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Supplement of

New observations of the distribution, morphology and dissolution dynamics of cryogenic gypsum in the Arctic Ocean

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New observations of the distribution, morphology, and dissolution dynamics of cryogenic gypsum in the Arctic Ocean

Supplements:

Fig. S1: ROVnet mounted on the AWI-ROV, prior to deployment during PS 106. The gypsum collector was mounted to the portside bar of the frontal frame. The gypsum net was attached to the broom during deployment to facilitate handling. During sampling it was stretched out inside the ROVnet.

Fig. S2: Cryogenic gypsum crystals (total $>30\ \mu\text{m}$ size fraction) from ROV samples of station 32 at 0 m (A and B) and 5 m water depth (C). Blue arrow bar is $1000\ \mu\text{m}$, red arrow bar is $100\ \mu\text{m}$.

Fig. S3: Cryogenic gypsum crystals (total $>30\ \mu\text{m}$ size fraction) from ROV samples of station 45 at 0 m (A and B), 5 m (C) and 10 m (D) water depth. Blue arrow bar is $1000\ \mu\text{m}$, red arrow bar is $100\ \mu\text{m}$.

Fig. S4: Cryogenic gypsum crystals from ROV samples of station 66 at 0 m (A ($>63\ \mu\text{m}$) and B ($>30<63\ \mu\text{m}$)), 5 m (total $>30\ \mu\text{m}$ size fraction) (C) and 10 m (total $>30\ \mu\text{m}$ size fraction) (D) water depth. Blue arrow bar is $1000\ \mu\text{m}$, red arrow bar is $100\ \mu\text{m}$.

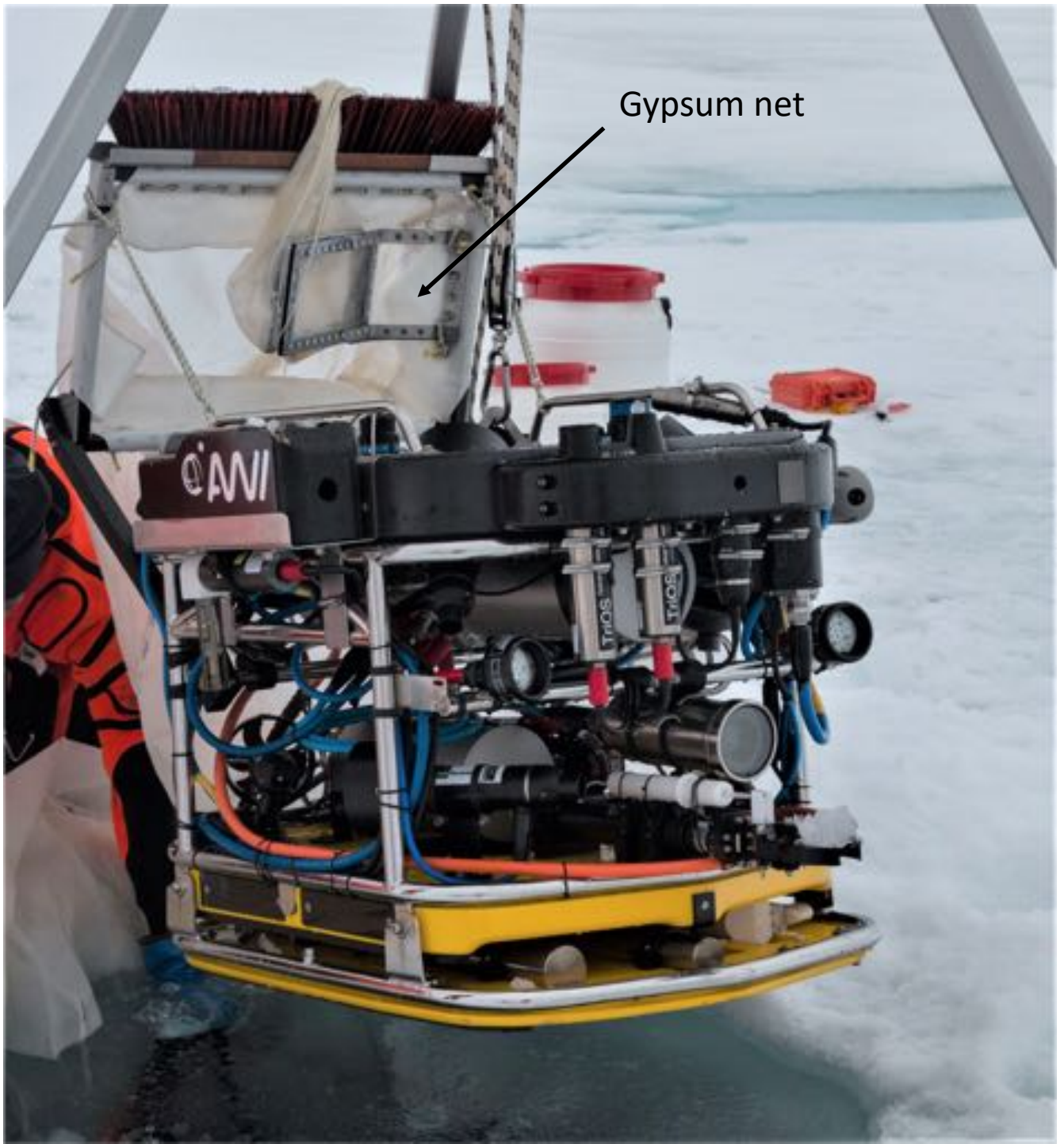
Fig. S5: Cryogenic gypsum crystals from ROV samples of station 80 at 10 m (A ($>63\ \mu\text{m}$) and B ($>30<63\ \mu\text{m}$)). C-F shows cryogenic gypsum crystals retrieved from the melted ice core sections of station 80. C ice core section 0-8 cm, D ice core section 11-22 cm, E ice core section 35-46 cm, F ice core section 46-57 cm. . Blue arrow bar is $1000\ \mu\text{m}$, green arrow bar is $500\ \mu\text{m}$, red arrow bar is $100\ \mu\text{m}$.

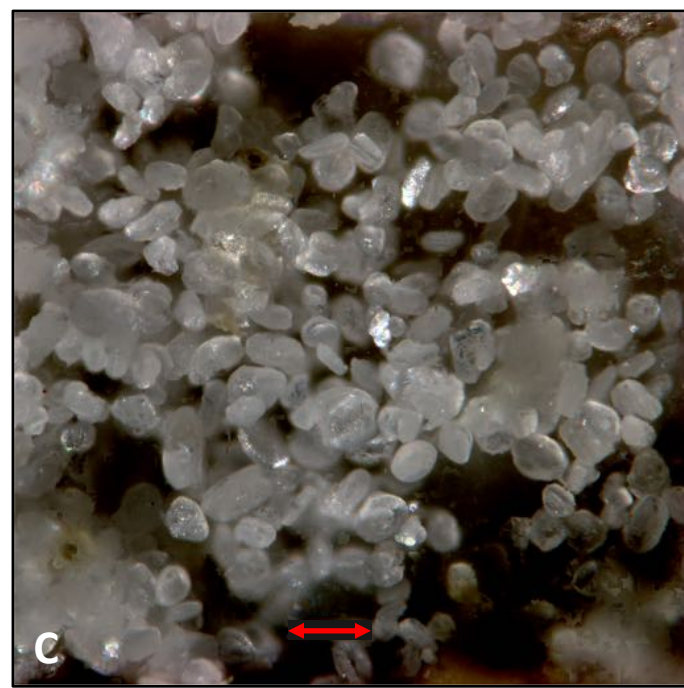
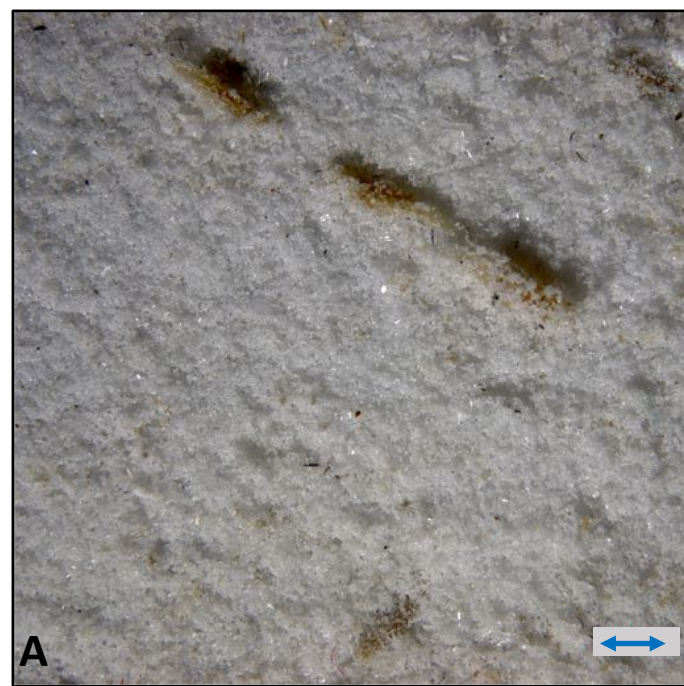
Fig. S6: Example photos of dissolution experiments from the water mass simulation trials of Polar Surface Water (A) and Atlantic Water (B). Crystals are shown before the experiment (A-1, B-1) and after the termination (A-2, B-2). Red arrow bar is $100\ \mu\text{m}$.

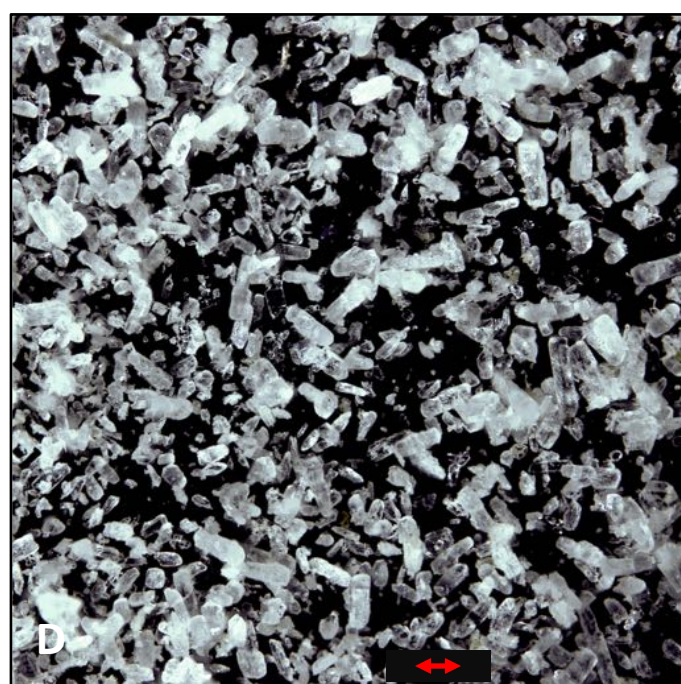
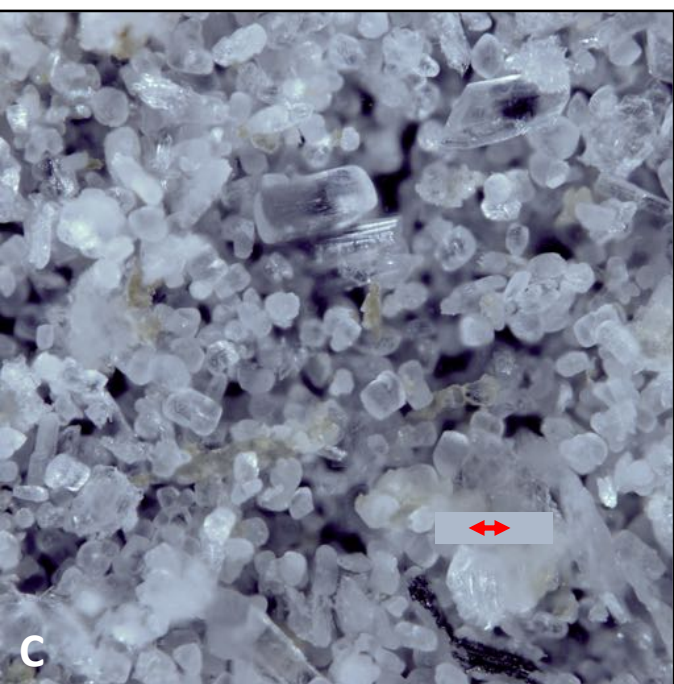
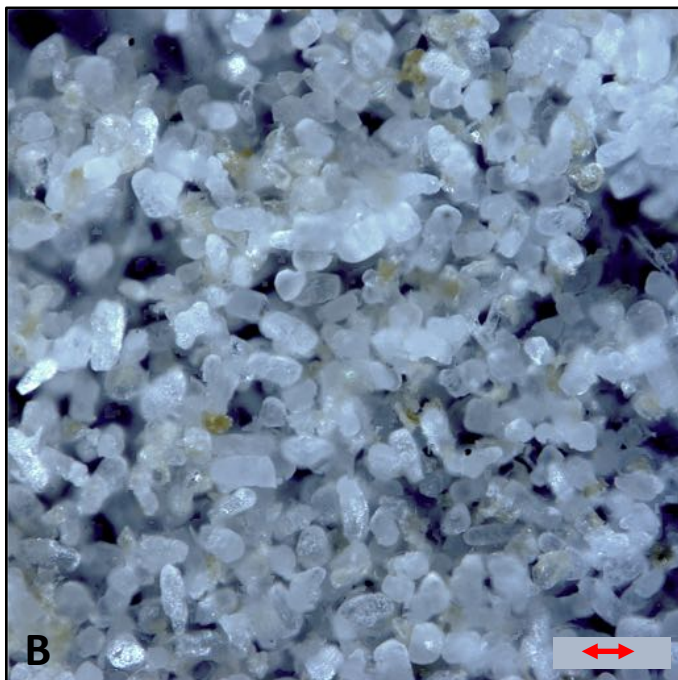
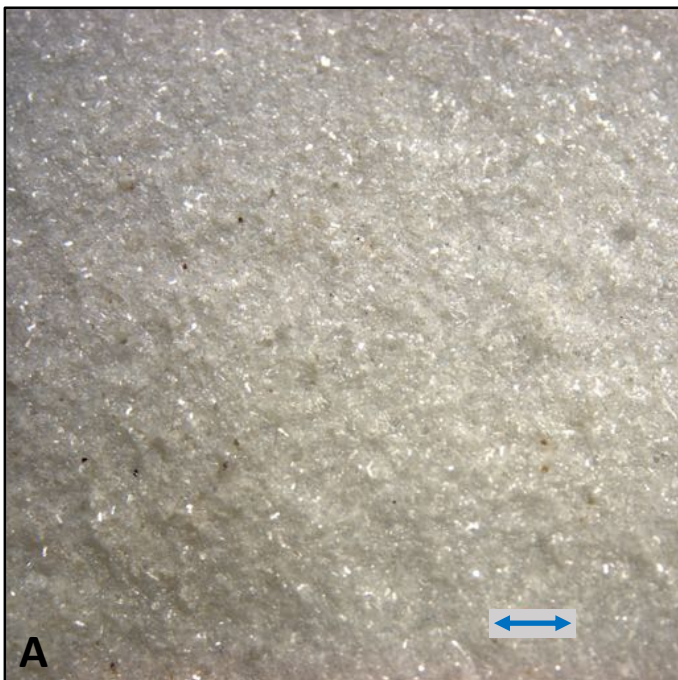
Fig. S7: Example photos of dissolution experiments from the deep-water mass simulation trial running at 150 bar) before the experiment (A-1, B-1, C-1) and after the termination (A-2, B-2). Red arrow bar is $100\ \mu\text{m}$.

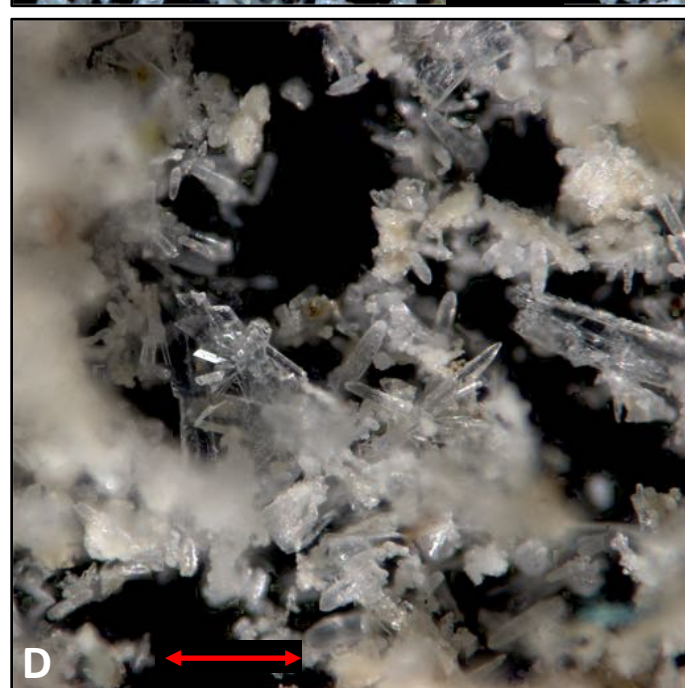
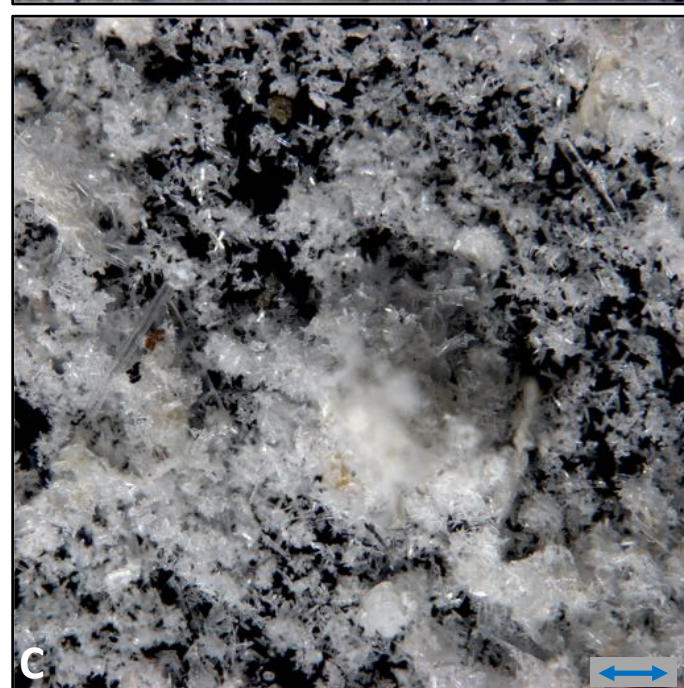
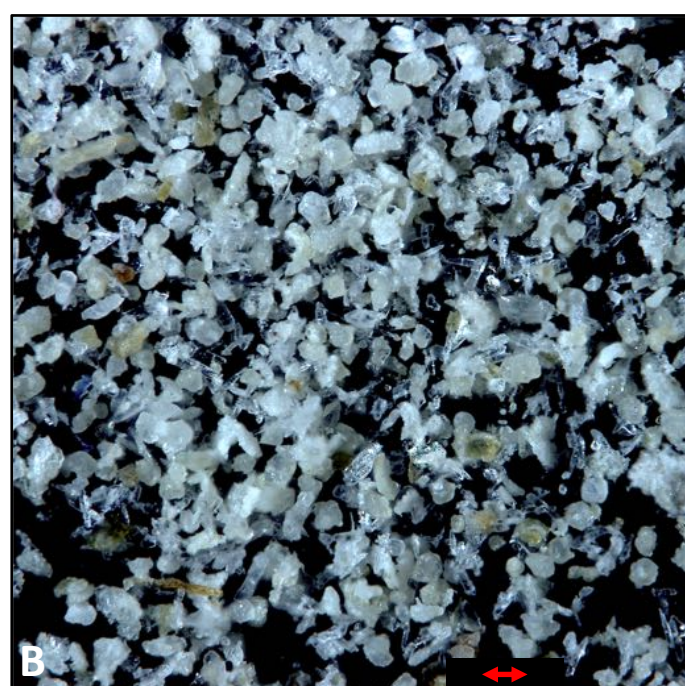
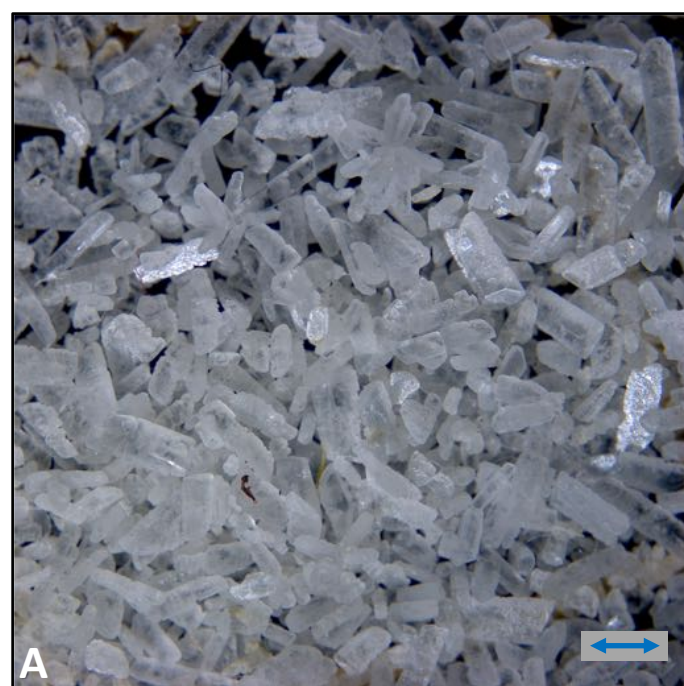
Fig. S8: Increasing surface roughness of cryogenic gypsum crystals with increasing crystal size and complexity, example SEM pictures of uncoated gypsum crystals. A-B) SEM pictures of gypsum crystals from station 45 collected at 10 m water depth. C-D) SEM pictures of a complex gypsum crystal from station 66 collected at 0 m water depth.

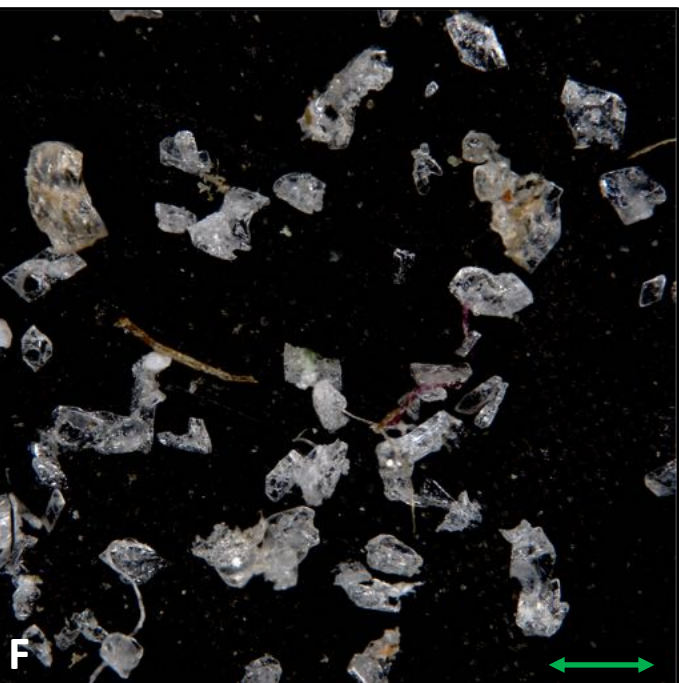
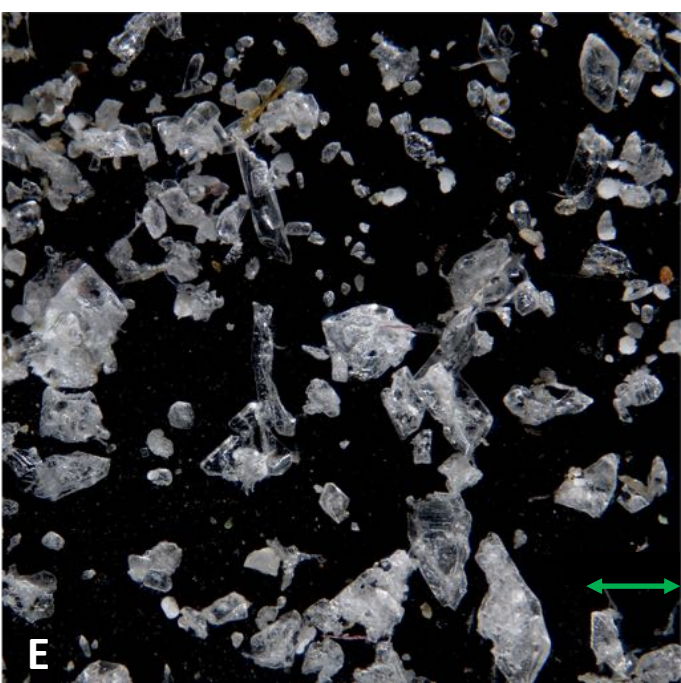
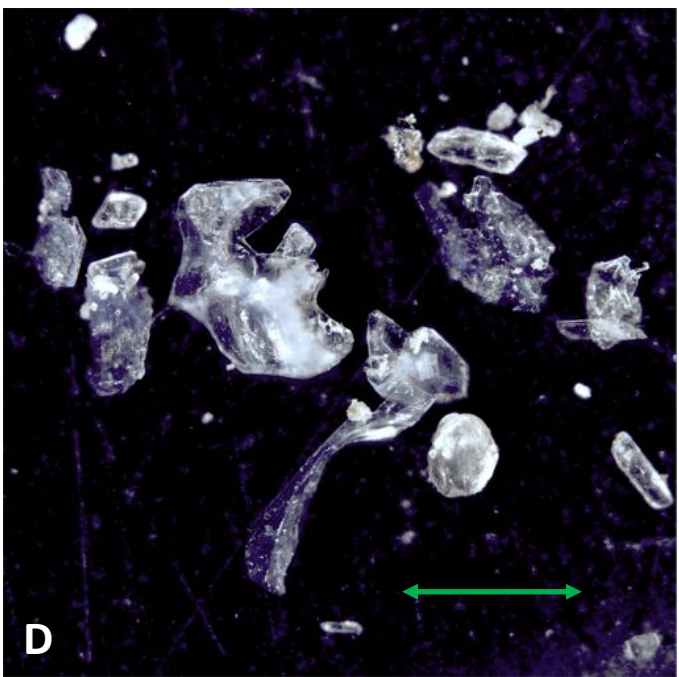
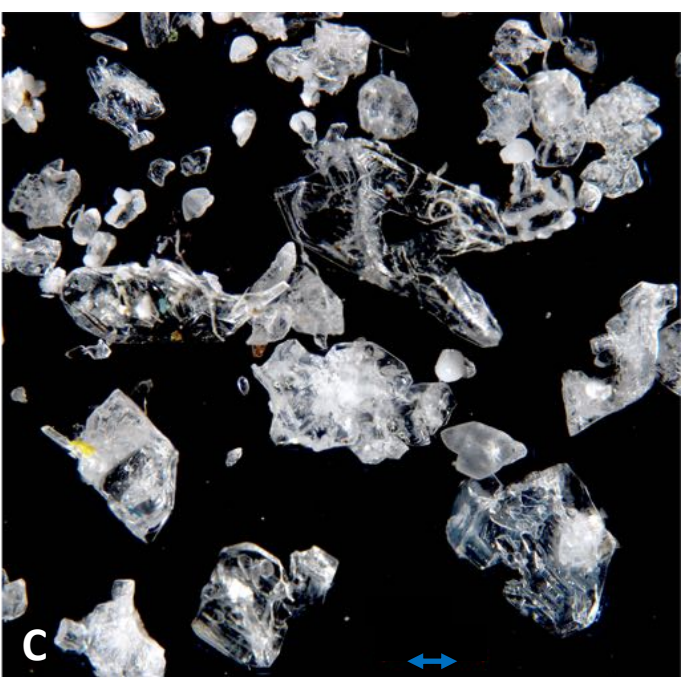
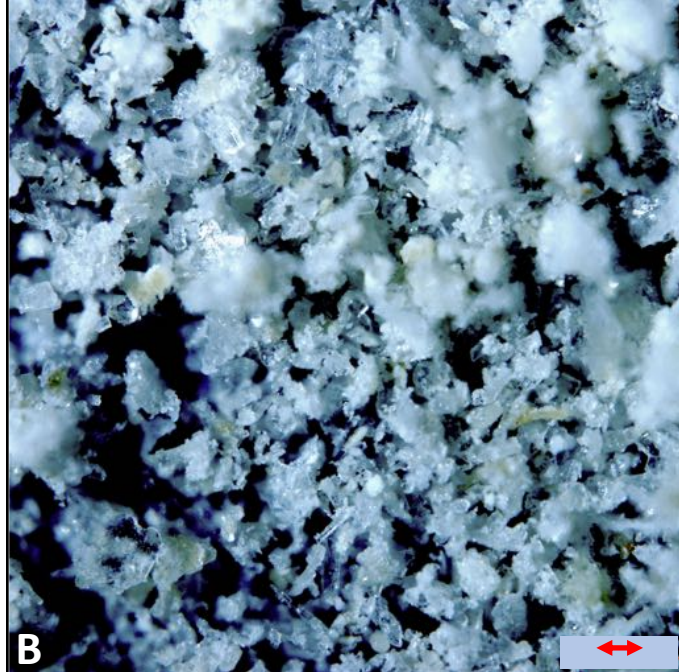
S9 Protocol for sampling cryogenic gypsum in the field. Fig. S9: A-C) Handmade net consisting of a translucent tube with 10 cm diameter that is conical at the end and a grey counter ring to fix a respective mesh between both items. D-E) Pictures of mesh transferred in a Falcon Tube with the adhering gypsum, the tube is filled with ethanol and closed until further treatment in the home laboratory.

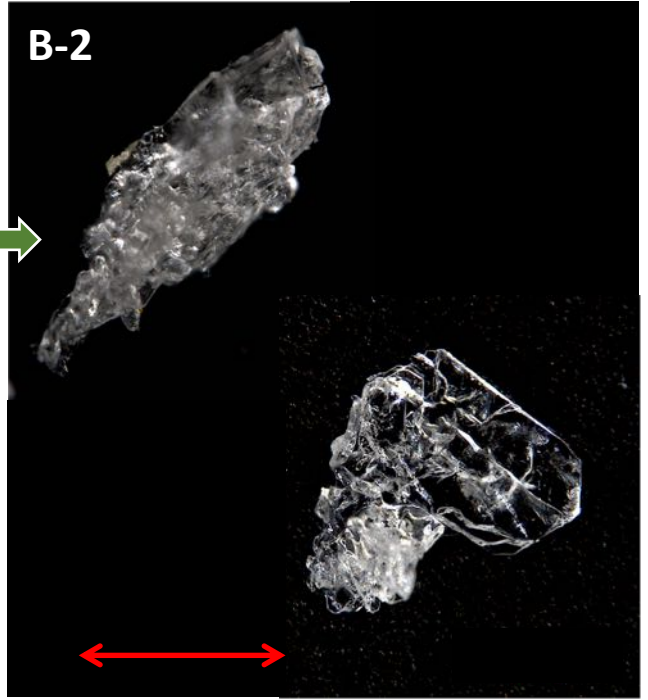
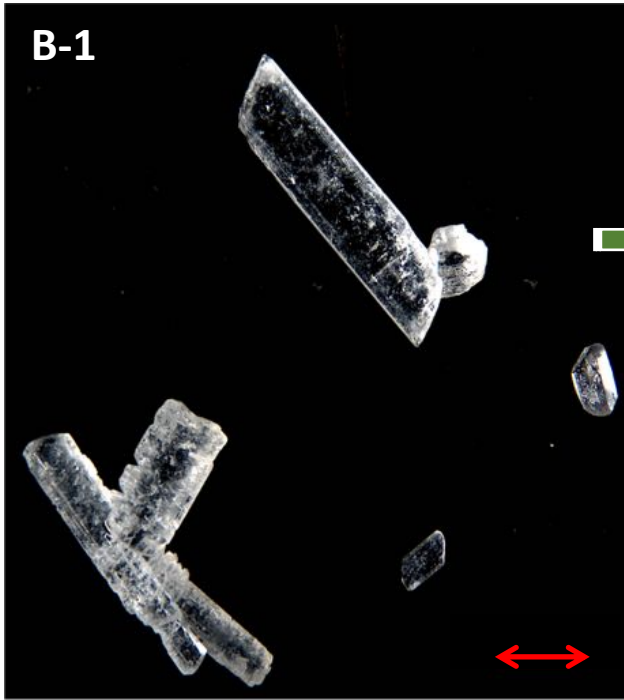
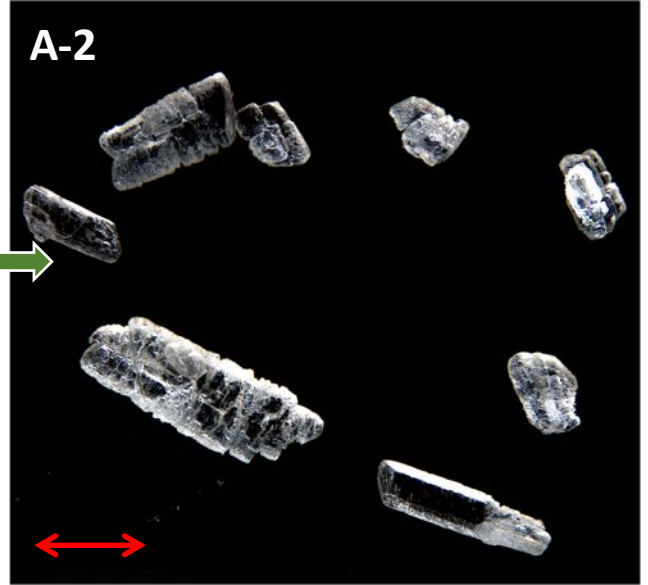
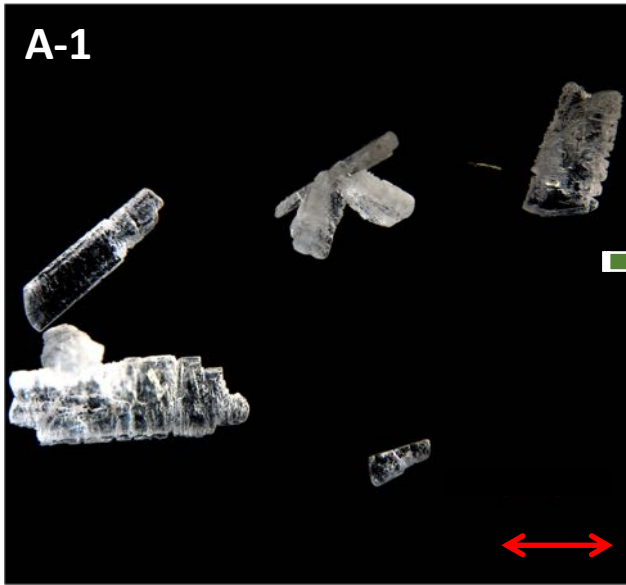


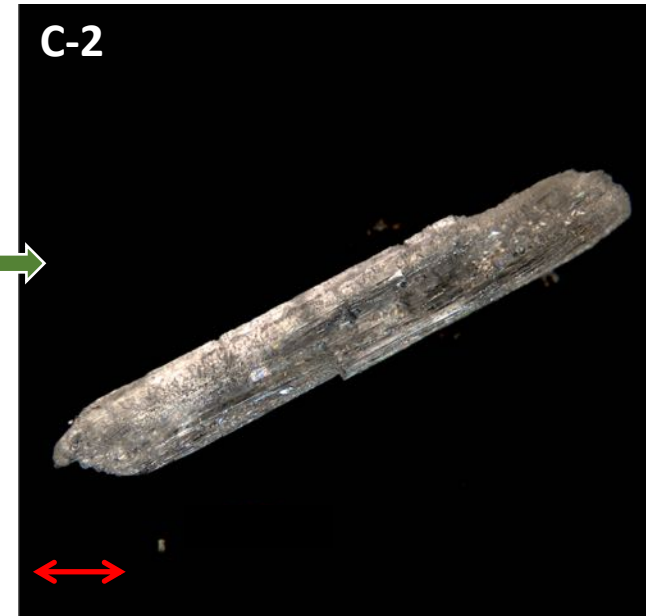
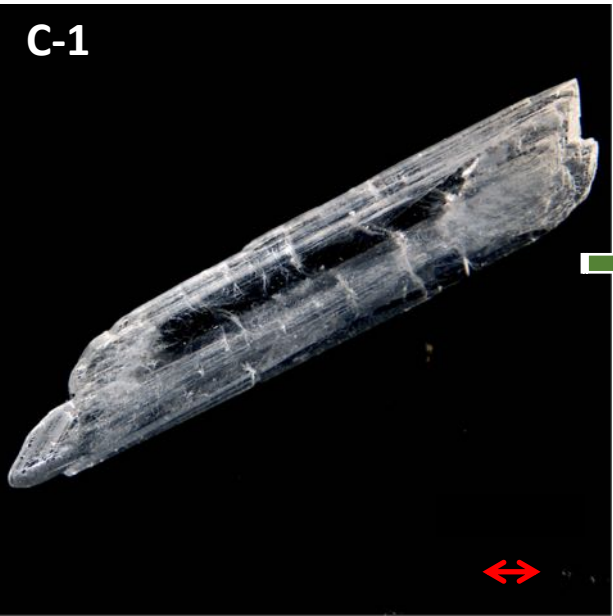
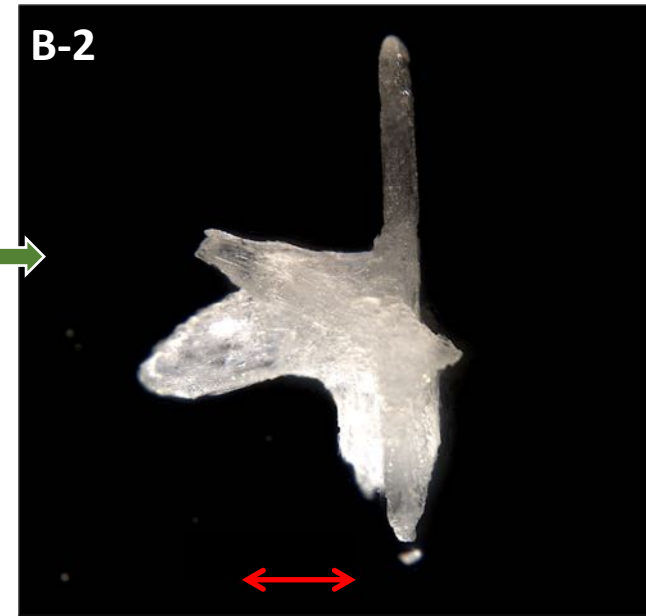
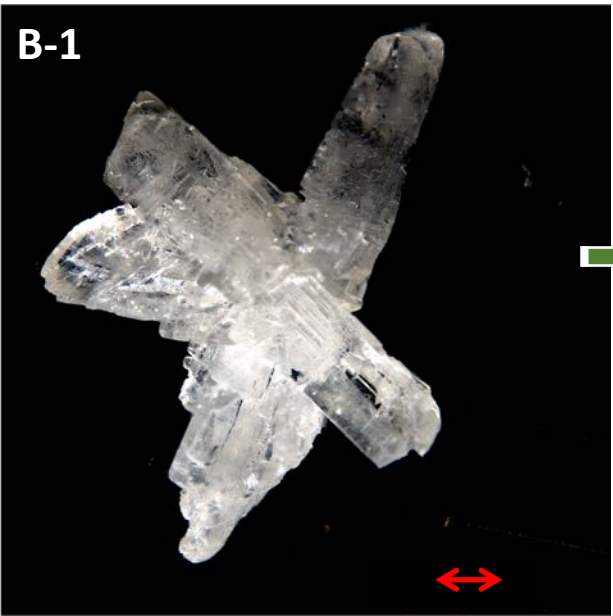
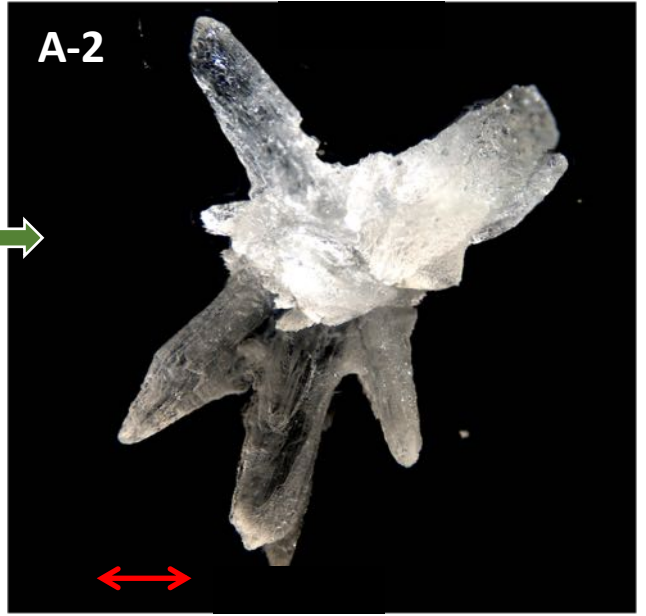
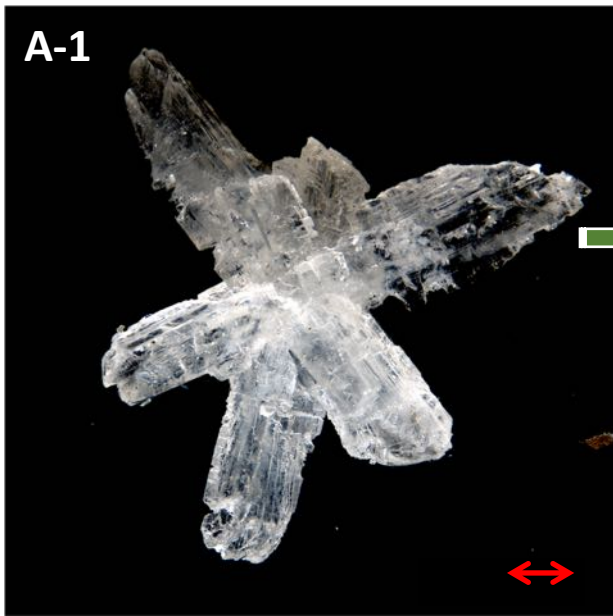


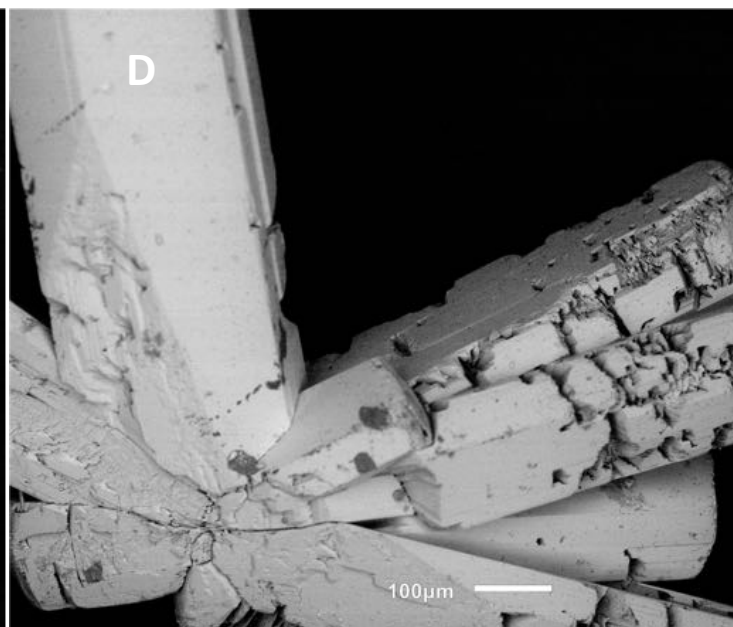
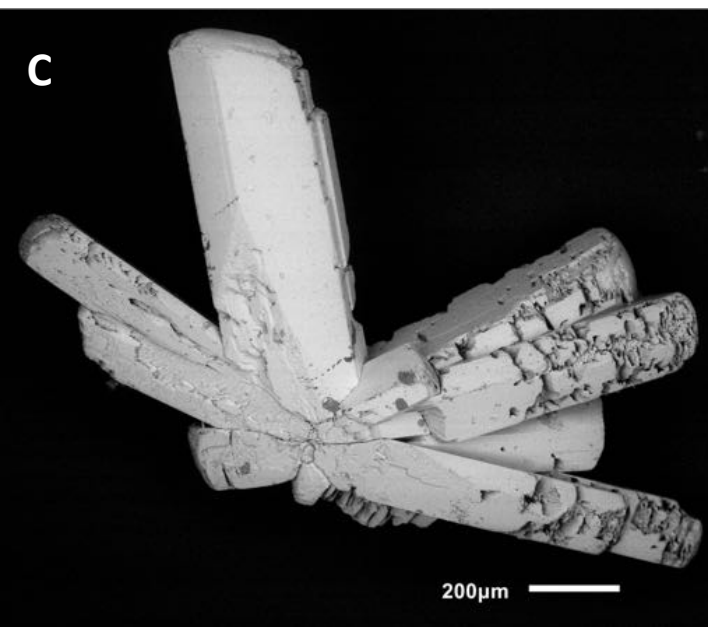
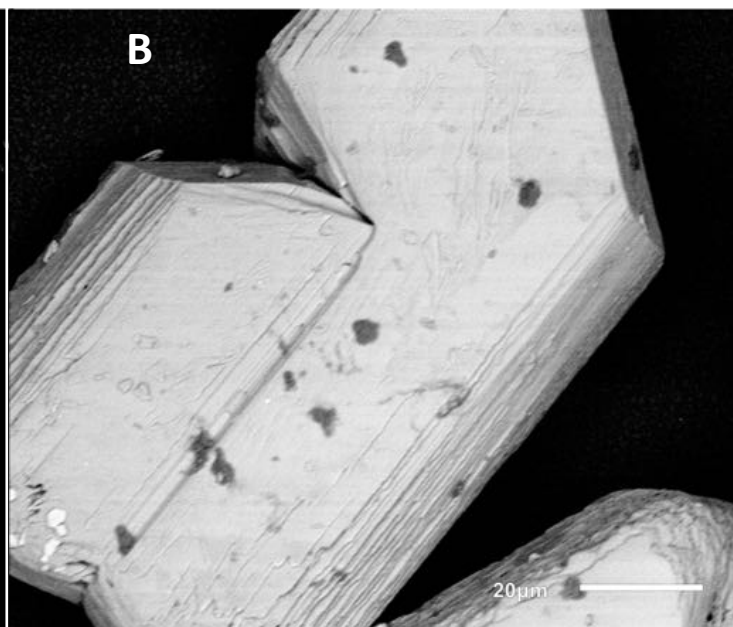
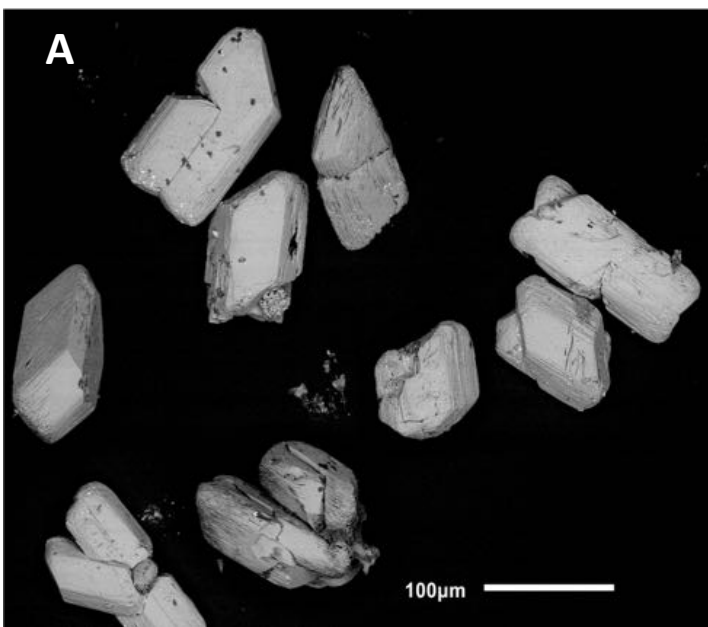


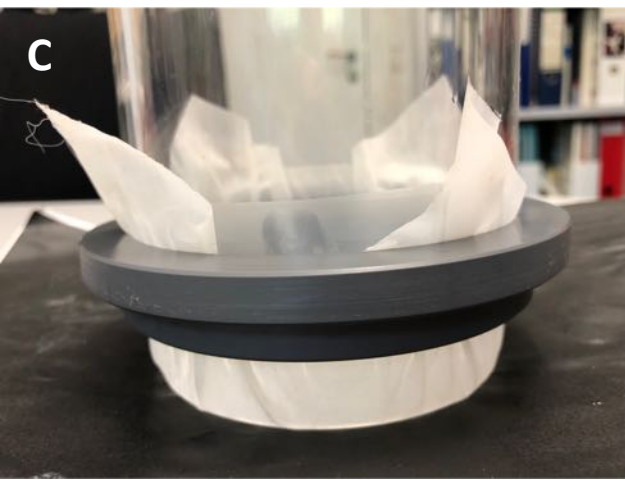
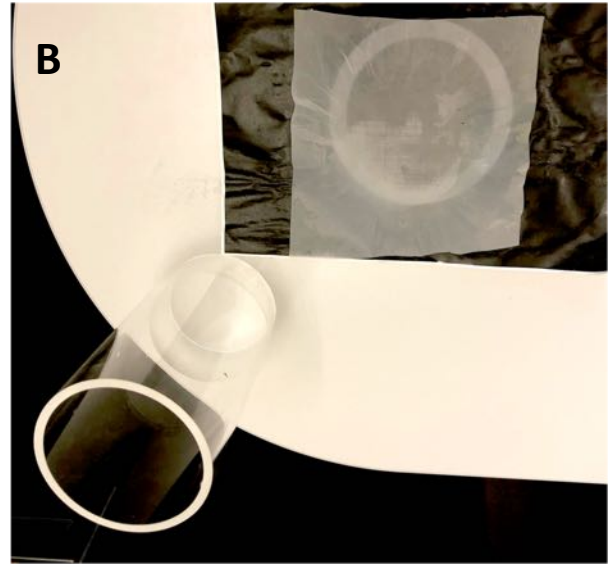












S9 Protocol for sampling cryogenic gypsum in the field

Water samples:

- Immediately after arrival, empty the sampling container (e.g. from the ROV net) over a handmade gauze sieve consisting of a clear tubus with a conical end, and a grey ring (inside conical) to fix a pre-cut 10 μm gauze to the tubus (Figs. S9A-C). In case of high particle density, use a 30 μm gauze to ensure quick drainage of the liquid. Washing with a hand-shower can help to rinse the sample, but should be very brief in order to minimize dissolution during sample treatment.
- Take off the ring of the handmade gauze sieve and carefully take the four corners of the gauze, fold the gauze and store this gauze with included particles in the Falcon tube.
- Fill this Falcon tube with 98% Ethanol before closing (Figs. S9C-E).
- Store the Falcon tube in a tube carrier in a cold room running not warmer than 4 °C until processing.

Ice-core samples:

- The ice-core is cut into 5 cm-thick slices.
- A measuring jug of 2 L is filled with 1 L of lukewarm, clean freshwater.
- Transfer one 5 cm-sample into the measuring jug and mark the volume increase with a stripe of tape.
- After two seconds, empty the sample-water mixture into your handmade gauze sieve (as described above, Fig. S9 A-C). Fill the jug immediately with lukewarm water again, add the remaining ice of this 5-cm slice and empty it again after 2 seconds into the sieve and continue to do so until the whole ice slice is melted.
- From this point onward proceed as described for the water samples. Repeat this procedure for each 5-cm slice of the ice core.

In the home laboratory

- The folded gauze is transferred into a dry Falcon Tube until the adhering ethanol has evaporated.
- After the gauze-adhering particles were carefully transferred into a micropaleontological tray, inspect the sieve's residue. As gypsum is white a large sheet of clean black paper at the place of sample operation helps to notice lost particles.