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Techniques for the concentration of foraminifera from coastal salt meadow sediments

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INTRODUCTION

Concentration of modern foraminifera from sediment samples is commonly performed by the heavy liquid carbon tetrachloride (CCl_4) flotation method. From mainly inorganic, siliclastic sediments from marine habitats, about 94% of the foraminifera contained within a sample can be isolated in the first step (Lutze, 1968). This procedure is used in order to reduce the time taken to examine the foraminiferal content of a sample. However, it is not practical in all cases. Surface sediments of salt meadows from the west coast of the German Bight (southern North Sea) can be divided into two main types: (1) in seaward parts with only a patchy distribution of spermatophytes there is soft mud with a high content of detritus (faecal pellets and plant material) and low content of inorganic components (clay and finest sand); (2) in landward parts there is low moisture soil with a high content of living and dead plant roots similar to that of terrestrial meadows. Foraminifera of sediments of these kinds cannot be isolated by the flotation method for the following reasons.

For sediment of type 1, if fractions 60–1000 μm (all clay eliminated by washing) have been dried in order to submit them to the flotation method, a serious problem arises. Flocky/grainy detritus aggregates to a cement-hard mass which encloses all the foraminifera. This 'cake' cannot be disaggregated without damaging or destroying the foraminifera.

For sediment of type 2, when sediment treated the same way as sediment of type 1 is dried, fine plant remains, mainly roots, adhere to one another forming a parchment-like mat enclosing the foraminifera.

PROCEDURE

The problem can be solved for sediment type 1. Prior to drying, the sample can be distributed (by means of a small amount of tap water) over a large iron tray (e.g. 60 by 80 cm) in as thin and homogeneous a layer as possible to separate the detrital particles from one another. The dry sediment can be detached from the tray with a flat paint brush which is pushed rather than pulled across the surface. By means of this method, 96% of the foraminifera can be isolated by flotation in one step. Samples of type 2 cannot be treated successfully by this method. Though foraminifera and plant residues are fairly well separated on the tray (less than 10% of the foraminifera still adhere to plant material) and can be removed from it successfully, foraminifera and plant material cannot separated by flotation because they are airfilled or light, respectively. The many small root fibres float together with the foraminiferal tests on the surface as well as within the heavy liquid and on the bottom of the beaker. From a sample of this kind only about 23% of the foraminifera can be isolated in the first step and only 15% in a second step of heavy liquid separation.

DISCUSSION

Cedhagen (1989) suggested a handling procedure for processing sediment samples using the detergent Ajax® and heating (80–90°C) to disaggregate clay concretions and faecal pellets. In comparison to our procedure there seem to be three uncertainties or disadvantages. There are six, partly more time consuming procedures instead of three; it is uncertain if soft monothalamous textulariines are well preserved; brood cysts will disintegrate.

In order to study genuine salt meadow sediments (the sediments of type 2) a quite different method has to be used. This is working with wet samples. Large parts of the plant material can be eliminated by decanting. In the remaining sample foraminifera can be easily recognized and isolated. Wet work yields still another surprising advantage. During drying, monothalamous species with soft tests lose their shapes and shrink to amorphous clumps no longer recognizable as foraminifera; in wet samples they are preserved. This has been shown by us through a comparison of dried with wet samples from the same habitat. Monothalamous agglutinated species (e.g *Ovammina opaca*, abundant in many samples, an undescribed *Ovammina* species and a *Bathysiphon* species) as well as fragile juveniles of calcareous species which had never been encountered in dried samples can be discovered in wet samples. In addition, cyst-like structures of agglutinated sand grains, surrounding a parent individual with its many juveniles were discovered to exist for the first time.

Discerning living from dead individuals by staining rose Bengal (Walton, 1952) is also facilitated in wet samples. As a consequence of drying, the stained protoplasm comes off the inner test wall and breaks down into particles. Thus, in spite of bright colouration, the protoplasm is often only poorly visible (Lutze & Altenbach, 1991). In adult agglutinated and miliolid species, both occurring in high densities in the salt meadows investigated, in most cases the test had to be broken to determine whether the individual was dead or alive. In wet samples, the rose Bengal stain is easily visible because of the expanded protoplasm and the higher transparency of the test.

For a complete record of foraminifera of coastal salt meadow habitats, including monothalamous agglutinated forms, fragile juveniles and brood cysts enclosing freshly born offspring, the study of rose Bengal-stained wet samples is recommended.

From a geological point of view, it can be argued that the loss of fragile specimens and stages through drying simulates what happens during fossilization. For micropalaeontologists this message, however, could be of interest: there is a method (wet treatment of sediment samples) which is apt to show the entire inventory of foraminifera including stages of reproduction and which also facilitates recognition of rose Bengal-stained agglutinated species and, if not relevant for micropalaeontological study, at least shows which part of the Recent and fossil record is excluded from being recognized. The 'tray method' now also allows micropalaeontologists to isolate the foraminifera from soft mud with a high detrital content.

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