

Preliminary Survey of the Distribution of Living Benthonic  
Foraminifera in Northumberland Strait\*

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Introduction

A preliminary investigation of the distribution and ecology of benthonic Foraminifera in Northumberland Strait was undertaken in August, 1967 as part of a larger continuing ecological program of the Bedford Institute of Oceanography (Fig. 1). Bottom sediments were collected for the analysis of the foraminiferal population at stations I, II and III (Fig. 1). Water depth(s) at these stations averages about 26, 56 and 60 feet respectively. Samples were obtained by SCUBA divers equipped with short plastic core liners. The divers attempted to collect undisturbed samples whenever feasible. Upon reaching the surface, divers removed the top centimetre of each core by extrusion, (Schafer, 1967a). The samples were treated with Rose Bengal stain to permit recognition of specimens that were alive at the time of collection (Walton, 1952).

Sediments

A detailed study of the bottom sediments in Northumberland Strait is currently being undertaken by Miss K. M. Kranck of the Bedford Institute of Oceanography. Particle size of the bottom sediment at Station I has a phi median diameter (Inman, 1952) of 1.49 and shows a symmetrical distribution curve. The sediment is mainly medium sand (Pettijohn, 1957). Bottom sediments at stations II (clayey silt) and III (fine sand) are finer grained, have phi median diameters of 6.54 and 2.52 respectively, and show slight positive skewness.

Foraminifera

The living foraminiferal fauna collected at station I is composed of 34 per cent calcareous specimens (Fig. 2). The dominant calcareous species is *Elphidium clavatum* (group CA, Fig. 2); relatively small numbers of *Ammonia beccarii*, *Asterellina pulchella* and *Quinqueloculina seminulum* (CB) are present. The similarity of subsamples 1 and 2 (collected several feet apart) suggests that the fauna is reasonably homogeneous in terms of numbers and kinds of species. However, specimens of *Quinqueloculina seminulum* were not observed in subsample 1 and no specimens of *Ammonia beccarii* were seen in subsample 2. The local occurrence of these two species may be due to a "patch-like" distribution of these Foraminifera (Schafer, 1967a; Vilks, 1967) at station I. The arenaceous fauna at this station is composed entirely of *Eggerella advena*.

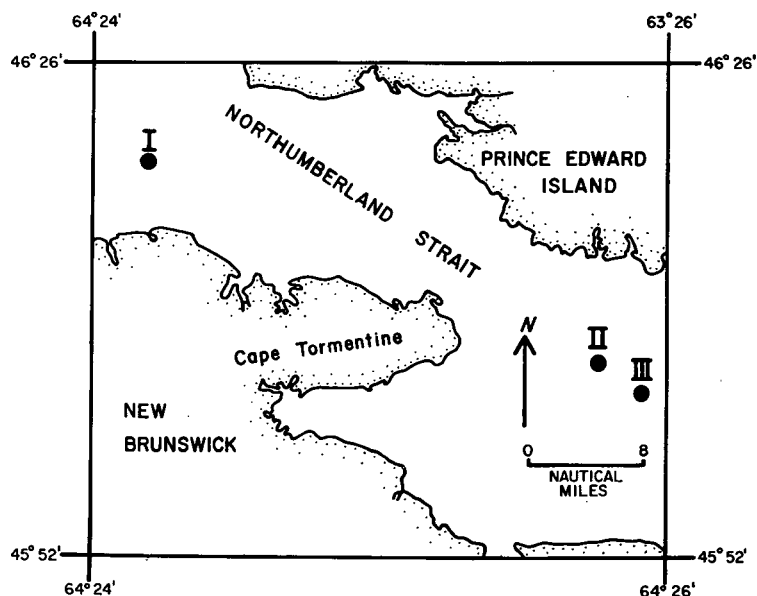


Figure 1 - Location of Sampling Stations in Northumberland Strait.

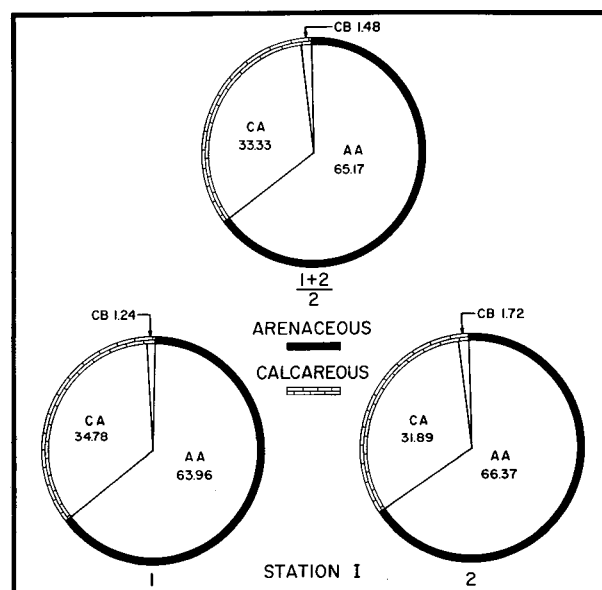


Figure 2 - Relative Percentages of Numbers of Benthonic Foraminifera Species at Station I.

The living foraminiferal fauna in subsamples 1, 2 and 4 at station II, consists of 89 per cent arenaceous specimens (Fig. 3) including *Eggerella advena* (AA), *Saccammina atlantica* (AB), *Ammotium cassis* (AC), *Reophax curtus* (AD), *Trochammina lobata* and *Miliammina fusca* (AE), and *Bigenerina arctica* and *Trochammina squamata* (AF). Differences in the relative percentages of these species in subsamples 1, 2 and 3 is shown in Figure 3. Possible explanations for differences in numbers of living benthonic Foraminifera in closely spaced subsamples have been given by Schafer (1967a; 1967b) and Vilks (1967). Sampling programs are currently being designed to determine the limits of this percentage variation in subsamples collected at certain locations in Northumberland Strait.

Relatively large numbers of living specimens of *Miliammina fusca* occur at station II (AE, subsample 2). Vilks (1967) reported large numbers of *M. fusca* at depths to 520 feet in Bras d'Or Lakes, Nova Scotia. However, this species is generally found in association with algae in marsh environments (Schafer, 1964; Parker 1952; Phleger and Walton, 1950) that are characterized by ecological conditions quite different from those observed in the Strait. Additional study of the distribution of this species with respect to nutrients, Ph, salinity, water temperature, and the nature of the bottom sediment may help to explain the anomalous occurrence of this species in the Strait.

The average relative percentage of living species of Foraminifera at station II (subsample  $\frac{1+2+4}{3}$ ) is in good agreement with that of the dead foraminiferal fauna samples at a depth of four centimetres below the sediment-water interface (Fig. 3, subsample 3). However, the arenaceous species *Bigenerina arctica*, *Trochammina squamata* and *Miliammina fusca* are absent in subsample 3. The reasons for the absence of these forms in the buried dead fauna are undetermined. Tentative explanations include: 1) transport of dead specimens to other areas by currents; 2) destruction of the tests of these species, especially of *Bigenerina arctica*, during early diagenesis; 3) insufficient sample size.

Calcareous species comprise the remaining 11 per cent of the living population at station II. Specimens of *Elphidium* spp. (CA) are most abundant. *Lagena gracillima*, *Globulina glacialis*, and *Buccella frigida* which occur in relatively small numbers are placed in Group CB. Although *B. frigida* and *L. gracillima* are represented by relatively few specimens, these species are consistently observed in nearly the same proportions in all samples collected at station II. The absence of *L. gracillima* in Bras d'Or Lakes (Vilks, 1967) and in Tracadie Bay (Bartlett, 1965) suggests that this species may prefer more open coastal waters. The occurrence of *L. gracillima* in nearshore areas of St. Margarets and Mahone Bays, Nova Scotia (Bartlett, 1964) seems to support this conclusion.

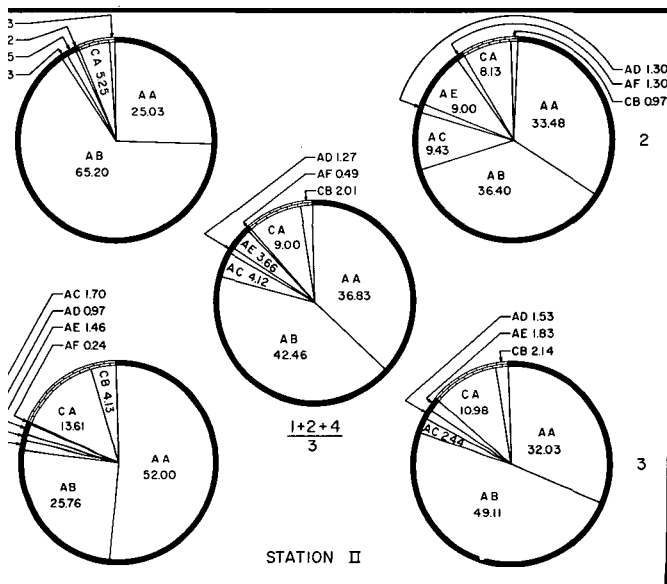


Figure 3 - Relative Percentages of Numbers of Benthonic Foraminifera Species at Station II.

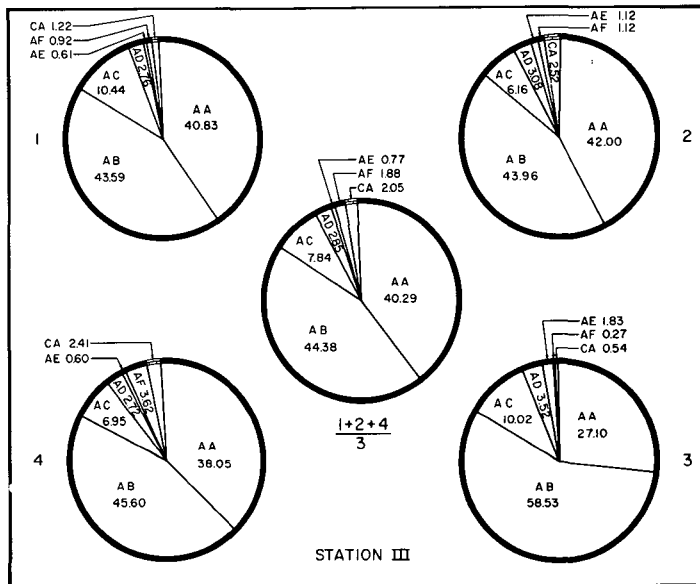


Figure 4 - Relative Percentages of Numbers of Benthonic Foraminifera Species at Station III.

Arenaceous species represent 98 per cent of the living population at station III (Fig. 4). Observed species include:  Eggerella advena (AA),  Saccammina atlantica (AB),  Ammotium cassis (AC),  Reophax curtus (AD),  Trochammina lobata and  Miliammina fusca (AE), and  Bigenerina arctica and  Trochammina squamata (AF).  B. arctica and  M. fusca are only found in subsample 2. Subsample 3 is characterized by an unusually large number of  Trochammina squamata.

The increased percentage of arenaceous specimens in the living population at station III as compared to station II may be due to the nature of the bottom sediment. The sediment at station III is primarily composed of a fine sand that can be easily obtained by Foraminifera for the construction of new chambers.

The only calcareous specimens present at station III are those belonging to the genus  Elphidium (CA).  Lagena gracillima,  Buccella frigida and  Globulina glacialis are not observed at this location although they comprise as much as four per cent of the living population at station II.

Comparison of the average relative percentage of living foraminiferal species (subsamples 1+2+4) with that of the buried dead fauna (subsample 3) indicates a decrease in the relative numbers of  E. advena,  T. squamata and  Elphidium spp., and an increase in the relative numbers of  Saccammina atlantica in the buried dead fauna at station III. These changes have probably occurred during early diagenesis and reflect a differential susceptibility of these species to dissolution (Olausson, 1967) or to destruction by worms and other marine invertebrates.

The geographic distribution of the size of the living population of Foraminifera, the number of tests per gram of sediment, the living to total ratio of Foraminifera (Phleger, 1955; Uchio, 1960), and the relative percentages of foraminiferal species will undoubtedly continue to be used in defining various conditions in marine environments (or in describing the environments themselves). It is therefore important to know how many samples are required in order to represent accurately the quantitative aspects of the foraminiferal fauna in any given area. An expanded version of this study, utilizing controlled quantitative sampling and counting techniques, has been scheduled for the summer of 1968 in order to determine adequate sample pattern densities for future investigations of foraminiferal ecology. In addition, attempts will be made to relate important physical and chemical characteristics of the bottom water and sediments to the quantitative distribution of the living and dead foraminiferal faunas in Northumberland Strait.

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