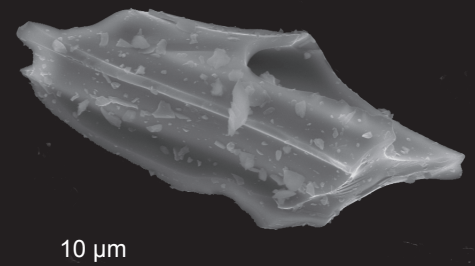
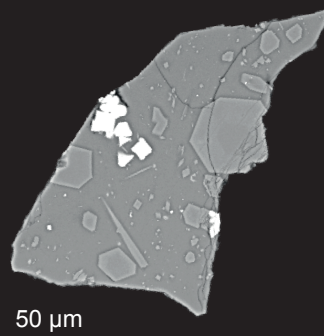
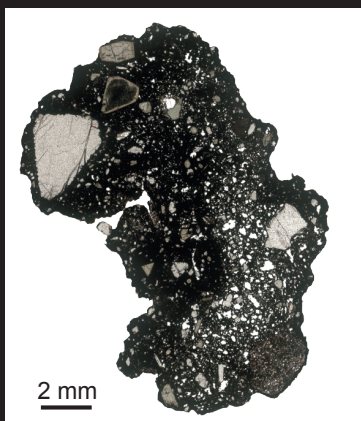


# Quantitative morphological analysis of mm- to $\mu\text{m}$ -sized volcanic particles



## Why study the shape of volcanic particles?

- to infer the fragmentation mechanisms triggering volcanic eruptions
- to reconstruct the eruptive processes and fragmentation history during a volcanic event
- to calculate so called “shape factors” crucial for the numerical modeling of ash transport and dispersal
- to investigate transport mechanisms (fallout vs. surge vs. pyroclastic flow)
- to evaluate the degree of reworking/resuspension of the particles
- etc...

The challenge is to obtain quantitative descriptors of shape...

## Particle Vision offers:

- **quantitative** shape characterization of mm- to few  $\mu\text{m}$ -sized volcanic particles by **fractal analysis**

### including....

- sample preparation and acquisition of images by Scanning Electron Microscopy (SEM)
- image processing and fractal analysis
- data treatment and preparation of graphs and reports

# Case study: deciphering fragmentation mechanisms (magmatic vs. phreatomagmatic) from morphological features of the pyroclasts

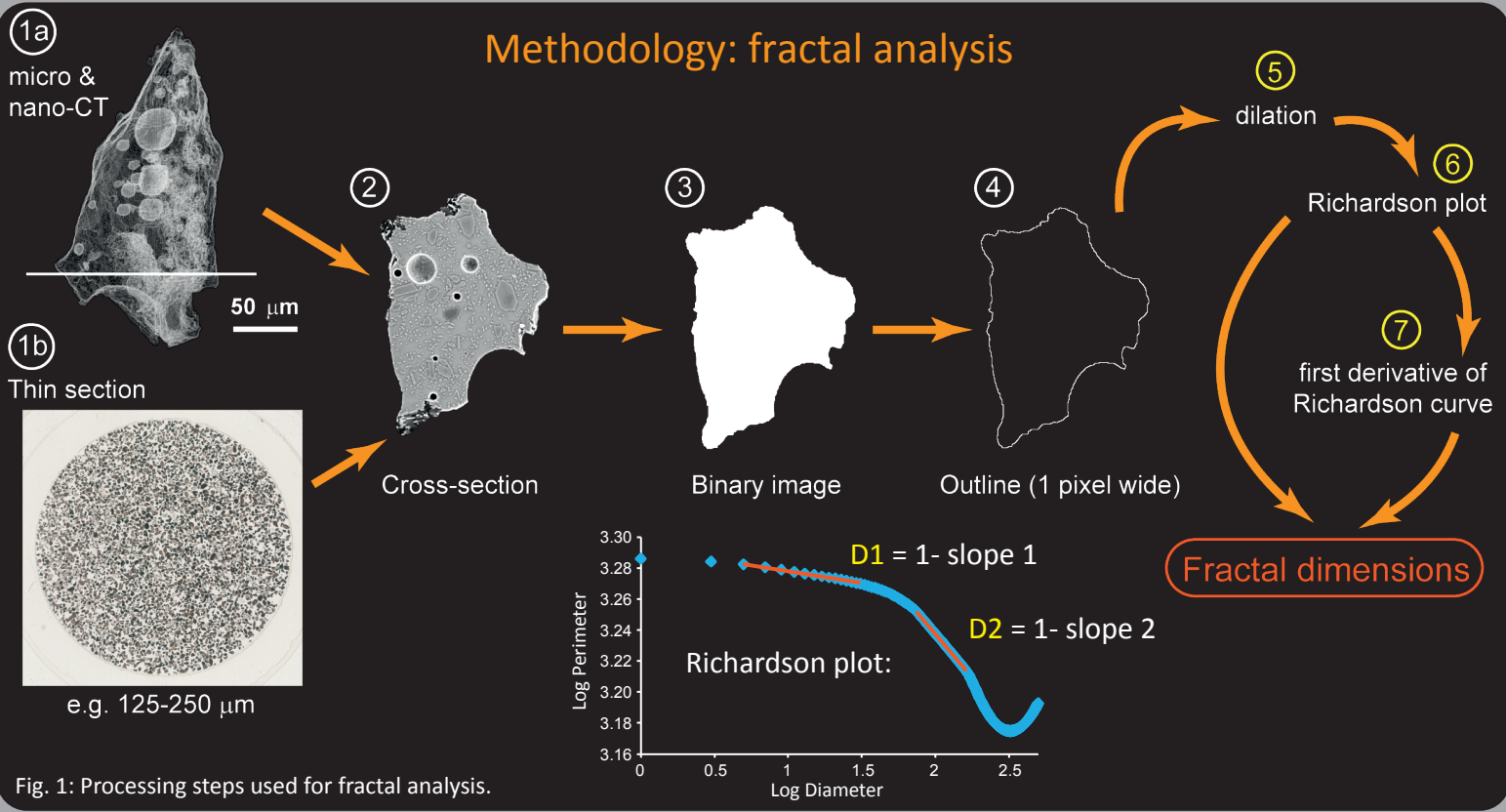


Fig. 1: Processing steps used for fractal analysis.

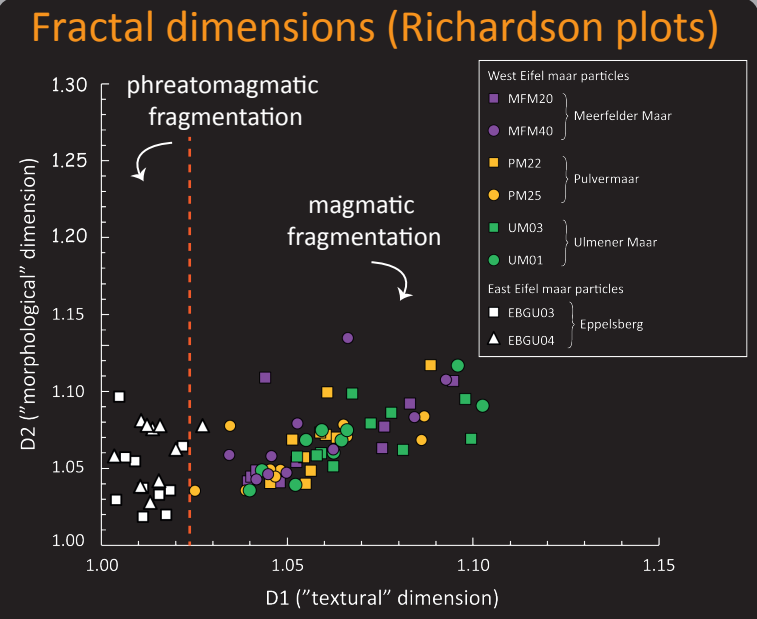


Fig. 2: D1 vs. D2 diagram showing the results obtained from the fractal analyses performed on pyroclasts from several maar volcanoes in the Eifel Volcanic Field (Germany).

- Conclusions**
- The quantitative characterization of the shape of pyroclasts sourced in various maar volcanoes using fractal analysis enabled the discrimination of the dominant fragmentation mechanisms triggering the eruptions.
  - West Eifel maar eruptions were strongly influenced by magmatic, while East Eifel maar phases were dominated by phreatomagmatic fragmentation.

**Fractal analysis is a powerful tool to quantitatively investigate the shape of volcanic particles.**

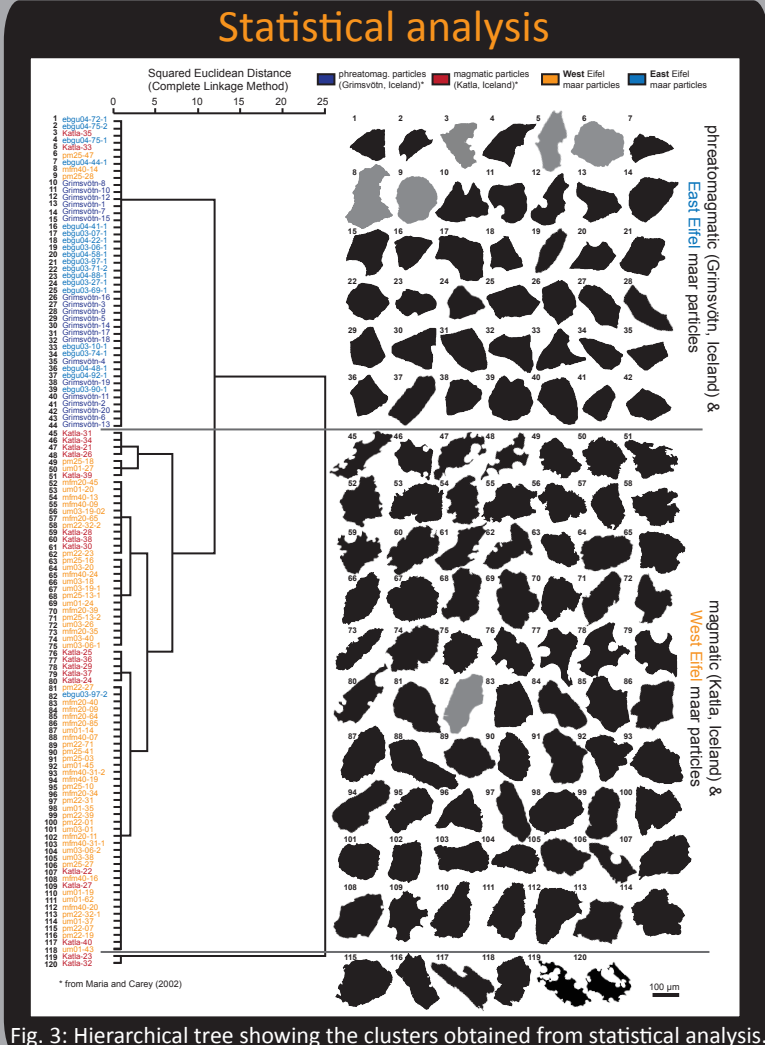


Fig. 3: Hierarchical tree showing the clusters obtained from statistical analysis.

**References**  
Rausch J, Grobety B & Vonlanthen P (in press) Eifel maars: Quantitative shape characterization of juvenile ash particles (Eifel Volcanic Field, Germany). J Volcanol Geotherm Res  
Maria A, Carey S (2002) Using fractal analysis to quantitatively characterize the shapes of volcanic particles. J Geophys Res: Solid Earth (1978-2012), 107(B11), ECV-7