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Chronique / Kroniek

Introducing the Brussels Bioarchaeology Lab (BB-LAB) of the Vrije Universiteit Brussel (VUB), Belgium

The last decades have seen a drastic increase in inter-disciplinary studies aiming at understanding the lives of past animal and human populations. Significant advances have been made in osteological and isotopic studies of ancient plant, animal and human remains to address questions related to diet, demography, weaning patterns, mobility, migration, and landscape use, as well as climate change. Until recently, such studies had only seldom been carried out on Belgian assemblages resulting in a gap in our knowledge of past Belgian populations. This gap was even larger in periods where cremation was the dominant funerary ritual as, due to the very high temperatures reached during cremation (up to 1000°C) and the highly fragmentary state of cremated human remains, these were rarely investigated. This changed in 2018, with the start of the inter-university EoS project CRUMBEL (Cremation Urns and Mobility – Ancient Population Dynamics in Belgium) between the Vrije Universiteit Brussel (VUB), the University of Ghent (UGent), the Université Libre de Bruxelles (ULB) and the Royal Institute for Cultural Heritage (KIK-IRPA). Within this project, a large number of Belgian cremations (> 1.000) were analysed using a multi-disciplinary approach including osteological analyses, radiocarbon dating, infrared studies and isotope analyses of carbon (C), oxygen (O) and strontium (Sr) (SNOECK *et al.*, 2019; SABAUX *et al.*, 2021). Thanks to this project, it became clear that a dedicated laboratory for bioarchaeology was needed in Belgium to comprehensively study ancient plant, animal and human remains from excavation to isotope analyses.

Established in 2021, the Brussels Bioarchaeology Lab (BB-LAB; Fig. 1) of the Vrije Universiteit Brussels (VUB), Belgium, regroups researchers focussing on the study of human, animal and plant remains from archaeological contexts using a wide range of methods going from isotope geochemistry and spatial modelling to zooarchaeology and osteoarchaeology. The members of the BB-LAB have backgrounds in archaeology, (geo)chemistry, engineering, history, geology, and biology, bringing together expertise from a wide range of fields and aiming at answering key questions about our past. The synergy between the researchers ensures an optimal interpretation of the results that, when available, are contrasted with written sources. The creation of the BB-LAB also increased the inter-

Fig. 1 – The Brussels Bioarchaeology Lab (BB-LAB) logo

faculty synergies at the VUB. Indeed, the BB-LAB is a sub-group of the Analytical, Environmental and Geo-Chemistry Research unit (AMGC) and the Maritime Culture Research Institute (MARI) and is working in close collaboration with the Historical Research into the Urban Transformation Processes Research Group (HOST) and the General Chemistry Research Group (ALGC). Christophe Snoeck is currently the head of the BB-LAB and is supported by six academics (P. Claeys, S. Goderis, B. Lambert, K. Nys, F. Tielens and B. Wouters). It regroups five post-doctoral researchers and eleven PhD candidates focussing on different research questions covering all of Europe and ranging from the Mesolithic to the Modern Period (see www.bb-lab.be for a full list of members, associated researchers, facilities, and projects).

The BB-LAB is composed of three major units hosted at AMGC: (1) the osteology and zooarchaeology lab, (2) the material characterization facilities, and (3) the two state-of-the-art mass spectrometry labs. The full access to these facilities enables the analysis animal, human and plant remains from the macro to the nano scale. The osteology and zooarchaeology lab, established in 2019 by Dr. Barbara Veselka, is where the samples first arrive and where they are cleaned, sorted, and identified. This lab has a unique expertise for the challenging analyses of ancient cremated human and animal remains and is focussing on developing new methods for age and sex estimation of cremated human remains (*e.g.* HLAD *et al.*, 2021; VESELKA *et al.*, 2021), as well as the detection of pathologies (*e.g.* VESELKA & SNOECK 2021). This lab is equipped with all the necessary reference collections, tools and instruments, including an IsoMet®1000 precision saw with which microscopic sections can be produced, ensuring high quality research, thereby contributing to a better understanding of life in the past.

A selection of identified samples can then be analysed in the material characterization facilities where the main instrument used is the infrared spectrometer (Bruker Vertex 70v FTIR) from which structural and chemical information can be obtained. This information is hugely important to assess the post-mortem alterations of archaeological materials (i.e. diagenesis), and in the case of cremated bone and teeth, provides crucial information about the way these have been burned (*e.g.* STAMATAKI *et al.*, 2021; SALESSE *et al.*, 2021). Micro X-Ray Fluorescence (Bruker Tornado 4 µXRF) is also highly useful to characterize the post-mortem alterations of bone and teeth in 2D (*e.g.* DE WINTER *et al.* 2019), which enables to adequately select sampling location(s) prior to isotope analyses.

To ensure that the samples analysed are free of all contamination, they are mechanically and chemically cleaned in the preparation and chemistry labs. Different extraction protocols (e.g. collagen extraction) also take place in the chemistry lab. Some samples then go to the light isotope lab composed of three Nu Instrument IRMS (2 Nu Perspective and 1 Nu Horizon) where C, N, O and S isotope ratios can be measured while other go to the clean lab. The newly designed class 1000 clean room is equipped with a class 100 laminar flow cabinet and a class 100 laminar flow fume cupboard. Different column chromatography extractions (*e.g.* Sr, Pb) are carried out in this lab prior to isotope analyses using MC-ICP-MS in the Plasma Lab. The Plasma Lab is composed of a PLASMA 3 MC-ICP-MS and a ATTOM ES ICP-MS both from Nu Instruments and were installed in 2021. The PLASMA 3 (Fig. 2) is funded by the ERC Starting Grant LUMIERE (www.erclumiere.be) and fully dedicated to the study of past human mobility and landscape use. The main focus is on strontium isotope ratios but other isotopic systems are also investigated. The ATTOM ES allows the measurement of elemental concentrations in a wide range of different organic and inorganic samples. In addition to the two mass spectrometers, the PLASMA lab is also equipped with a state-of-the-art industrial microwave UltraWAVE from Milestone that allows for the digestion of almost any type of samples. This is particularly useful for the digestion of plants needed for the creation of biologically available strontium (BASr) baselines.

All the data obtained is then used to answer archaeological and historical questions with the help of spatial modelling and predictive models. All isotopic data is also deposited

Fig. 2 – The new Nu Instrument PLASMA 3 MC-ICP-MS of the BB-LAB funded by the European Union's Horizon 2020 Research and Innovation programme under grant agreement 948913 (ERC Starting Grant LUMIERE). This MC-ICP-MS is fully dedicated to the study of plant, animal and human remains.

in the IsoArcH database (www.isoarch.eu; SALESSE *et al.*, 2018), an important partner of the BB-LAB. The combination of expertise, facilities, and international network make the BB-LAB a unique lab for bioarchaeological research in Belgium, and is a centre for the new developments of osteological and isotopic methodologies for both unburnt and cremated human and animal remains.

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Author's adresses:

Christophe SNOECK
Research Unit: Analytical
Environmental & Geo-Chemistry
Department of Chemistry
Vrije Universiteit Brussel
AMGC-WE-VUB
Pleinlaan, 2
1050 Brussels, Belgium

Maritime Cultures Research Institute
Department of Art Sciences & Archaeology
Vrije Universiteit Brussel,
Pleinlaan, 2
1050 Brussels, Belgium