SCIENCES & BIOENGINEERING SCIENCES

The Research Group

Analytical, Environmental and Geo- Chemistry

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

Sietze J. de Graaff

to obtain the degree of Doctor of Sciences

Joint PhD with ULB

Title of the PhD thesis:

Making Sense of Destruction, a Geochemical and Petrological Investigation of the Impact Melt Rocks and Crystalline Basement of the Chicxulub Impact Structure

Promotor:
Prof. dr. Philippe Claeys (VUB)
Prof. dr. Nadine Mattielli (ULB)

Co-promotor :
Prof. dr. Steven Goderis (VUB)

The defense will take place on
Tuesday, April 26, 2022 at 16h in auditorium D.2.01

The defense can also be followed through a livestream. Please contact sietze.de.graaff@vub.be for more information

Members of the jury

Prof. dr. Yue Gao (VUB, chair)
Prof. dr. Corentin Caudron (ULB, secretary)
Prof. dr. John Spray (University of New Brunswick)
Dr. David Kring (Lunar and Planetary Institute)

Curriculum vitae

Sietze de Graaff obtained his BSc and MSc at the Vrije Universiteit Amsterdam. In 2017 he started as a PhD researcher at the Vrije Universiteit Brussel where his research focused on the formation and emplacement of impact-generated melt rock of the Chicxulub crater, Yucatán, Mexico. He has (co-)authored 12 international peer-reviewed articles of which 4 as first author (of which 2 are currently submitted) and has presented his work at multiple international conferences. Additionally, he has supervised 3 MSc theses

Abstract of the PhD research

In the northwestern corner of the Yucatán Peninsula, México, lies buried the Chicxulub impact structure, the structure whose formation harkened the end of the Cretaceous period and, more famously, the dinosaurs. The Chicxulub impact structure is also considered one of the best-preserved large impact structures on Earth. This is entirely due to the fact that the structure was buried under hundreds of meters of sediment directly after impact.

In 2016 the International Ocean Discovery Program (IODP) and International Continental Scientific Drilling Program (ICDP) Expedition 364 drilled into the *peak ring* structure of the crater. The peak ring refers to a concentric ring in the middle of the crater that consists of basement material that is uplifted closer to the surface. The final core that was drilled is referred to as the M0077A core and totals 303 continuous subcores with a total cored length of 828.99 m sampling a maximum depth of 1334.69 mbsf. In this core a multitude of rocks were sampled, namely (from the bottom to the top): Largely uninterrupted crystalline basement rock, which is interrupted by molten material that was formed by the impact (impact melt rock). This is overlain by additional impact melt rock and transitions into suevite, a rock consisting of reworked impact material. Finally on top of that we can observe normal sedimentary infill of the crater.

For this PhD-thesis we focused on samples recovered in the Hole M0077A core with the focus to better understand the impact melt rock material on one hand, and the underlying crystalline basement on the other. We wanted to both understand exactly what part of the basement was molten during impact, and to better understand how it was formed and how it behaved during the impact. Secondly, we wanted to further understand the Yucatán subsurface because not only is the Chicxulub crater buried, the majority of the basement in Yucatán is not exposed at the surface. So, the sampling of largely uninterrupted crystalline basement also presented an opportunity to better understand the geological history of the peninsula. This research culminated in 8 chapters with the aims to present a better understanding of both the formation of the Chicxulub impact structure and the Yucatán subsurface.