Rhizon - an excellent pore water sampler for low maintenance collection and filtration of small volume samples

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Introduction

Rhizon soil moisture samplers were originally designed as micro-tensiometers for soil science for seepage water sampling in the unsaturated zone some ten years ago (Meijboom and Van Noordwijk 1991).

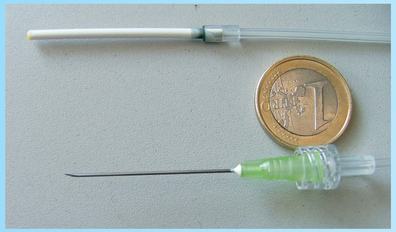

Fig. 1: **Rhizon Core Solution Sampler**, 50mm length, 2.5mm diameter (Rhizosphere Research Products, Wageningen NL). The hydrophilic microporous tube (white) is supported by a nylon wire. The sampler is connected to Tygon tubing.

We have introduced these samplers for the use in marine sediments and in saturated groundwater environments for direct pore water sampling.

Fig. 2: **Rhizon pore water sampling in marine sediment cores,** to our knowledge the first attempt to collect pore water samples from marine sediments using rhizon soil moisture samplers..

Material and Methods

Rhizons consist of a small microporous polymer tube (2.5mm diameter) supported by a stabilizing wire that is connected to a PVC-tube and a standard luer-lock connector.

The pore width of the tube is 0.15 micron. The stabilizing wire may be stainless steel, Nylon, PEEK, titanium or carbon fibre, depending on analytical needs.

By attaching vacuum to the luer connector by either a syringe, a vacuumtube or a peristaltic pump, small volumes of pore water samples may be extracted from sediments without further maintenance. As a side effect of the 0.15 micron pore width of the polymer tube, the samples are automatically filtered.

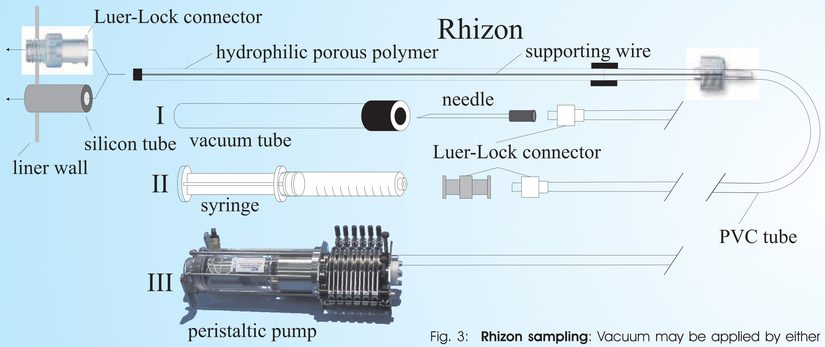

Fig. 3: **Rhizon sampling**: Vacuum may be applied by either **I** a needle inserted into a blank vacutube, **II** a syringe with the plunger kept open by a spacer or **III** by a peristaltic pump. The peristaltic pump shown (KC Denmark deep sea peristaltic pump) is suitable for underwater use.

Fig. 4: **Rhizon CSS,** connected to a needle and inserted through the rubber stopper of a plain vacutube. This is the most basic setup for unattended collection of filtered pore water samples from sediments.

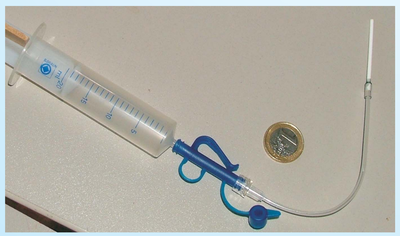

Fig. 5: **Rhizon Core Solution Sampler** connected to a 20 mL disposable syringe. Vacuum is simply applied by pulling the plunger and keeping it in place with a spacer.

Applications

We successfully used these samplers for high resolution sampling from closed sediment cores. The Rhizons were inserted through 3mm holes in the liner walls. By this method very high resolution pore water profile samples may be taken without disturbance of the sediment structure. Since samples are collected in directly attached syringes or vacuumtubes, contact with ambient oxygen is avoided for anoxic environments, thus eliminating both, the need for glove box sampling and eliminating the need for cumbersome pressure filtration.

Fig. 6: **Manual semi In situ sampling**. A liner driven is into wadden sediments then one wall is cleared and rhizon samplers are pushed through predrilled holes in the wall. Sampling by disposable syringes with spacer. Despite all the "dirt" on the picture the samples are clean and 0.15micron filtrated

Fig. 7: **Pore water sampling from a core liner** using Rhizon samplers attached to a needle and blank vacutubes. For special purposes also preloaded vacutubes may be used

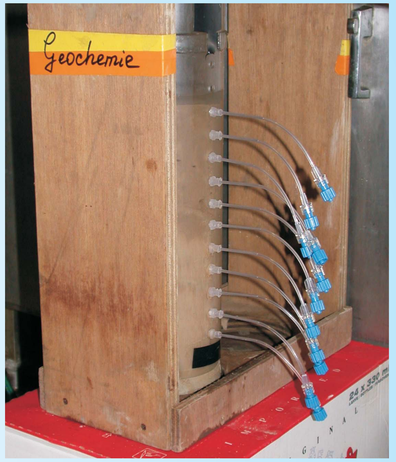

Fig. 8: **Porewater sampling from MUCs.** Multicorer liner tube on a Polarstern Cruise with rhizons installed through predrilled holes in the liner wall. Sampler connectors are sealed by blue caps until syringes are attached. Vertical distance of sampling points is 2 cm.

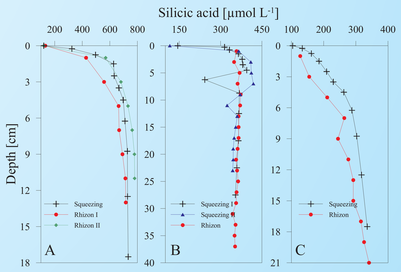

Fig. 9: **Comparison between rhizon sampling and conventional squeezing.** Porewater concentrations of silicic acid in the MUC tube above measured from both rhizon sampling and conventional sampling by pressure filtration of the sediments.

Discussion

Advantages

Rhizon pore water samplers are small, easy to use with minimum handling and maintenance effort.
Samples are filtered upon collection.
Many samples may be collected simultaneously.
High resolution sampling is easy.
When sampling in situ or sampling from closed cores no glove box setup is necessary to maintain anoxic conditions.
Low sampling speed and low sampling volume may be compensated by multiple samplers per depth and by simultaneous sampling

Disadvantages

Low flow rates, low sample volume per time (some 10 mL per hour). Rhizons are clearly the wrong samplers when large sample volumes are needed.
Possible sorption losses on tubing.
Possible temperature change upon sampling.
Tiny fragile devices not suitable for rough use.

Outlook

Recently other Rhizon models with carbon fibre support that allow pushing in of longer filter lengths (20cm) without external support have been presented by the manufacturer Frits Meijboom (Rhizosphere Research Products, Wageningen, NL). A micro-version of the micro tensiometer is also available in the meantime with a tube diameter of 1mm such that even smaller sampling intervals are possible. Rhizon related news are found on our labmethods pages:
Http://www.geochemie.uni-bremen.de/koelling/rhizon.html

References

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