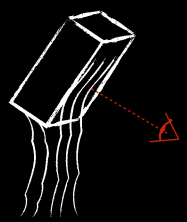
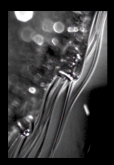
EROSION PATTERNS ON DISSOLVING/MELTING SURFACES

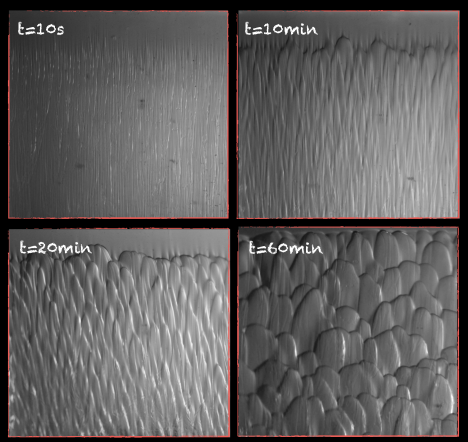
Caroline Cohen, Julien Derr, Michael Berhanu, Sylvain Courrech du Pont
Laboratoire MSC, Université Paris-Diderot, France

Patterns observed underneath a block of solid caramel dissolving in water. Black lines depict the sharp slopes of the pattern and thin filaments witness the downward flow of dissolved caramel. These patterns are 5mm-wide and 0.5mm-deep.

Lab experiment

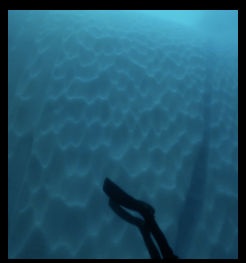


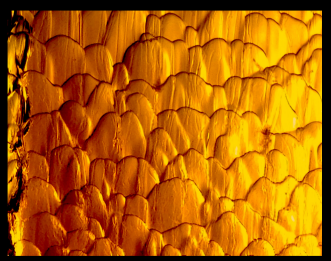




The dissolving caramel is denser than water. It results in a buoyancy-driven instability of the dissolution flow, a local variation of solute concentration in the vicinity of the surface, and finally a differential dissolution of the solid. The longitudinal stripes observed at short times (t=10s) interact with the flowing caramel and the patterns evolve: the stripes cross and form chevrons (t=10min). Then chevrons open, which leads to scallops (t=60min).

Scalloping icebergs





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Like in our lab experiments, patterns appear on icebergs underwater. They are typically 20cm-wide and 5cm-deep. In this case scallops always indicate the top. The fresh water due to the melting of iceberg is less dense than the sea saltwater. The flow upward induces variations of salt concentration or temperature which influences the melting of ice and shapes its surface.