SCIENCES & BIOENGINEERING SCIENCES

The Research Group
Archaeology, Environmental Changes & Geo-Chemistry

has the honour to invite you to the public defence of the PhD thesis of

Tom Boonants

to obtain the degree of Doctor of Sciences

Title of the PhD thesis:

**From falling stars to cremated bone:
towards a robust methodology of trace element determination
in these Ca-heavy matrices**

Promotors:
Prof. dr. Steven Goderis
Prof. dr. ir. Christophe Snoeck

The defence will take place on

Wednesday, March 5, 2025 at 5 p.m.

VUB Etterbeek campus, Pleinlaan 2, Elsene, auditorium I.2.01

The defence can be followed through a live stream on Microsoft Teams:

ID: 361 391 762 473 Password: CV2Qi6ok

Members of the jury

Prof. dr. Philippe Claeys (VUB, chair)
Prof. dr. Barbara Veselka (VUB, secretary)
Dr. ir. Alicia Van Ham-Meert (ULB)
Prof. dr. Nives Ogrinc (Jožef Stefan Institute, Slovenia)

Curriculum vitae

Tom Boonants obtained his BSc in Chemistry in 2018, and his MSc in Chemistry in 2020, both at the VUB. Following successful BSc and MSc theses with respectively Prof. Christophe Snoeck and Prof. Steven Goderis, Tom joined the AMGC research group for a PhD project. During this doctoral trajectory, he developed methodologies for measuring samples with a Ca-rich matrix using newly acquired mass spectrometry instruments. He presented the results of his studies at multiple international scientific conferences, and won an award for best podium presentation in 2024.

Abstract of the PhD research

Over the last couple of decennia, mass spectrometry has played a key role in (geo)chemical research. When investigating a sample of interest, the ability to accurately and precisely determine elemental and isotopic compositions using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) is essential to every modern scientific laboratory. In this thesis, an overview of the most recent developments in the field of ICP-MS is provided. Next, several popular instrument configurations (high resolution ICP-MS, triple quadrupole ICP-MS, and multi-collector ICP-MS) are tested for their abilities to quantify Sr concentrations in Ca-heavy matrices. Once the methodologies are optimized for such matrices, bioarchaeological investigations are carried out in the context of specific case studies, first on cremated bone material from Destelbergen, Belgium, and then from southeastern Slovenia, and results are interpreted in their respective bioarchaeological context. As a final main task, the scope of this study is broadened to a different type of Ca-rich sample matrix, with the application of laser ablation (LA-)ICP-MS to highly vaporized, refractory element-rich melted micrometeorites, and the study of a wide array of major and trace element concentrations. The results of these analysed extraterrestrial particles recovered from East Antarctica are then interpreted in their cosmochemical context, and linked to precursor mineralogy, high-density phase loss, evaporation, and redox shifts. Finally, the overall findings of this study are compared, leading to a number of recommendations for the development of accurate and precise analytical procedures of other samples with a Ca-heavy matrix (e.g., shells, speleothems, and apatite minerals).