A FAST PROCEDURE FOR SAMPLING SEDIMENTARY STRUCTURES DOWN TO 1.1 M. IN UNCONSOLIDATED WET SANDS

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ABSTRACT

van den Berg, J.H. (1977). A fast procedure for sampling sedimentary structures down to 1.1 m. in unconsolidated wet sands. Geol. Mijnbouw, 56, p. 259-262.

An inexpensive, simple and efficient method has been developed for sampling sedimentary structures, down to 1.1 m. below the sediment surface, in unconsolidated wet sands. The method can be used on land and in quiet water to a depth of at least 4 metres. The procedure makes possible the study of sedimentary structures in the form of lacquer peels measuring 1.1 m. high and 0.1 m. wide within one hour after coring has been started.

INTRODUCTION

The sampling procedure consists of three parts: a. the taking of cylindrical tube cores 0.1 m. in diameter to a depth of 1.15 m; b. a quick method for removal of the sample from the corer, without damaging the core or the core tube; c. a method of making lacquer peels of the wet samples, directly after the removal of the core tube.

Originally the procedure was designed for use in beach foreshore sands. However, in the summer of 1976 the coring method was adapted to a shipboard operating technique which was employed successfully in water as deep as 4 m. in small tidal channels of the Oosterschelde estuary, The Netherlands. This adaptation will also be discussed briefly.

CORING

Cylindrical iron tubes of 1.2 m. length with an internal diameter of 0.104 m. and a wall thickness of 0.003 m. are used for coring. This tube penetrates the sand by means of vibration generated by a commercially available COBRA Motor Drill type BBM 47 SPA (obtainable from Atlas Copco, Zwijndrecht, The Netherlands), placed on top of the tube with an adapted drilling tool in between. This two stroke engine imparts a force to the coring tubes of 2,5 kgm at rates up to 2600 rpm.

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Owing to the drilling process the sand in the corer becomes so tightly packed that no core catcher is needed; the vacuum force exerted by a rubber stopper which is placed just above the sand in the tube after drilling has been finished, showed to be sufficient to prevent losing the sample during pull-out.

The corer is brought up with a hand-winch mounted on a tripod.

REMOVAL OF CORE BARRELS

Extruding sandy samples of more than 1 m. length from the core tube is difficult. When trying to do this, sand grains are pressed immediately sideways against the wall and the sample becomes so strongly fixed in the tube that it can hardly be removed. Of course, extruding is not necessary if the corer is cut length wise, but in doing this the core barrel is spoiled and the sample is easily disturbed. However, if the samples consist entirely or almost entirely of clean sands, it is not necessary to remove the corer by extrusion of the sample. As the corer is brought up and the rubber stopper is removed gravity usually proves to be sufficient to overcome the friction of the sand with the wall of the corer, causing the core to slide down. Some water added to the sample and some blows of a small hammer against the core barrel facilitates the sliding process.

After pulling the corer out, it is placed in a vertical position on a dry sandy spot. The rubber stopper is removed, and the tube is lifted carefully with the help of the winch. A split iron tube with the same dimensions as the corer, is placed on either side of the corer to support the cores as they are removed from the corer.

The spot on which the corer is placed must have a high permeability so that some of the pore water in the initially saturated core can escape easily through the bottom of the sample during removal of the tube; otherwise the lower part of the core will become supersaturated, followed by a collapse of the core.

PREPARATION OF LACQUER PEELS

To prepare the samples for lacquering the core is laid down so that the upper half of the split tube and sample can be removed. The remaining lower half is smoothed with a trowel. Peels are made using NITROL PROFILE LACQUER CL 28 type B of the SIGMA COATINGS Company, The Netherlands. The same lacquer was made formerly under the name TORNOL PROFILE LACQUER B of which the applications have been described earlier by B o u m a (1969).

For reasons of efficiency it is desirable that lacquer peels of the samples be made directly after coring in the field. By doing so, time-consuming transport and preparation in a laboratory is avoided. Results are directly available so that failures such as disturbed samples can be traced down immediately.

In contradiction to the widespread opinion that lacquer peels can not be made from wet samples (e.g. B o u m a 1969, p. 24) I found that lacquer peels of good quality can be obtained if lacquer is poured over samples in a water-saturated condition. In that case the addition of lacquer causes a brief moment of over-saturation which results in pore-water flow towards the extreme ends of the split tube, where the superfluous water runs out of the sample. Within this short period of pore water flow the lacquer can penetrate into the sample.

It must be emphasized here that it is absolutely necessary that the sample is practically saturated with water before pouring the lacquer. It appears that if, after cutting the core, only 15 minutes pass, too much air will already have penetrated into the sample and no pore water flow can occur and the lacquer does not penetrate effectively.

The lacquer peels made from the cores show that artificial bedding disturbance in the sample owing to the penetration of the tubes into the sand is limited to the top of the sample and merely consists of a slight bending of laminae along the sides (Fig. 1).

SAMPLING LARGE SCALE BEDDING STRUCTURES

Although the depth reached by the cores is satisfactory, the diameter of the sampling tubes is too small to define large-scale bedding-structures fully. Emplacement of sampling tubes 1 cm. apart in an aligned series, however, permits reconstruction of a section of internal structures of 1.15 m. high and of every desirable length.

In an investigation on sedimentary structures carried out by the author at the beach of Schouwen, The Netherlands (v a n d e n B e r g, 1977), at sampling locations usually 6 samples are taken grouped in an L-configuration, with 3 corings aligned normal and 3 corings parallel to the shoreline, providing a 3-dimensional view of internal structures based upon two sections measuring about 1.15 × 0,4 m. (Fig. 1).

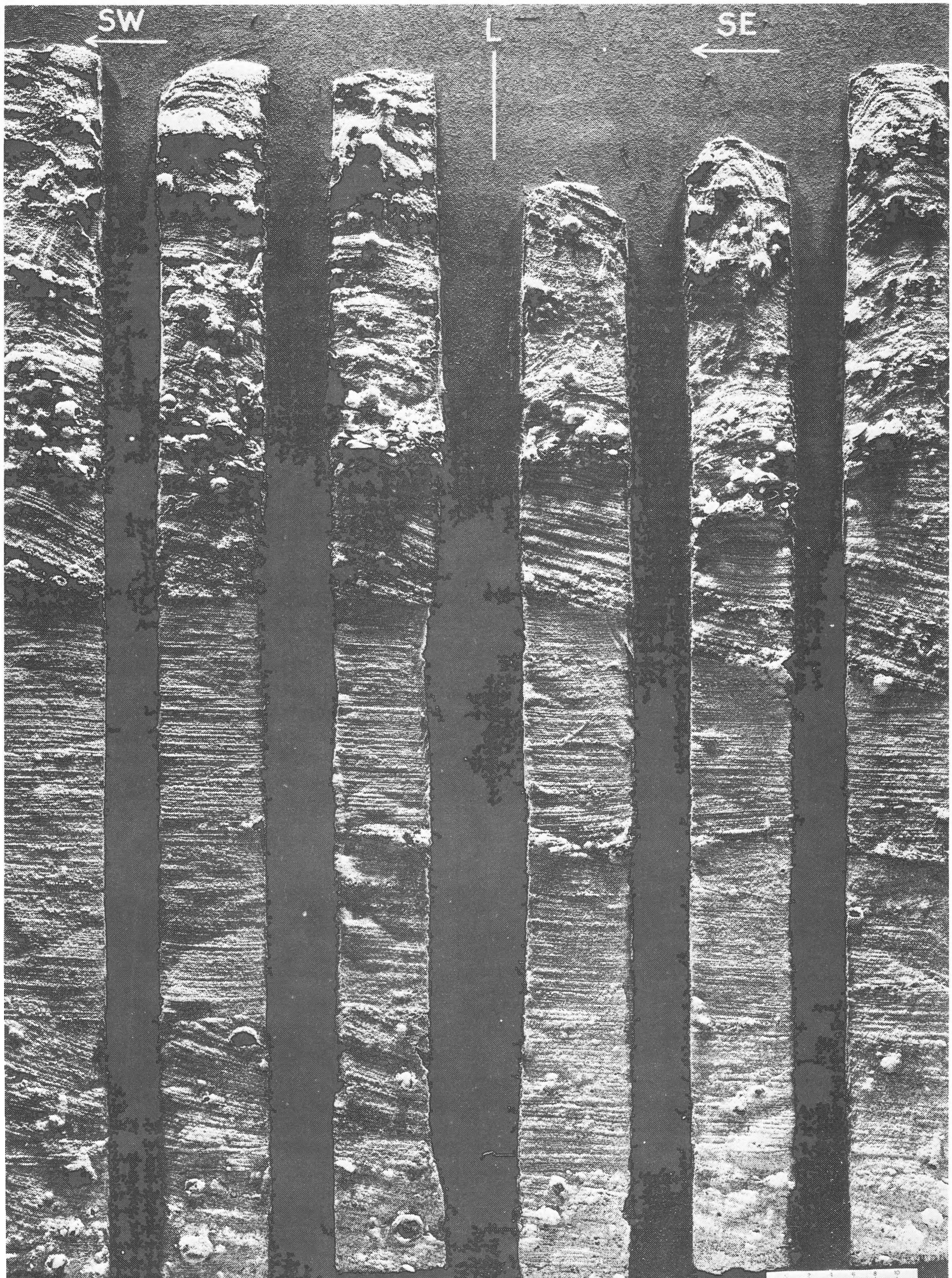
Unfortunately the drilling process causes some compaction of the sand layers around the penetrating core barrel. For this reason the emplacement of more corings right next to the first takes relatively more time. On Schouwen beach the 1.15 m. penetration of the first coring always was achieved within 5-10 minutes. Every following coring took about 7-15 minutes. The whole procedure, from drilling tubes into the sand till the removal of the peels from a set of 6 cores can be carried out by 2 persons and takes about 3 hours. Obviously an improvement in the speed of penetration is achieved if a stronger vibrator is used. In the vibrocoring device described by P i e r c e & H o w a r d (1969), a modified soil tamper is used as a vibrator. The motor of this soil tamper has a vibrating force of 33.4 kgm and runs at rates up to 2500 rpm. In foreshore sands of Sapelo Island, Georgia, with this vibrator full penetration of 1.5 m steel core barrels 7 cm outer diameter, 6,7 cm inner diameter was achieved in $\frac{1}{2}$ to 2 minutes. It must be mentioned here, however, that although this vibrator is described as a 'portable' vibrocorer it can hardly be considered as such, since it weighs between 90 and 115 kg, whereas the COBRA Motor Drill weighs only 25 kg.

MODIFICATION OF THE CORING METHOD FOR USE IN SHALLOW WATER

During the summer of 1976 the Sedimentology Group of the State Universities of Leiden and Utrecht started a research project in the Oosterschelde Estuary, The Netherlands. For this project the coring method described above was modified to a shipboard operating technique.

In this modified version the same core barrel and vibrator is used. The vibrator operates right next to, or above, a well in the research vessel. The vibration of the Motor Drill is transmitted to the core barrel by means of iron rods (hollow percussion drill tubes, outside diameter 3 cm, extensible by means of bushes with inner thread and obtainable from SALZGITTER, Salzgitter-Bad, Germany).

Fig. 1
Lacquer peels of 6 corings emplaced 2 cm. apart in an L-configuration. Samples are taken from foreshore sediments of the beach of Schouwen, The Netherlands, within the scope of an investigation recently carried out by the author and published else in this volume.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Instead of placing a rubber stopper into the corer for sealing it off after drilling, rubber 0-rings are fitted between the hammering plug and the wall of the tube. A plastic ball introduced in an opening in the plug acts as a one-way valve, allowing the upward escape of water out of the tube as it is penetrating the sediment.

On board of the Sedimentology Group's research vessel 'Santa Barbara' the method was employed successfully up to a water depth of about 4 meters; we did not try to employ it in deeper water but it is obvious that below some depth, as yet undetermined, which will depend on distinct sediment characteristics like grain size and particle roundness, a core catcher at the bottom of the core barrel will be needed to prevent losing the sample during recovery of the tube due to pressure of the pore water.

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