

Lake Constance sediments recovered using novel piston coring system

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Objectives

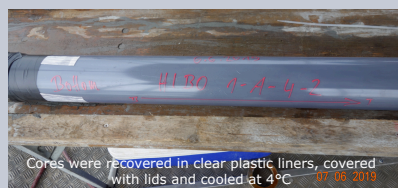
Key archives in environmental and past climate research are buried in soft sediment but investigations are often hampered by the lack of continuous, complete and undisturbed samples. We have developed the new core-drilling instrument Hipercorig to overcome these issues and we have tested this tool successfully on the perialpine Lakes Mondsee and Constance at up to 204 m water depths and down to 64 m core length.



Hipercorig modular barge and coring system on Lake Constance in July 2019.



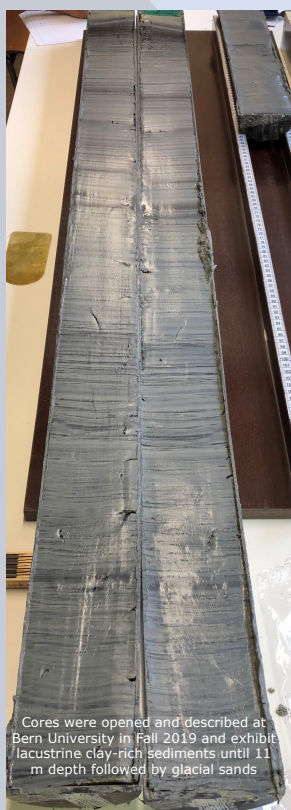
Hipercorig is a modular system stored and shipped in four 20ft containers including 2 support boats.



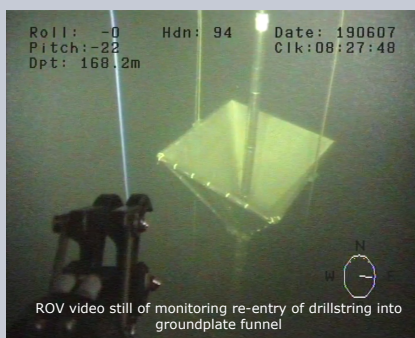
Cores were recovered in clear plastic liners, covered with lids and cooled at 4°C.



Coring assembly lowered through the pipe handler into the lake.



Cores were opened and described at Bern University in Fall 2019 and exhibit lacustrine clay-rich sediments until 11 m depth followed by glacial sands.



ROV video still of monitoring re-entry of drillstring into groundplate funnel.

Hipercorig design

Hipercorig comprises a hydraulically hammered down-the-hole piston coring system capable to reach up to 100 m core length in up to 200 m water depths. The well-proven piston system ensures high-quality intact cores while the hydraulic hammer drive allows penetrating hard-layers such as sand, gravel or tephra. The piston-hammer system, casing string and ground plate is connected via Kevlar ropes to a coring rig and deployment is controlled via underwater cameras. For lake, estuarine and shallow marine projects buoyance and working space is provided through a barge with four anchors and winches. The complete system is consisting of modular elements to be shipped in four 20-foot-containers including two boats and outboard motors. Hipercorig allows for about 10 m rate of penetration per shift and produces 7.5 cm cores in 2 m long core runs.

Coring Lake Constance

A first deployment on Lake Mondsee to initially test and modify Hipercorig recovered 64 m sediment core from glacial tills. A follow on shake-down cruise on Lake Constance served as deep-water trial and to sample so far unearthened pre-Holocene strata below about 12 m sediment depth. Coring was performed in summer 2019 in 204 m water depth, 2 km SSW of Hagnau, Germany. The site is located close to the deepest part of this basin with best possible preservation of a continuous and undisturbed depositional record. Two sediment cores of 24 and 20.5 mblf were retrieved and complemented by three 2-m-long surface cores. The uppermost 11 m of sediments consist of Holocene lacustrine clays with increasing intercalations of silt, while late Quaternary glacial sands dominate below 11 m. The piston coring device was modified to allow for penetrating these rigid sand layers, but the sands slowed down core recovery and caused core loss of ~15 cm at the end of each core run but overlapping coring was used to compensate the loss. While samples for microbiology have been taken immediately, core opening, description, and sampling was performed at Bern University, Switzerland, in October 2019.

Utilizing Hipercorig

Currently Hipercorig received final upgrades for safety and flexibility so that the whole system is available from spring 2020 on for scientific coring projects on a non-for-profit base to teams with funded research projects. They will have to raise transport and operations costs as well as a maintenance fee that will serve to sustain the tool. The German Scientific Earth Probing Consortium GESEP will provide an oversight board to prioritize projects and support projects in implementation.

Acknowledgement

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