A Klován-Type Box Corer for Use with SCUBA

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Abstract

A stainless steel, Klován-type box corer for use by SCUBA divers in shallow water has been developed. Details for construction of the 0.45 × 0.30 × 0.20-m wedge-shaped corer are provided together with operational details. Excellent undisturbed samples have been collected from gravelly sands, sands, and muds at water depths ranging from 15 m to intertidal. The wet sand cores typically are treated in the field using an epoxy to obtain high-relief sediment peels.

Introduction

An efficient box corer for water-saturated sediments has been used successfully for 10 years by the Scarborough College Coastal Research group [1]. This technical note has been prepared in direct response to continuing requests for construction details. The unit described is based on a design for a remotely operated, deep-water coring frame that can be deployed from large ships [2]. The present corer has been extensively modified for manual use by SCUBA divers in shallow nearshore waters.

Box Corer Design

The modified Klován-type corer is depicted in Figures 1 and 2 as design drawings and in Figure 3 as a photograph. The instrument can be constructed in a range of sizes limited only by the ability of one or more divers to operate the corer un-

derwater. The primary component is a wedge-shaped, stainless steel box, supported on a hollow pipe handle which is bolted (for ease of disassembly) to the top of the box by a flat steel plate to which the handle is welded. The handle is approximately 1.3 m long and parallels the closed side of the box, which itself is approximately 0.45 m high, 0.30 m wide, and 0.20 m deep at its maximum. The box is made from a double thickness of 16 gauge steel, cut, pressed into shape, and spot welded. It has a V-shaped, hardened steel lip welded to the leading edge, which enters the sediment and under which fit both the leading edge of the liner and the gate upon closure. The use of a double thickness provides greater resistance to bending during operation and allows shaping of the material with a small steel press.

A sliding gate is used to close the box. This gate is also constructed from a double thickness of 16 gauge steel. However, it is reinforced on its upper edge by a steel envelope: to this a U-shaped slot for a gate-closer lever is welded, together with a raised block used as a surface for forcing the gate open. The gate is controlled by an external U-shaped guide supported by triangular flanges and an internal guide; the latter is a square groove, 4 mm deep, cut into the sides of the wedge-shaped box. The box has fitted liners made from 16-gauge steel pressed to a size commensurate with the internal dimensions of the wedge-shaped box when the gate is fully closed. The liners, which can be capped and secured with sheet metal screws (Fig. 2a) allow repeated use of the box corer.

The sliding gate is closed by means of a lever mounted on a sleeve which slides along the box handle and which can be driven by a sleeve hammer (Fig. 2b). The lever fits the V-shaped slot at the top of the sliding gate during the gate closing operation (Fig. 3b) and can either be removed or allowed to slide freely to the top of the box while the latter is

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Figure 1. Engineering drawing of Klován-type box corer. Scale is 1:20 and dimensions are in centimeters.

Figure 2. Accessories: (a) liner and cover; and (b) lever for closing the sliding gate. Note: not to scale; dimensions are in centimeters.

being driven into the sand with the gate open. The angle of the lever must be at 90° to the driving line of the sliding gate to optimize the transfer of the driving stress from the sleeve hammer. The lever is therefore mounted at 70° to the pipe sleeve (Figs. 2b and 3b). A 35-kg sleeve hammer is used to drive the box into the sediment and to close the sliding gate.

Corer Operation

The corer is driven vertically into the sediment with the sliding gate either removed or held in a raised position by a shear pin penetrating a hole drilled through both guide and gate (Fig. 3a). When the corer is completely inserted, the gate is closed to allow withdrawal of the core. To preserve surface bedforms, a 2–3-cm layer of dyed sand (waterproof India ink is usually sufficient) is placed over the area prior to coring and held in place by an 8-cm-high rectangular frame of galvanized steel with dimensions large enough to allow easy passage of the corer.

After extraction, the corer can be opened by first tapping the raised block on the sliding gate. Liner removal is assisted by using a small hook which penetrates a hole drilled in the backwall of the liner (Figs. 2a and 3c). The liner is capped to allow easy transport and/or storage of the core. Samples can be kept for several months if necessary, but the usual procedure is to produce an epoxy relief peel in the field. To do this, the core is cleaned while still moist by removing the surface 1–5 cm of sand; this eliminates artifacts such as dis-

Figure 3. Klov-type box corer: (a) plan view; (b) side elevation; and (c) oblique view with liner and hook to aid liner removal.

tortion induced by shear at the contact with the sliding gate, cracks induced by surface drying, etc., and also allows the cutting of a near-vertical section.

A wide range of techniques is available for peel production [3], but the most successful procedure for water-saturated sediments is that modified from Burger and others [4]. A mixture of CIBA-GEIGY Epoxy #6005 and Hardener #850, in a ratio of 2:1 by volume, is stirred and poured over the surface of the core face which is placed in a near-horizontal position. A slight slope on the surface allows the epoxy mixture to both penetrate vertically and flow evenly over the core as the mixture is applied. Approximately 300 ml of epoxy mixture will suffice for a single 0.45×0.30 -m core in medium-to-fine sands to produce a 1-cm-thick peel. If it is necessary to strengthen the peel, a double sheet of cotton muslin can be placed on the core surface immediately after pouring.

Curing time depends on sediment characteristics and ambient temperature, but is usually no longer than 24 h. The peel is removed by flexing the liner sides, washed, oriented correctly, and photographed using an oblique light source from the upper right corner. The latter procedure is important to prevent a shadow orientation which can produce inverted relief. A typical peel is shown in Figure 4 and illustrates the clarity of the preserved structures and textures.

The corer has been used by SCUBA divers operating from a small boat in both marine and lacustrine environments, in water depths ranging from intertidal to 15 m. Successful peels have been obtained from textures ranging from muds to gravelly sands.

The major advantages of the modified Klov-type corer over the more traditional Senckenberg box [5], push-box [6], and can corer [7] are: (a) increased efficiency of insertion and removal, which restricts surface scour during operation;

Figure 4. Typical epoxy peel illustrating primary sedimentary structures. The core is from the crest of a straight, marine nearshore bar in 2.5 m of water. Note the inclusion of a wide range of textures from gravel to fine sand. The arrow indicates the direction of the shoreline.

(b) the larger size of the core obtained; and (c) the lower degree of distortion of the primary sedimentary structures at the core margins.

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