

## Size and shape of solid particles in a Greenland ice core

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Concentrations and size distributions of insoluble solid particles in ice cores provide us with information on the changes in provenance, aridity, atmospheric circulation, etc. Most of the previous studies have focused on concentrations and size distributions. However, several studies (e.g., Barnes et al., 2002; Lambert et al., 2008; Simonsen et al., 2018) reported that particles formed aggregates and had various shapes. For a better environmental reconstruction, we need to study shapes and aggregation processes of the particles together with concentrations and size distributions.

Using a cryogenic scanning electron microscope (cryo-SEM), we carried out in-situ observations of solid particles in ice core samples without melting them. From the observations on selected ice samples (124 m depth in the present interglacial period, 1548 m depth in the last glacial period and 2406 m in the last interglacial period) retrieved by North Greenland Eemian Ice Drilling (NEEM), we found that many particles formed aggregates, and that individual particles (particles forming the aggregates) had elongated shapes (aspect ratio: 0.4-0.8). We also found that the sizes of the aggregate and individual particles showed log-normal distribution. The aggregates were larger in the interglacial periods than those in the glacial period (median diameter: 4.5  $\mu\text{m}$  in the present interglacial period, 5.9  $\mu\text{m}$  in the last interglacial period, and 2.2  $\mu\text{m}$  in the last glacial period). These results need to be taken into account to interpret the size distribution data obtained by analyses on melted ice cores.

### References

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Lambert, F. et al., 2008, *Nature.* 452. pp 616-619

Simonsen, M.F. et al., 2018, *Clim. Past.* 14. pp 601-608

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