5.3 INVERTEBRATES OF THE STONY BOTTOM

(by G. Bretschko and M. Leichtfried)

5.3.1 Introduction

As grain sizes of sediments increase, the difficulties in quantitative sampling also increase. Limiting grain sizes are sandy sediments for coring samplers and gravel sediments for grab samplers (Elliott & Drake, 1981). Both techniques can be used to obtain samples in sediments dominated by their limiting grain size classes but with severe shortcomings with respect to quantitative sampling. Very expensive, high-tech methods have been exployed to overcome these problems, such as large diving-bells (Sopp, 1983; Schmitz, 1986) or the so called „polyp-grab" (Titizer, pers. comm.). In this study, the N_2-freezing corer technique has been adopted for sampling shallow areas. A self-operating N_2-freezing corer, powered by a hydraulic system, has been developed for sampling deeper areas, but it is not yet working satisfactorily. For the time being, a qualitative slurp-gun is used (Herrig, 1975).

5.3.2 Equipment

5.3.2.1 The N_2-freezing corer for shallow areas

A detailed description of this method is given in Klemens (1985) and Bretschko & Klemens (1986). The main instrument is a steel pipe with a closed and tipped lower end (Fig. 5.3.1). Sampling is done in six steps:

a) Using a sledge hammer, the corer is hammered into the sediments until the desired depth is reached. A steel rod (as electrode) is hammered to a depth of about 1 m into the sediments, at least to the same depth as the corer. The low electrical resistance of the sediment-water-complex in the Danube made it necessary to use the corer itself as a second electrode to achieve the required voltage.

b) To overcome the consequences of the physical perturbations, the sampling site was left undisturbed for at least two days (Pugsley & Hynes, 1983).

c) An electric field (650V, 50Hz) is created between the electrodes for ten minutes.

d) To prevent the conduction of heat from the surface water, the corer is protected with low heat-conductive material above the sediment surface. A wooden mantle, about 30 – 40 mm in thickness, proved to

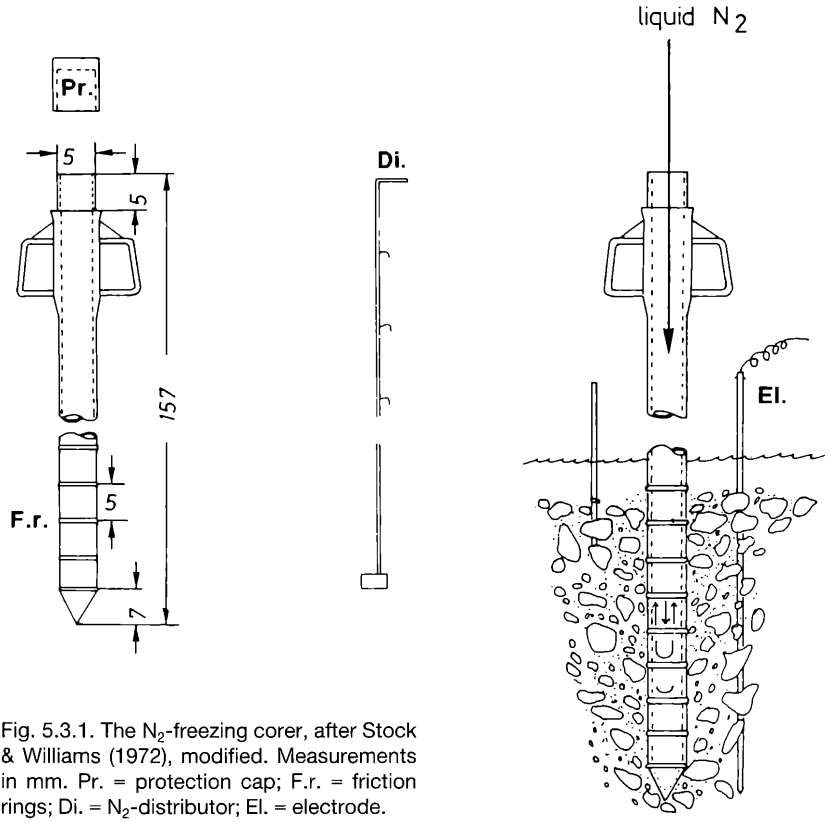

Fig. 5.3.1. The N_2-freezing corer, after Stock & Williams (1972), modified. Measurements in mm. Pr. = protection cap; F.r. = friction rings; Di. = N_2-distributor; El. = electrode.

be the best solution. Liquid N_2 is poured into the corer and distributed with a spoon-like distributor (Aigner, 1983) over the length of the corer to achieve an even core (Fig. 5.3.1). The required amount of liquid N_2 depends upon the length of the core, the sediments, the water current and the ambient temperature. In the Danube, the amount of liquid N_2 varied between 5 and 10 kg per core.

e) Because of the highly unconsolidated and spherical sediments of the Danube, a simple lever (Fig. 5.3.2) is sufficient for extruding the frozen core, instead of block and tackle (Klemens, 1985).

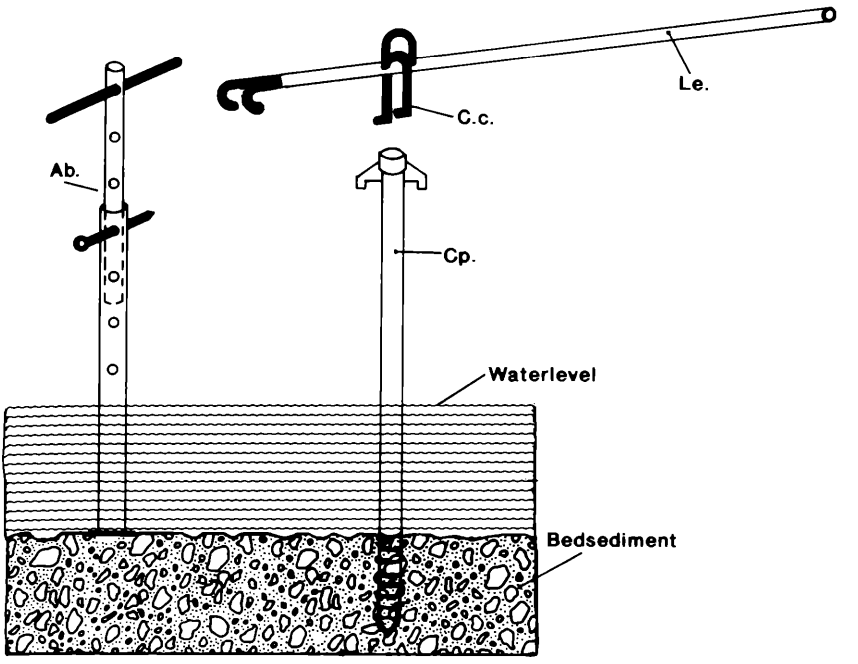

Fig. 5.3.2. Lever for extruding the frozen core. Ab. = aboutment; Cp. = corepipe; C. c. = connection to corepipe; Le. = lever.

f) Using the friction rings (Fig. 5.3.1), the core is easily segmented. The volume of each segment is determined before fixation for further processing. In the Danube, four layers are usually separated, namely 0-10, 10-20, 20-40 and 40-60 cm of sediment depth.

Four significant steps of the sampling procedure are shown in Plate 5.3.1 (a)-(d).

5.3.2.2 The slurp-gun for deep areas

A slurp-gun as described by Herrig (1975) has been built and tested successfully. Modifications to the original design are:

a) The diameter is slightly smaller; the sample compartment has a volume of roughly five litres.

b) All parts are stronger and heavier.

c) The power support is not a built-in battery but a connection cable to the boat.

d) The release mechanism is not automatic.

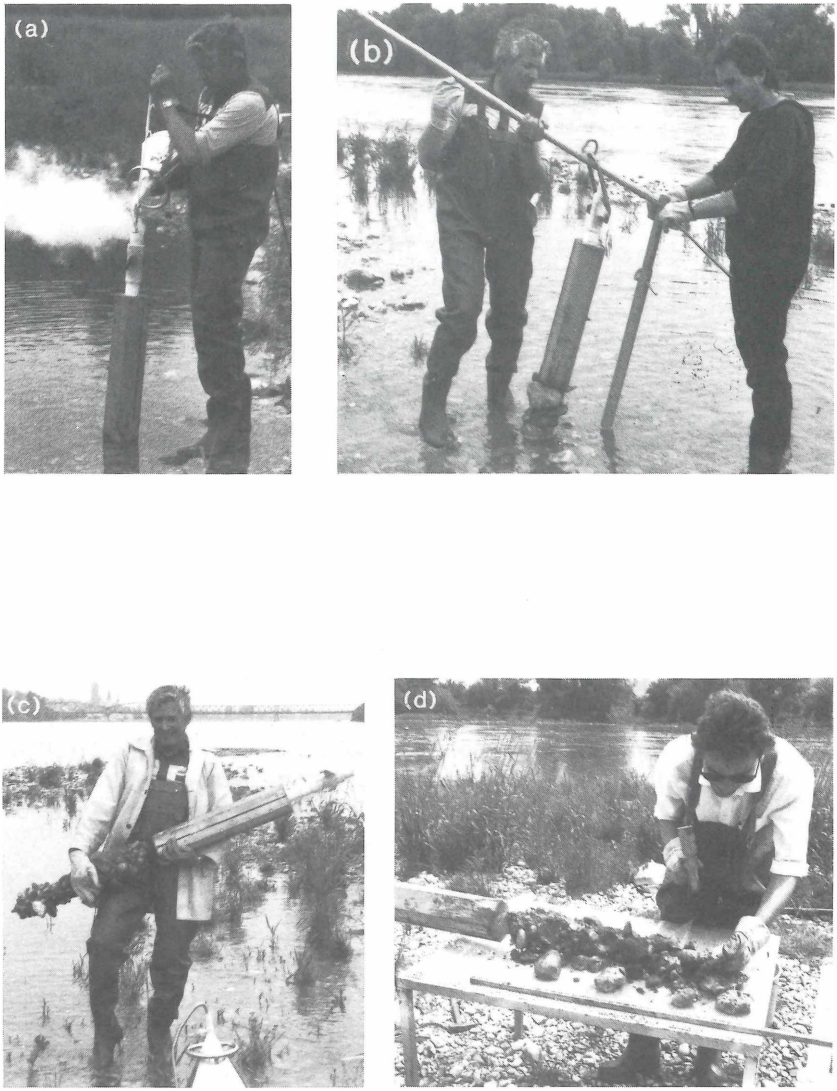

Plate 5.3.1. Significant steps of the sampling procedure: (a) Liquid N_2 is poured from a five kg Dewar vessel into the corer, which is protected by a wooden mantle. In the left hand of the operator is the distributor (Fig. 5.3.1). (b) The core is extruded with the help of a lever. (c) The frozen core. (d) The core is segmented.

A schematic cross section is shown in Figure 5.3.3. The slurp-gun is mounted horizontally in a heavy stabilizing frame with a long tail fin to keep the entire apparatus parallel to the current (Plate 5.3.2.). During lift-off the weight of the sample brings the slurp-gun automatically into a vertical position to save the sample. Herrig (1975) notes that in gravel sediments (maximal grain size: 60 mm) the weight of the sample is roughly 7 kg, collected from a circular area with an average diameter of 27 cm and a sediment depth of at least 6 cm.

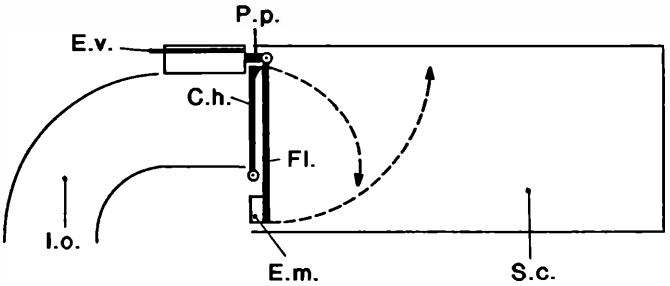

Fig. 5.3.3. Schematic cross section (1:5, in cm) of a slurp-gun, after Herrig (1975), modified. C.h. = closing head; E.m.= electric magnet; Fl. = flap; I.o. = ingestion opening; P.p.= point of pressure; S.c. = sample compartment; E.v. = Evacuation valve.

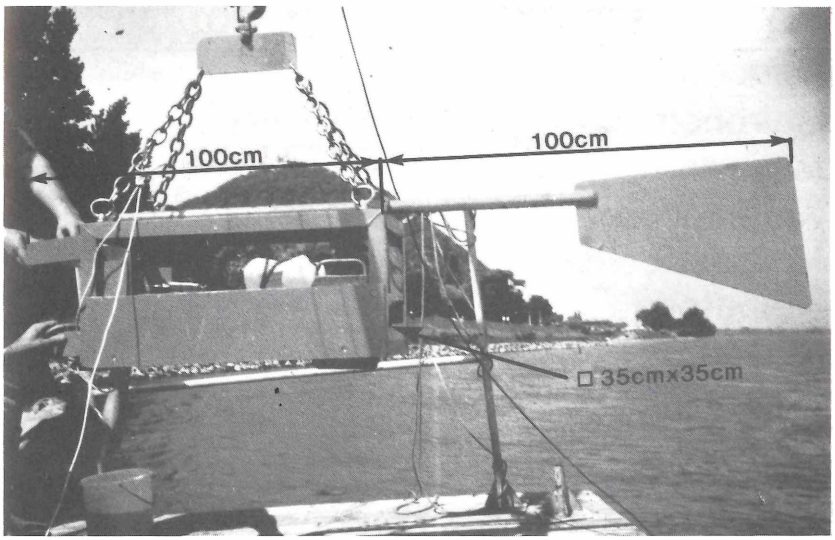

Plate 5.3.2. Slurp-gun after lifting.

Fig. 5.3.4. Mean relative grain size (in mm) distribution (in %). ☐ = Slurp-gun (Q1 = 2.15, Md = 8.4, Q3 = 18.0; n = 5); ■ = Freeze-core of 20 cm diameter (Q1 = 8.0, Md =16.0, Q3 = 25.5; n = 3). P = Probability level.

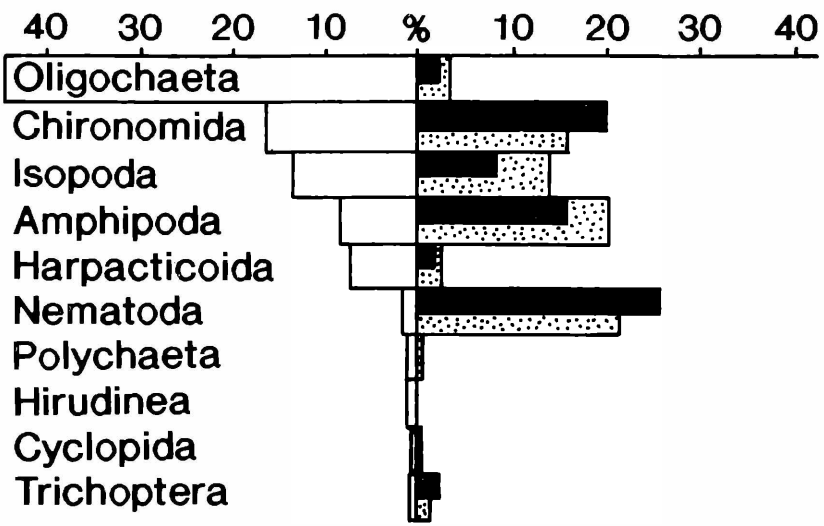

Fig. 5.3.5. Mean relative distribution of faunal taxa in slurp-gun (☐) and freeze-core (■ = diameter 10 cm, ▒ = diameter 20 cm) samples.

5.3.3 Results

Freeze-core and slurp-gun samples have been taken for comparison downstream of the „Hundsheimer Haufen" (km 2005) in a water depth of about 1 m. As expected, the slurp-gun overestimates grain sizes smaller than 6.3 mm and underestimates grain sizes larger than 15 mm in relation to freeze-core samples (0 – 20 cm; Fig. 5.3.4). The mean weight of slurp-gun samples is 1488 g (confidence interval 589 – 3809 g) and therefore in the range of freeze-core samples (0 – 20 cm, mean 2127 g, confidence interval 1170 – 3866 g). In spite of this similarity, a quantitative comparison is impossible because of basic differences in the sampling operation. The relative distribution of faunal taxa is similar in both types of samples with two exceptions: the slurp gun overestimates Oligochaetes and underestimates Nematodes in relation to freeze core samples (0 – 10 and 0 – 20 cm; Fig. 5.3.5).

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