PROCEDURES TO PREVENT THE OCCURRENCE OF POTENTIALLY DANGEROUS SITUATIONS DURING THE OPERATION OF THE MACKERETH 1-METRE MINI OR SHORT SEDIMENT CORER

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Introduction

During the 1950s and 1960s, F. J. H. Mackereth developed and published the plans for a series of pneumatic samplers for lake sediments (Mackereth 1958, 1969). Since then these corers have been used very successfully by large numbers of researchers in many institutions. Unfortunately, as the equipment was continually evolving during ensuing research, no user manuals, beyond the original publication, have been published since John Mackereth's untimely

death in 1972. Nevertheless, this situation has been satisfactory and the corers have been operated perfectly safely due to the accumulated knowledge of the users, who were trained directly by John Mackereth himself or by members of his staff with great experience of the equipment. However, over the last few years a significant number of these well-trained research workers have retired. Whether by coincidence or as a result of these retirements, a few potentially very serious accidents have occurred recently with the 1-metre corer (the mini or short corer), which have stimulated us to carry out a risk assessment. This highlighted two weaknesses in the design and its later developments. They can be corrected simply by checking for screw threads that may have been added to the exhaust port on the mini-corer, and by changing the operating procedure, thus allowing the corer to be operated safely by a new generation of users.

Check for screw threads on the exhaust port

In the original publication for the short corer (Mackereth 1969), the outlet from the stainless steel tube (item 17 in Fig. 1 of Mackereth's diagram), which holds the fixed piston in place and releases air trapped in front of the moving piston holding the core tube, is simply open to the water. However, it has come to our attention that a number of corers have been built which have a screw thread on this exhaust port. This confusion has arisen because of similarities between the 1-m and the 6-m (long) Mackereth corer (Mackereth 1958). On the latter, air can be applied to a central screw connector in order to retract the core tube from the sediment when the corer has become stuck. In many cases, the thread on this connector is the same size as that on the air line. Hence, the latter can be connected to the inner tube in error. But the long corer has additional features incorporated into it which allow the air to escape when the core tube is fully retracted. Because this particular procedure is unnecessary with the short corer it does not incorporate the extra features and there is nowhere for the air to escape. As a result the pressure is maintained in the corer when it is hauled to the surface, creating dangerously high pressures which can cause the system to explode. This potential danger can be avoided completely as follows.

Check the corer to see if the screw connector on the airline fits not only the outer connector on top of the main cylinder but also the inner one. If the answer is NO, there is no problem and the corer can continue to be used safely. If the answer is YES, we recommend that an engineer removes the threads from the central connector so that the air line cannot be connected. **Do not seal or remove this vent.** It is integral to the operation of the corer and allows air below the piston to escape when pushing the core tube into the sediment.

Additional safety step in the procedure for raising the mini-corer

The risk assessment also identified a second, rare but potentially dangerous occurrence. If the corer fails to extend fully there is no pathway for the air to escape from the main cylinder. Since, for every 10 m reduction in the depth of the corer, the pressure inside increases by a factor of two, a potentially dangerous situation could occur when the corer is raised through the water column. This potential danger can be eliminated by incorporating the following extra step in procedure when raising the corer from the sediment.

Raise the corer slowly from the sediment. When the top of the corer is about one metre below the water surface, reconnect the airline quick release coupling (the air bottle will already be turned off at this stage because it was disconnected from the air line in order to raise the corer) and **check the pressure in the main barrel** of the corer using the line gauge at the needle valve. If the reading is NOT ZERO, any excess air pressure must be released. This can be achieved by disconnecting the air bottle from the air line and inserting, into the quick release connector, a spare male coupling, to which about 15 cm of tubing is attached. This tubing should be open to the atmosphere at the other end, allowing the air to escape. **Under no circumstances should any part of the corer be lifted clear of the water until the air pressure in the main cylinder has fallen to zero.**

Final comments and a new user-manual

If, as outlined above, the barrel exhaust is checked carefully and threads are removed from the central connector, if necessary (to prevent inadvertently connecting the air line), and if the additional safety step is incorporated into the core-lifting procedure, the mini or short corer then can be used safely to collect undisturbed sediment cores with a clear sediment-water interface.

An A4 nine-page user manual, fully illustrated (Allen, Hodgson et al. 1998), is now available from the authors. A small charge (£10 in 1998) will be made to cover handling costs and postage.

References

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