Ancient TL

www.ancienttl.org · ISSN: 2693-0935

Bubenzer, O., 2001. *Manual coring equipment for the collection of stratified samples from dry sand dunes.* Ancient TL 19(1): 1-3. https://doi.org/10.26034/la.atl.2001.326

Manual coring equipment for the collection of stratified samples from dry sand dunes

Olaf Bubenzer

University of Cologne, Department of Geography,
Albertus-Magnus-Platz, D-50923 Köln, Germany,
e-mail: olaf.bubenzer@uni-koeln.de,
Fax.: 0049-(0)-221-470-5124, Tel.: 0049-(0)-221-470-3966

(Received in final form 8 January 2001)

Introduction

The analysis of the sandy layers of dunes, especially from draas (or megadunes), are suitable for dating palaeo-processes and the reconstruction of palaeo-windsystems (Besler, 1998). The sand layers in dunes are created by different wind directions and/or velocities and often show different grain sizes and colours. Thus, many dunes show a clear structure and their separate analysis is important for a large range of sedimentological, geomorphological, climatological and archaeological studies. Dry, non-fixed sand with no observable cohesion or pedogenetic developments behave in some way similar to liquids (Haynes and Johnson, 1984). Therefore, it is difficult to collect samples by drilling or digging because the sand flows immediately back into the hole. Until now it was only possible to reach depths of 1-2 m with manual drilling methods (Besler and Gut, 1997). Drilling to greater depths required heavy machines and large water supplies, which is not feasible for sampling in remote areas. Other problems arise from the fact that samples for luminescence dating have to be undisturbed and not be exposed to light. Furthermore, sample sizes in the range of about 500g are required. Wallinga and van der Staay (1999) described a suction corer, which is suitable for collecting samples from waterlogged sands. This paper describes a lightweight manual coring equipment for dry sands to reach deep sediment layers and to collect undisturbed samples. It was developed within the Collaborative Research Center ACACIA (Arid Climate, Adaptation and Cultural Innovation in Africa, SFB 389, University of Cologne) - section A „Holocene Environment and Cultural History in Northeastern Africa.

Equipment, drilling and sampling method

Figure 1 shows a schematic drawing of the drilling and sampling equipment, which can be used for sample collection to depths of up to 6 m. It weighs about 25 kg for the basic tools and the sampling equipment and 6 kg/m for the tubing. It is available from Eijkelkamp Co., P.O. Box 4, 6987 ZG Giesbeek, The Netherlands (www.eijkelkamp.com). The water consumption is about 1-2 l/m.

The coring equipment can be used in two configurations:

(i) Collection of mixed samples

The plastic liner tube (1) is placed on the sand surface. A light drilling-rod with a bayonet connection (2) and an Edelman sand auger (3) is inserted and used to core below the liner. Movable casing tube clamps (4) are used to hold the liner in place and to press it down whilst lifting the auger. For the first 1 to 2 m no water supply is necessary because it takes only a very short time to lift the auger. At greater depths, about 200 ml water is needed for one auger scoop of 10 to 20 cm. The full auger produces about 250 cm^3 sand. The coring works by cutting, therefore, the auger samples are mixed over the average coring depth of 10-20 cm.

(ii) Collection of undisturbed, stratified samples

After the liner has been driven to a given depth, it is possible to collect stratified samples with diameters of 6.5 cm and lengths of 40 cm. A removable stainless steel tube (6) with a core catcher (7) on the head of a rod with a conical

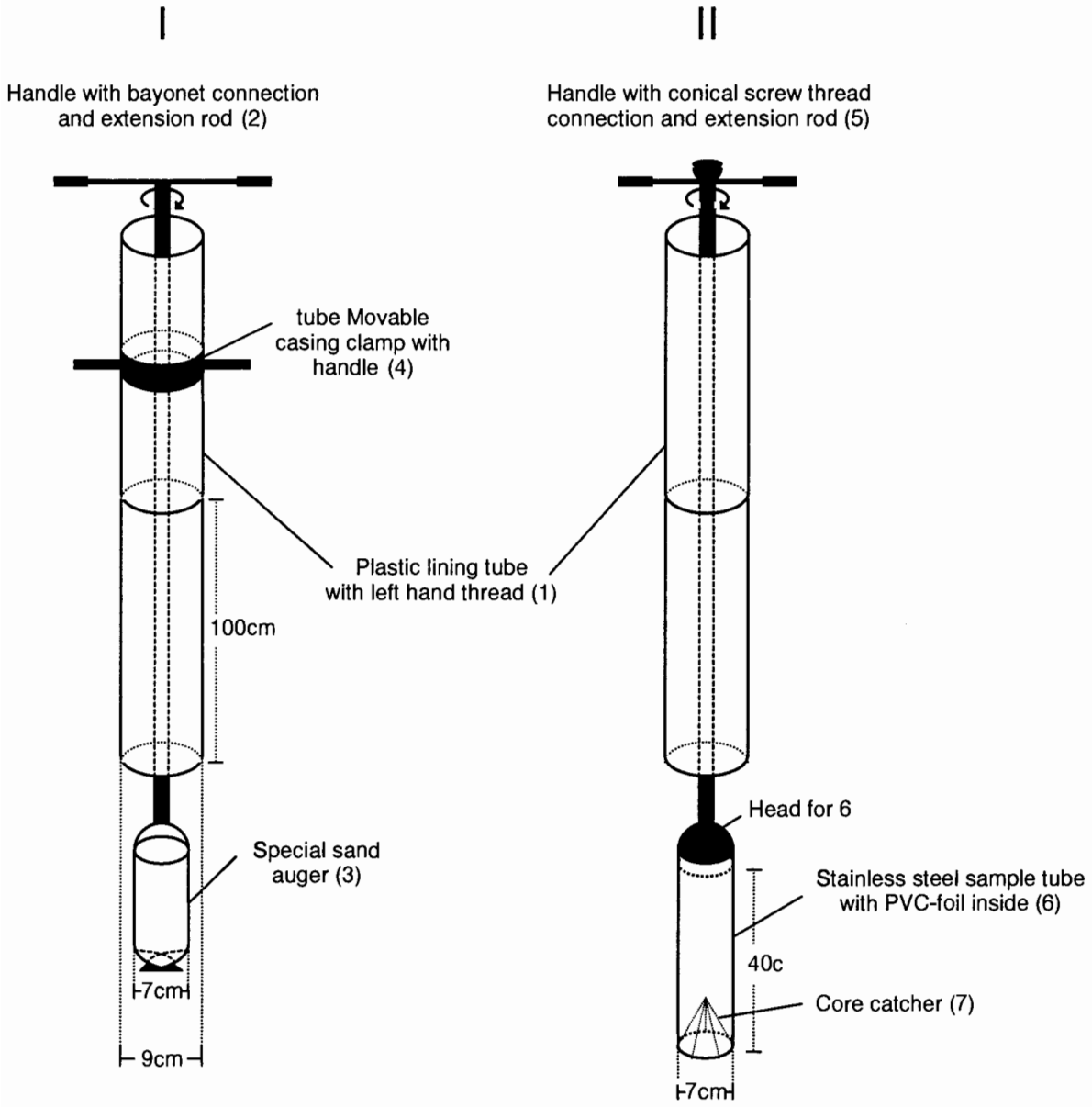

Fig. 1: *Schematic drawing of the coring equipment*

screw thread connection (5) is pushed with a percussion-free hammer into the sediment, which is watered prior to the insertion of the equipment. The watering in conjunction with core catcher ensure that the sediment is hauled as a complete sample core. The inner PVC-foil ensured that the sediment cores stays intact. The stainless steel tubes can be disconnected from the rod and taken to the laboratory where the sample is extracted in darkroom conditions. The maximum sediment volume in a sample tube is 1.400 cm^3. Two persons will require about 2 to 3 hours to reach a depth of 3 m and collect one sample.

Depending on grain size and sediment density it is possible - in our experience - to reach maximum depths of about 6 m. The equipment is maintenance-free and can easily be carried a few hundred meters without a car.

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Reviewer

Rainer Grün