

The Research Group

Analytical, Environmental and Geo- Chemistry

has the honor to invite you to the public defense of the PhD thesis of

Stef VANSTEENBERGE

to obtain the degree of Doctor of Sciences

Title of the PhD thesis:

Reconstruction of last interglacial and last glacial inception paleoclimate using stable isotopes and trace elements from Belgian speleothems.

Promotor:

Prof. Philippe Claeys

The defense will take place on

Friday May 25 2018 at 16:00 h

in Auditorium D.0.02 at the campus Humanities, Sciences and Engineering of the Vrije Universiteit Brussel, Pleinlaan 2 - 1050 Elsene, and will be followed by a reception.

Members of the jury:

Prof. Marc Elskens (chairman)

Prof. Yue Gao (secretary)

Dr. Sophie Verheyden (co-promotor)

Prof. em. Edward Keppens

Prof. Philippe Huybrechts

Prof. Heather Stoll (ETH, Zurich)

Prof. Hubert Vonhof (Max-Planck Chemie, Mainz)

Curriculum vitae

In 2013, Stef Vansteenberge graduated as Master of Science in Geology at Ghent University. Afterwards, in 2014, he started his PhD research in paleoclimatology at the AMGC research group.

This PhD research resulted in six manuscripts, four of which as first author, published in international peer-reviewed journals. Some of his findings even made it to the national media. In addition, Stef supervised one BSc and two MSc students with their thesis research and he taught several practical courses.

Abstract of the PhD research

Climate change dominates the media and the public opinion at regular intervals. Scenarios that predict the extent of future climate change are of uttermost importance to enable society to assess mitigation and adaptation strategies that could limit the socio-economic impact of ongoing climate change. Predictions of the future climate state rely on a profound knowledge of the complex, dynamic and non-linear climate system. A substantial amount of our current understanding of the climate system has resulted from studying past climate change. Earth's recent history is dominated by alternating glacial and interglacial climate states. During the last interglacial period, which occurred between 128 000 and 116 000 years ago, global mean temperature was 1 to 2 °C higher and sea-level was 6 to 9 m higher than present. Therefore, the last interglacial can provide crucial insights in the mechanisms of natural climate variability in a warmer-than-present climate state. In this study, stalagmites from Belgian caves (Han-sur-Lesse and Remouchamps) are used to reconstruct the climate existing during the last interglacial. During their growth, stalagmites record within their chemistry, changes of climate variables, such as temperature and amount of precipitation. Yet, the main advantage of using stalagmites is that excellent, independent chronologies can be constructed using radiometric dating techniques.

Using selected geochemical proxies, such as carbon and oxygen stable isotope ratios and changes in trace element concentration, it is shown that the end of the last interglacial in Belgium is characterized by a sudden turnover in the vegetation type caused by a cooling that was present above the caves. Within 200 years, the interglacial vegetation (dominated by deciduous trees) is replaced by more glacial vegetation (dominated by grasses and shrubs). The start of this turnover occurred $117\,700 \pm 500$ years ago, which is a few hundred years earlier than what was expected from previous studies. Furthermore, climate changes observed in the Belgian stalagmites show a strong affinity with ice cores from Greenland and sedimentary archives from the North Atlantic Ocean. This provides the potential to improve these less-constrained chronologies using the chronology obtained from Belgian stalagmites.