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PRELIMINARY NOTES ON RECENT SPECIES OF ELPHIDIIDAE IN SHALLOW WATERS OF THE ATLANTIC PROVINCES OF CANADA

by

G. A. BARTLETT
(Geological Survey of Canada)

REPORT B.I.O. 65-13

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B E D F O R D I N S T I T U T E O F O C E A N O G R A P H Y

D A R T M O U T H, N. S. - C A N A D A

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INTRODUCTION

The species of Elphidium and Elphidiella described in the following report are from collections obtained - April through December - from 1961 to 1965. The study area includes part of the Atlantic Continental Shelf and several large bays and estuaries along the Atlantic coast, the Fundy coast and Gulf of St. Lawrence (Figure 1). Samples were collected by hand during "SCUBA" diving operations, and with oceanographic sampling devices such as dredges and grabbers during launch operations in deeper water. Samples were collected in the intertidal zone, and to depths of 120 metres. Water temperatures range between 1.3°C. and 26°C. and salinities range from 12.63°/oo to 32.67°/oo. Substrates vary considerably and do not bear a direct relationship to species distribution. However, the hydrogen ion, oxygen, and nutrient content of the sediment affect the distribution of species of Elphidium. Living/Total ratios of most species of Elphidium are low (2%-17%), however, E. margaritaceum occasionally maintains a living population of 60%. Stations with the largest number of Elphidium tests generally have the lowest number of living individuals. There is a marked increase in both species and specimens of Elphidium from the intertidal zone to depths of 40 metres. The highest L/T ratios, however, are present in the intertidal zone, and nearshore shallow waters (10 metres) of protected marine areas.

The marked variation within distinct species of Elphidium prompted the present paper. Previous studies (Bartlett, 1963, 1964, 1965) indicated that an ecological study of Recent foraminiferal faunas of the Atlantic Provinces required a complete taxonomic study of individual species. The problems existing in this area are similar to those described by Loeblich & Tappan (1953) pp. 1-4. Errors such as misidentification, misrepresentation, poor descriptions, and ill-figured specimens occur in some previous investigations. A thorough study of many of the existing problems will require investigation of the original types of Brady, Parker and Jones, Parker, Loeblich and Tappan and many others.

Special thanks are extended to Derek W. Sarty for illustrating the Foraminifera described in this report.

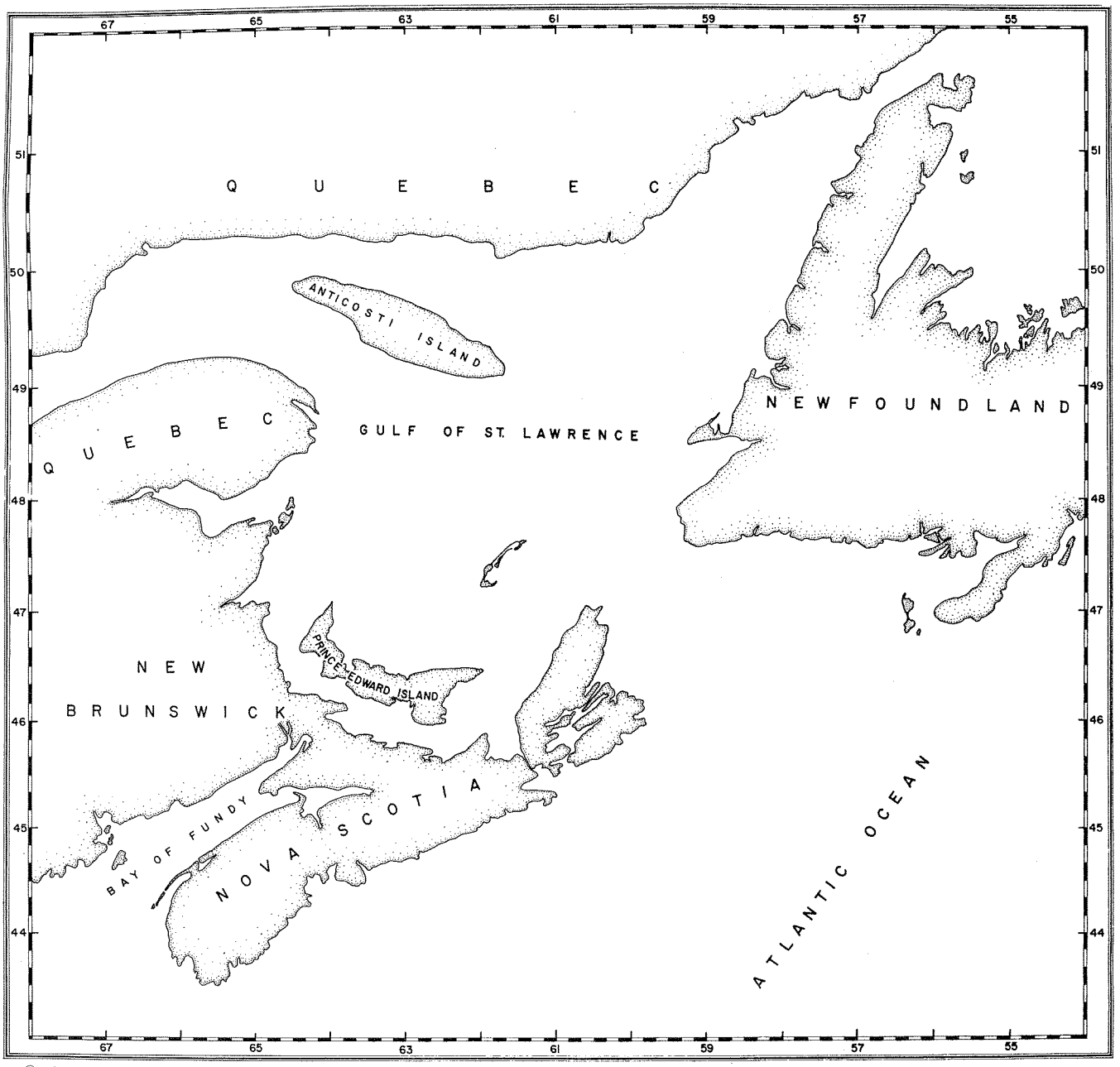

Figure 1 Location Map of Study Area.

HISTORICAL

Species of Elphidium from shallow waters of the Atlantic Provinces are similar to those described or listed by: Williamson (1858) from Great Britain; Dawson (1870) from Gulf and River St. Lawrence; Heron-Allen and Earland (1916) from coast of Scotland; Mcfadyen (1932) from East Anglia; Shupack (1934) from Western Long Island; Cushman (1944, 1948) from New England Coast and Arctic Ocean; Parker (1952) and Phleger (1952) from New Hampshire; Loeblich & Tappan (1953) from the Arctic; Harrington (1955) from Bay of Fundy; Ronai (1955) from New York Bight; Deitling (1958) from Oregon; Todd and Low (1961) from Martha's Vineyard; Bartlett (1962, 1963, 1964, 1965) from Atlantic Provinces and Scotian Shelf; Cockbain (1963) from British Columbia; Leslie (1963, 1965) from Hudson Bay and Buzas (1965) from Long Island Sound. Many other occurrences are reported by various authors in widely separated areas. Therefore, representatives resembling or identical to species of Elphidium from shallow waters adjacent to the Atlantic Provinces, are almost universally distributed.

GENERAL DISCUSSION

The distributions of the various species are discussed under individual taxonomic descriptions. A literature review indicates that almost every author has a different idea of what constitutes a particular species in this genus. Present investigations indicate that subjective separation on one occasion could probably be changed in subsequent determinations if additional material were available. A careful study of original type specimens, thin sections, micro-radiographs, trace-element analysis and a study of living specimens, (i.e. growth and physiology), are a few of the methods which can be employed in subsequent studies of this and other genera of Foraminifera. It is apparent that one solution to the speciation problem is a study of living Foraminifera. An investigation of this nature should at first be restricted to one species. The genus Elphidium is a good first choice in view of its adequate supply in the nearshore waters of the Atlantic Provinces and related areas.

Recent species of the genus Elphidium are extremely variable in external morphology. Large quantities from the same sample show a marked intergradation between subjectively differentiated species. In general, many of the differentiated "species" of Elphidium could be referred to as a "complex" (e.g. the Elphidium incertum "complex") with biofacies figured on total occurrence of all forms in the "complex" rather than on individual species. However, studies in Tracadie Bay (Bartlett, 1965) and the Scotian Shelf (Bartlett, 1963,1964) indicate that differences in external morphology of some specimens of Elphidium incertum are apparently related to environmental parameters. Large, opaque forms are commonly associated with turbulent nearshore environments or the outer shelf. Translucent, biumbonate forms with one or more umbilical bosses, together with translucent biumbilicate specimens, generally characterize more normal marine environments, such as inner shelves and open bays. Back-bay and lagoonal specimens are generally smaller, extremely variable in external morphology, and commonly possess pointed alar elongations that give the umbilicus a definite, depressed, slit-like appearance. Chamber overlap in the umbilical region is commonly broken into numerous knobs and slits that form either uniform or irregular patterns. Pores are larger and more distinct in translucent biumbonate or umbilicate forms associated with inner-shelf assemblages.

Retral processes in the Elphidium incertum "complex" are more strongly developed in opaque and umbilicate specimens, and are so strongly developed in some specimens that they approach Elphidium excavatum or E. margaritaceum in external appearance. Those with well developed umbilical bosses and knobs resemble E. gunteri, and others resemble forms described as E. incertum var. mexicanum, E. discoidale and E. clavatum. Specimens with indistinct pores and lacking retral processes resemble E. orbiculare. Several "species" of Elphidium commonly associated with E. incertum in

various marine environments are probably only variations within the species. These variations within the "complex" may be important environmental indicators that will aid in ecological and paleoecological interpretations.

GENERAL DISCUSSION OF SPECIES

Eight distinct species of Elphidium and one species of Elphidiella are recognized in the study area.

Elphidium bartletti Cushman is the largest of the species represented in the area under discussion. It is usually found in central bays or off headlands below wavebase and under more normal marine conditions than other species of Elphidium. The living representatives occur in small numbers, although some stations have large populations. The opaqueness of the test may mask the Rose Bengal stain effects; consequently, larger numbers of the specimens collected may be living forms. Two features of this species requiring further investigation are (1) the apparent relationship - based on external morphology - between transparent forms with fine sutural pores closely resembling both Elphidium bartletti and Elphidium orbiculare and, (2) the presence of an arenaceous "jacket" on numerous tests. It is very difficult to separate opaque and transparent forms of the same size, although transparent specimens bear a closer similarity to members in the E. orbiculare assemblage.

Distinct specimens of Elphidium clavatum Cushman and Elphidium incertum (Williamson) are present and can be differentiated. Variations between the two are more difficult to assign, and the species seem to intergrade one with the other in many instances. There is an uninterrupted series of specimens grading from E. clavatum Cushman to E. incertum (Williamson) at many localities. Such a series is an indication that variations may be attributed to growth stages or may be morphological representatives of different environments. Three to four chambered Elphidium clavatum progress in an apparently uninterrupted series to nine through thirteen chambered E. clavatum. Tests within this series have gently curved sutures, distinctly perforate thin transparent to translucent walls, and an umbilical region that may have a small oval depression or an elevated boss or bosses.

Similarly, three to four chambered E. clavatum may follow an uninterrupted series to E. incertum. Adult tests of E. incertum are comparable in size to those of nine through thirteen chambered specimens of E. clavatum. Specimens in the E. incertum series begin with a small elevated boss (E. clavatum) and develop, as a result of chamber overlap through extensions of the latter chambers, into forms with the umbilicus depressed or flush with the test wall. The umbilical region is generally broken by long, radiating grooves ending in a depression, boss or bosses. Adult specimens of E. incertum are always opaque, whereas those of the E. clavatum type may be translucent or opaque. Throughout the series, translucent, bossed forms become opaque with progressive chamber overlap. These intricate patterns of two or more specimens have prompted the author to refer to forms with the above characteristics as the Elphidium incertum "complex". The prevalence of the E. clavatum type in

previous studies is probably attributable to character of environment sampled or time of year and its effect on growth stages. E. incertum forma clavatum is a stage of the E. incertum "complex".

Elphidium cf. excavatum (Terquem) is a minor constituent of the foraminiferal fauna. Faunal trends are not apparent from its scattered distribution. Detailed studies may warrant elevation of this form to a new species or relegate it to one stage in the variation that exists in the Elphidium incertum "complex" listed above.

Elphidium frigidum Cushman is also a minor constituent of the foraminiferal fauna. It is easily recognized by the increase in size of the ultimate chamber and the marked offset of the last few chambers away from the general contour of the test. It is difficult to distinguish from E. subarcticum when the latter develops short retral processes on the last few chambers.

Elphidium margaritaceum Cushman is abundant, and is usually the only calcareous form present in the intertidal Zostera zone. It is associated with Miliammina fusca, Trochammina lobata and Trochammina spp. Generally, living representatives of this species are more abundant than those of the arenaceous forms. E. margaritaceum is commonly the only living form from the intertidal biofacies below Mean Low Water (M.L.W.) in shallow depths, and brackish water conditions. It is commonly replaced below M.L.W. along the Atlantic Coast and Bay of Fundy by Elphidium orbiculare and in many ocean facing beaches of the Gulf of St. Lawrence by specimens of the E. incertum "complex". In the Atlantic Provinces E. margaritaceum is prevalent in intertidal environments and shallow, brackish water bays.

Elphidium orbiculare (Brady) is a common form inhabiting quiet, slightly brackish marine environments of the study area. It replaces E. margaritaceum seaward from the intertidal zone, and is associated with this species in many instances immediately below M.L.W. in shallow back bays. Specimens under discussion are identical to forms described as E. orbiculare by Loeblich & Tappan (1953) and Buzas (1965a).

Many Elphidium orbiculare and a few E. bartletti tests possess a surficial arenaceous "jacket" composed of silt and sand size quartz and mica grains. These grains are imbedded in an organic tectinaceous or pseudochitinous layer lying immediately against the calcareous test wall. There is no previous record of this phenomenon for these particular species. All forms possessing the external arenaceous layer were living when collected. Most were collected in medium to coarse sand substrates. Many specimens are uniformly covered, while others contain one or more large quartz or mica grains that cover at least one side of the test. It is possible that this binding together of sand grains by calcareous Foraminifera provide a means of attachment in turbulent waters or protection against unfavorable environments. It may also provide a means of encystment during reproduction.

Large numbers of arenaceous covered calcareous tests are found in sediments wet-sieved in a "Fisher-Wheeler Sieve Shaker" with a "continuous spray" water attachment. Smaller numbers are found in sediments washed with the "finger-rubbing" process. Commonly, the arenaceous covered tests resemble species of Saccammina or Psammosphaera. However, when wetted, or punctured with a needle, the calcareous Elphidium test is visible. These factors may account for the apparent absence of specimens possessing the arenaceous coating in earlier studies.

Elphidium subarcticum Cushman is a minor constituent of the total fauna. It is sparsely scattered throughout the study area. No marked distributional trends are indicated from the scattered occurrence of this species.

Elphidiella arctica (Parker & Jones) is restricted to cold, normal marine waters of the Atlantic Continental Shelf and Newfoundland. Living specimens are rare on the "Shelf", but are prolific in marine waters of western Newfoundland.

This brief discussion presents a few of the problems existing in a study of a small number of species of one particular foraminiferal genus. This discussion is by no means complete. It does suggest that extreme caution and careful investigation must be initiated in any taxonomic study, and that such an investigation is a prerequisite for detailed ecological studies.

SYSTEMATICS: INTRODUCTION

Many individuals interested primarily in stratigraphy are prone to splitting Foraminifera on the slightest external morphological characteristics. Species, subspecies and varieties have previously been erected on the basis of minor morphological changes. Such species, subspecies and varieties, are frequently based on a few specimens so that the range of variation of a particular species is unknown. The following taxonomic descriptions and discussions are indicative of the variation existing in a few Recent species of the genus Elphidium.

SYSTEMATIC DESCRIPTIONS

Family ELPHIDIIDAE

Genus ELPHIDIUM Montfort, 1808

ELPHIDIUM BARTLETTI Cushman

Plate 1 - Figures 1a, b

Elphidium bartletti Cushman, 1933, Smithsonian Misc. Coll., vol. 89, no. 9, p. 4, pl. 1, fig. 9, 1939 U.S. Geol. Surv., Prof. Pap. 191, p. 64, pl. 18, fig. 10; 1949, Cushman Lab. Foram. Res. Spec. Publ. 23, p. 59, pl. 6, fig. 13, Loeblich and Tappan, 1953, vol. 121, p. 96, pl. 18, no. 7, figs. 10-14.

Cribroelphidium arcticum Tappan, 1951, Contr. Cushman Found. Foram. Res., vol. 2, pt. 1, p. 6, pl. 1, figs. 27, 28; 1951 U.S.G.S., Oil and Gas Invest. Map OM-126, sheet 3, fig. 21 (1a, b).

Elphidium articulatum (d'Orbigny) F. Parker, 1952, 1952 (not ?)

Polystomella articulata (d'Orbigny, 1839), Bull. Mus. Comp. Zool., vol. 106, no. 9, p. 411, pl. 5, figs. 5-7.

Test free, medium to large, lobulate, robust, 7-11 chambers, usually 9, walls flat, curved towards broadly rounded periphery; involute and planispiral, some of the more open coiled forms appear to be slightly evolute; sutures straight to gently curved, generally granular with 8-12 pores visible along each; umbilicus depressed and granular usually with a number of pores; walls calcareous, translucent to opaque, finely perforate; aperture consists of a basal row of pores, with others scattered over the apertural face.

Maximum diameters .41 mm - .86 mm

Maximum thickness .26 mm - .38 mm

Remarks: Specimens resemble those described and figured by Loeblich and Tappan (1953) and Cushman (1939). This species is very robust and generally opaque. A few specimens possess an arenaceous "jacket" resembling species of Saccammina or Psammosphaera.

ELPHIDIUM cf. EXCAVATUM (Terquem)

Plate 1 - Figure 2

Elphidium excavatum (Terquem) Cushman, 1930, U.S. Nat. Mus. Bull. 104, pt. 7, p. 21, pl. 8, figs. 1-7, - Parker, 1952, Mus. Comp. Zool. Bull., vol. 106, no. 10, p. 448, pl. 3, fig. 13, Cont. Cush. Found. Form. Res., vol. 7, pt. 1, p. 19, pl. 2, fig. 5.

Test free, discoidal, planispiral, involute, sides slightly rounded, periphery rounded, margin slightly lobulate, especially latter 3 or 4 chambers; sutures straight to slightly curved, 7-15 chambers; retral processes distinct, with those near the umbilicus giving the impression of transverse rings around the test; test translucent, umbilicus slightly depressed, containing one to many small knobs. Aperture a row of pores at base of apertural face.

Maximum diameters .38 mm - .66 mm

Maximum thickness .12 mm - .18 mm

Remarks: Specimens differ from those described by Terquem and Cushman in larger number of chambers, and short apertural face. Specimens resemble those figured by Todd and Low (1961). This form may warrant elevation to a new species, or it may be included as a variant in the E. incertum "complex".

ELPHIDIUM FRIGIDUM Cushman

Plate 1 - Figure 3

Elphidium frigidum Cushman, 1933, Smithsonian Misc. Coll., vol. 89, no. 9, p. 5, pl. 1, fig. 8; 1939, U.S.G.S. Prof. Pap. 191, p. 64, pl. 18, fig. 8; 1948, Cushman Lab. Form. Res. Spec. Publ. 23, p. 57, pl. 6, figs. 9-11, Loeblich and Tappan, 1953, Smith. Misc. Coll., vol. 121, no. 7, p. 99, pl. 18, figs. 4-9.

Test free, involute, walls flat to gently convex, calcareous, transparent; chambers increasing in size as added, latter ones markedly lobulate in most specimens, projecting away from general contour of the test; umbilicus depressed, granular; sutures with small pores, gently curved; aperture a basal row of pores and scattered pores over the apertural face.

Maximum diameters .35 mm - .72 mm

Maximum thickness .18 mm - .20 mm

Remarks: Generally 8-10 chambers, but in some cases 7; transverse markings on chambers are not readily apparent in most specimens.

ELPHIDIUM INCERTUM (Williamson) "COMPLEX"

Plate 1 - Figures 4-12

In describing P. umbilicatula Walker, Williamson (1858) gives the following account, "shell sub-compressed laterally; roundish,

the outermost convolution concealing the rest, and containing from ten to fourteen segments - - umbilicus slightly depressed."

In his variety incerta, he states, "differs from the typical form in the smaller number of the transverse crenulations along the septal lines, in their uniform aspect, and more unequal size. Sometimes they form long radiating grooves, especially near the umbilicus".

Brady's (1884) description in the "Reports on the Challenger Expedition" includes P. umbilicatula in P. umbilicatula var. incerta Williamson under P. striatopunctata Fichtel and Moll shown in pl. CIX, figs. 22, 23. Barker (1960) attributed fig. 23 to E. incertum. Brady's description in part is as follows.."test discoidal and equilateral, the umbilici, generally, though not always depressed slightly .... the septal bridges marking the retral processes are always more or less apparent".

Barker's discussion is as follows: "(1350 fms) ..... From similarities of Brady's figure to the figures of Macfadyen 1932 and Phleger 1952 (see Loeblich and Tappan, L.C.) and the description of Williamson has been inferred tentatively to E. incertum."

In Bull. 104, pt. 7, Cushman's description of a new variety is:

"Variety differing from the typical (here incertum) in the ornamentation of the test, the umbilical portions being occupied by several large irregular bosses, very distinct, but not forming a definite umbonate mass - test usually yellowish brown in colour", for E. incertum (Williamson) " .... margin entire or with the last two or three chambers lobulated, umbilical regions slightly depressed, often with a slight knob or irregularly arranged slits at the base of the sutures; chambers few, usually less than 10 in the last formed whorl - aperture composed of several small, rounded openings at the base of the apertural face".

Loeblich and Tappan's description of E. clavatum Cushman is as follows "biumbonate, periphery subacute, 9-13 chambers in final whorl increasing gradually in size as added; .... wall calcareous very distinctly perforate, thin and thanslucent, umbilical region with a somewhat elevated boss;" under remarks they continue, " .... but E. clavatum differs in being thickest through the umbonal region, with an elevated central boss which may be subdivided into more than one irregular knob, and the test is much more coarsely perforate."

Specimens of the Elphidium incertum Williamson "complex" in shallow waters of the Atlantic provinces are described as follows:

Test free, of medium size, involute, planispiral, periphery subacute; biumbonate, or slightly depressed umbilicus, with or without boss or bosses; translucent to opaque occasionally hyaline,

retral processes strong to absent, with umbilical slits occurring in both depressed and umbonate forms; sutures slightly curved, with pores; 9-14 chambers, with 11 being the most common number, maximum diameter 0.34 - 0.84 mm, average 0.45 - 0.50 mm. Cross sections varied, walls calcareous, perforate granular; chambers increase in size as added, commonly the last three or four are transparent or lobulate, periphery sharp to broadly rounded. Most abundant species of Elphidium in study area.

Remarks: As already pointed out by Loeblich and Tappan (1953) and Buzas (1965) a great deal of misidentification and misinterpretation has plagued this particular species since initiated in 1858 by Williamson. Williamson (1858) in his description of P. umbilicatula, p. 43, states, when referring to the test, ".... and containing from 10-14 segments (chambers)." In his figured specimen he shows only 9. Dimensions of the tests are 1/50 of an inch which is approximately 0.5 mm, comparable to specimens in the present collection. Williamson's measurements of P. umbilicatula probably apply to the var. incerta because there is no mention of size when he discusses differences from P. umbilicatula.

Apparently, only Macfadyen (1932), Phleger (1952) Parker (1952), Todd and Low (1960) and Buzas (1965) have shown what may be regarded as a true E. incertum (Williamson). In all cases, however, the E. clavatum type is the most abundant form in the assemblages discussed. Collections from the Atlantic provinces have the following variations - translucent with biumbonate knobs, translucent with depressed umbilicus, translucent test, slits with or without knobs, also opaque forms with all the previously mentioned umbilical characteristics. Here, however, the slits are much more pronounced than those of Cushman (Bulletin 104, pt. 7, pl. 7, 1930, 4a, 5-10a), Loeblich and Tappan (1953, pl. 19, figs. 8a, b, 9, 10) and those of Todd and Low (1961, pl. 2, figs. 1 and 2) a further indication of the marked variations within the "complex".

ELPHIDIUM MARGARITACEUM Cushman

Plate 1 - Figure 13

Elphidium advenum (Cushman) var. margaritaceum Cushman, 1930, Bull. 104, U.S. Nat. Mus., pt. 7, p. 25, pl. 10, fig. 3 - F. Parker, 1952, Bull. Musc. Comp. Zool., vol. 106, no. 10, p. 447, pl. 3, fig. 10.

Test free, small, generally compressed, occasionally inflated, periphery rounded, lobulate in the larger forms, acute, almost carinate in the minute forms, wall calcareous, perforate, retral processes pronounced, occupying from one-quarter to one-half the

chamber, 8 to 13 chambers in the final whorl, mostly 11; umbilicus depressed, occasionally with an umbilical boss, otherwise sutures meet in the umbilical area. Aperture a row of pores at the base of the apertural face. Sutures gently curved with 8 pores on each suture, white to transparent in the final chamber.

Maximum diameters	.33	.34	.36	.40	.41	.46	.50 mm
Maximum thickness	.15	.18	.24	.17	.26	.22	.20 mm

Remarks: This form is easily recognized in all assemblages. It is widely distributed in the intertidal zone and brackish waters of estuaries and back bays. It has not been found living in normal marine waters.

ELPHIDIUM ORBICULARE (Brady)

Plate 1 - Figures 14a, b

Nonionina orbicularis Brady, 1881, Annals and Mag. Nat. History, ser. 5, vol. 8, p. 415, pl. 21, fig. 5.

Nonion orbiculare (Brady) Cushman, 1948, Cushman Lab. Foram. Res. Spec. Pub. 23, p. 53, pl. 6, fig. 3.

Elphidium orbiculare (Brady) Loeblich and Tappan, 1953 Smith Misc. Coll., vol. 121, no. 7, p. 102, pl. 19, figs. 1-4, Contr. Cush. Found. Foram. Res., vol. 7, pt. 1, p. 20, pl. 2, fig. 11.

Test free, small for the species generally, extremely robust, planispiral and involute, walls convex, calcareous, distinctly nodial, perforate, hyaline - transparent; sutures distinct and depressed, curved slightly towards the umbilicus, granular to small pores; chambers of about equal size, some increasing as added, latter ones lobulate; umbilical area depressed and generally granular grading as such to sutures; apertural face short and broad, base perforate, with a row of distinct pores in most specimens.

Maximum diameters 0.27 mm (6 chambers) - 0.61 mm (9 chambers)

Remarks: Differs from specimens of Loeblich and Tappan (1953) in smaller size, and fewer chambers. All specimens are not opaque as suggested by Todd and Low (1961). Numerous specimens possess a surficial arenaceous "jacket" composed of silt and sand size quartz and mica grains. All specimens with "jackets" are living when collected.

ELPHIDIUM SUBARCTICUM Cushman

Plate 1 - Figures 15a, b

Elphidium subarcticum Cushman, 1944, Cushman Lab. Foram. Res. Spec. Publ. 12, p. 27, pl. 3, figs. 34, 35; 1948, Cushman Lab. Foram. Res. Spec. Publ. 23, p. 58, pl. 6, fig. 12, F. Parker 1952, Bull. Mus. Comp. Zool., Vol. 106, no. 9, p. 412, pl. 5, fig. 9, Loeblich and Tappan, 1953 Smith Misc. Coll., vol. 121, no. 7, p. 105, pl. 19, figs. 5-7.

Test free, planispiral, involute, 8-9 chambers, 8 most common, sides flat, periphery rounded, smooth to lobuate; wall opaque, perforate, calcareous to translucent; chambers approximately equal in size as added; sutures straight to slightly curved, granular with tiny pores in central region, umbilicus flush to slightly depressed, granular sutural pores occasionally extending to the umbilicus, aperture consists of a basal row of pores with others irregularly scattered over the apertural face. In two specimens the last two chambers lacked the broad granular sutures, but were replaced by short retral processes and small distinct pores.

Maximum diameters .34 mm - .59 mm

Maximum thickness .20 mm - .24 mm

Remarks: Broad granular sutures with central pores are distinguishing features. E. subarcticum is distinct from E. frigidum except when short retral processes are developed in the last few chambers of the former.

Genus ELPHIDIELLA Cushman, 1936

ELPHIDIELLA ARCTICA (Parker & Jones)

Plate 1 - Figures 16a, b

Elphidium arcticum (Parker and Jones) Cushman 1930, U.S. Nat. Mus. Bull. 104, pt. 7, p. 27, pl. 11, figs. 1-6.

Elphidiella arctica (Parker and Jones) Cushman 1939, U.S.G.S. Prof. Pap. 191, p. 65, pl. 18, figs. 11-14, Cushman and Todd, 1947, Contr. Cushman Lab. Foram. Res., vol. 23, pt. 3, p. 65, pl. 15, fig. 20, Cushman 1948, Cushman Lab. Foram. Res. Spec. Pub. 23, p. 59, pl. 6, fig. 15, Loeblich and Tappan, 1953, vol. 121, no. 7, p. 106, pl. 20, figs. 1-3.

Test large, planispiral, involute, robust, larger forms compressed with almost flat sides, others rounded, periphery broadly rounded; chambers increasing in size as added, occasionally causing periphery to be lobuate, 10-13 in the final whorl; sutures

elevated with a double row of pores becoming more slit like; wall calcareous, opaque, smooth except for sutural pores; aperture a small slit at the base of the apertural face, with two almost parallel rows of pores just above the base.

Maximum diameters 1.12 mm - 1.32 mm

Maximum thickness 0.47 mm - 0.60 mm

Remarks: Very few specimens are well preserved, they are generally broken with indistinct ornamentation. These tests have a well worn appearance probably due to long transportation or reworking. Loeblich and Tappan (1953) believe that many of the Arctic tests of this species are actually fossil, weathered from the Pleistocene in the Alaska area. Living juvenile and adult tests have been collected in the Bay of Islands, western Newfoundland. Living specimens have not been found in collections from the Atlantic Continental Shelf.

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PLATE 1 . . . ELPHIDIIDAE

Plate 1 . . . . Elphidiidae

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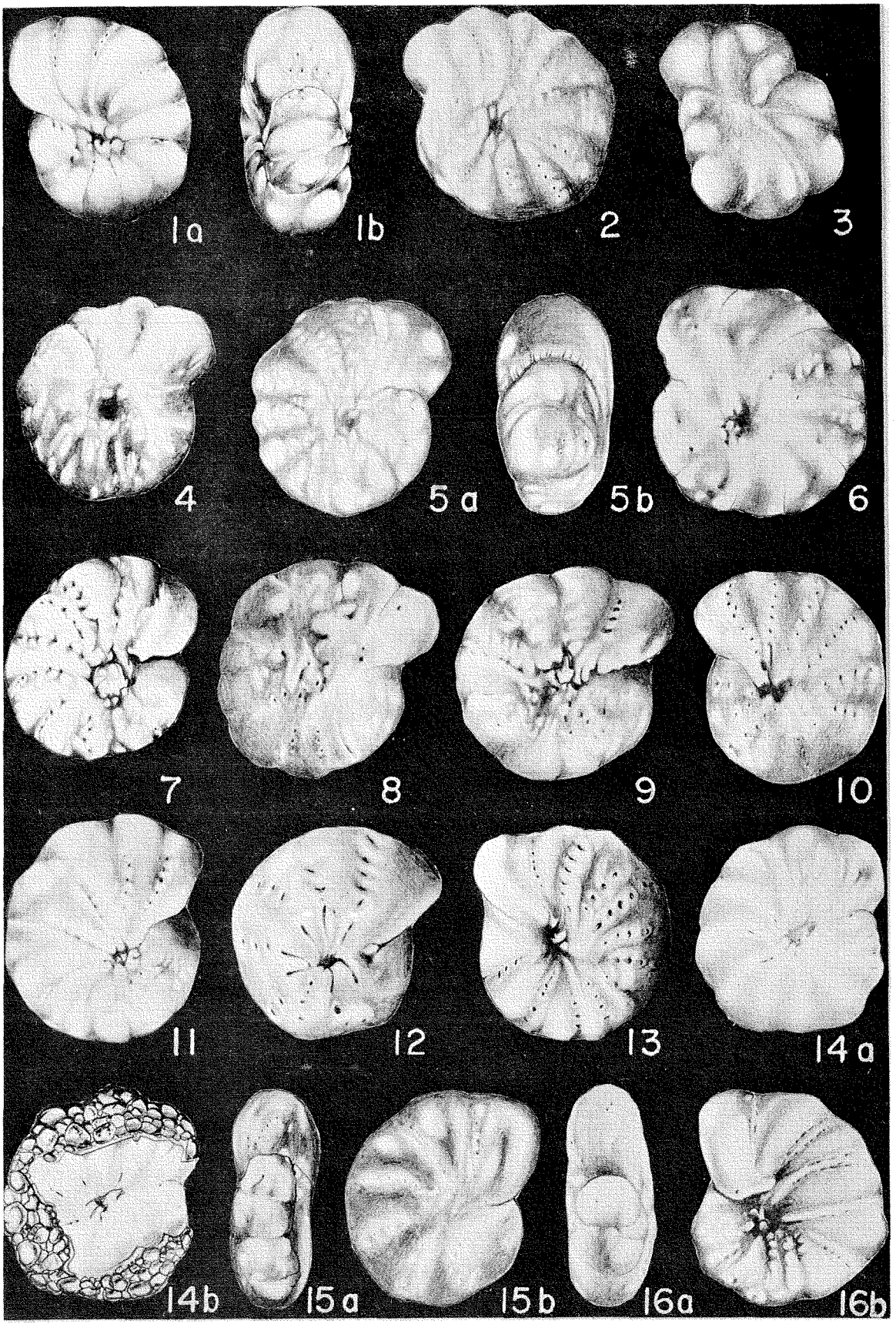
* Hypotypes of figured specimens stored with Marine Geology collections at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada.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