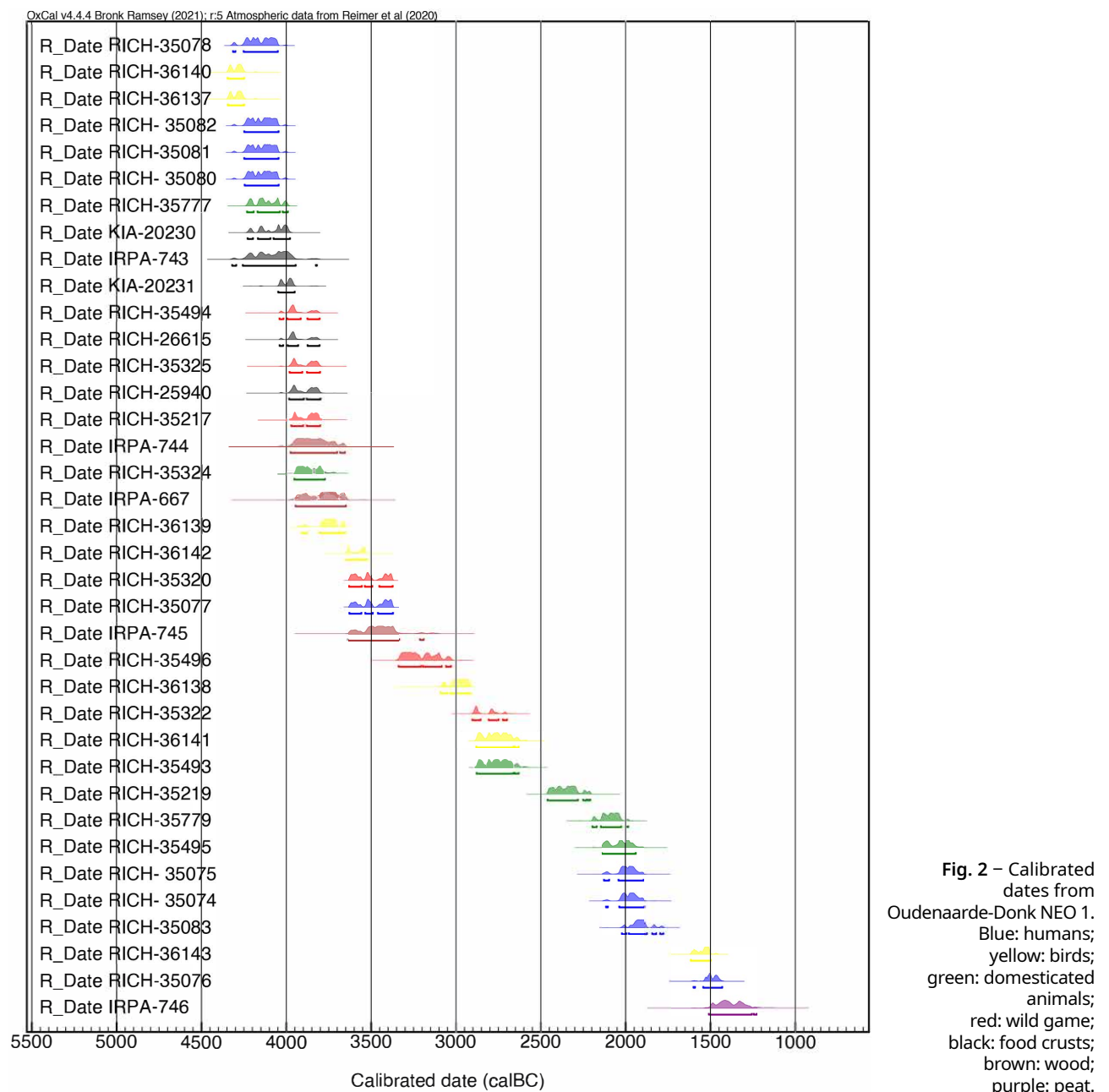
#### 3.1. Site level

Shortly after its excavation (Parent *et al.*, 1987a; 1987b), a series of five radiocarbon dates were performed on different types of samples (**Tab. 1**: IRPA-dates). Three of these (IRPA-667, IRPA-743, IRPA-744) confirmed the Middle Neolithic age of the first occupation phase, while the fourth date from a small pit (IRPA-745) referred to a Late Neolithic age. The last sample aimed at dating the covering peat layer (IRPA-746); the obtained date indicated that the site was covered between *ca.* 1500 and 1200 cal BC, corresponding to the Middle Bronze Age.

In more recent years, four potsherds from the Michelsberg Culture phase were dated on food crusts in the context of ongoing research at Ghent University (**Tab. 1**: KIA-20230; KIA-20231; RICH-26615; RICH-25940) (Craig, 2004; Craig *et al.*, 2007). Despite the presumed freshwater effect resulting from the processing of fish in these vessels (Craig *et al.*, 2007; Teetaert *et al.*, 2024), the obtained dates confirmed the Middle Neolithic age of the pottery and contexts.

In the framework of an inventory project of prehistoric human remains from the Scheldt valley (De Groote *et al.*, in press), in 2023, a series of new samples on human and animal bone were selected from different contexts at the NEO 1-site of Oudenaarde-Donk. Altogether 30 new dates were performed leading to a revision of the occupation chronology of the site (**Tab. 1**).

Overall, the new dates confirm the long occupation history of the site (**Fig. 2**). Except for two dates from the covering layer (context II) dating to the Roman period and most likely performed on intrusive material, all dates pre-date the formation of peat from *ca.* 1500 cal BC onwards. However, in contrast to the original interpretation there is no clear-cut separation in two distinct occupation phases. The dates are almost continuously spread over the second half of the 4<sup>th</sup> millennium cal BC until the mid-2<sup>nd</sup> millennium cal BC, including the Middle, Late and Final Neolithic as well as the Early to Middle Bronze Age. However, if only the dates on human remains (**Fig. 3**) are considered, a distinction between two occupation phases becomes evident. The first cluster of human bone dates situates between *ca.* 4300 and 4000 cal BC, while a second cluster dates to the transition between the Final Neolithic and Early Bronze Age around 2000 cal BC. This is in perfect agreement with the initial in-



Lab ID	Field ID	Dated material		<sup>14</sup> C lab code	BP date	st. dev.	cal BC (95.4 % probability)		C:N
Context I (deep pit/gully)									
OD08	OD85/90	Ovis ammon aries/Capra aegagrus hircus	sheep/goat	RICH-35777	5274	27	4232	3991	3.3
		foodcrust inner wall pottery		IRPA-743	5240	71	4319	3821	
OD038	OD85/64	Castor fiber	beaver	RICH-35325	5116	29	3981	3802	3.2
OD07	OD85/74	Cervus elaphus	red deer	RICH-35217	5103	28	3971	3800	
OD037	OD85//74	Canis lupus familiaris	dog	RICH-35324	5048	28	3953	3773	3.2
OD024	OD85/70	Capreolus capreolus	roe deer	RICH-35322	4225	27	2904	2700	3.2
	OD85/89	Anas size platyrhynchos	duck	RICH-36141	4163	29	2880	2631	3.4
OD09	OD85/107	Ovis ammon aries/Capra aegagrus hircus	sheep/goat	RICH-35219	3869	28	2461	2209	3.3
Context II (overlying layer)									
OD015	OD85/82	Sus scrofa	wild boar	RICH-35494	5140	31	4041	3804	3.3
		outer rings of wooden beam		IRPA-744	5050	70	3976	3655	
	OD85/61	Anser size albifrons	goose	RICH-36139	4984	26	3910	3652	3.3
OD042	OD85/81	Felis silvestris	wild cat	RICH-35496	4475	26	3339	3030	3.2
OD011	OD85/63	Ovis ammon aries/Capra aegagrus hircus	sheep/goat	RICH-35493	4161	29	2879	2631	3.2
OD030	OD85/118	Bos primigenius taurus	cattle	RICH-35779	3703	26	2196	1985	3.2
OD028	OD85/118	Bos primigenius taurus	cattle	RICH-35495	3653	30	2137	1941	3.2
OD035	OD85/110	Equus ferus caballus	horse	RICH-35323	1851	26	125 AD	241 AD	3.2
OD020	OD85/110	Sus scrofa domesticus	pig	RICH-35321	1800	25	207 AD	337 AD	3.3
Context III (mixture context I & II)									
OD08	OD85/130	Human temporal		RICH-35083	3568	28	2021	1778	3.3
	OD85/91	Corvus corax	common raven	RICH-36143	3276	25	1616	1498	3.4
Context IV (pit 1)									
	OD85/13	cf. Haliaeetus albicilla	white-tailed eagle	RICH-36142	4821	27	3648	3528	3.4
OD017	OD85/13	Sus scrofa	wild boar	RICH-35320	4728	28	3630	3377	3.3
		small wood fragments		IRPA-745	4670	70	3637	3191	
Context V (profile 2)									
	OD85/11	Haliaeetus albicilla	white-tailed eagle	RICH-36140	5439	28	4346	4248	3.3
OD3	12B	Human scapula R		RICH-35081	5312	30	4248	4046	3.1
OD11	OD85/coupe 2	Human parietal		RICH-35078	5329	31	4314	4050	3.2
OD10	OD85/11	Human ilium		RICH-35077	4719	30	3628	3375	3.6
Context VI (upper zone)									
	OD85/46	Aves size Anas platyrhynchos	medium-sized bird	RICH-36138	4380	26	3091	2912	3.4
Undefined context									
	?	Haliaeetus albicilla	white-tailed eagle	RICH-36137	5437	27	4345	4248	3.4
OD6	V22/1 juist onder XXX?	Human femur		RICH-35082	5313	30	4248	4046	3.3
OD2		Human radius?		RICH-35080	5308	30	4246	4045	3.2
	OD85/144-6	foodcrust inner wall pottery		KIA-20230	5250	30	4228	3979	
	OD85-190/32-27	foodcrust inner wall pottery		KIA-20231	5180	30	4048	3951	
	OD85/64-12	foodcrust inner wall pottery		RICH-26615	5138	29	4040	3805	
	OD85/90-36	foodcrust inner wall pottery		RICH-25940	5116	33	3984	3799	
OD5	E27-OD5	Human femur L		RICH-35075	3625	28	2124	1896	3.2
OD4	V3 272	Human femur R		RICH-35074	3614	27	2112	1891	3.2
OD7	OD85/150	Human ulna		RICH-35076	3237	27	1600	1431	3.3
Covering peat									
		peat		IRPA-746	3130	60	1510	1229	
Lower sector (wet area)									
		wood		IRPA-667	4990	70	3946	3649	

terpretation of the site by the excavators. The only date deviating from this pattern (RICH-35077) has a high C:N ratio (3.6) and might therefore be contaminated with exogenous carbon. Well-preserved, uncontaminated fresh bone collagen has a C:N ratio of 3.1-3.2 (Boudin *et al.*, 2017). The more a C:N ratio of archaeological bone collagen approaches these values, the less it is contaminated, since an increase of the C:N ratio with 0.1 means the presence of 2 % exogenous carbon. Hence, it may be assumed that the date obtained on this sample is too young. This implies that it is not excluded that this bone sample also dates to the Michelsberg Culture phase.

But how do we need to interpret the dates on animal remains dating to the period in between these two occupation phases? A first series of animal dates (RICH-35494; RICH-35325; RICH-35217; RICH-35324; RICH-36139) situated between *ca.* 4000 and 3800/3700 cal BC, most likely belong to the same Michelsberg Culture occupation event. The discrepancy of several centuries between the dates performed on human and animal bones might be explained by either a plateau in the calibration curve around 5100/5000 uncal BP or a freshwater reservoir effect on the human dates due to the consumption of freshwater food resources. The latter is supported by lipid analyses on food crusts from several Michelsberg potsherds (Craig *et al.*, 2007; Teetaert *et al.*, 2024) showing evidence of the processing (and hence also the consumption) of aquatic resource, most likely freshwater fish. Two of these food crusts (KIA-20230 and IRPA-743) yielded radiocarbon dates perfectly compatible with the dates on human bones, while the three remaining ones (KIA-20231, RICH-26615 and RICH-25940) agree well with the dates on animal bone. Ongoing isotope analyses will probably shed more light on the consumption of aquatic resources by the Michelsberg occupants and its possible effect on the radiocarbon dates (Robert *et al.*, in prep.). Awaiting this, the Michelsberg occupation at Oudenaarde can be dated between *ca.* 4350 and 3800/3700 cal BC, which covers the entire duration of the Michelsberg Culture in the Scheldt basin and Belgium (Crombé & Vanmontfort, 2007; Vanmontfort, 2004).

In the absence of human remains, the animal bone samples dated to between *ca.* 3600 and 2200 cal BC are more challenging to interpret. They might refer to animals that died a natural cause and therefore cannot be used as proof of human presence at the site. Yet, two dated bone samples (RICH-35320; RICH-36142) come from an anthropogenic feature (pit), suggesting some kind of human activity on the site between *ca.* 3600 and 3400 cal BC, *i.e.* the Late Neolithic. Remarkably, most sampled bones from domesticated species

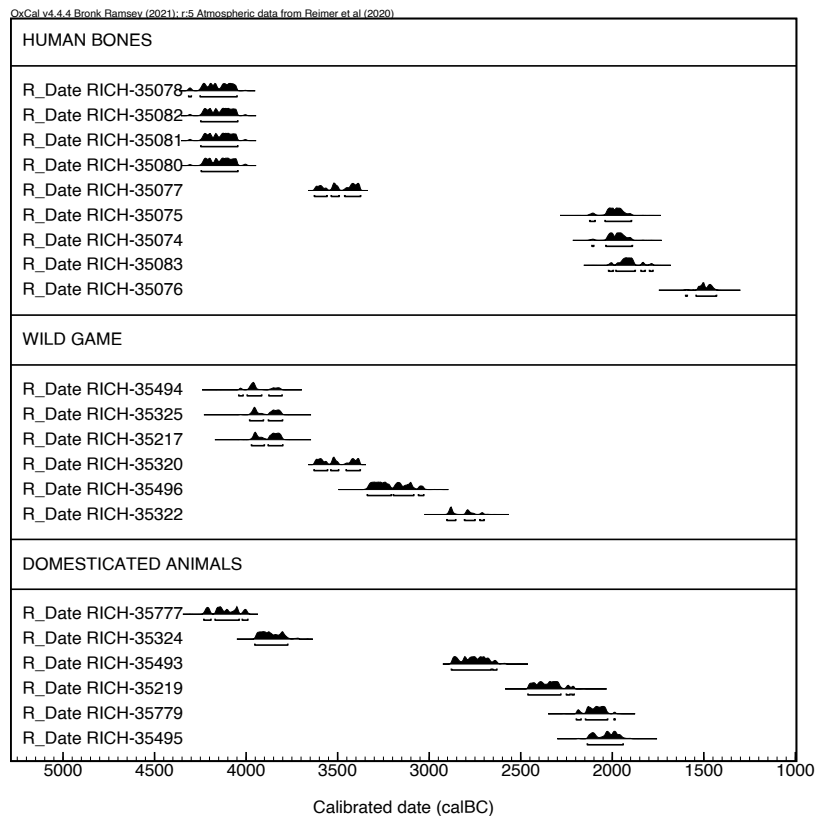


Fig. 3 – Calibrated dates performed on bones from humans, wild game and domesticated animals.

Tab. 1 (previous page) – List of radiocarbon dates from Oudenaarde-Donk NEO 1. Calibration is performed with Oxcal version 4.4 and the IntCal20 calibration curve (Reimer *et al.*, 2020)<sup>1</sup>.

1. RICH-35217 is the only bone sample which did not yield enough carbon and nitrogen to determine the C:N ratio. This implies that the quality of the obtained date cannot be fully assessed.

(sheep/goat, cattle) date back to the Final Neolithic; four of the six dated samples situate in the 3<sup>rd</sup> millennium cal BC, while only two (a sheep/goat and a dog) are contemporaneous with the Michelsberg occupation (Fig. 3). Conversely, all wild species (red deer, beaver, wild boar), except one, pre-date 3000 cal BC. Based on this, some doubt may exist about the importance of domesticated animals within the Michelsberg subsistence, emphasizing the need for further research (cf. 3.2.1).

### 3.2. Feature level

#### 3.2.1. Deep pit/gully (context I)

The radiocarbon dates obtained from this context cover a much longer chronology than was initially assumed on the basis of the recovered ceramic and lithic finds (Parent *et al.*, 1987a, b). Although most dates (N = 5) fall within the chronological boundaries of the Michelsberg Culture, there are three much younger dates which refer to the 3<sup>rd</sup> millennium cal BC (Fig. 4). However, given the lack of detailed stratigraphical information it is not possible to determine the exact position of each dated sample within this deep feature. If the youngest samples were collected from the upper part of the infilling, they could be considered intrusive. In this case the

feature would date to the Michelsberg Culture phase. If, on the other hand they were situated deeper within this feature, they might point to a mixed context, comparable to the deep pit/gully excavated at the nearby site of Enne-Stuw (Crombé *et al.*, 2024). A detailed analysis of the pottery and lithic artefacts from this context might provide more clarity on this matter.

#### 3.2.2. Covering layer (context II)

The six radiocarbon dates obtained from this layer, both intrusive Roman samples not included, cover the entire 4<sup>th</sup> and 3<sup>rd</sup> millennium cal BC. Here again, the lack of stratigraphical information hinders a further interpretation of this pattern. However, the broad time frame might indicate that this covering layer was built up gradually. This is also suggested by the results of a paleoecological study conducted in 1985 (De Ceunynck *et al.*, 1985); the studied pollen record showed very high levels of *Cerealia* indicating a probably late date, at least for the upper part of the layer. A possible similar layer, consisting of very humic clayey sand, was found during excavations a few hundred meters south of the NEO 1-site (Ameels *et al.*, 2003). The latter also contained Neolithic finds from different phases and some Roman material in its top.

## 4. Conclusion

This extensive dating project revealed a far more complex formation of the Neolithic site of Oudenaarde NEO 1 than previously thought. The most important remaining research question is whether the deep pit/gully, which yielded the vast majority of pottery and stone artefacts from the Michelsberg Culture, is fully homogeneous. Finding a conclusive answer to this question is important for the interpretation of the associated faunal assemblage, which presents a mixture of wild and domesticated species. Hopefully a detailed study of the archaeological finds will bring further clarification.

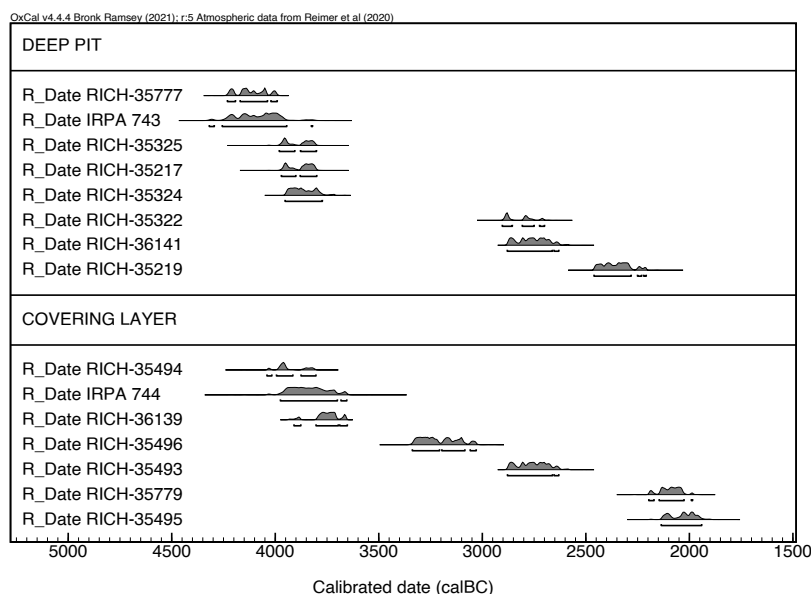


Fig. 4 – Calibrated dates from context I and II.



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## Abstract

In this paper 30 new radiocarbon dates from the Neolithic wetland site of Oudenaarde-Donk NEO 1 are presented. These dates shed a new light on the internal chronology of the site, raising questions about the site integrity. The latter is important for the interpretation of the numerous animal bone fragments that we collected from a deep pit.

**Keywords:** Oudenaarde, prov. of East-Flanders (BE), Scheldt basin, Neolithic, radiocarbon dates, faunal remains.

## Samenvatting

In deze korte bijdrage wordt een reeks van 30 nieuwe koolstofdateringen afkomstig van de neolithische site van Oudenaarde-Donk NEO 1 gepresenteerd. De dateringen bieden een nieuwe kijk op de interne chronologie van de site en doen vragen rijzen over de integriteit van de site. Dit laatste heeft mogelijke implicaties voor de interpretatie van de talrijke faunaresten die voornamelijk uit een diepe kuil werden gerecupereerd.

**Trefwoorden:** Oudenaarde, prov. Oost-Vlaanderen (BE), Scheldebekken, neolithicum, koolstofdateringen, faunaresten.

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