A handy impact corer for sampling lake surface sediment

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Abstract

A handy impact corer for sampling of surface sediment (< 50 cm) in lakes is described. The coring apparatus consists of a sample tube, tube holder, stopper, stopper holder, shaft with wing, shaft holder, hammer, and pushing rod. The total weights are 3.8 kg (Type I: 2.3 cm inside diameter of the tube) and 6.7 kg (Type II: 5.5 cm inside diameter of the tube). The system enables confirmation of the vertical landing of the corer onto the lake bottom and effective entering of sediment into the sample tube using hammer, and prevention of falling out of the core using stopper and pushing rod.

Introduction

Coring apparatus have been used in lakes and oceans to collect surface and/or deep sediments for the investigation of vertical and horizontal distribution of chemicals and biological substances such as nutrients, trace metals, radionuclides (\(^{137}\)Cs and \(^{210}\)Pb), pollen, diatom and microorganisms. However, most of the coring apparatus used in lakes and oceans (Mackereth, 1958; Hopkins, 1964; Holme, 1964; Barton & Burden, 1979) are heavy and somewhat inconvenient for obtaining samples from many stations in lakes, ponds, and bays, and confirmation of a good landing of corer onto lake bottom is difficult. Some of the corers have depth limitation of use, and taken the overlying lake water with the surface sediment is also difficult (Livingstone, 1955; Vallentyne, 1955; Walker, 1964). The corer previously presented by the author has the limitation of sample size (Satake, 1983). The objective of this study is to present a hand operated corer which is light, unsophisticated and reliable for sediment sampling in shallow as well as deep lakes to avoid ineffective drive and time consuming extra work in the field.

Description and operation of coring apparatus

The newly devised coring apparatus and its construction are shown in Fig. 1. The coring apparatus is consisted of acryl sample tube (a) (Type I: 30 cm long, 2.3 cm inside diameter, Type II: 50 cm long, 5.5 cm inside diameter), brass tube holder with two rubber O-rings (b), brass stopper holder (c), brass shaft holder (d), hammer with steel wire rope (e), shaft (f), acryl stopper (g), stainless steel supporting rod (h), pushing rod (i) with hook of the rod (e). The total coring apparatus weight is 3.8 kg (Type I) and 6.7 kg (weight of the all stainless steel corer produced by RIGOSHA Ltd. is 6.0 kg) (Type II).

The stopper holder (c) and shaft holder (d) have windows for the free flow of water through the acryl sample tube and the holders (Fig. 2). The shaft (f) is consisted of stainless pipe (f1), guide of wire (f2) and wing (f3), and it contains a pushing
Fig. 1. A handy impact coring apparatus for sampling lake sediment (Type II) and its construction (a: acryl sample tube, b: acryl tube holder, c: acryl stopper holder, d: shaft holder, e: hammer, f: shaft, g: acryl stopper, h: stopper rod, i: pushing rod, j: hook of rod).

rod (i) (Fig. 3 and Fig. 4). The pushing rod (i) is locked using hook of rod (j) on the upper ditch of the stainless pipe before pulling the apparatus out of the water, and unlocked just before pulling up the apparatus onto the boat. Hammer (e) for hammering the coring apparatus into the sediment is operated from boat using single rope tied to the steel wire rope with shackle. The transparent acryl sample tube (a) held to the tube holder with rubber O-ring has a ditch at the upper part for the tight fixation to the acryl tube holder with screw. The acryl stopper (g) with stainless steel rod (h) for retention of core sample moves upwards with flow of water through the tube and moves downwards with its weight after hammering. The pushing rod (i) is used for cling the stopper to the rubber O-ring at the tube holder to prevent entering air into the tube just before pulling up the apparatus onto the boat (Fig. 4). Entering the air into the core tube through a chink between sample tube and the stopper is one of the major cause of fall out of the core just before pulling up the core onto the boat.

In the field, the coring apparatus is laid down onto the sediment using single rope, and released into the sediment for settlement, then hammered several times for sufficient entering of sediment into sample tube. If the coring apparatus is settled vertically onto the sediment, the operator can hear the sound of hammering from boat. If not, the