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Sampling in waterlogged sands with a simple hand-operated corer

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Introduction

Sampling for luminescence dating requires the collection of uncontaminated sediments that have not been exposed to light during sampling. Exposures enable very easy sampling, but unfortunately they are sparse in most environments. In lowland areas the groundwater table is often relatively close to the surface, which makes man-made exposures fill with water rapidly. Drainage is extremely costly, and therefore normally not feasible for scientific purposes. In the absence of exposures, samples have to be taken using some sort of coring device. However, most suitable devices available are mechanical and consequently heavy, which makes drilling problematic both because of the costs involved and the logistic requirements. Hand-operated coring devices offer major advantages over mechanical drilling in both aspects. In this paper we describe the Van der Staay suction corer, which is a simple hand-operated coring device. The corer is suitable for taking samples from waterlogged sands to a depth of some 10 meters without contamination or light exposure.

The corer

The Van der Staay suction-corer was developed at the Geological Survey of the Netherlands in the early 1970's. Van de Meene *et al.* (1979) provided a detailed description of the equipment and its use. That publication is however difficult to obtain, therefore we will briefly discuss the construction and working of the Van der Staay suction-corer. People interested in the original publication should feel free to contact us in order to receive a copy of that paper. The basic parts of the corer are outlined in figure 1. The corer consists of two PVC tubes, of which the outer tube normally has a diameter of 35mm. The outer tube works both as casing as well as a corer. The inner tube fits into the outer tube and is fitted with a leather cup on its lower end. The leather cup allows the user to suck a vacuum facilitating the penetration of the outer tube into the sand (fig. 1). The corer only works in waterlogged sandy deposits, since otherwise no vacuum can be created. After coring, both tubes are extracted from the hole together, and in standard use the sampled material is squeezed out of the tube to allow examination.

Prior to using the Van der Staay suction-corer, a hole has to be drilled penetrating the non-saturated layer at the surface using a simple hand auger (fig. 1A). Van der Staay suction-corers of different lengths (2.5 and 5 metres) are used for coring to different depths in water saturated sand. Extension tubes of two and a halve metres or five metres in length enable routine coring to depths of some ten metres. However, even depths up to 30 metres have been reached according to Van de Meene *et al.* (1979). An extension tube is tightly fitted into a widened bottom end of the main corer and can be connected and disconnected manually. For holes penetrating more than 3 meters of waterlogged sand, the hole is normally drilled in several steps of a few metres each using the corers of different lengths and if necessary an extension tube. After every step the entire corer is extracted from the hole, which results in collapse of the hole. Experience has however learned that the tubes can be quite easily pushed back to the depth reached during the prior step. Ideally the corer is pushed back to this depth while the inner tube is attached to the outer tube, so that no material from this course is sampled. The corer is relatively easy and cheap to construct, and also easy to transport and operate. Two to three people are needed to handle the corer. The corer has been widely used in The

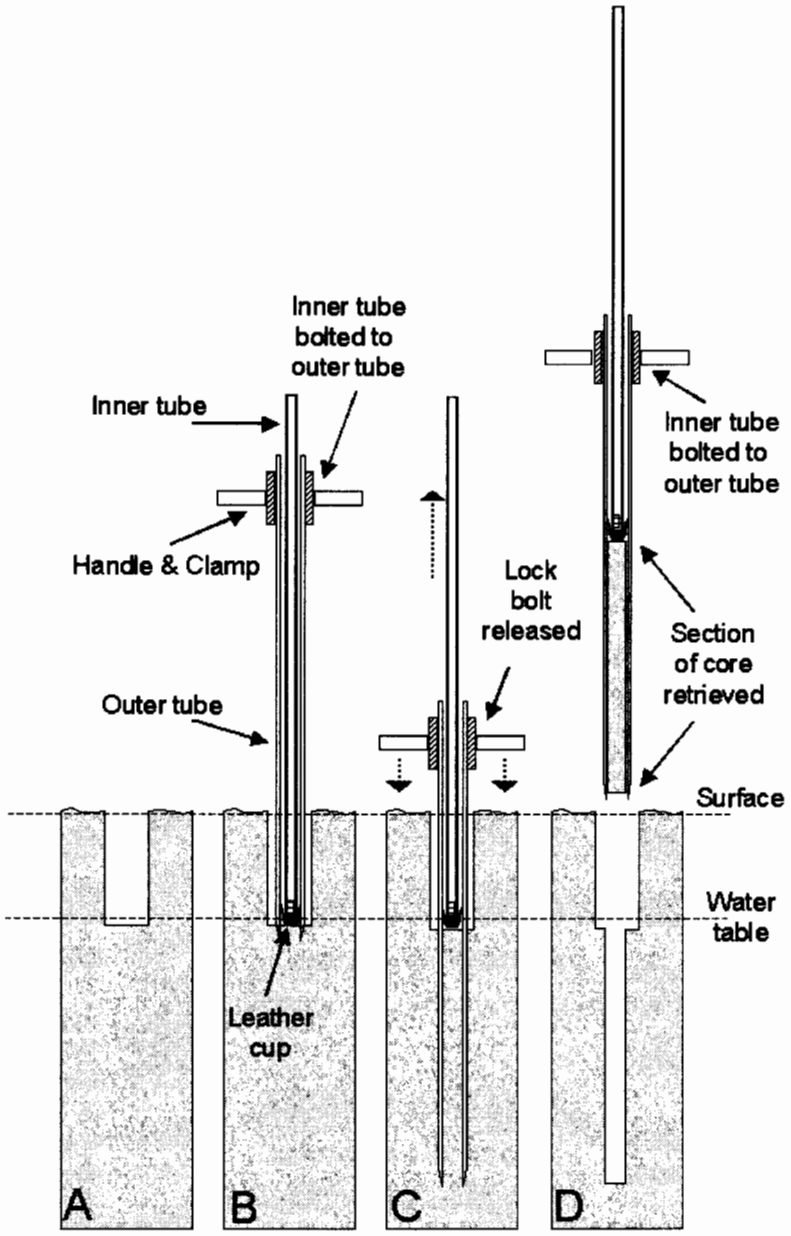

Figure 1. *Basic parts of the Van der Staay suction-corer, as well as the working principles (adapted from van de Meene et al., 1979).*
A – Hole penetrating to water saturated zone, drilled with auger.
B – Van der Staay suction-corer is placed into the hole.
C – The outer tube is pushed down while inner tube is kept in place, or pulled slightly upwards to create a vacuum.
D – The inner tube is bolted to the outer tube, subsequently the corer, including core, is extracted from the hole.

Netherlands (e.g. Törnqvist *et al.*, 1993) and also in Asia.

Sampling

Samples for luminescence dating have to be retrieved without light exposure to prevent bleaching of the luminescence signal. To enable us to do so we had to modify the Van der Staay suction-corer slightly. The lower end of the outer tube was fitted with a sampling tube of the same diameter and about 30cm in length. The length of the sampling tube can be varied depending on the amount of sample needed for analysis. The sampling tube is fitted into a widened lower end of the corer, in the same way as the extension tube is.

To obtain a sample, a hole is drilled to the water table using an auger. Then the suction-corer is placed in the hole and the lock-bolt fixing the inner tube to the outer tube released. Subsequently the outer tube is pushed to the lower depth of the sample, while the inner tube of the corer is alternately pulled and released in order to create a vacuum, which facilitates the penetration of the outer core. When the lower sampling depth is reached the inner tube is fixed to the outer tube by the use of the lock bolt on the top of the outer tube. The corer is then carefully extracted from the hole to ensure that no sample falls out of the tube. The system relies on the suction created in the tube to prevent the sample from falling out. As soon as the lower end of the corer reaches the surface, a black plastic cap is used to seal the lower end of the sample tube. It is advisable to pinch a small hole in the cap to allow water to drain. After sealing the lower end, the corer is laid flat on the ground and the inner tube is squeezed into the outer tube to drain excessive water and push the sample firmly into the sample tube. Subsequently the corer is put upright again; the sampling tube is disconnected from the main corer and immediately sealed with a black plastic cap. At this point it is ensured that the sample tube is completely full so that the light exposed outer ends are fixed. The outer ends are discarded off in a lab under subdued red light conditions. The remaining sample has never been exposed to any light and is therefore suitable for luminescence dating.

Experience and conclusion

We have used the modified Van der Staay suction-corer to obtain samples from fluvial channel deposits in the Rhine-Meuse delta (The Netherlands). All samples were sandy and saturated with water. The Van der Staay suction-corer proved to be a very useful piece of equipment in obtaining samples to a depth of 7 meters. Several samples can be taken from the same hole at different depths by coring in several steps. We were able to take up to 12 samples in a field day, operating the corer with three people. The OSL dating results did not show any indication of light exposure during sampling (Wallinga and Duller, in press). We conclude that the Van der Staay suction-corer is a suitable corer to obtain samples for luminescence dating from relatively shallow, water saturated sands. The corer is cheap and easy to construct, operate and transport which provides big advantages over other coring techniques used to obtain samples for luminescence dating.

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Reviewer

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