Sampling erratic boulders for in-situ cosmogenic ^{26}Al and ^{10}Be dating at the southern periphery of the Fennoscandian Ice Sheet

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Abstract

Poster presents the first sampling campaign of the "DatErr 2.0" project, which aims to reconstruct the exposure history of erratic boulders resting on Saalian glacial landforms in Poland and Germany. Erratic boulders were sampled for quartz, from which paired in-situ cosmogenic nuclides ^{26}Al/^{10}Be will be employed to determine exposure history and surface exposure ages of boulders. Fieldwork campaigns were conducted in June in Brandenburg (Germany) and at the end of July in Eastern and Western Poland. We collected more than 50 samples from the upper surface of large and intact boulders, protruding significantly above the ground surface. These are samples from the late Saalian ice-marginal belt from 53 localities. Paired in-situ cosmogenic nuclides ^{26}Al/^{10}Be results which we will obtain in the future will contribute to a deeper understanding of the late Saalian ice sheet dynamics and chronology in Europe.

Introduction

- Importance of understanding past ice sheet dynamics and chronology for reconstructing Earth's climatic history and predicting future changes.
- Fennoscandian Ice Sheet covered large parts of Northern Europe during the Pleistocene, leaving behind erratic boulders as geological features.
- Erratic boulders serve as valuable archives of the ice sheet's history, transported and deposited by glacial activity.
- Surface exposure dating with cosmogenic nuclides is currently one of the most widely used technique constraining glacial chronologies (e.g., Heyman et al., 2016; Tylmann et al., 2019).
- This method enables direct dating of deglaciated surfaces, such as bedrocks or erratics, by measuring the concentration of cosmogenic nuclides which build up predictably over time in minerals exposed to cosmic rays (Ivy-Ochs & Briner, 2014).

Objective

- **Main Goal**: Reconstruct the exposure history of erratic boulders resting on Saalian glacial landforms in Poland and Germany and to reconstruct the chronology and dynamics of the late Saalian ice sheet
- **Main task**: Determine surface exposure ages using paired in-situ cosmogenic nuclides ^{26}Al and ^{10}Be.

Project Area

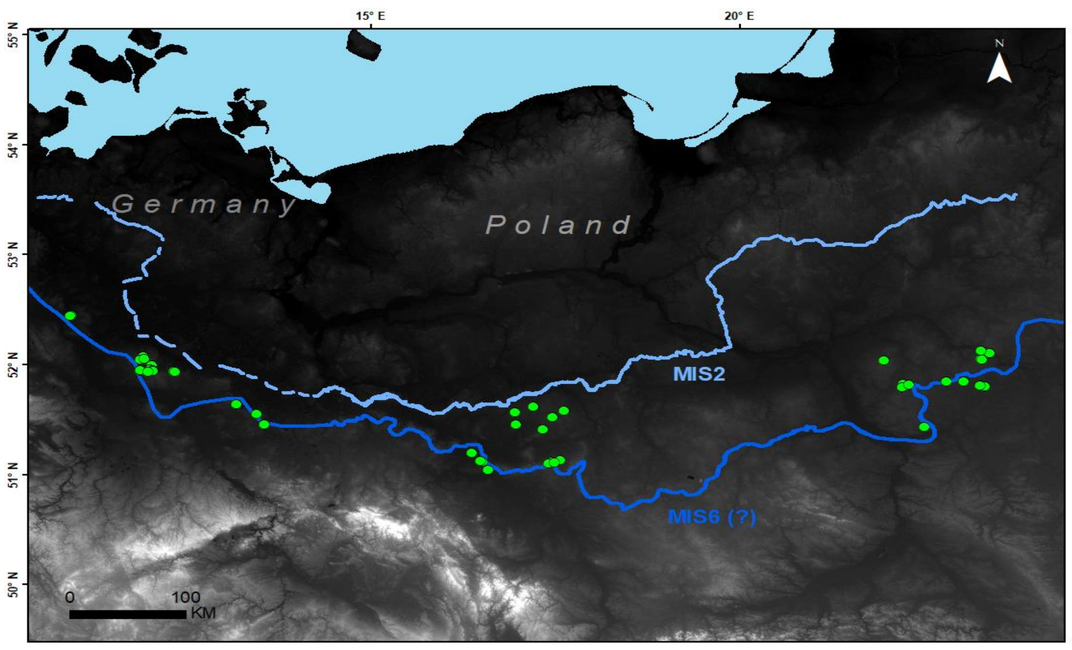


Figure 1. Map Showing Sampling Locations at the Southern Periphery of the Fennoscandian Ice Sheet.

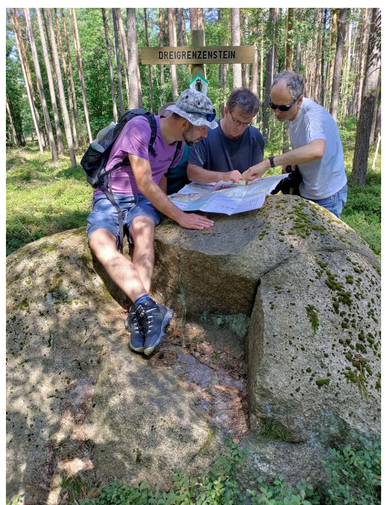
Methodology

Fieldworks

- Conducted in Brandenburg and Saxony-Anhalt from June 24 to June 29.
- Conducted in Eastern and Western Poland from July 20 to July 28.

Sampling

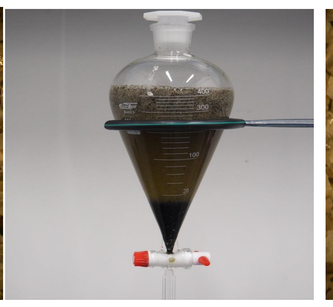
- A total numer of 57 samples were collected from the upper surface of large, intact boulders significantly elevated above the ground.



Methodology

Cosmogenic Nuclides: Laboratory Preparation

- **Sample Cleaning and Preparation**
  - Clean the collected boulder samples to remove any surface contamination.
  - Size-reduce the samples for subsequent processing.
- **Sample Processing**
  - Sieve the samples to 0.25-0.71 mm.
  - Perform density separation using heavy liquid (2.7 g/cm³).
  - Use froth flotation.
  - Conduct acid leaching with HF+HNO3 (2%) in a hot ultrasonic bath.
  - Check the samples for aluminium content using ICP-MS.



Cosmogenic Nuclide Analysis

- Analyse the samples using techniques such as cosmogenic ^{10}Be and ^{26}Al measurements.
- Use Accelerator Mass Spectrometry (AMS) for the analysis.

Preliminary Result

Summary of the samples collected and their initial analysis.

Sample Characteristics:

- **Boulder Size:** Samples taken from large, intact erratic boulders.

- **Material**: Samples consist of quartz-rich rocks, essential for cosmogenic nuclide analysis.

Expected Outcomes:

- Surface Exposure Ages: Determination of precise surface exposure ages for the sampled erratic boulders using paired in-situ cosmogenic nuclides ^{26}Al and ^{10}Be.
- Exposure History: Reconstruction of the exposure history of these boulders to understand the duration and timing of their exposure since deposition.

Future Work

- **Data Analysis:**
  - Cosmogenic Nuclide Measurement: Detailed laboratory analysis to measure ^{26}Al and ^{10}Be concentrations.
  - Exposure Age Calculation: Calculating precise surface exposure ages for each sample.
- **Integration with Other Data:**
  - Geophysical Surveys: Integrating results with geophysical surveys and other geological data.
- **Publication and Dissemination:**
  - Scientific Publications: Publishing findings in peer-reviewed journals.

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Expert involvement from CEREGE (France) will help in final samples preparation and AMS measurements

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