Universität Bremen

Petrology of the ocean crust

EGU22-9301
GMPV-9.7

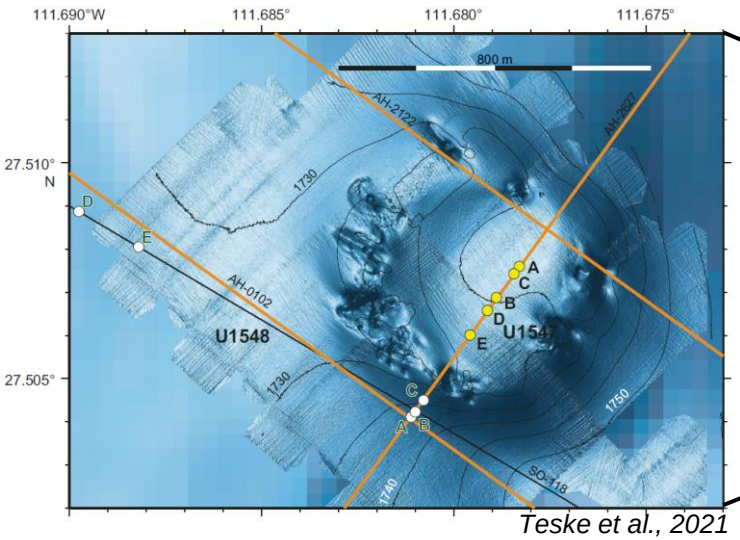
Microstructural and chemical investigation of magma-sediment mingling in natural and laboratory samples

Christin Wiggers (cwiggers@uni-bremen.de), Christophe Galerne, Marisa Acosta, Mattia Pistone, Wolfgang Bach, Wolf- Achim Kahl, Ewa Burwicz-Galerne, Patrick Monien, Lukas P. Baumgartner, Tobias Höfig, and Andreas Klügel

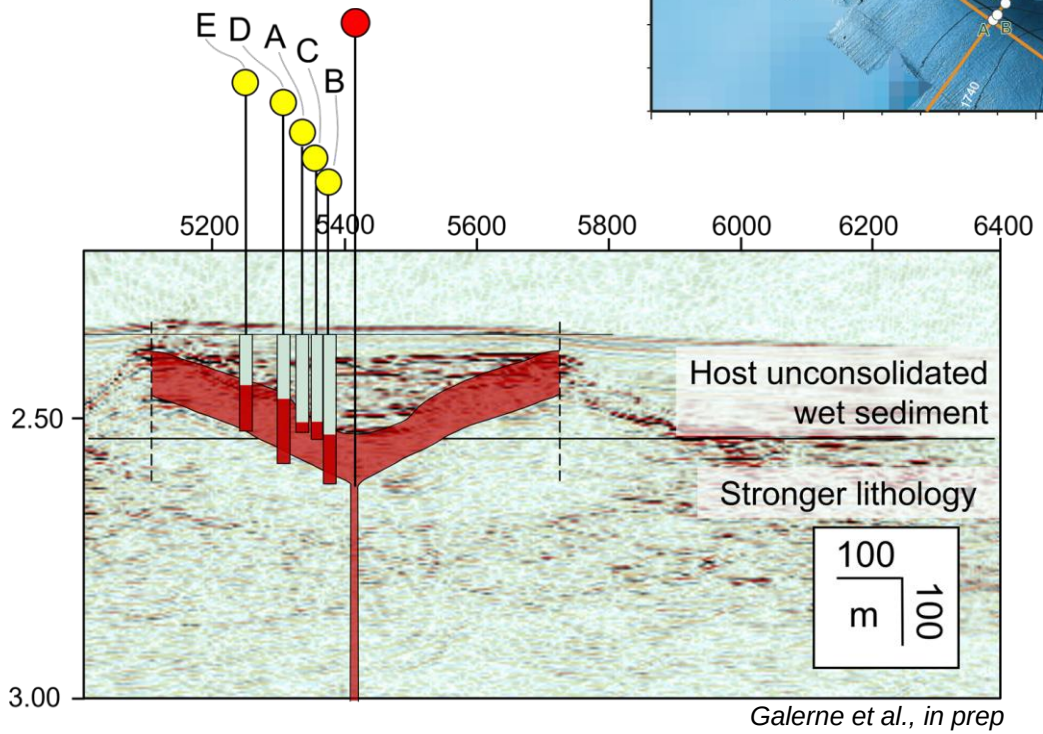
25.05.2022

Study area

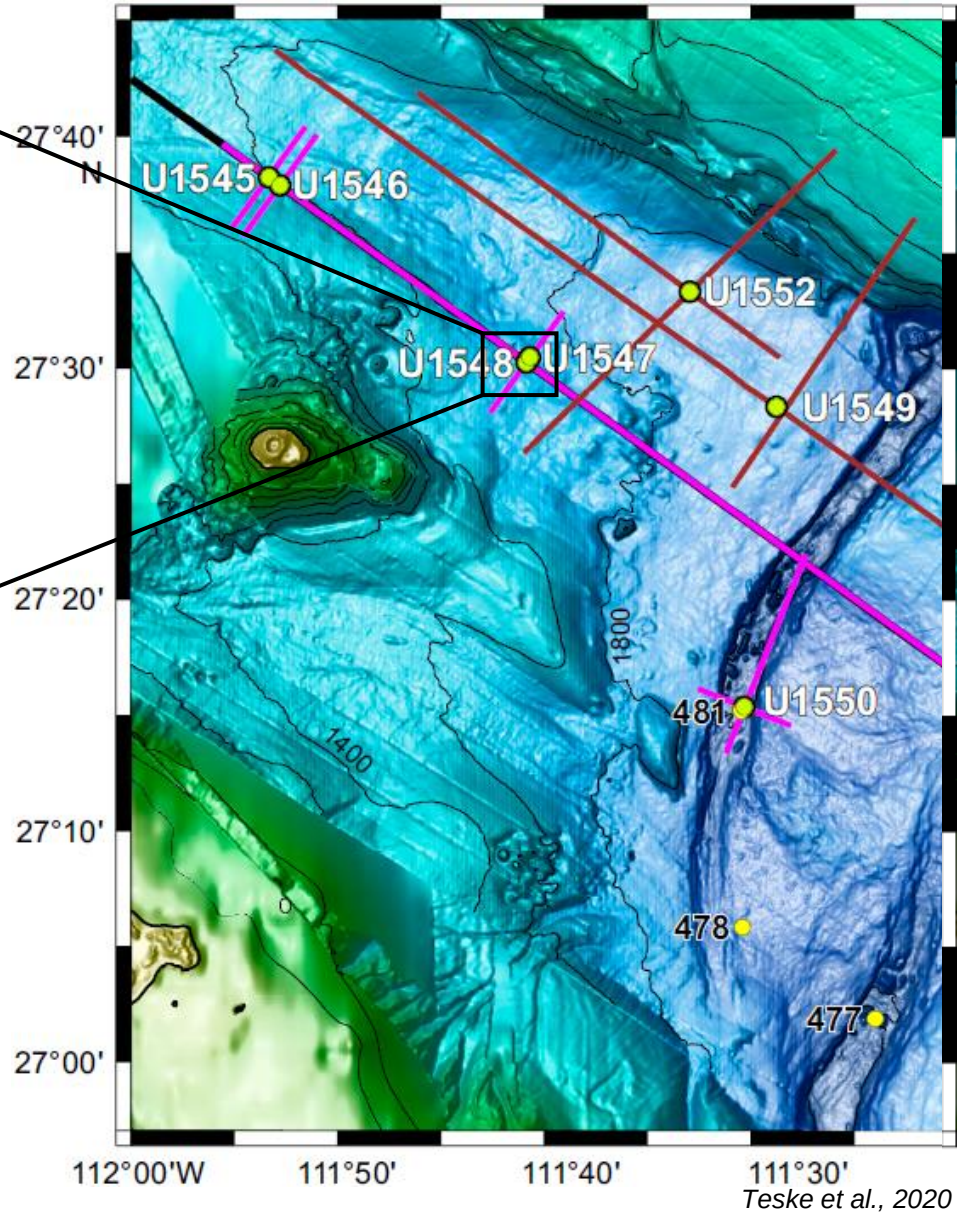
- Area of interest:
  - Sill at Site 1547
  - Ringvent
- Cone shaped sill



Teske et al., 2021



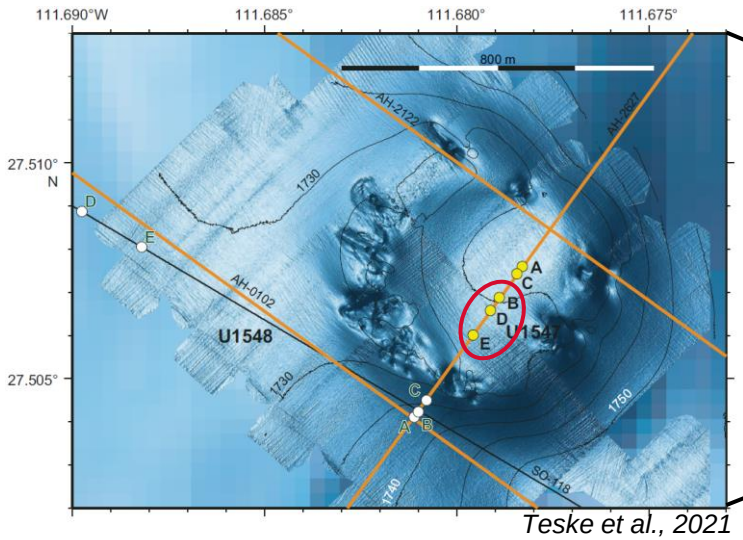
Galerne et al., in prep



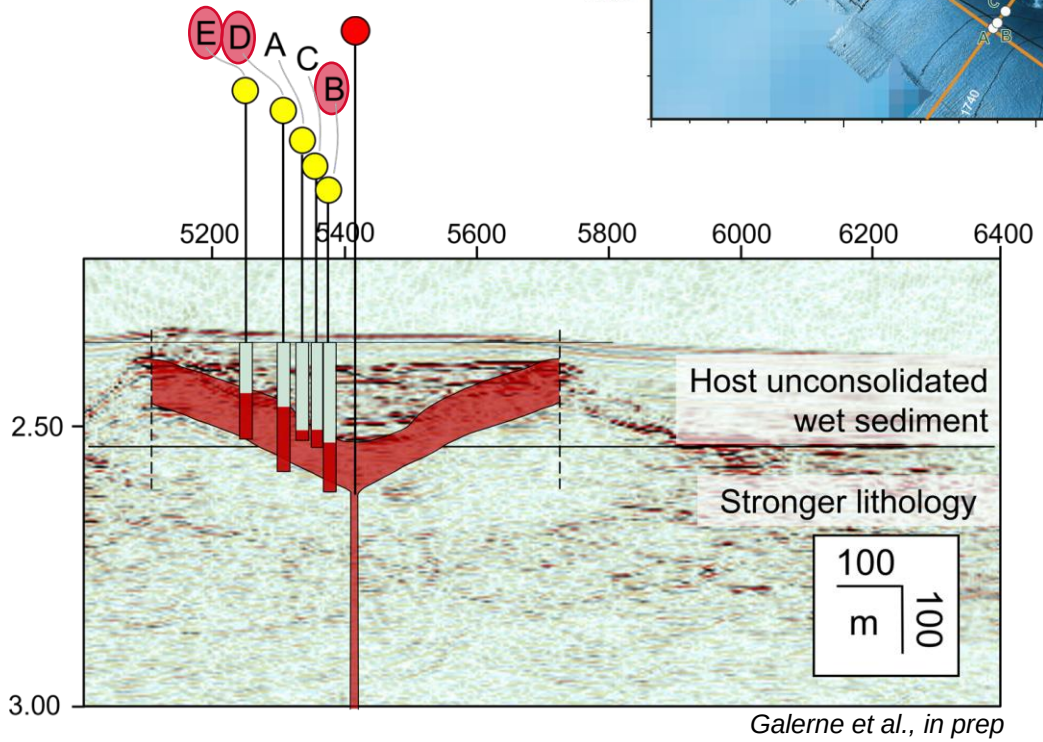
Teske et al., 2020

Study area

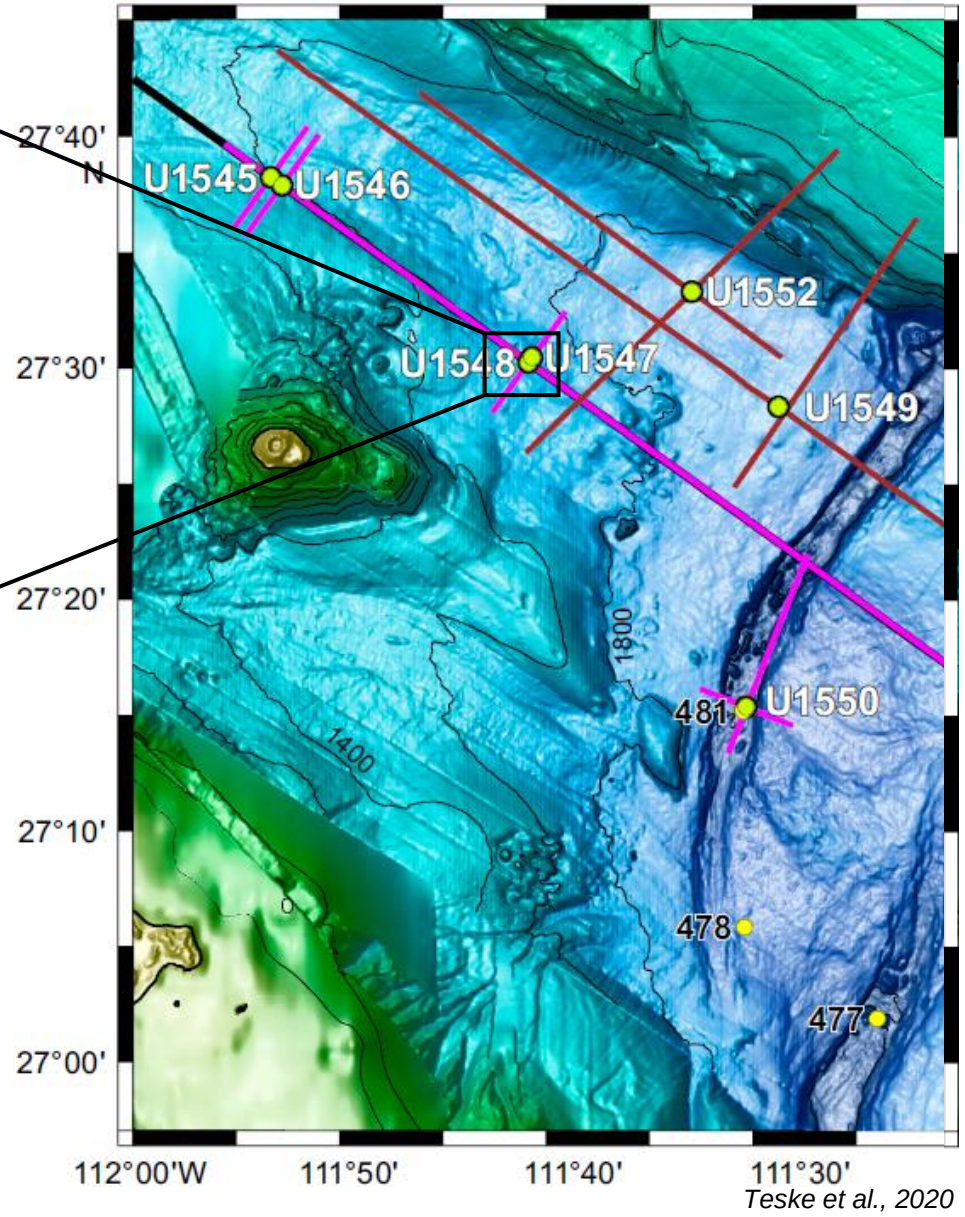
- Area of interest:
  - Sill at Site 1547
  - Ringvent
- Cone shaped sill



Teske et al., 2021



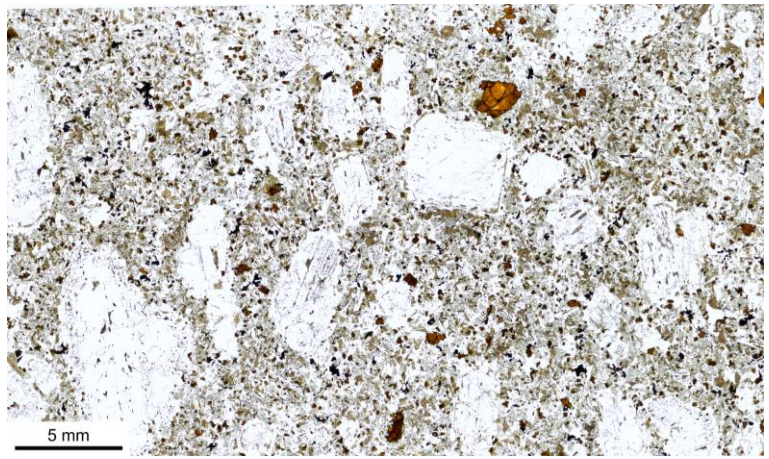
Galerne et al., in prep



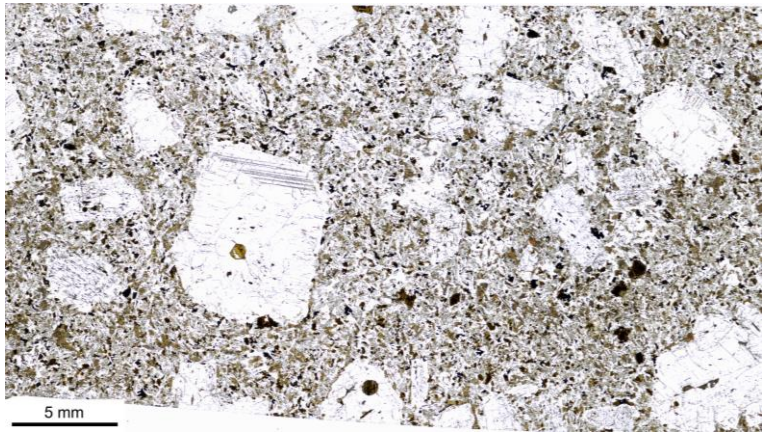
Teske et al., 2020

Introduction

- A common porosity inside a sill is 3-4 %

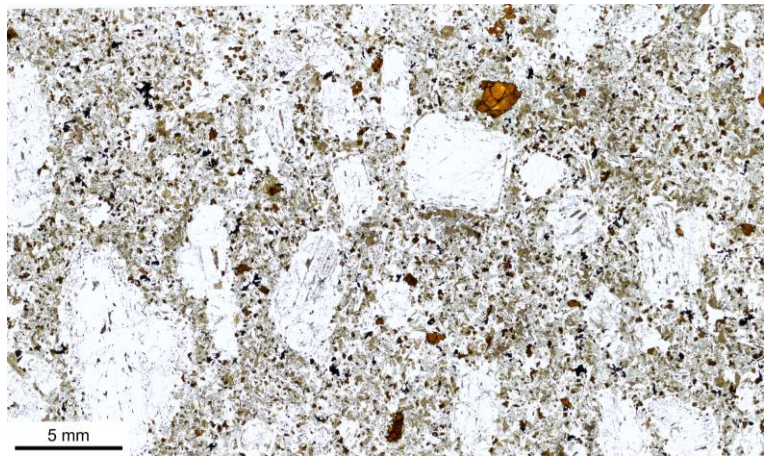


Bottom of sill 1546

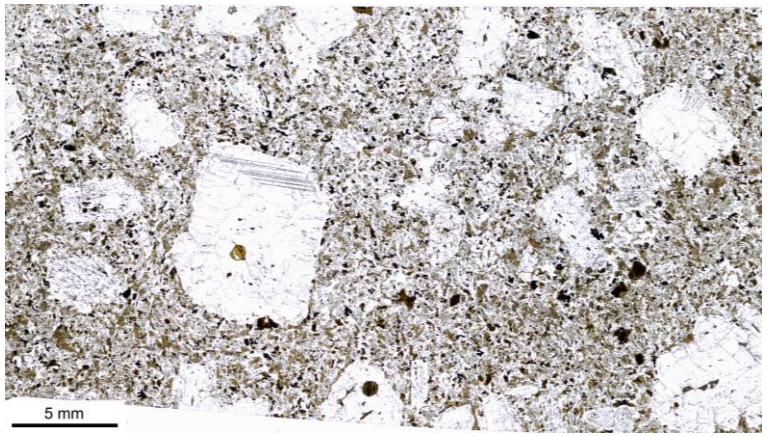


Introduction

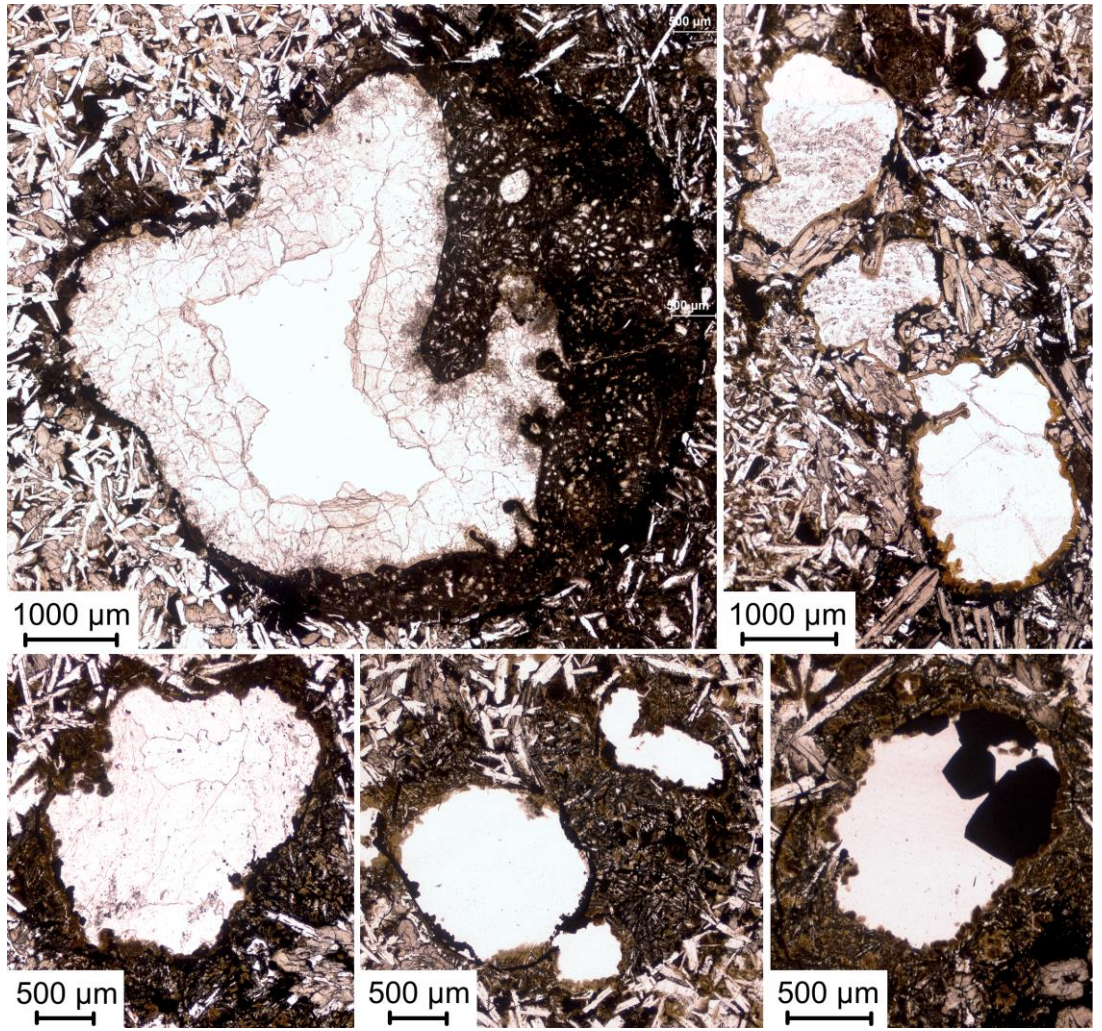
- A common porosity inside a sill is 3-4 %



Bottom of sill 1546

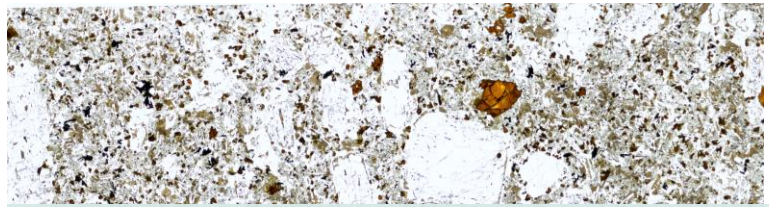


- Ringvent has ~15 % porosity
- large contribution from vesicles

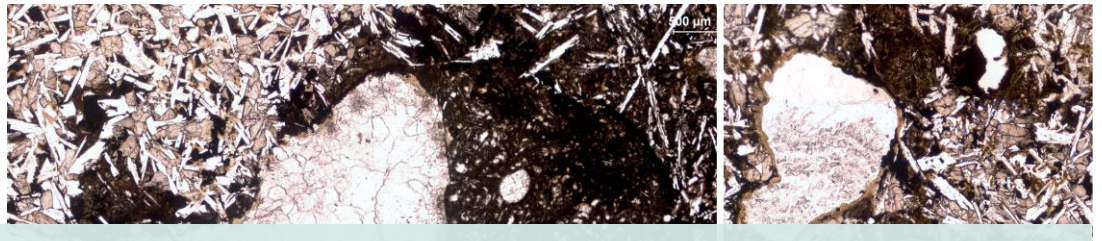


Introduction

- A common porosity inside a sill is 3-4 %

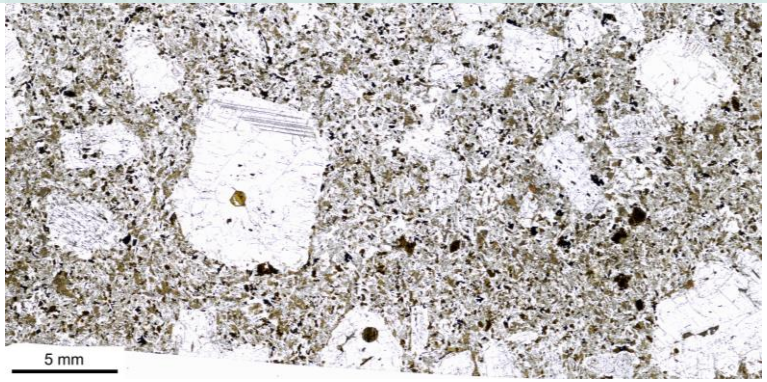


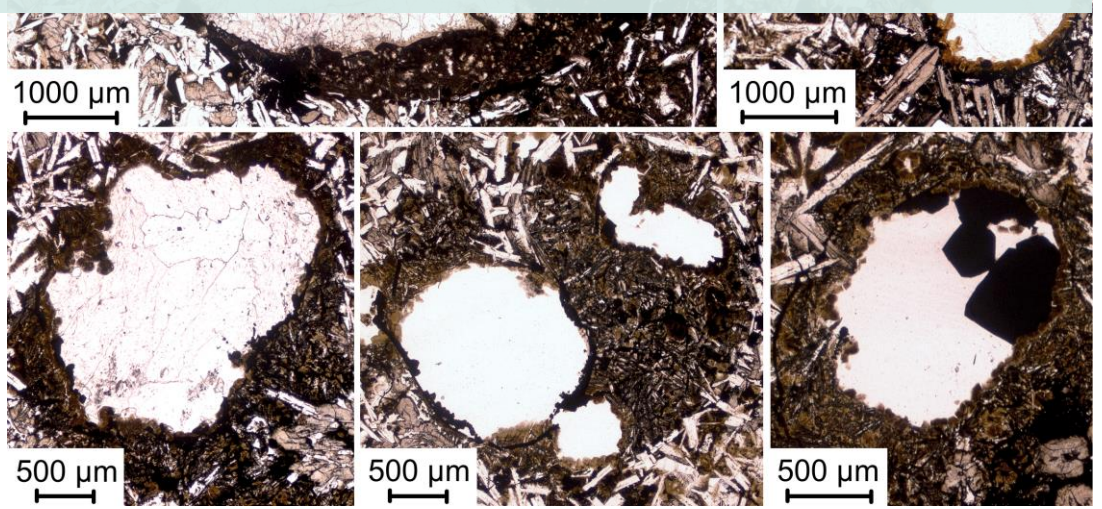
- Ringvent has ~15 % porosity
- large contribution from vesicles



Hypothesis: **High porosity and vesicles originate from thermogenic gas liberated inside the sill during the emplacement and mingling with organic rich sediment**

Bottom of sill 1546



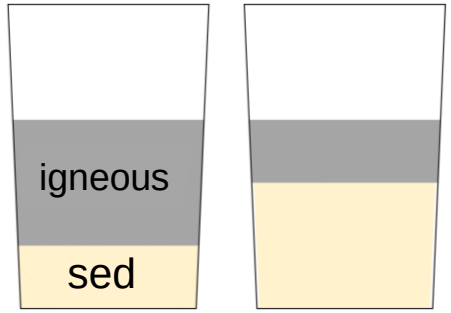


Methods

- Samples from the Ringvent:
  - EMP analysis on thin sections
  - Whole rock analysis

- Experiments:
  - Gas-mixing furnace
  - Temperature: 1200 °C
  - $\log(f_{O2}) = -8$ (QFM)
  - Pressure: 1 atm
  - Duration: 1 h
  - dry sediment
  - Stratified

- EMP analysis on experimental samples

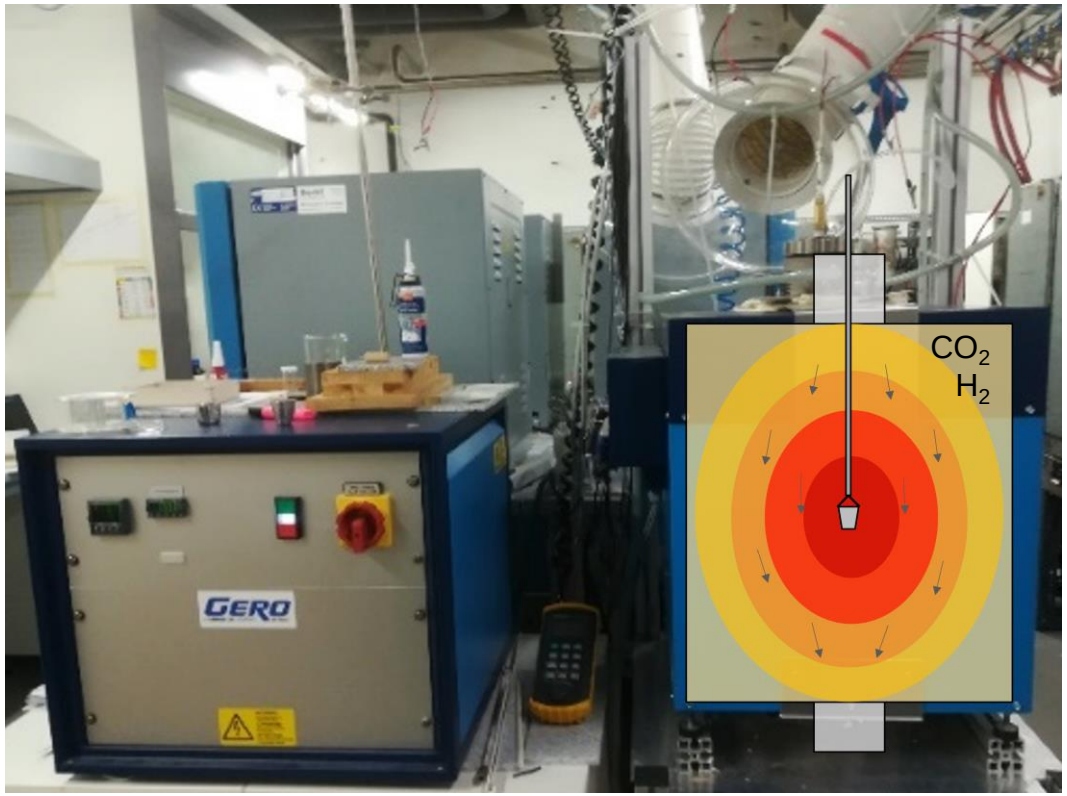


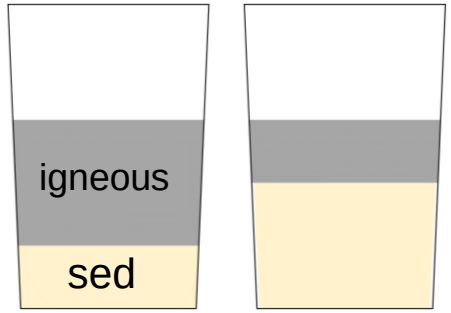
Methods

- Samples from the Ringvent:
  - EMP analysis on thin sections
  - Whole rock analysis

- Experiments:
  - Gas-mixing furnace
  - Temperature: 1200 °C
  - $\log(f_{O2}) = -8$ (QFM)
  - Pressure: 1 atm
  - Duration: 1 h
  - dry sediment
  - Stratified

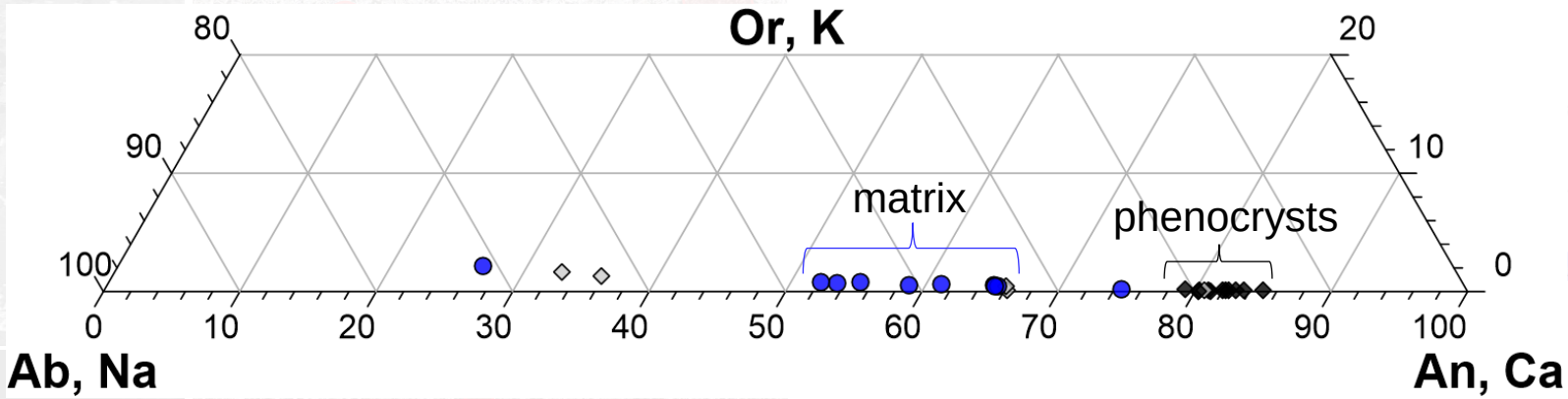
- EMP analysis on experimental samples



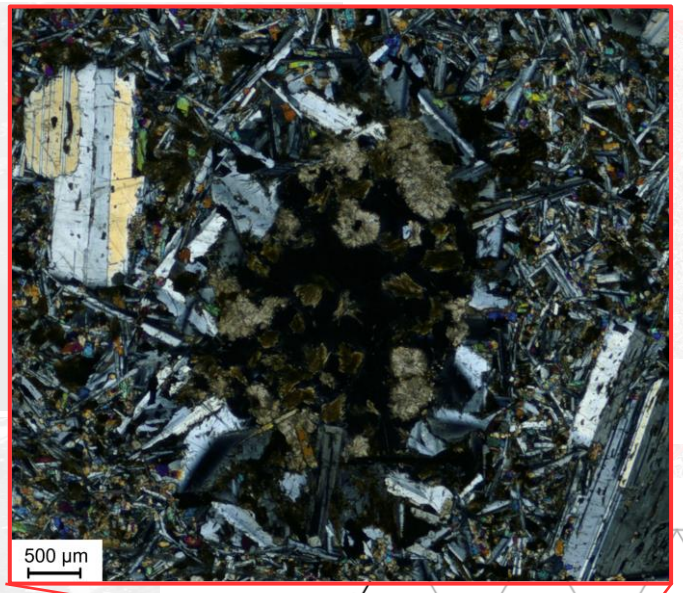


Results of EMP analysis on natural samples

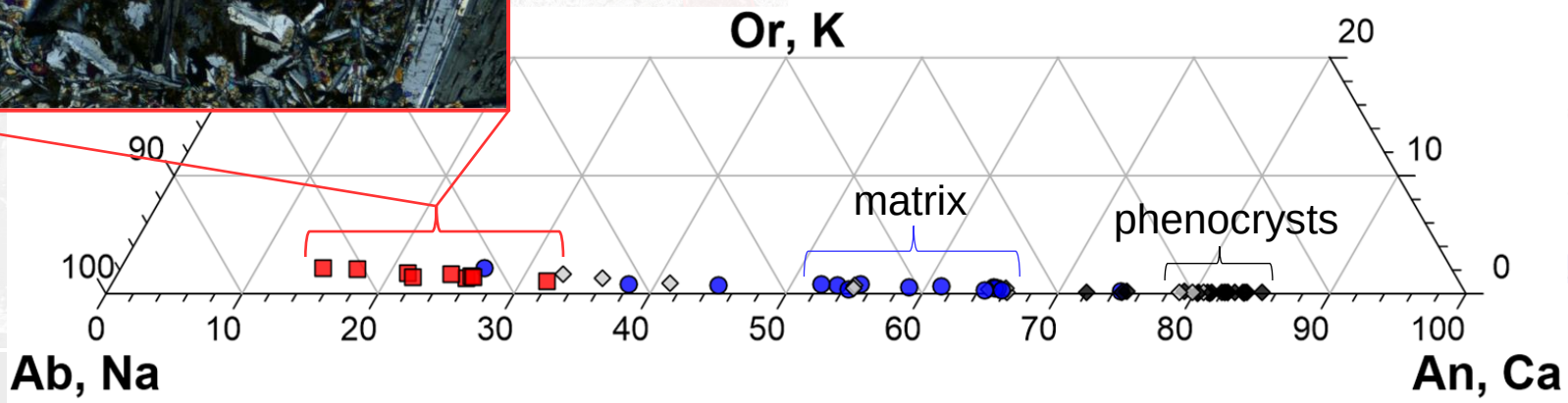
Bottom of the sill at 1546



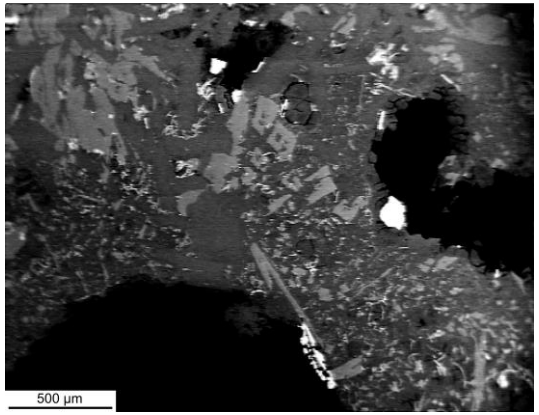
Results of EMP analysis on natural samples

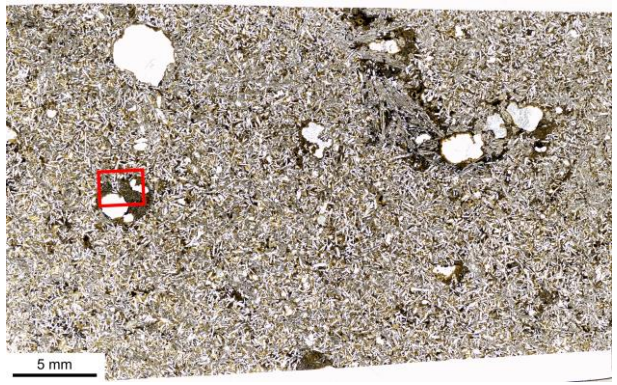


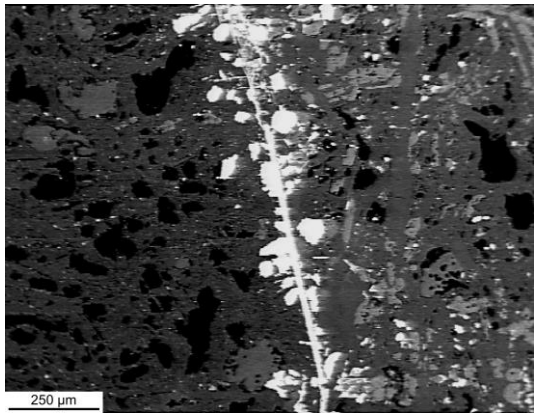
Sill at 1546

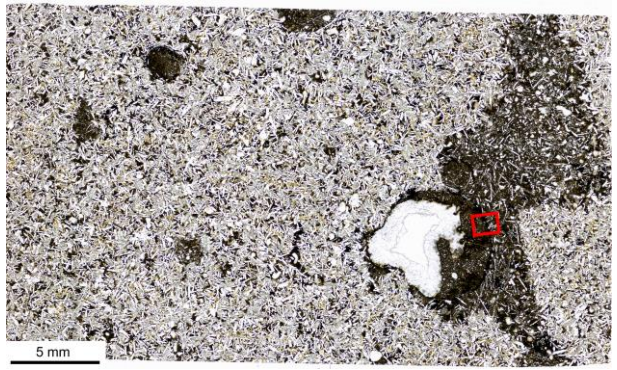


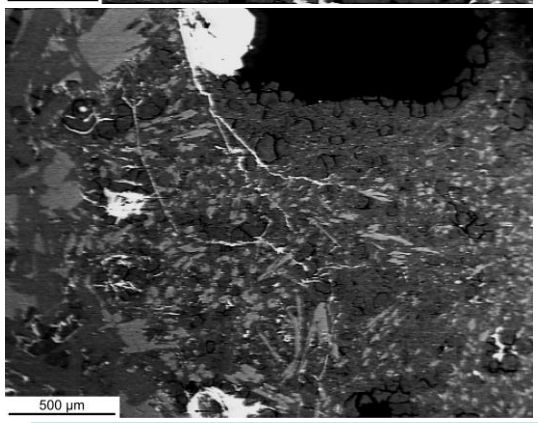
Results of EMP analysis on natural samples

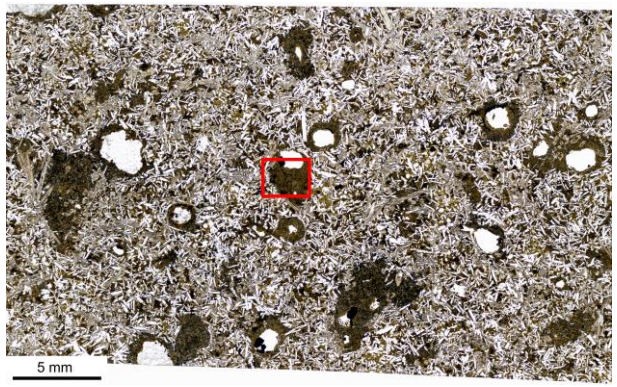




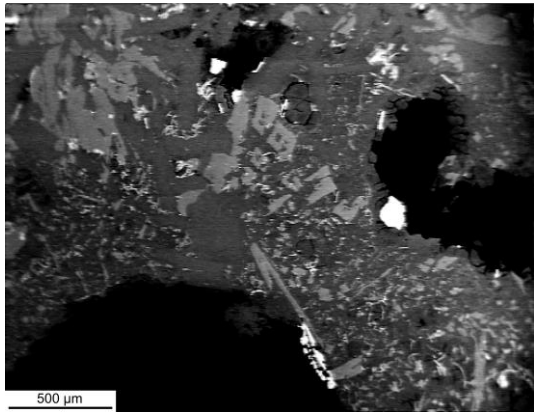


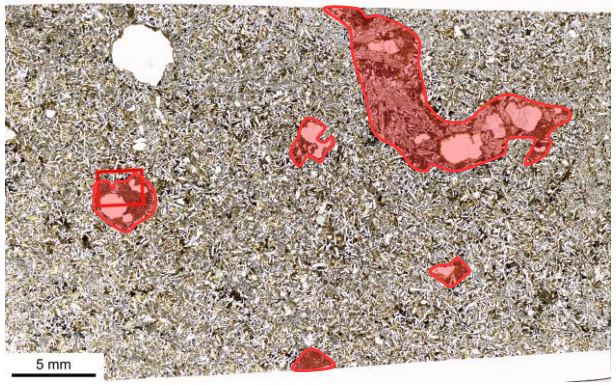


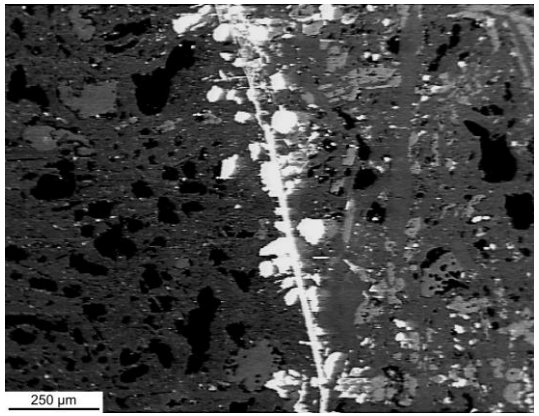


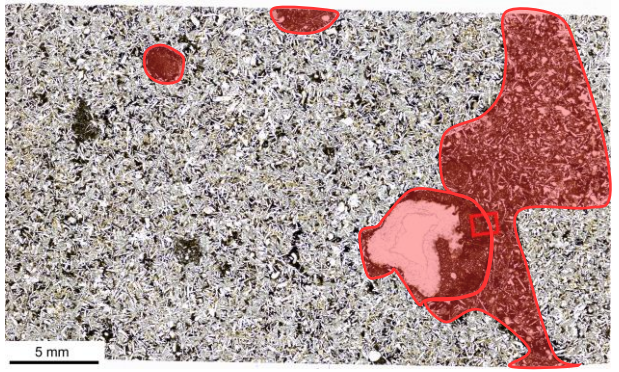


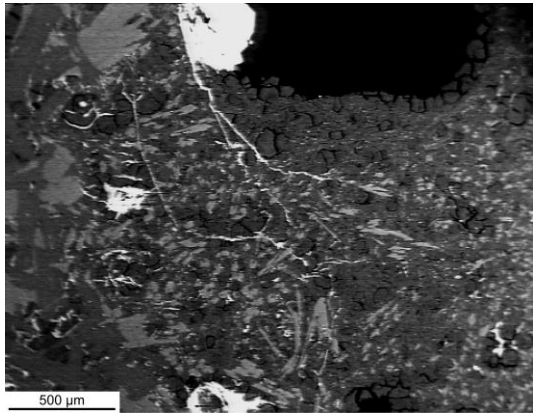
Results of EMP analysis on natural samples

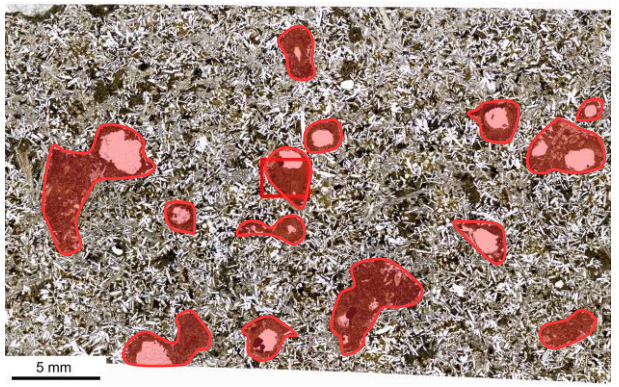


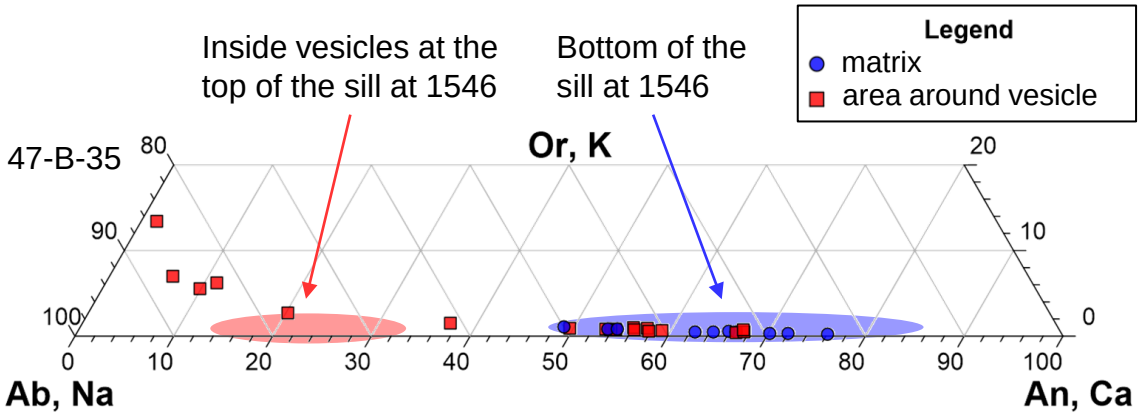


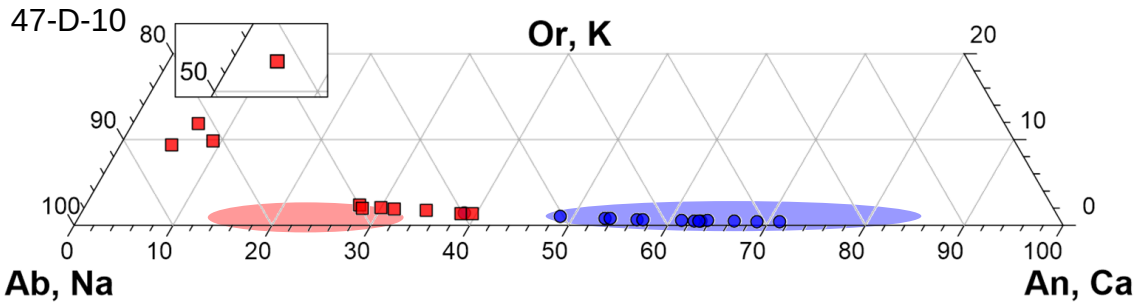


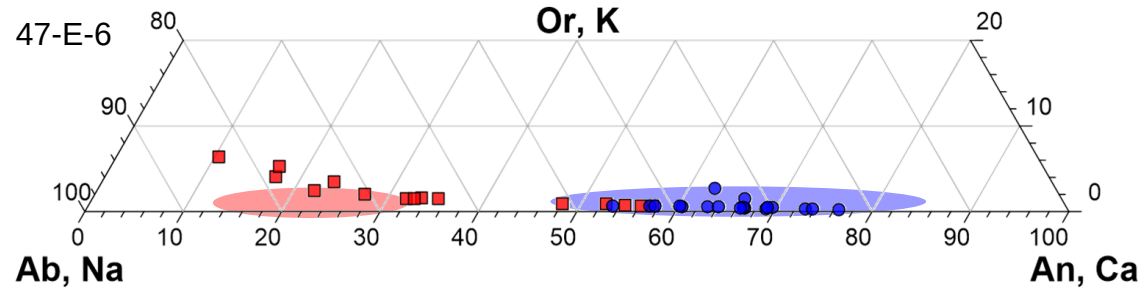




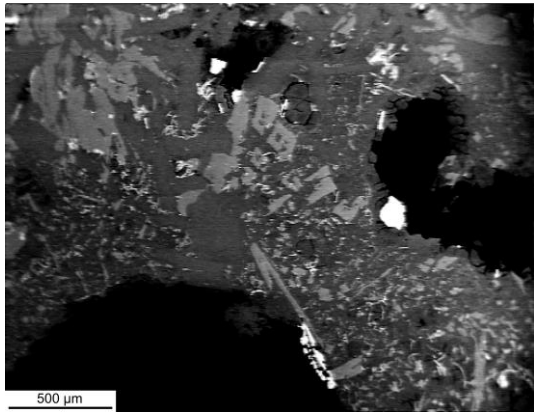


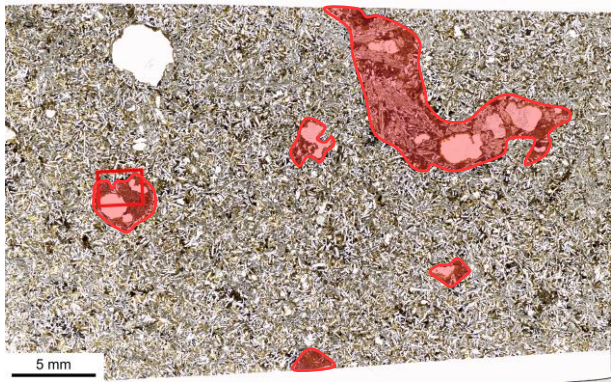


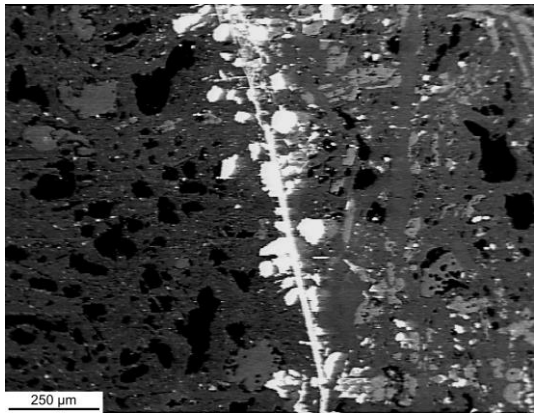


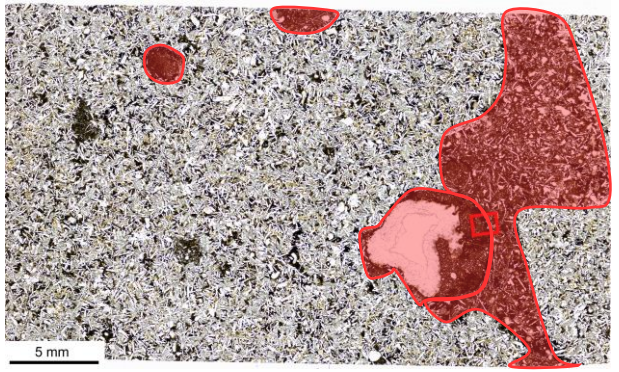


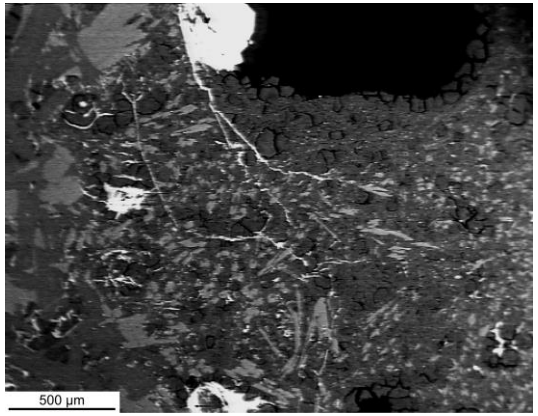
Results of EMP analysis on natural samples

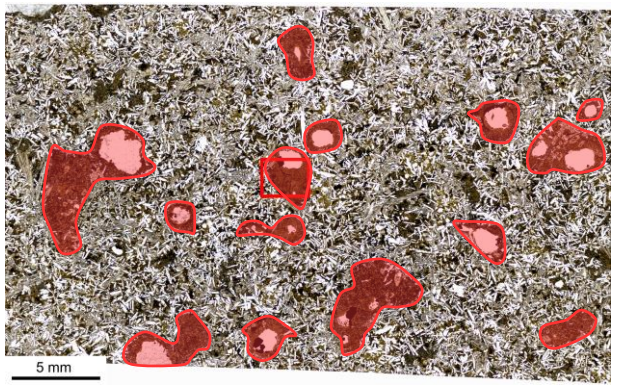


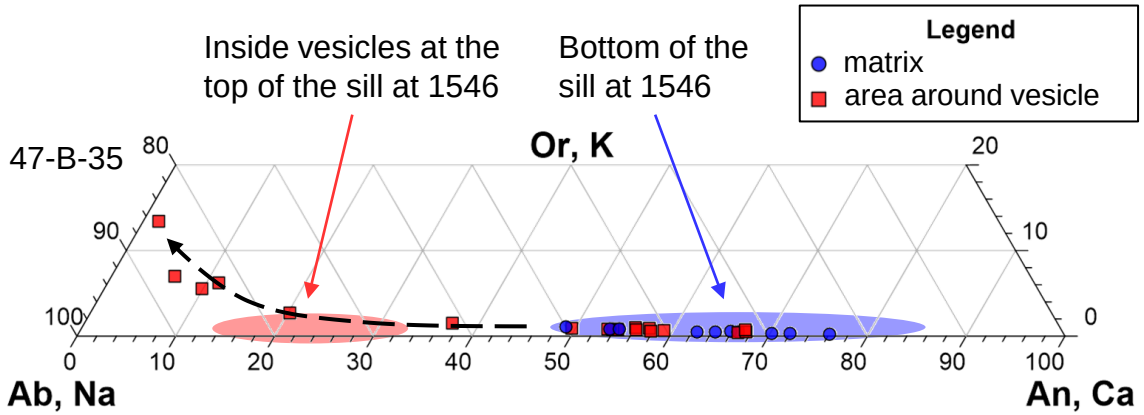


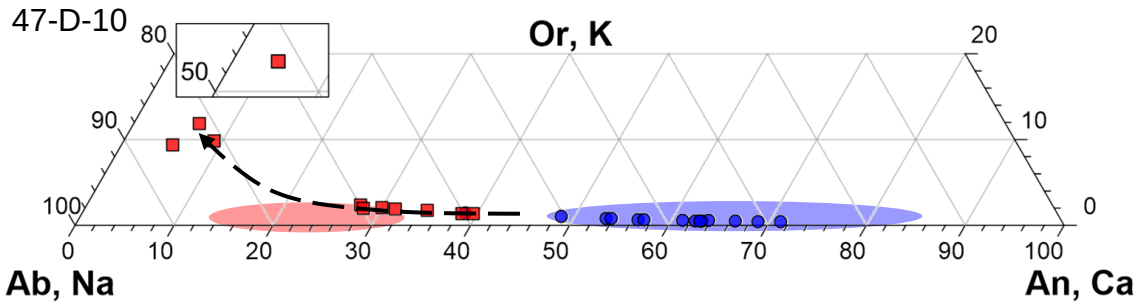


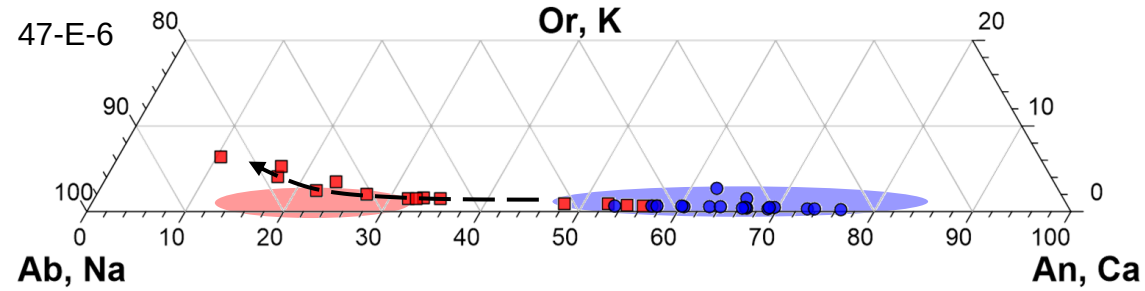








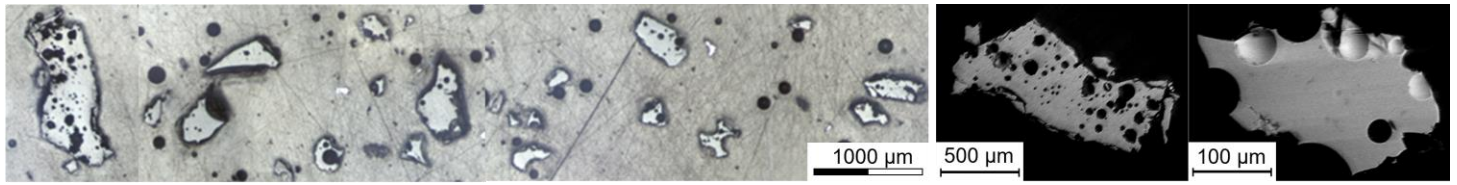




Results Experiments

Only sediment:

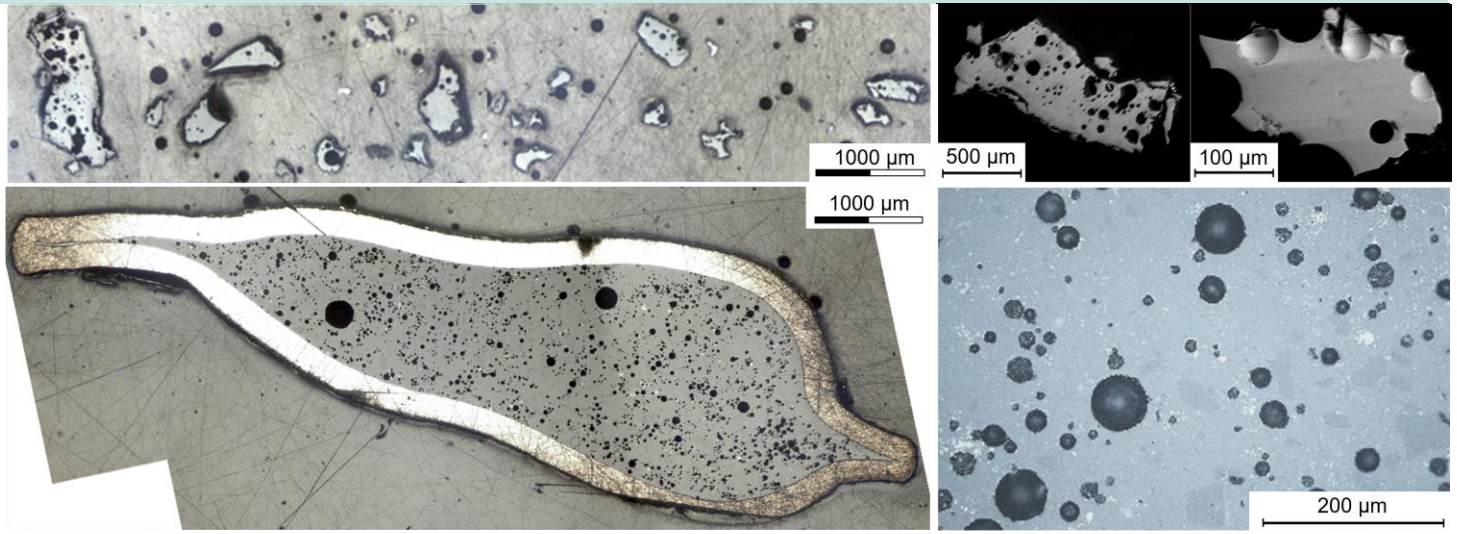
- Coated walls of the capsule



Results Experiments

Only sediment:
- Coated walls of the capsule

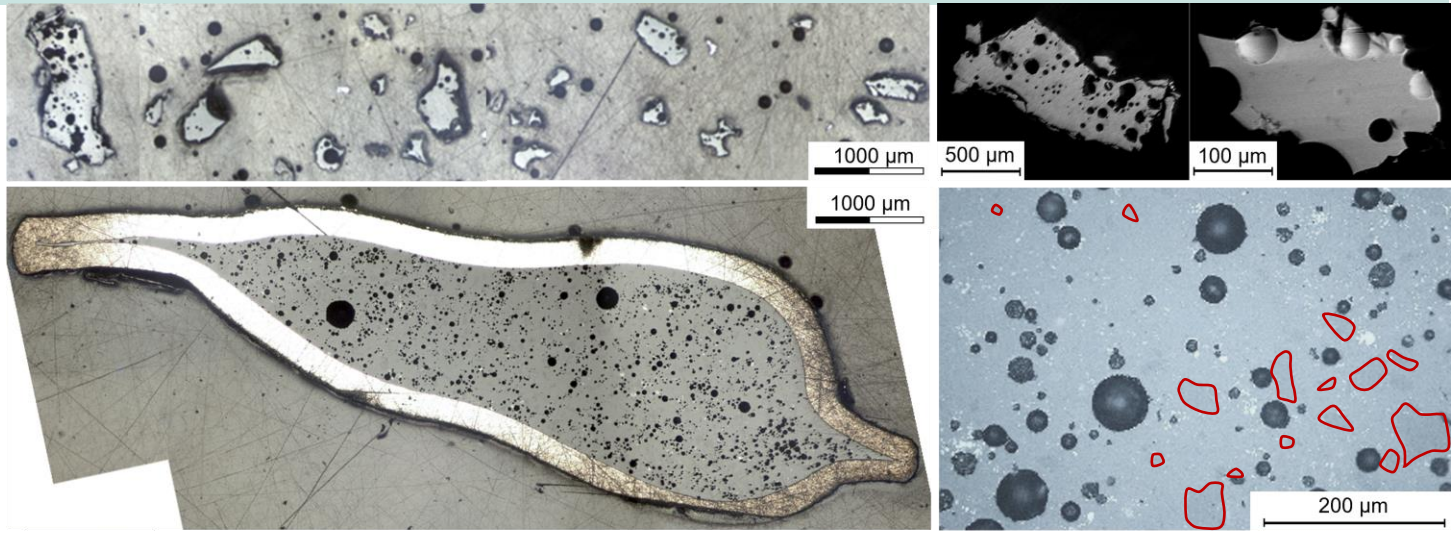
Only igneous powder:
- Small vesicles
- Darker areas = plagioclase



Results Experiments

Only sediment:
- Coated walls of the capsule

Only igneous powder:
- Small vesicles
- Darker areas = plagioclase

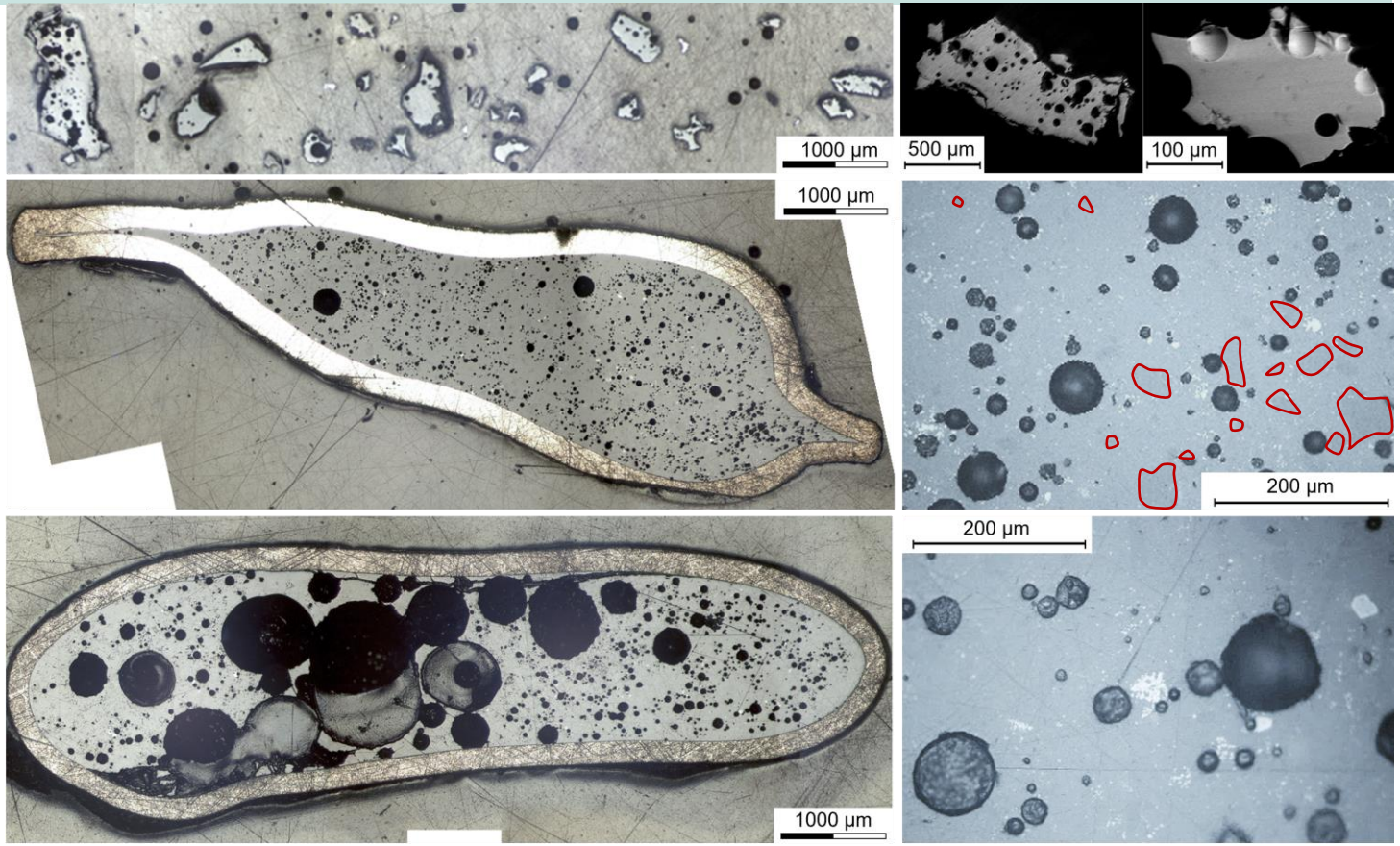


Results Experiments

Only sediment:
- Coated walls of the capsule

Only igneous powder:
- Small vesicles
- Darker areas = plagioclase

1/3 sediment:
- Larger vesicles concentrated in one area
- Less and smaller plagioclase

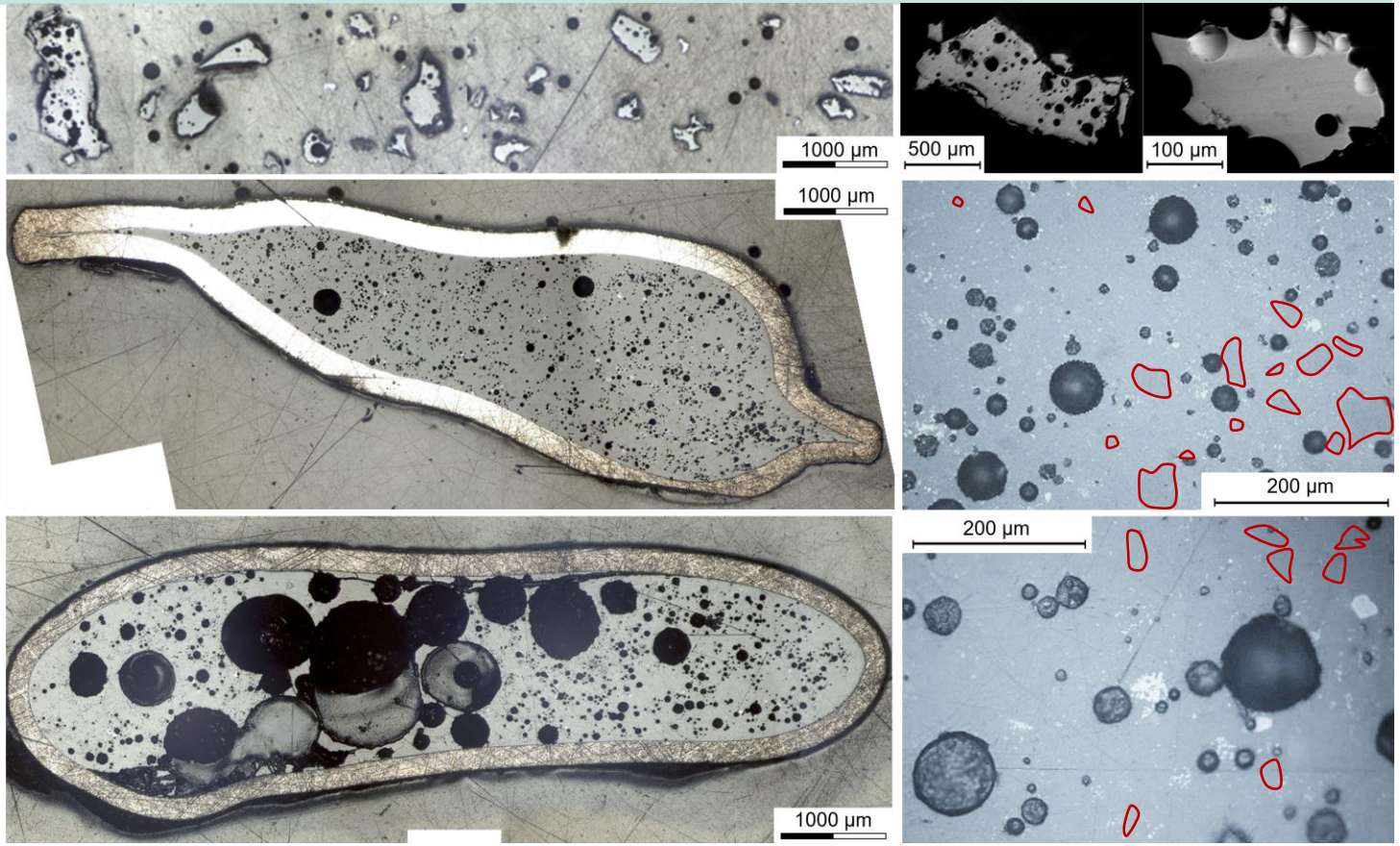


Results Experiments

Only sediment:
- Coated walls of the capsule

Only igneous powder:
- Small vesicles
- Darker areas = plagioclase

1/3 sediment:
- Larger vesicles concentrated in one area
- Less and smaller plagioclase



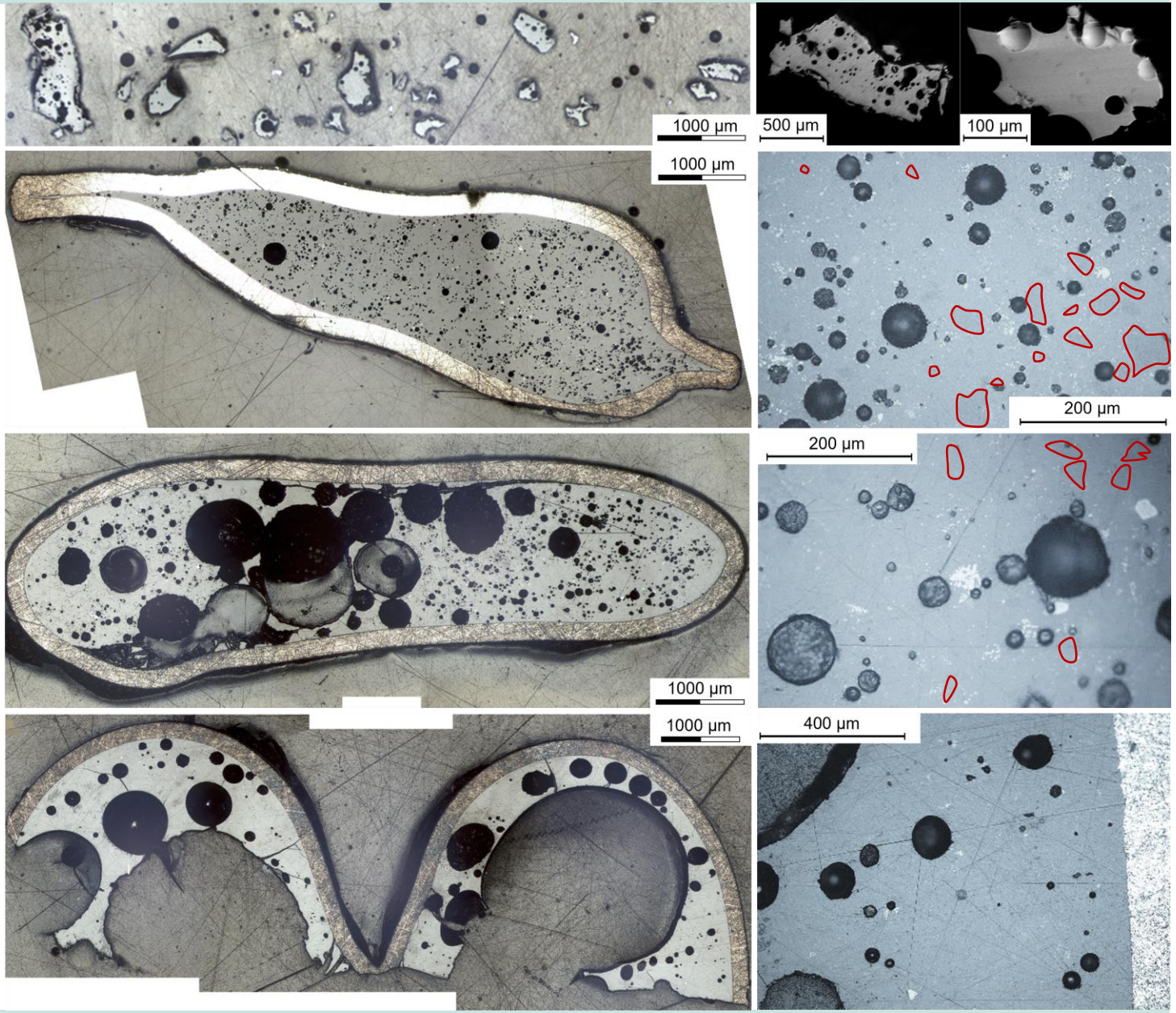
Results Experiments

Only sediment:
- Coated walls of the capsule

Only igneous powder:
- Small vesicles
- Darker areas = plagioclase

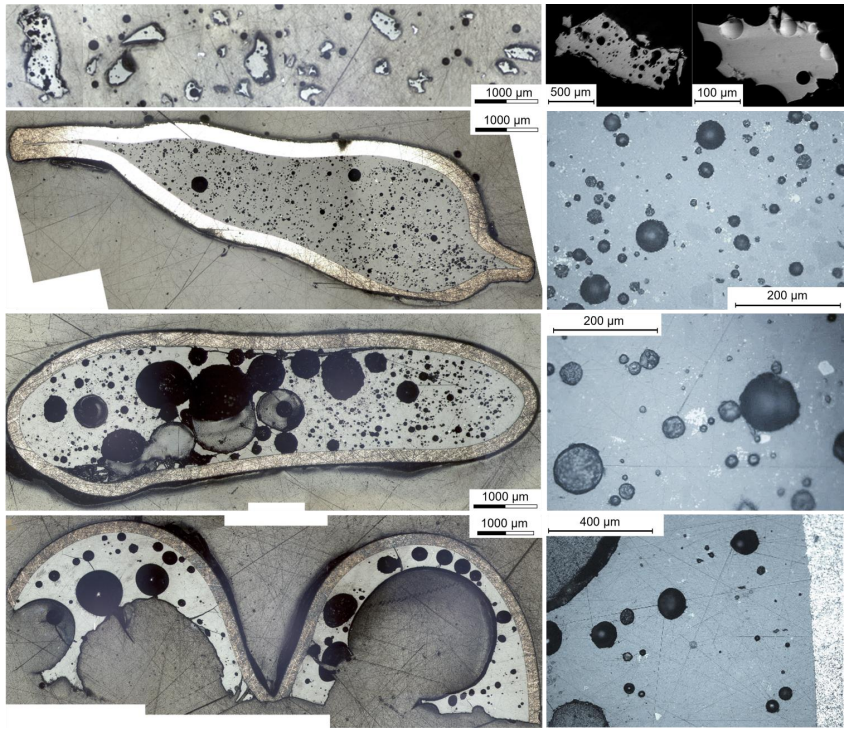
1/3 sediment:
- Larger vesicles concentrated in one area
- Less and smaller plagioclase

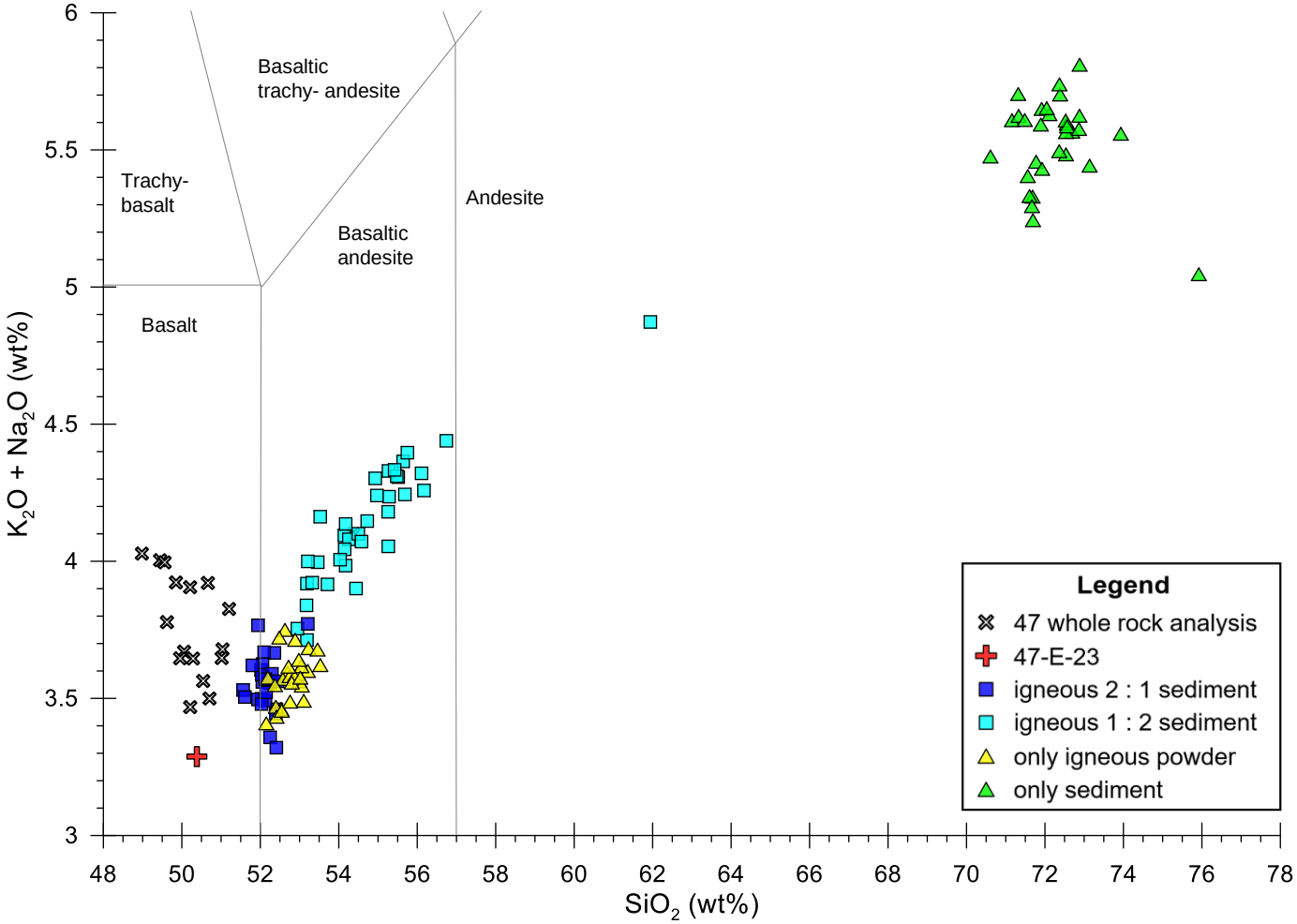
2/3 sediment:
- Very large vesicles in the centre
- Very little remaining plagioclase



Results Experiments

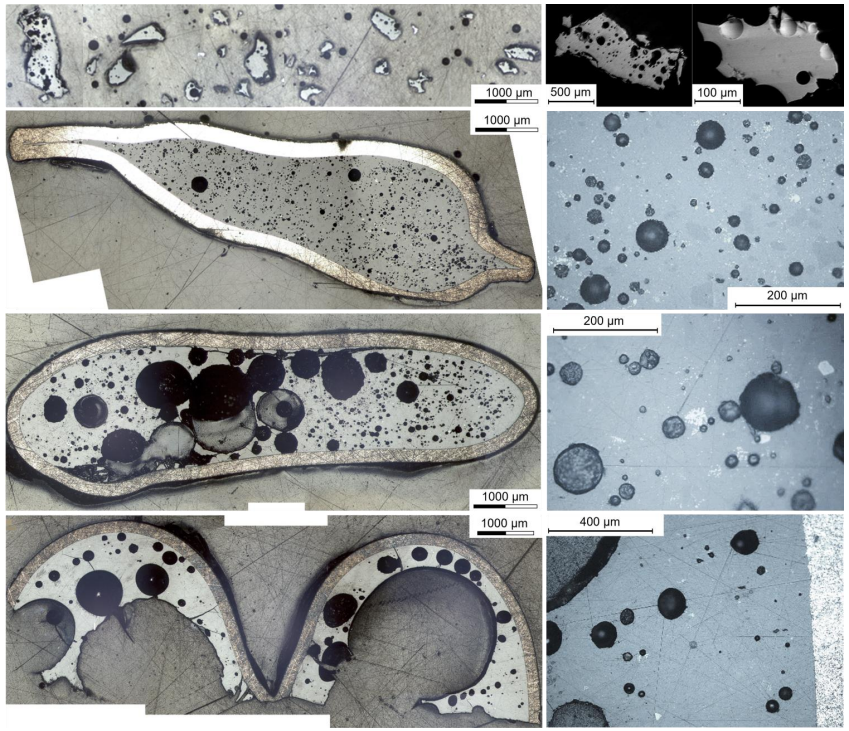
- Experiment with only igneous powder and 1/3 sediment are similar in composition
- Experiment with 2/3 sediment shows trend towards higher alkali content

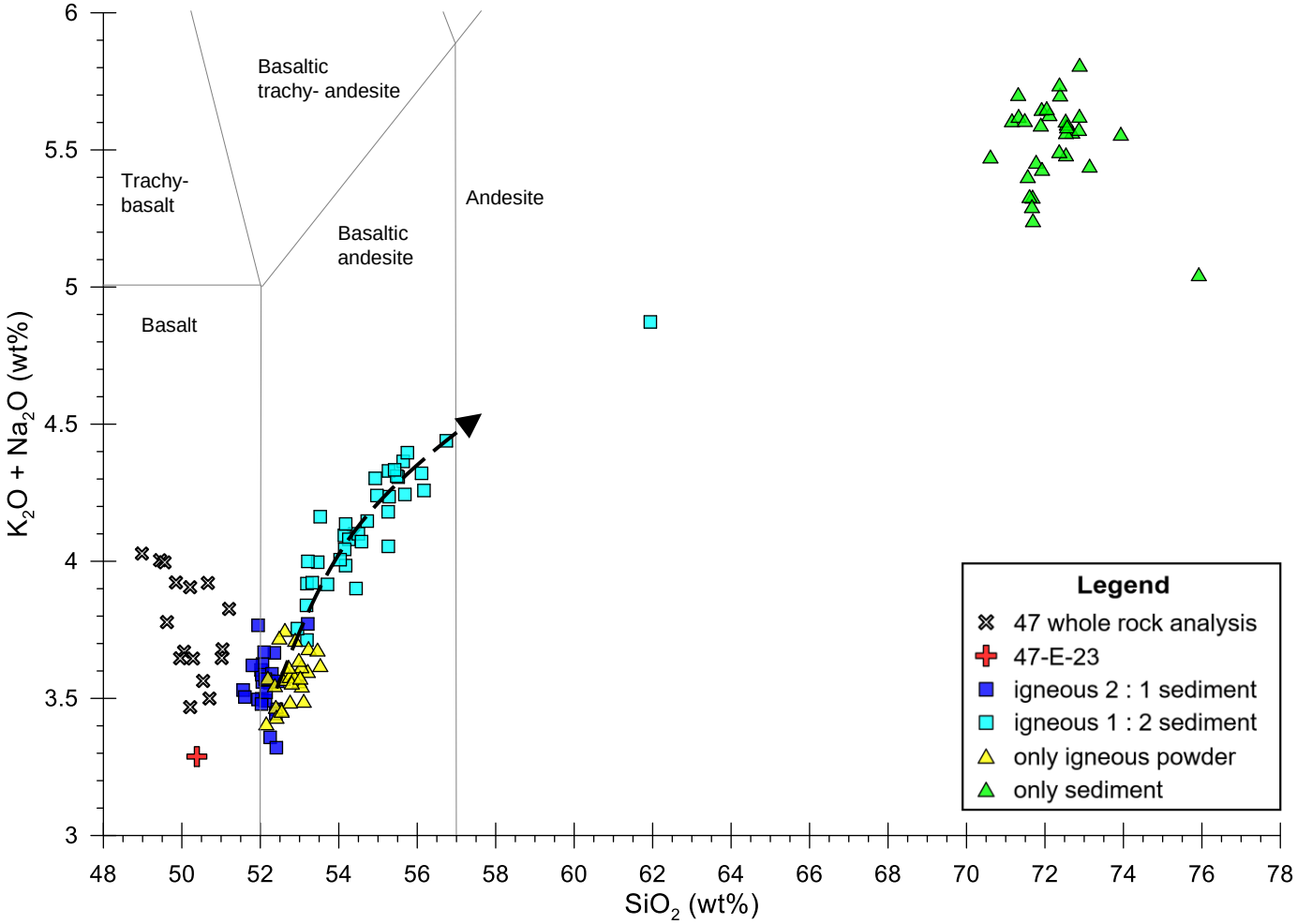




Results Experiments

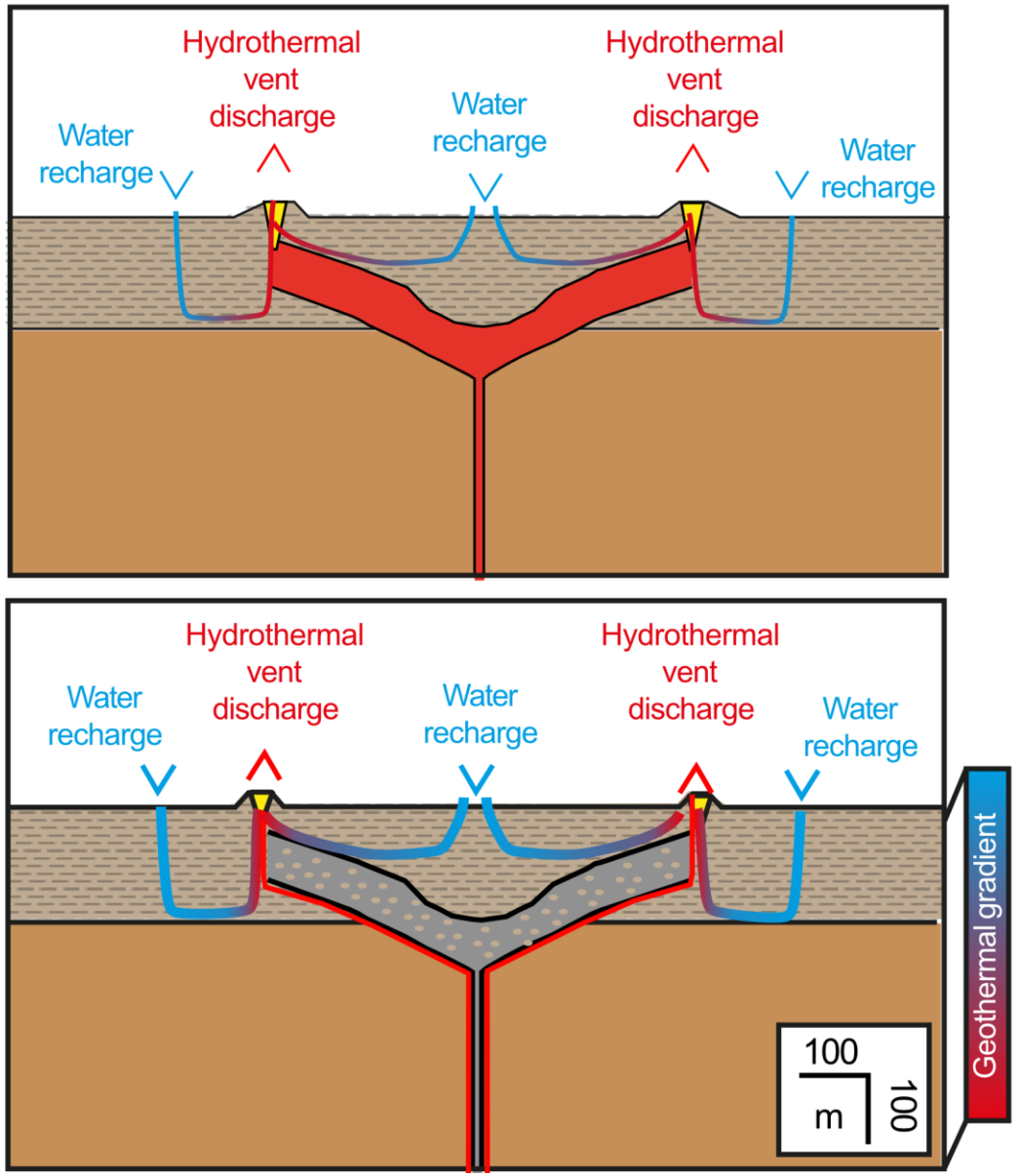
- Experiment with only igneous powder and 1/3 sediment are similar in composition
- Experiment with 2/3 sediment shows trend towards higher alkali content





Conclusion

- In the experiment larger vesicles form due to assimilation of organic rich sediment
- Higher alkali content due to contamination of sediment
- High porosity inside the sill originates from mingling with organic rich sediment
- Hydrothermal fluids can use porosity of the sill for more effective pathways



Galerne et al., in prep

Thank you!

Universität Bremen

Petrology of the ocean crust

EGU22-9301