LUNULA. Archaeologia protohistorica, XXXIV, 2026, p. 127-131.

A late Iron Age charcoal-rich pit from Lierde - Kloosterstraat (prov. East Flanders, Belgium)

Koen Deforce[1] & Arne De Graeve[2]

1. Introduction

During an archaeological salvage trial trenching campaign preceding the construction of a rainwater buffer basin in December 2024, conducted by SOLVA on behalf of the community of Lierde, a charcoal-rich pit has been excavated (Savels & De Graeve 2026). In this paper, we report on the results of the anthracological analysis and radiocarbon dating of the content of this pit and discuss the functional interpretation of this feature.

2. Site location

The site is situated in the Kloosterstraat in Sint-Martens-Lierde (prov. East-Flanders, Belgium), close to the modern center of the village (400m), which moved in the early 19th century ca. 1,2 km to the east from the older village center (De Graeve 2024). The project is situated on the edge of the alluvial plain of a small stream called the "Larebeek". Soils are very wet to moderately wet loamy soils with a gleysolic profile (Adp) (fig. 1). During a campaign of manual augering, preceding the excavation of the trial trenches, soil oxidation phenomena were observed. These were present in all boreholes and throughout the entire soil profile, indicating important fluctuations of the groundwater level throughout the year. Land use of the project area preceding the excavations was grassland. With the exception of the charcoal-rich pit, only a few undated archaeological traces have been found during the trial trenching campaign(Savels & De Graeve 2026).

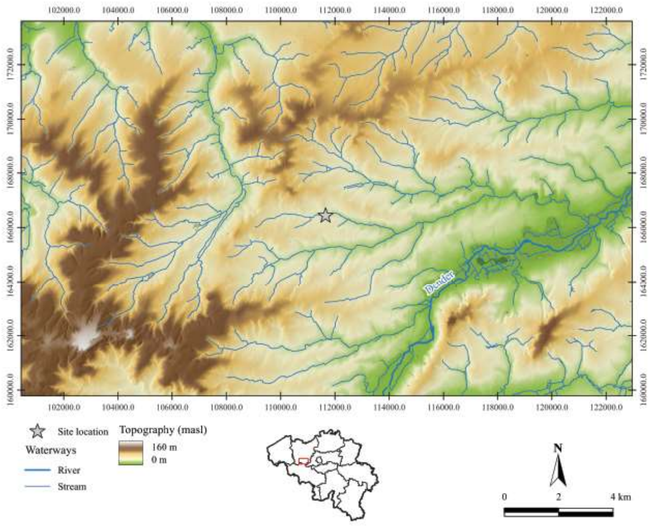

Fig. 1. Location of the site on the digital elevation model.

3. Feature description and finds

The pit PS1-4, had a rectangular outline (ca. 3 m x 1,7 m) with rounded corners in the upper level and sharp corners near the bottom of the pit (fig. 2). It had a flat bottom and straight, almost vertical sides. It was preserved c. 70 cm below modern-day ground level. Two layers could be discerned in the fill of the pit.

The top layer of the pit (PS1-4) consisted of back-filled soil and had no traces of in situ burning (+-50 cm thick). It contained a large number of pottery fragments. This layer covered a layer of charcoal (PS1-7) on the bottom of the pit. This lower layer had a thickness of c. 10 cm and contained only charcoal. The edges and the bottom of the pit showed traces of *in situ* burning.

Fig. 2. Cross section (top) and horizontal plane (bottom) of pit PS1-4 during excavation.

[1] Ghent University, Department of Archaeology, Sint-Pietersnieuwstraat 35, B-9000 Gent & Royal Belgian Institute of Natural Sciences, OD Earth and History of Life, Vautiestraat 29, B-1000 Brussel, koen.deforce@ugent.be
[2] SOLVA Industrielaan 25b, Erembodegem. Arne.de.graeve@so-lva.be

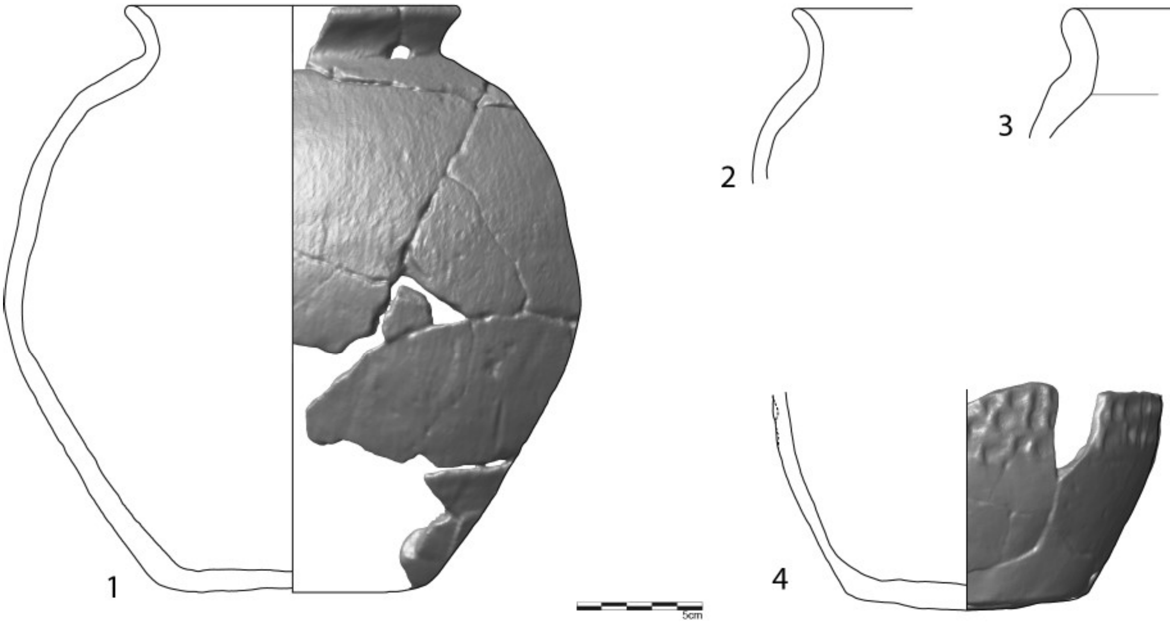

Fig. 3. Pottery from the upper layer of the pit.

In the top layer, 127 pottery fragments were found, originating from at least 4 individuals. Most of the fragments come from a large brushed pot with comb marks and an outwardly curved rim (fig 3.1). The pot is smoothed at the shoulder and the bottom and has a groove on the shoulder. This type of pot shows close parallels with assemblages from the late La Tène C2 and D1 excavated in Flanders and Northern France cf. Buchez 2011: 327. Type 22.21; Verbrugge *et al.* 2021 fig. 88.13: 200 BC-40AD. There is another pot or storage vessel with a distinctive groove on the shoulder (fig 3.3), a S-shaped pot (fig. 3.2) and the lower part of a pot with fingertip prints. This decoration is common during the early stages of the La Tène, but is also (rarely) seen in contexts dating back to the late La Tène and early Roman period (De Clercq 2009: 419). About half of the largest vessel was preserved in the pit (fig. 3.1). The other vessels were highly fragmented with only a few remaining shards. None of the pottery fragments showed signs of burning.

4. Charcoal analysis and radiocarbon dating

4.1. Material and methods

Bulk samples (140 l) taken from the charcoal layer in the lower part of the fill of the pit were wet-sieved (mesh size 1 mm) with tap water and the residues were air-dried for eight weeks. Charcoal fragments were randomly selected from the dried residue, independent of their size, and studied using a microscope with incident dark field illumination and following standardised procedures (Gale & Cutler 2000). Identifications are based on wood anatomy identification literature (Schweingruber 1990; Schoch *et al*. 2004) and the anthracological reference collection of the Archaeobotanical Research Laboratory (ArBoReaL) at UGent. The nomenclature of the identified wood types follows Schweingruber (1990). From the identified charcoal fragments, two fragments were selected for radiocarbon dating. Selection was aimed at short lived materials, thus avoiding or minimising a potential old wood effect (Waterbolk 1971). Radiocarbon dating was done at the Royal Institute for Cultural Heritage in Brussels (Boudin *et al*. 2015). Calibrations of the obtained radiocarbon dates were performed with OxCal v4.4.4 (Bronk Ramsey, 2021) using Atmospheric data from Reimer *et al.* (2020).

4.2. Results

The sieved residue contained a large number of large, well-preserved fragments of charcoal, most of which looked rather fresh, i.e. with sharp edges. A total of 189 charcoal fragments has been studied. Of these fragments, 121 have been identified as oak (*Quercus* sp.) and 68 have been identified as bark. Bark cannot be identified to species level, but since no taxa other than oak have been found, these bark fragments can likely be attributed to oak as well. All fragments likely originate from a trunk or large branch based on the absence of a visible curvature of the growth rings in the charcoal fragments.

Two samples that have been identified as oak (*Quercus* sp.) sapwood based on a low frequency of tyloses in the earlywood vessels (Dufraisse *et al*. 2018) have been dated using radiocarbon analysis (tabl. 1; fig. 4). When combined using the R_Combine function in OxCal, these two dates result in a probability distribution of 95.4% between 348 cal BC and 60 cal BC (95,4%).

5. Interpretation and discussion

Both the radiocarbon dating results and the typological study of the pottery fragments indicate a late Iron Age date for the pit. The function of the pit, however, is less clear. This feature has several characteristics in common with charcoal pit-

Sample	Lab-code	Age (uncal BP)	Age (cal BC/AD, 2σ range)
Charcoal sapwood *Quercus* sp.	RICH- 38454	2129 ± 24	343BC (8.0%) 321BC 202BC (76.8%) 90BC 80BC (10.7%) 53BC
Charcoal sapwood *Quercus* sp.	RICH-38455	2168 ± 23	356BC (46.2%) 279BC 256BC (0.8%) 248BC 232BC (45.4%) 147BC 136BC (3.0%) 111BC
R_Combine	X2-Test: df=1 T=1.4(5% 3.8)	2149 ± 17	348BC (25.7%) 312BC 206BC (69.4%) 102BC 64BC (0.4%) 60BC

Table 1. Results of the radiocarbon analysis. Calibrations were done with OxCal v4.4.4 Bronk Ramsey (2021); using r:5 Atmospheric data from Reimer et al. *(2020).*

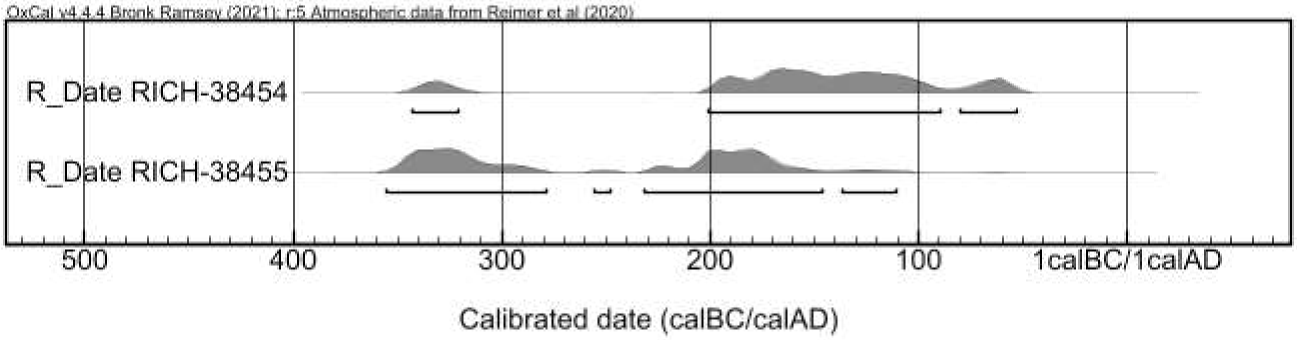

Fig. 4. Multiplot with calibrated age distributions (95.4% probability range) of pit PS1-4. (OxCal v4.4.4. Bronk Ramsey 2021, Atmospheric data from Reimer et al. *2020).*

kilns, i.e. pits that were used for the production of charcoal (Deforce *et al*. 2021a). Pit kilns for charcoal production are frequently found in Northern Belgium and The Netherlands and generally date between the late Iron Age and c. 1300 CE, although it has been demonstrated that probably all late Iron Age dates from these pit kilns are affected by an old wood effect and actually date to the Early Roman period (Deforce 2024; Deforce *et al*. 2021a; 2021b). Similar to pit PS1-4 excavated in Lierde, pit kilns are characterised by a rectangular or circular outline, a flat bottom, and straight vertical sides (Deforce *et al*. 2017, 2021a, 2021c). Also, rubification of the bottom and/or sides of the pit resulting from exposure to heat is a common characteristic with charcoal pit-kilns, as is the layer of charcoal on the bottom of the pit (Deforce *et al*. 2017, 2021a, 2021c). Finally, the low taxonomic diversity, i.e. the presence of only one or a few different wood taxa, in most cases oak (*Quercus* sp.), is a typical characteristic of the charcoal assemblage of charcoal kilns (Deforce *et al*. 2015; 2020; 2021b; 2021c; Draily & Deforce 2020).

On the other hand, there are also some crucial differences between the pit from Lierde and pit kilns from Northern Belgium and the Netherlands. The earliest securely dated pit kilns (i.e., radiocarbon dated on short-lived materials) from Northern Belgium and the Netherlands date to the early Roman period, while the pit from Lierde clearly dates to the Late Iron Age. Another difference is the presence of a large number of pottery fragments in the fill of the pit from Lierde, whereas pit kilns typically contain no artefacts. If they do, this is at most a few small pottery fragments (e.g. Deforce *et al*. 2015). Finally, a large number of charred bark fragments, as been found in the fill of the pit from Lierde, has never been reported for a charcoal pit kiln. Cremation graves, on the other hand, can contain both charcoal and pottery fragments. Although Roman-period cremations can sometimes be quite large and contain a large volume of charcoal (Deforce & Haneca 2012), Iron Age cremations are generally much smaller and contain only a small amount of charcoal (Capuzzo *et al.* 2020). As for the pit from Lierde, the charcoal assemblage of cremation graves is frequently characterised by a low taxonomic diversity and is, in most cases, dominated by oak (*Quercus* sp.) (Deforce & Haneca 2012; Hofman *et al*. 2026). However, cremation graves with high percentages of bark have not been reported. An important difference is the presence of cremated human bone in these graves, while no bones have been found in the pit from Lierde.

The rubification of the sides of the pit indicates that there must have been an intense fire inside the pit. The size and morphology of the charcoal fragments indicate that this fire was abruptly extinguished, although probably not by covering it with sediment as the sediment directly on top of the charcoal does not show traces of rubification. The large number of pottery fragments indicate their intentional deposition in the pit. Also this must have been done when the fire was already extinguished as the pottery fragments have not been burned.

Based on the elements outlined above, we can exclude the interpretation of the pit as a a cremation grave. Also the interpretation as a pit kiln for charcoal production is unlikely, or it should be an exceptionally early one and one that later has been re-used as a refuse pit. The latter is unlikely however as these structures are generally a typical off-site phenomenon.

Pits with somewhat similar characteristics, i.e., that contain a lot of charcoal and that show rubification along the bottom and/or sides, have been excavated at several locations in the region, although these generally show a circular or oval outline. In Lierde – Tempel, only at 480 m from Lierde- Kloosterstraat, a pit of unknown age, with an oval outline has been excavated. The bottom of the pit contained a layer of charcoal, and no other finds were recovered (Cox *et al*. 2011). The sides of the pit showed some traces of rubification (Cox *et al*. 2011, fig. 30).

Also, three late Neolithic pits mostly filled with charcoal, and a flat bottom and straight sides that show traces of rubification have been found in Wortegem-Diepestraat (De Maeyer *et al*. 2018), Outer Stuypenberg (De Graeve *et al*. 2022) and Roeselare-Coellievijverbeek (Deconynck *et al*. 2024). Also for this features, the function remains unknown.

6. Conclusion

A charcoal-rich pit with an unknown function has been excavated in Lierde – Kloosterstraat. Both the typological analysis of the ceramics and the radiocarbon analysis of two charcoal fragments from the fill, place this pit in the late Iron Age. The structure's morphological features correspond to those of charcoal pit kilns, but its early age and the presence of a large number of pottery fragments make this interpretation unlikely.

Bibliography

BOUDIN, M., VAN STRYDONCK, M., VAN DEN BRANDE, T., SYNAL, H. A., & WACKER, L. 2015. RICH - a new AMS facility at the Royal Institute for Cultural Heritage, Brussels, Belgium. *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms*, **361**, pp. 120-123.

BUCHEZ, N. 2012. La protohistoire récente – état de la documentation et principaux résultats issus de la fouille des sites funéraires de la Tyne moyenne à la Tène finale sur les grands tracés linéaires en Picardie occidentale. In : D. BAYARD, N. BUCHEZ & P. DEPAEPE, (Dir.). *Quinze ans d'archéologie préventive sur les grands tracés linéaires en Picardie. 1*. Amiens (Revue Archéologique de Picardie*,* **3/4**), pp. 267-340.

CAPUZZO, G., SNOECK, C., BOUDIN, M., DALLE, S., ANNAERT, R., HLAD, M., KONTOPOULOS I., SABAUX C., SALESSE K., SENGELØV, A., STAMATAKI, E., VESELKA, B., WARMENBOL E., DE MULDER, G., TYS, D. & VERCAUTEREN, M. 2020. Cremation vs. inhumation: modeling cultural changes in funerary practices from the Mesolithic to the Middle Ages in Belgium using Kernel Density Analysis on ^{14}C data. *Radiocarbon*, **62**, pp. 1809-1832.

COX, L., VAN REMOORTER, O., KREKELBERGH, N. 2011. *Archeologische prospectie met ingreep in de bodem, Lierde (Sint-Martens-Lierde) – Tempel*. Gent (BAAC Vlaanderen Rapport, **18**).

DE CLERCQ, W. 2009. *Lokale gemeenschappen in het Imperium Romanum. Transformaties in de rurale bewoningsstructuur en de materiële cultuur in de landschappen van het noordelijk deel van de civitas Menapiorum (Provincie Gallia-Belgica, ca. 100 v. Chr. – 400 n. Chr.)*, Doctoraatsthesis, Universiteit Gent (onuitgegeven).

DECONYNCK, J., VERGAUWE, R. & SLABBINCK, F. 2024. *Collievijverbeek, Roeselare, West-Vlaanderen. Eindrapport vlakdekkend archeologisch onderzoek*. Brugge: Ruben Willaert NV.

DEFORCE, K. 2024. Romeinse houtskoolmeilers als laatste getuigen van een verdwenen bos uit Zuidwest-Vlaanderen. *In*: R. VAN LANEN, J. VAN DOESBURG, H. BAAS, J.R. ABRAHAMSE & J. STÖVER, eds.). *De logica van het landschap. Opstellen over archeologie, ecologie en geschiedenis.* Hilversum: uitgeverij Verloren, pp. 43-50.

DEFORCE, K. & HANECA, K. 2012. Ashes to ashes. Fuelwood selection in Roman cremation rituals in northern Gaul. *Journal of Archaeological Science*, **39**, pp 1338-1348.

DEFORCE, K., MARINOVA, E. & DALLE, S. 2015. Vijf Romeinse houtskoolbranderskuilen in Emblem (Ranst, prov. Antwerpen). *Signa*, **4**, pp. 75-79.

DEFORCE, K., DE CLERCQ, W., HOORNE, J., LALOO, P., BOUDIN, M., VANSTRYDONCK, M., & CROMBÉ, P. 2017. Anthracologisch onderzoek en radiokoolstofdatering van Romeinse houtskoolbranderskuilen uit Rieme (Evergem, prov. Oost Vlaanderen). *Signa*, **6**, pp. 27-32.

DEFORCE, K., BASTIAENS, J., CROMBÉ, P., DESCHEPPER, E., HANECA, K., LALOO, P., VAN CALSTER, H., VERBRUGGHE, G., DE CLERCQ, W. 2020. Dark Ages woodland recovery and the expansion of beech: a study of land use changes and related woodland dynamics during the Roman to Medieval transition period in northern Belgium. *Netherlands Journal of Geosciences*, **99**, e12.

DEFORCE, K., GROENEWOUDT, B. & HANECA, K. 2021a. 2500 years of charcoal production in the Low Countries: the chronology and typology of charcoal kilns and their relation with early iron production. *Quaternary International*, **593/594**, pp. 295-305.

DEFORCE, K., MESTDAGH, B., VANHOUTTE, C., EGGERMONT, N., DERWEDUWEN, N. 2021b. Anthracologisch onderzoek en radiokoolstofdatering van Romeinse houtskoolbranderskuilen uit Ingelmunster (prov. West-Vlaanderen). *Signa*, **10**, pp. 67-70.

DE GRAEVE, A., DE MAEYER, W. & VANDENDRIESSCHE, H. 2022. A new Final Neolithic charcoal-rich pit feature and Mesolithic/Neolithic artefacts from Outer-Stuypenberg (Ninove, East-Flanders, BE). *Notae Praehistoricae*, **42**, pp. 123-132.

DE GRAEVE, A. 2024. *Sint-Martens-Lierde Kloosterstraat. Archeologienota – 2024B141*. Erembodegem (SOLVA Archeologierapport, **288**).

DEFORCE, K., VANMONTFORT, B. & VANDEKERKHOVE, K. 2021c. Early and High Medieval (c. 650 AD–1250 AD) charcoal production and its impact on woodland composition in the Northwest-European lowland: a study of charcoal pit kilns from Sterrebeek (Central Belgium). *Environmental Archaeology*, **26**, pp. 168-178.

DRAILY, C. & DEFORCE, K. 2019. Two late iron age charcoal kilns from the Arlon forest (Arlon, province of Luxemburg, Belgium). *Lunula. Archaeologia protohistorica*, **XXVII**, pp. 129-132.

DUFRAISSE, A., COUBRAY, S., GIRARDCLOS, O., DUPIN, A. & LEMOINE, M. 2018. Contribution of tyloses quantification in earlywood oak vessels to archaeological charcoal analyses: Estimation of a minimum age and influences of physiological and environmental factors. *Quaternary International,* **463**, pp. 250-257.

HOFMAN F., VESELKA B., DE MULDER G., SNOECK C. BRUYLAERT F., CLAEYS P., DE CLERCQ W., DEGRYSE P., LAMBERT B., DE GROOTE I., FANTOLI M. & DEFORCE, K. 2026. Charcoal analysis of Bronze and Iron Age cremation graves in the Low Countries – a review. *Lunula. Archaeologia protohistorica*, **XXXIV**, pp. 13-19.

SAVELS, L. & DE GRAEVE, A. 2026. *Sint-Martens-Lierde Kloosterstraat. Nota proefsleuvenonderzoek – 2025A64*. Erembodegem (SOLVA Archeologierapport, *331*).

VANDECATSYE, S. & DE CLERCQ, S., 2008. *Archeologie op het gasleidingstracé Brakel-Haaltert*, (unpublished repport).

VERBRUGGE, A., VANDENDRIESSCHE, H., DE GRAEVE, A., GUILLAUME, V., PEDE, R. & CHERRETTÉ, B. 2021. Ruien Rosalinde, Archeologisch onderzoek. Erembodegem (SOLVA Archeologierapport, **26**).

WATERBOLK, H. T. 1971. Working with radiocarbon dates. *Proceedings of the Prehistoric Society,* **37**, pp. 15-33.