Draft comments by S. D'Hondt (Chief Scientist) on

piston-coring effort of Knorr expedition 195(3), Jan-Feb 2009,

Highlights of first scientific coring attempts with the long piston-coring system

1. All scientific objectives of the expedition were met, through a combination of long cores (piston and gravity), short gravity cores, and very short multicores. See figure below for an example of how the piston-coring capability enabled this success.

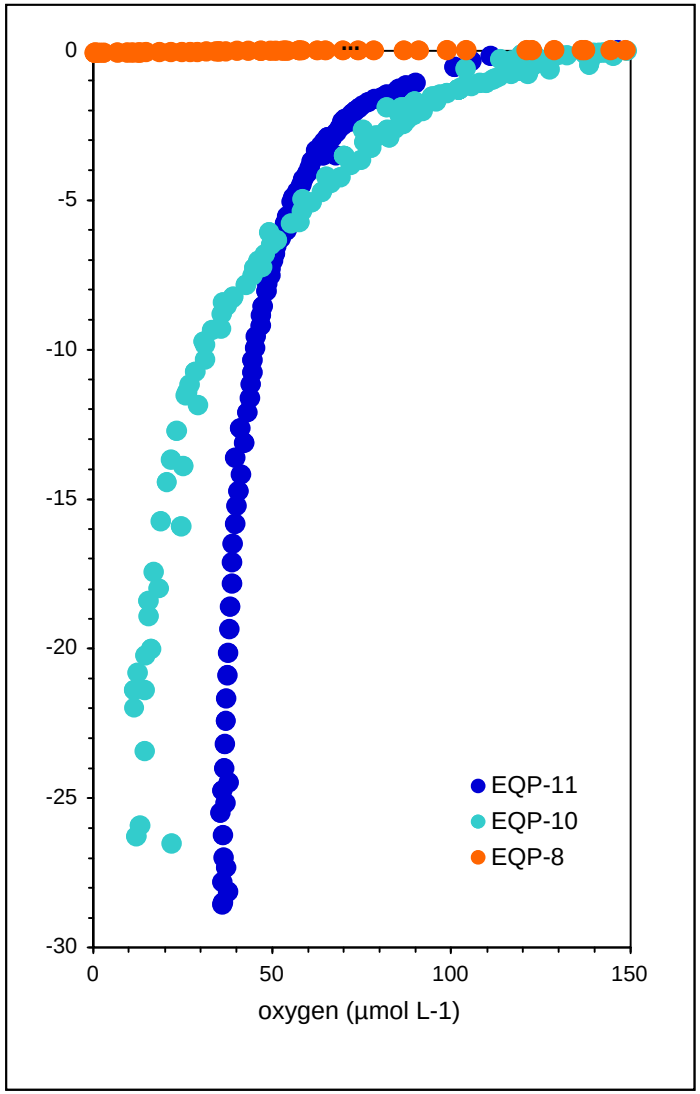

Figure caption. The long piston coring capability enabled us to identify the deepest penetration of oxygen ever observed in marine sediment. This in turn, allowed us to determine that rates of O_2 reduction per unit volume varied by eight orders of magnitude from site to site, in concert with seasurface productivity and organic flux to the seafloor.

2. In the process, one or two long piston cores were recovered at 8 of 11 sites. The longest of these was 41 m.

3. The long-coring system was successfully used as a long gravity corer (at sites 3 and 4). Cores with lengths of 18 m and 21 m were recovered in this manner.

4. Individual members of the coring team consistently worked very hard throughout the expedition.

Failures of first scientific coring attempts with the piston-coring system

1. Failure of one or more piston-coring attempts at 5 of 11 sites (1, 2, 9, 10, 11).
   - In most cases, this was because the piston corer's electronic release mechanism did not work.
   - In two cases (sites 1 and 2), it was because the trigger system failed.
   - In one case (site 11), it was because the drum used for the coring rope failed.

Consequences:

- At two sites (2 and 9), no piston cores were recovered; at one site (3), none was attempted; and at two other sites (1 and 11), only one piston core was recovered from two attempts.
- At site 2, the entire coring system below the `dog dish' (core-top acoustic and electronic system) was lost at the seasurface.
- At site 11, 3800 m of line required simultaneous direct handling by most of the coring group, science party and ship's crew to maintain tension (without which, the winch would not operate), pass to the bow (the only open deck), and coil on the deck.

Failures of first scientific coring attempts with the piston-coring system

2. No sediment was recovered from our long gravity coring attempt at site 9, presumably due to loss during transit through the watercolumn. This probably could have been avoided if a one-way valve was placed at the corer top. To avoid this problem, such valves are routinely used in other gravity coring operations. A valve was built toward the end of the expedition, after the three long gravity coring attempts had taken place.

Core quality issues with new piston-coring system

All of the problems described below occurred at multiple sites and they often occurred at the same sites.

1. Disruption of the upper several meters of core occurred in at least 5 of 13 long piston cores, due to `blow-ins' of the core liner at liner joints. The blow-ins result in water jetting into the core through the liner wall. This problem precludes all studies of the upper sediment column in these cores and greatly complicates attempts to correlate the piston cores to each other and to co-located gravity cores (which are usually shorter than the interval of disturbed sediment). This problem is routinely minimized with other piston coring systems. It might be better avoided with stronger core liner. During the expedition, blow-ins were eventually minimized by gluing and taping all liner joints, appropriately orienting the direction of the joints, and offsetting the liner joints from the pipe joints. These actions must become standard practices; when the coring group reverted to not gluing and taping the joints at site 10 (after doing so at site 8), the problem returned. See image from site 10; the blow-in occurred at the joint between section 3 and section 4.

Core quality issues with new piston-coring system

2. The uppermost one to more than two meters of the upper sediment column were not recovered in individual long piston cores at multiple sites. This problem precludes all studies of the upper sediment column in these cores and greatly complicates attempts to correlate the piston cores to each other and to gravity cores (which are often shorter than the interval of missing sediment). Failure to recover the uppermost meter or more of sediment is typically due to the corer being triggered below the seafloor. At two sites, it was at least partly due to the piston being suspended eight feet farther below the control assembly (dog dish) than intended (the piston was suspended on a line that was 138 feet, but believed to be 130 feet). At other sites, it was presumably due to the entire system being lower relative to the seafloor than intended.

Core quality issues with new piston-coring system

3. Up to five sections (several meters) of the upper core were disturbed in multiple long piston cores, due to sediment flow as the cores were brought from vertical to horizontal and the cores were removed from the pipe. See image below from site 8. This problem precludes all studies of the upper sediment column in these cores and it also greatly complicates attempts to correlate the piston cores to each other and to co-located gravity cores (which were typically no longer than the interval of disturbance in the piston cores). It is typically minimized with other coring systems by blocking the sediment from flow, e.g., by leaving the piston in place throughout the operation or by placing a sediment `stop' in the core liner at the sediment/water interface prior to bringing the core horizontal.