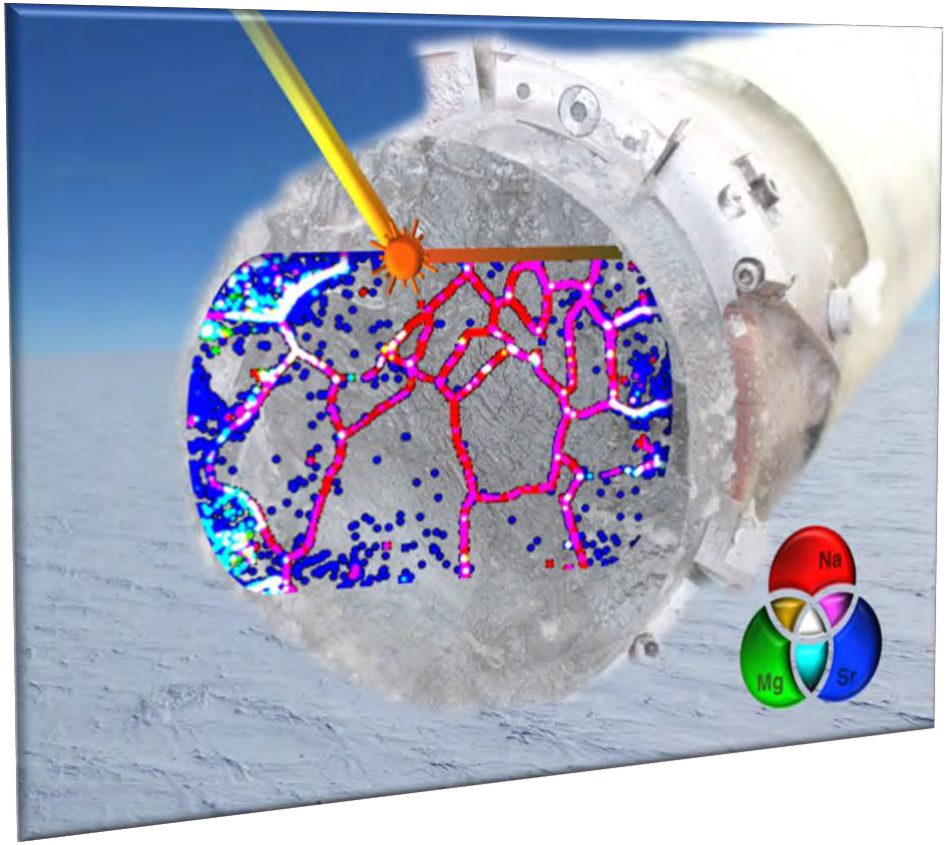

GOLD-ICE

Next generation analysis of the oldest ice core layers

A Marie-Skłodowska-Curie Incoming Fellowship at Ca'Foscari University of Venice

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Funded by the European Union

MARIE CURIE ACTIONS

RATIONALE THE PROJECT PUBLICATIONS

RATIONALE

Ice cores drilled on polar ice sheets have revealed invaluable insights into our climate system. Due to continuous thinning of layers with depth, *there is a demand for novel high-resolution analysis to better decipher highly thinned layers in the deepest part of ice cores*.

In the GOLD-ICE project,

- Laser-Ablation Inductively-Coupled Plasma Mass Spectrometry (LA-ICP-MS) is refined for glaciochemical ice core analysis.
- highly thinned deep layers of Antarctic ice cores are investigated for untapped paleoclimatic signals.
- the role of impurity localization in the ice crystal matrix are taken into account.

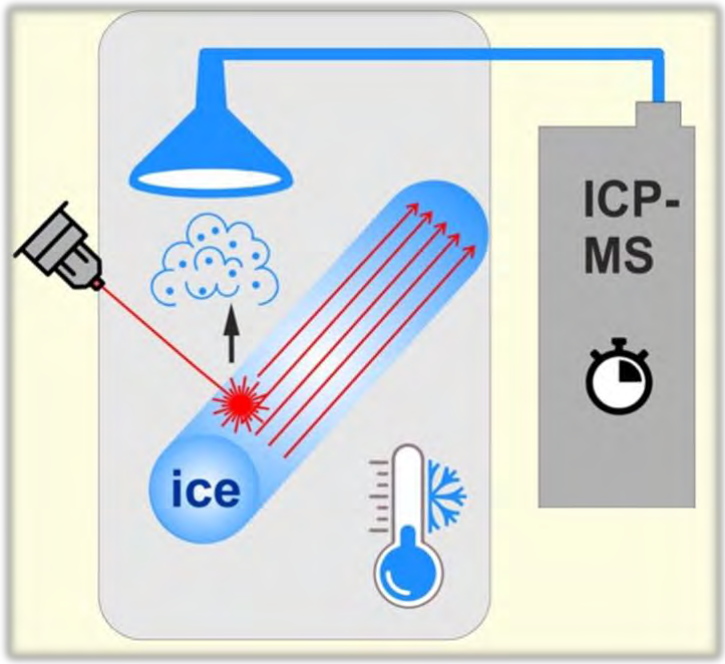
Ultimately, this will pave the way for the next generation of LA-ICP-MS ice core analysis.

THE PROJECT

LASER ABLATION INDUCTIVELY-COUPLED PLASMA MASS SPECTROMETRY

Laser-Ablation Inductively-Coupled Plasma Mass Spectrometry (LA-ICP-MS) *offers micron-scale glacio-chemical ice core analysis* to investigate high-resolution paleoclimate records.

- It is a *micro-destructive technique*, with only a few tenths of µL of ice ablated from the surface by the laser.
- The sample is transported by an inert carrier gas to the mass spectrometer, where it is analyzed for various elemental impurity species.
- During analysis the strips of ice core are kept frozen in a specially designed cryogenic sample holder.



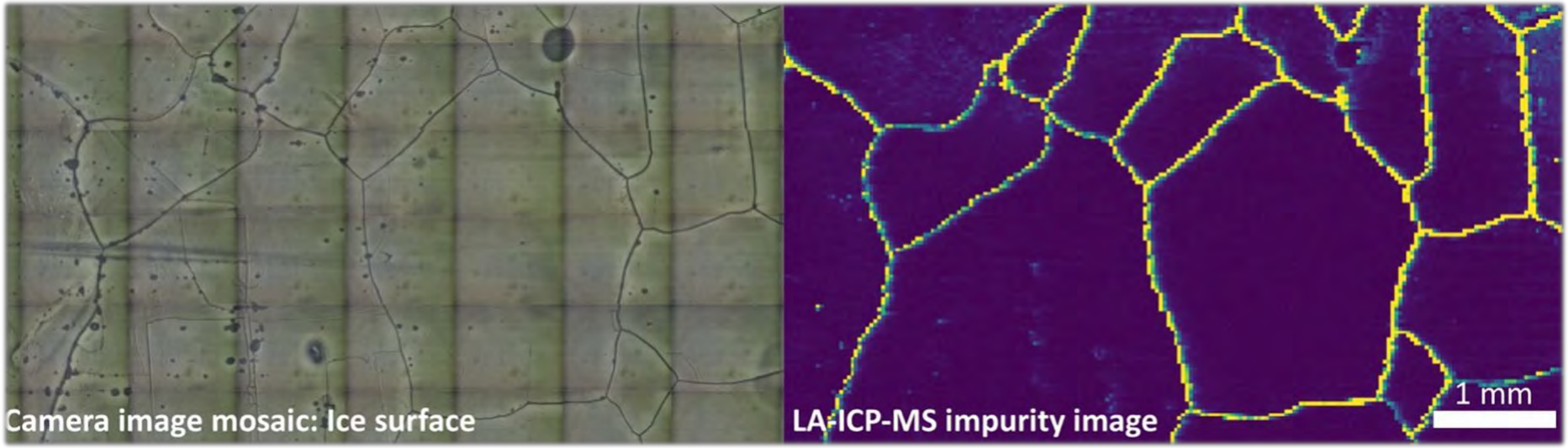
LA-ICP-MS is also *a powerful technique for imaging* the 2D impurity distribution of solid samples, an application which still remains to be fully exploited for ice cores.

LA-ICP-MS FOR NOVEL 2D IMPURITY IMAGING ON ICE CORES

Post-depositional processes through the interaction of impurities with the ice matrix can cause microscopic movement of impurities which may ultimately corrupt the original layer sequence. At the fine-scale resolution of LA-ICP-MS *it is crucial to take into account the localization of impurities* within the ice crystal matrix.

- GOLD-ICE shows how employing *LA-ICP-MS for imaging the impurity distribution* in ice cores can be refined and strongly improved.
- This LA-ICP-MS imaging method for ice cores can map the localization of impurities at high spatial resolution (tens of µm), at high speed and without imaging artifacts.

This promises not only new insights into the impurity distribution in glacier ice but also lays the ground *for an improved understanding of the LA-ICP-MS signal* obtained from ice cores.



PUBLICATIONS

- Bohleber, P., Roman, M., Šala, M., and Barbante, C.: Imaging the impurity distribution in glacier ice cores with LA-ICP-MS. Journal of Analytical Atomic Spectrometry. https://doi.org/10.1039/D0JA00170H, 2020.
- Bohleber, P., Casado, M., Ashworth, K., Baker, C. A., Belcher, A., Caccavo, J. A., Jenkins, H. E., Satterthwaite, E., Spolaor, A., and Winton, V. H. L.: Successful practice in early career networks: insights from the polar sciences, Adv. Geosci., 53, 1–14, https://doi.org/10.5194/adgeo-53-1-2020, 2020.
- Bohleber, P., Roman, M., Barbante, C., Stenni, B., and Delmonte, B.: Towards an improved understanding of high-resolution impurity signals in deep Antarctic ice cores, EGU General Assembly 2020, Online, 4–8 May 2020, EGU2020-8537, https://doi.org/10.5194/egusphere-egu2020-8537, 2020

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