BENTHIC FORAMINIFERAL ASSEMBLAGES IN EFFINGHAM INLET, A FJORD OF WESTERN VANCOUVER ISLAND, BRITISH COLUMBIA:

IMPLICATIONS FOR LATE HOLOCENE PALEOPRODUCTIVITY OF THE NORTHEASTERN PACIFIC.

By

Trecia Marie Schell

Submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy

at
Dalhousie University
Halifax, Nova Scotia
August 2003

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Departmental Representative:

DALHOUSIE UNIVERSITY

DATE: 15 August 2003

AUTHOR: Trecia Marie Schell

TITLE: Benthic Foraminiferal Assemblages in Effingham Inlet, a fjord of Western Vancouver Island, British Columbia: Implications for Late Holocene Paleoproductivity of the Northeastern Pacific.

DEPARTMENT OR SCHOOL: Department of Earth Sciences

DEGREE: Doctor of Philosophy CONVOCATION: October YEAR: 2003

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ABSTRACT

Scientific interest in the evidence linking oceanographic processes and fish population dynamics in Canada has increased since the highly publicized Pacific salmon collapse off the west coast of British Columbia and the collapse of the Atlantic cod fishery. To study this problem in a prehistoric context, Effingham Inlet, western Vancouver Island, British Columbia was chosen as a study site. This inlet is a 17-km long by 1-km wide fjord (with anoxic to dysoxic bottom waters) located at the apparent northern extreme of the California Current with a connection to the open ocean. Historical fish catch data suggest an expansion and contraction of this favorable habitat due to the changes in oceanic conditions that affect climate, *i.e.*, the 3 – 7 year ENSO (*El NiÑo* Southern Oscillation) and 30 – 50 year NP-DO (North Pacific Decadal Oscillation), but up until now there were no prehistoric data to verify long term trends.

Foraminiferal assemblages can be used as proxies for paleoclimatic and paleoceanographic conditions such as temperature, oxygen, salinity, and organic matter (OM) production. Various combinations of these factors may indicate periods of enhanced and suppressed upwelling, oxygenation events associated with marine incursions into the fjord and associated changes in productivity. Once the paleoceanography of a region is understood, it may serve as a proxy for the suitability of a paleohabitat for particular pelagic fish species over time. The restricted nature of Effingham Inlet is an ideal primary study site with its deep basins, shallow sills, laminated sediments and low sediment oxygen content, which provide well preserved sedimentological and paleobiological records of upwelling and other ocean-climate events.

The presence of foraminiferal species tolerant of low-oxygen (microxic) conditions in the innermost, restricted basin sediment cores, indicates that while anoxic conditions may predominate, they are not permanent. There are several discrete pulses of a marine, open-water/shelf foraminiferal associations containing *Buccella frigida* (indicating an influx of oxygenated marine shelf waters), followed by an increased presence of the opportunistic, low oxygen-tolerant foraminifer, *Fursenkoina fusiformis*. These pulses or 'events' are repeated many times, suggesting that there have been many incursions of freshly oxygenated marine waters the during last 4000 years into the inlet with a frequency of ~ 30 to 50 years. These marine incursions are followed by episodes of high productivity triggered by the ephemeral introduction of dissolved oxygen and nutrients into the restricted basins. These episodes of high productivity are followed by bottom water anoxia caused by the increased biological respiration and organic flux to the sea floor. These changes in dissolved oxygen levels and productivity are recorded by changes in the benthic foraminiferal assemblages found in Effingham Inlet.

An increase in river-borne thecamoebians are found in both basins of Effingham Inlet over approximately the last 3000 cal yBP, thus indicating an increase in precipitation. The cooler and wetter climate is consistent with the current regional climate regime of the last 4000 years. In addition, productivity (or frequency of marine incursions) is high over ~ the last 3000 years in Effingham Inlet.

EPIGRAPH

" These minute animals are interesting objects of study, geologically and biologically as well as esthetically. As objects of beauty they arrest the attention of even the casual observer by the delicacy of their structure as well as the symmetry and variety of their forms. Geologically they are of interest because they are among the most ancient and abundant of fossils and also the most efficient of rock builders. Biologically they are instructive examples of the powers and possibilities of an individualized bit of protoplasm."

James M. Flint, 1899, Recent Foraminifera: *A Descriptive Catalogue of Specimens Dredged by the U.S. Fish Commission Steamer Albatross.* (Sen Gupta 1999).

ACKNOWLEDGEMENTS

Financial support for this project was made possible through a National Sciences and Engineering Research Council (NSERC) of Canada strategic grant entitled "Long term variability in pelagic fish abundance and oceanographic conditions on the British Columbia Shelf: Implications for Strategic Fisheries Planning." awarded to the principle investigator – Dr. R.T. Patterson of Ottawa-Carleton University, and supplemented by and NSERC research grant to Dr. D.B. Scott. Fellow student collaborators included A. Dallimore, A. Chang (Ottawa-Carleton U.), M. Hay (U. Laval), and M. Skinner (U. Victoria). In addition I would like to thank Audrey for 'being the glue' that held this project together. I really do not know what we would have been able to accomplish without her fortitude.

I would like to thank the crew and Captain. P. Frost of the *CCGS J.P. Tully*, and K. Conway and B. MacDonald of the Pacific Geoscience Centre – Geological Survey of Canada, for making our 1999 research cruise a success – even in the adverse weather!

I would like to thank Dr. D.B. Scott for his supervision of this thesis, the opportunity to swim amongst the stromatolites in Shark Bay, and many, many other things. I would like to acknowledge the support of the Faculty of Graduate Studies, Dalhousie University for several graduate scholarships I received during my Ph.D. tenure. I would also like to acknowledge the help and guidance I received during the final days of thesis preparation from Dr. F.S. Medioli. And thank you Chloe for preparing my TOC samples for The Last Core. Oh, and of course the Geograd Brew Crew for four years of stimulating coffeetime discussions,… or incursions into the totally weird areas of the human psyche…

I would like to thank Kumiko and Karen, for encouraging me to go back to school. Linda and Simon, Christopher, followed by James and then Miss Margret, for all the ever-growing fabulous funny family dinners, christenings, birthday parties… you are awesome!...

But first and foremost I would like to very much thank my parents – Gary and Marie Schell, for all their unconditional love and support. My two Big little sisters – Tonya and Nadine, for their never-ending hugs, and letters of encouragement. My niece and nephew – Jennille and Jesse, for their giggles, smiles and sticky fingers. They are my sunshine.

I would also like to dedicate this thesis in memory of Mrs. Lorraine Schell, and Mr. M. Robert Young.

Thank you.

"Difficulties are just things to overcome."

~ Sir Ernest Shackleton

Chapter 1

INTRODUCTION

Foraminiferal assemblages have been used as proxies for paleoclimatic and paleoceanographic conditions such as temperature, oxygen, salinity, and organic material production (Kennett 1982). Changes in these oceanographic conditions lead to changes in the foraminiferal species deposited in sediments. Hence, changes in the foraminiferal assemblages may indicate periods of enhanced or suppressed biological productivity due to conditions such as oxygen and nutrient-rich upwelling events that occurred in a fjord.

In turn, once the paleoceanography and paleoclimatology of a basin are understood, the suitability of a paleohabitat for a particular pelagic fish species can be established. The current understanding of fish stock management is limited to historical records, hence there is no long-term reliable research on the paleoproductivity of commercially and ecologically important Pacific pelagic fish species, such as salmon and herring (Figure 1.1). The use of the Recent Quaternary history derived from micropaleontological and sedimentological records may extend our knowledge of the paleohabitat and thus natural fluctuations in fish stock (Finney *et al.* 2000).

In recent years, there has been a resurgence of interest in 'ocean-climate' changes, largely due to local and global economics from the commercial fisheries to forestry, and the management of natural resources. Examples are the controversy generated by the highly publicized Pacific salmon collapse off the west coast of British Columbia (Figure 1.1; Glavin 1999; Joyce 1999) and the collapse of the Atlantic cod fishery (Proctor 1999). Benthic foraminiferal associations have been used extensively in paleoceanography (Kennett 1982). There is a growing realization that the traditional information provided by micropaleontological studies also has a much greater value in extending our knowledge of historical climate regimes (Finney *et al.*

2000; Scott *et al.* 2001). Marine micropaleontology, especially in coastal areas, is rapidly becoming more important to determine if there is a relationship between oceanographic processes and climate dynamics, such as hurricanes and upwellings, and how distinct that 'coupling' may be recorded in geological history in the sedimentological record (Scott *et al.* 2001).

Off western boundaries such as the West Coast of Canada, upwelling is the principal mechanism driving nutrient supply to the coastal ocean (Baumgartner *et al.* submitted.). Upwelling is the flow of deep marine water from depths of 100 - 200 m to the surface caused by the wind-driven Ekman transport of surface waters away from the coast (Dallimore 2001). It is known that shifts in the position and intensity of the Aleutian Low system over the North Pacific exert a major control on the occurrence of upwelling events; this has also been correlated to the stock recruitment of many British Columbian fisheries (Pacific anchovy, Pacific herring, Pacific hake, sardine and mackerel) (Glavin 1999, Figure 1.1). It is these climate changes that influence the stratification and offshore upwelling, and thus nutrient and oxygen availability, which can influence increases in plankton abundance that can transfer productivity up the trophic pyramid. Unfortunately, the nature of the long-term oscillations in this ocean-climate system (decadal to millennial) and the accompanying effects are not well known (Baumgartner *et al.* submitted).

Effingham Inlet is exposed to the shelf waters off Vancouver Island, so that information about the physical, chemical and biological oceanographic conditions of the coastal ocean is recorded in the varved sediments of this inlet.

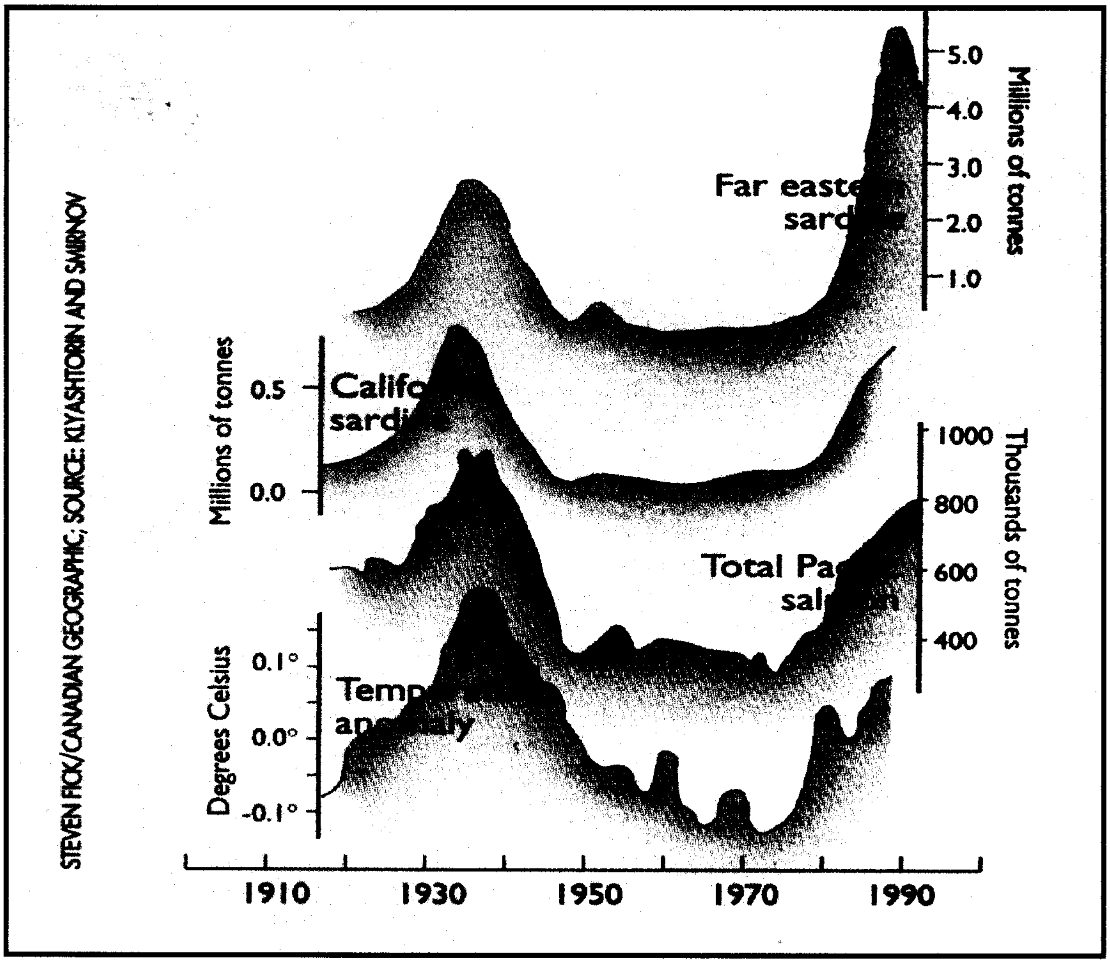


Figure 1.1. Pacific pelagic fish stocks, correlation of catch data and ocean-climate interactions in the Northeastern Pacific (after Glavin 1999).

Study site

The restricted nature of Effingham Inlet, a fjord on western Vancouver Island, British Columbia located near the northern extreme of the California Current, is an ideal study site (Figure 1.2). Fjords are useful in paleoceanographic research because in many cases only the strong oceanographic events are felt in their inner basins, thus removing most of the background productivity; the high sedimentation rates provide a high-resolution record (Thomson 1981). Effingham Inlet's deep basins, shallow sills and low sediment-oxygen content, provide an excellent sedimentological and paleobiological record of these upwelling and other ocean-climate events. It is the intent of this thesis to discover if there is a natural periodicity of the oceanographic processes and marine ecosystems of the northern Pacific Ocean throughout the late Holocene preserved in the sediments of the Inlet.

In addition, a fjord is a geomorphologically well-defined entity (Brattegard 1979). In biological terms it is an easily defined, almost closed ecosystem showing less variability than the open coast or ocean. In practical research the system can be conveniently divided up into three parts vertically, according to the hydrodynamics: the upper levels where the estuarine circulation takes place, middle levels influenced by the intermediate water masses, and the deeper levels below the level of the sill. It is possible, at least in theory, to estimate water exchange and inputs and outputs of energy and matter. As in estuaries, biological production and productivity in fjords are generally high (Brattegard 1979).

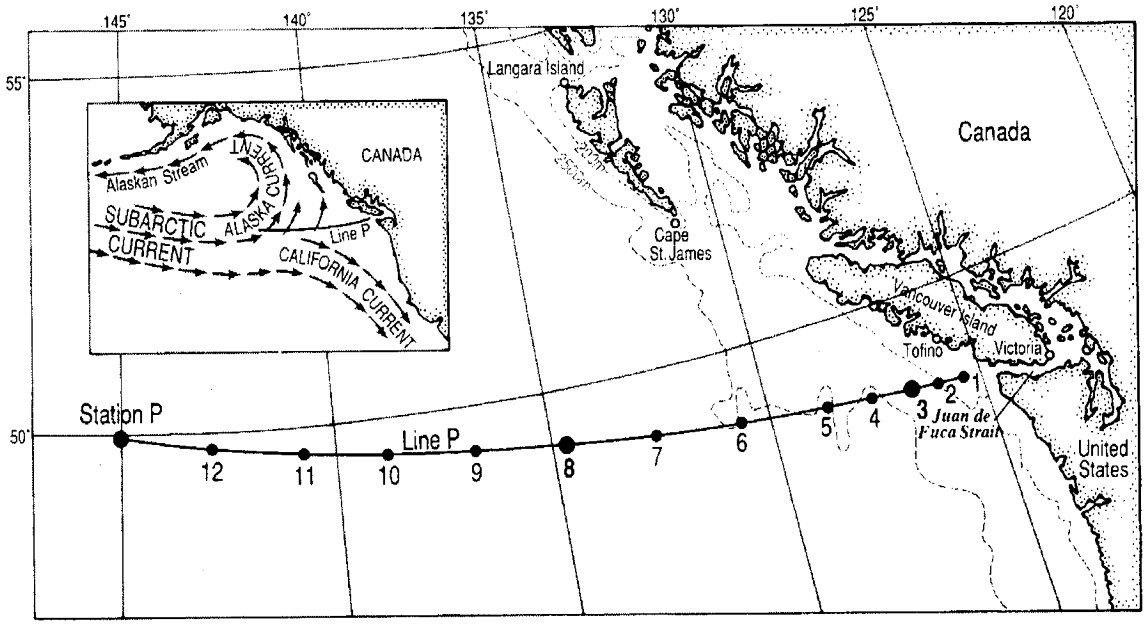


Figure 1.2. Chart of portion of the northeastern Pacific showing the bifurcation point of the two major offshore currents, and the sampling transect line to Ocean Station P (after Tabata 1989).

Foraminiferalogy.

Foraminifera are an enormously successful group of microscopic or almost microscopic amoeboid protists. They are abundant and diverse in modern oceans from coastal to the deep sea, they are pelagic to epi- and endobenthic, and utilize a diversity of trophic mechanisms (Goldstein 1999). Foraminifera are exclusively unicellular and yet accomplish nearly all of the fundamental functions of life performed by multicellular organisms. They eat, defecate, move, grow, reproduce, and respond to a variety of environmental stimuli (Goldstein 1999). Metazoans have evolved organs and other specialized features through multicellularity. Foraminifera and other protists specialized by diversifying subcellular components or organelles to perform these various functions (Goldstein 1999).

Two broad morphological features distinguish foraminifera from other protists (Loeblich and Tappan 1964). First, all foraminifera possess granuloreticulopodia which are fine, thread-like, pseudopodia that anastomose and have a granular texture when viewed with the light microscope. Secondly, nearly all foraminifera possess a test or shell that encloses the organism and separates it from the surrounding milieu. The test may be organic, agglutinated (constructed of foreign particles cemented together) or composed of secreted calcium carbonate (aragonite, and high or low Mg calcite) and, in very rare cases, silica (Goldstein 1999). In cases where the calcareous shell has been dissolved, the inner tectinaceous organic shell lining may remain as evidence of the presence of a calcareous foraminifer (Scott *et al.* 2001).

Benthic foraminifera utilize a broad range of feeding mechanisms and their nutritional resources include algae, bacteria, yeasts, fungi, and sometimes smaller animals and dissolved organic carbon (Goldstein 1999). The algal cells are of particular importance to planktic species that inhabit the photic zone, but are also important to benthic species that utilize the plankton phytodetritus at the seafloor.

Fossil assemblages.

The fossil assemblages preserved in bottom sediments show varying degrees of difference from the living assemblages from which they were drawn (Murray 1991). The causes include production differences between species, seasonal succession of genera and species, loss or gain through current transport, and loss of calcareous tests through dissolution. However, notwithstanding this, in most cases, sufficient information is preserved to make a paleoecological reconstruction possible (Murray 1976).

Where oxygen is present in the sediment (and then of course also in the bottom waters), the oxidation of organic matter produces CO_2, which lowers the pH of the sediment pore waters. Thus, this produces conditions corrosive to calcareous tests (pers. comm. Dr. S. Calvert). However, under anoxic conditions, where sulphate reduction occurs, abundant carbonate alkalinity is produced, which tends to buffer the effect of CO_2 production, leading to the better preservation of calcareous tests (pers. comm. Dr. S. Calvert). This was shown in the Santa Barbara Basin by Sholkovitz (1973) and Berger and Soutar (1970). Hence although the low oxygen, high organic conditions might intuitively suggest dissolution of carbonate, in fact they promote calcium carbonate preservation in a fjord-type environment, which is why Effingham Inlet is an ideal study site.

My examination of the foraminiferal samples has yielded extremely rare occurrences of foraminiferal organic linings, which suggests either very little dissolution of the calcareous tests has occurred, or that even the tough, residual organic inner shell linings were degraded. The calcareous tests were quite fragile, and thin – and their delicate nature made their extraction from the samples difficult. This fragility suggests that these organisms were able to exist and flourish in this harsh, or less than optimal environment but their deficiency in calcium carbonate may be indicative of the response to major biophysical stress.

Previous work on Regional Foraminiferal Assemblages

Fossil foraminifera may be used as a proxy of paleoproductivity (Scott *et al.* 2001). In particular the North American Upwelling Zone may be distinguished using foraminiferal species associations to differentiate upwelling events from other oceanographic phenomena by identifying benthic forms, in dysoxic and oxygenated areas.

It is the long-term biological and environmental time-series (several decades to centuries) that are necessary to provide the type of climate information needed to be able to distinguish between anthropogenically and naturally induced environmental changes, and for monitoring environmental change over time, irrespective of the causes (Alve, *in press*). Numerous investigations have shown that benthic foraminifera, which leave a fossil record in most marine sediments, are well suited for this purpose (Scott *et al.* 2001).

Several paleoceanographic studies of late Quaternary cores of modern surface material have been carried out on the British Columbia continental shelf in recent years using benthic foraminiferal distribution data as proxies (Cockbain 1963; Patterson 1991, 1993; Matthewes *et al.* 1993; Patterson *et al.* 1995; Guilbault *et al.* 1997; Patterson *et al.* 2000; Patterson and Kumar 2002). These studies examined the uppermost 1-2 m of boxcores, or surficial sediments (upper 10 cm) in coastal shelf areas to the north and south of this study area.

On the West Coast, upwelling driven ocean changes (Thomson and Ware 1996; Thomson, 1981) are accompanied by subtle foraminiferal faunal shifts (Guilbault *et al.* 1997). This relatively stable foraminiferal species distribution is due to the continuous upwelling of deep, warmer water of the California Undercurrent onto the shelf, partially offsetting any local atmospheric or climatological effects (Patterson *et al.* 1995). The impact of upwelling can be seen in the similar distributions of shelf-dwelling foraminifera along the entire West Coast of North America, despite the geographic distances. There are only three recognized, major faunal boundaries between Panama and the Aleutian Islands: in the Juan de Fuca Strait, at Point Conception, and at the southern tip of Baja California (Lankford and Phleger 1973; Buzas and Culver 1990) (Figure 1.3). These boundaries correlate roughly with the oceanographic domains of Thomson and Ware (1996; Ware and Thomson 2001). This means that the paleoceanographic interpretations based on the distribution of foraminiferal faunas can be directly compared along much of the west coast of North America, making foraminifera particularly valuable in interpreting widely dispersed phenomena such as migrating fish stocks.

Buzas and Culver (1990) compiled a database of the known and available data sets of Recent foraminiferal census data from the continental margin of North and Central America. They applied a cluster analysis (Jaccard coefficients) to the database to define 13 groups, of which 7 were regarded as having biogeographic significance. The most northerly two faunal provinces, the Oregonian and Aleutian, bathe the areas of continental margin that provide the fresh marine waters in the region of Effingham Inlet (Figure 1.3). It is the Oregonian and Aleutian faunas that may influence the exotic 'blue water' foraminiferal faunal assemblages that enter the fjord under upwelling conditions. Buzas and Culver (1990) list the foraminiferal species that characterize the Aleutian province and that occur in the Oregonian province as *Buccella frigida*, *Cibicides fletcheri*, *C. lobatulus*, *Elphidium excavatum*, *Epistominella vitrea*, *Islandiella californica, I. limbata,* and *Trifarina fluens.* These 8 species comprise 67 % of the total characteristic species. The foraminiferal species that characterize the Oregonian province, and are found in the Aleutian province, include *Buccella frigida, Buliminella elegantissma, Cibicides fletcheri, Dyocibicides biserialis*, *Eggerella advena*, *Elphidium excavatum*, *Rosalina columbiensis*, *Islandiella californica*, *I. limbata*, *Nonionella baspinata*, *N. stella*, *Rosalina columbiensis*, *Trochammina charlottensis* and *T. pacifica.* These 14 Oregonian province species comprise 66 % of the total characteristic species.

In a much earlier study of the distribution of foraminifera in Juan de Fuca and Georgia Straits of British Columbia, Cockbain (1963) found two main faunal divisions comprising 9 separate faunas (total populations, from sizes greater than 74 μm). He found that the deep-water mud bottom area north of the Fraser River Delta contained low numbers of predominantly agglutinated foraminifera. To the south of the delta the bottom is shallower and sandy, and calcareous foraminifera are abundant and diverse. Cushman and Todd (1947a) pointed out that it is remarkable that a small number of species dominate the faunas of the region. Of the 83 species recorded in Cockbain's (1963) study, the most abundant were *Cassidulina limbata*, *C. californica*, *Elphidiella nitida*, *Elphidium clavatum*, *E. subarcticum*, *Buccella* spp. (Including *B. frigida*, and *B. tenerrima*), *Cibicides lobatulus* and *C. fletcheri.* These 9 species comprise 70 % of the calcareous foraminifera. The most common arenaceous species include *Eggerella advena*, *Adercotryma glomerata*, *Ammotium plannissimum*, *Spiroplectammina biformis*, *Recurvoides turbinatus* and

Trochammina spp. As would be expected in a nearshore area, planktic foraminifera were extremely rare, and were found in only 5 out of 175 sample sites.

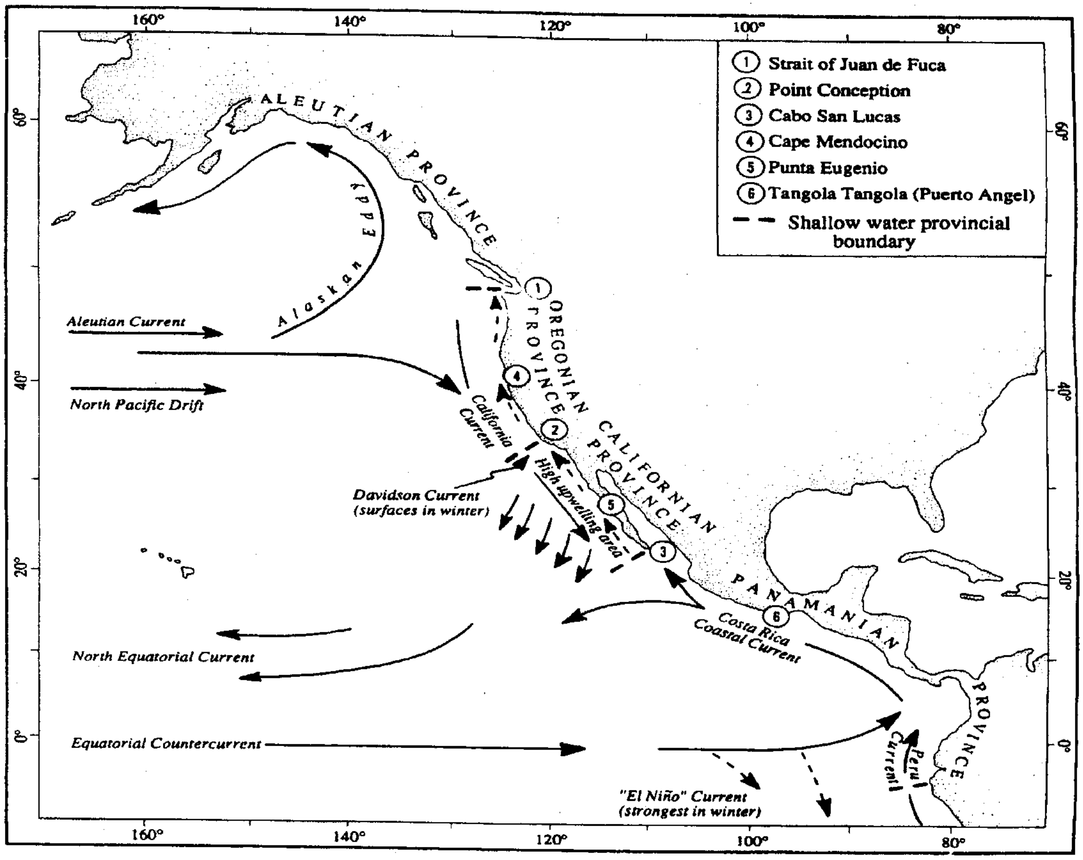


Figure 1.3. Location of offshore Eastern Pacific currents, and foraminiferal faunal domains (from Buzas and Culver 1990).

Recent Fjord Foraminiferal Assemblages.

In comparison to the present fjord study, Blais-Stevens and Patterson (1998), using ODP Leg 801 materials, describe the sedimentology, paleoseismology and paleoceanography of Saanich Inlet, which is near Victoria, on eastern Vancouver Island (Figure 1.4). Saanich Inlet is much shallower, less restricted and therefore much more oxygenated and bioturbated than Effingham Inlet. Saanich Inlet is also not exposed to the open coastal waters, unlike Effingham Inlet. According to Hebda (1995) and Dallimore (2001), the approximate paleoclimate zones are similar to Effingham Inlet, and some possible seismic events are concurrent, but not all are directly correlatable. In addition, Patterson and Kumar (2002) reexamined the foraminiferal associations of these ODP cores from Saanich Inlet and described several associations similar to the surface foraminiferal associations described by Patterson *et al.* (2000) from the 1997 Effingham Inlet cruise box core material. The Saanich Inlet sampling spans longer into the sedimentary record, predating the end of the last glaciation (~15 000 cal yr BP) compared to approximately 4000 cal yr BP for 1999 and 1997 cores from Effingham Inlet (Dallimore 2001).

In 1997, a research cruise was carried out in Effingham Inlet; gravity cores representing the upper 10 cm of sediment column were collected at various locations and depths in the fjord to document the modern distribution of benthic foraminifera in relation to well-oxygenated, reduced oxygenation and anoxic conditions. Patterson *et al.* (2000) examined 31 surface sediment samples collected during the 1997 *J.P. Tully*'s cruise to Effingham Inlet and found 146 species - including 31 thecamoebians, 6 marsh foraminiferal species, 104 subtidal benthic species, and 5 planktic species. Planktic foraminifera were almost absent from counted samples, as expected in a fjord with restricted marine access, and relatively shallow coastal areas. Thecamoebians dominated the faunas collected from the shallow innermost parts of the inlet, where waters are the least saline and foraminifera least abundant. Although thecamoebians could have been washed into the inlet from anywhere above high tide, the species present differ from those found in inland lakes and are mostly typical of tidal marshes, or of areas close to sea level (Guilbault *et al.* 1997; Patterson *et al.* 1985, 1996, 2000).

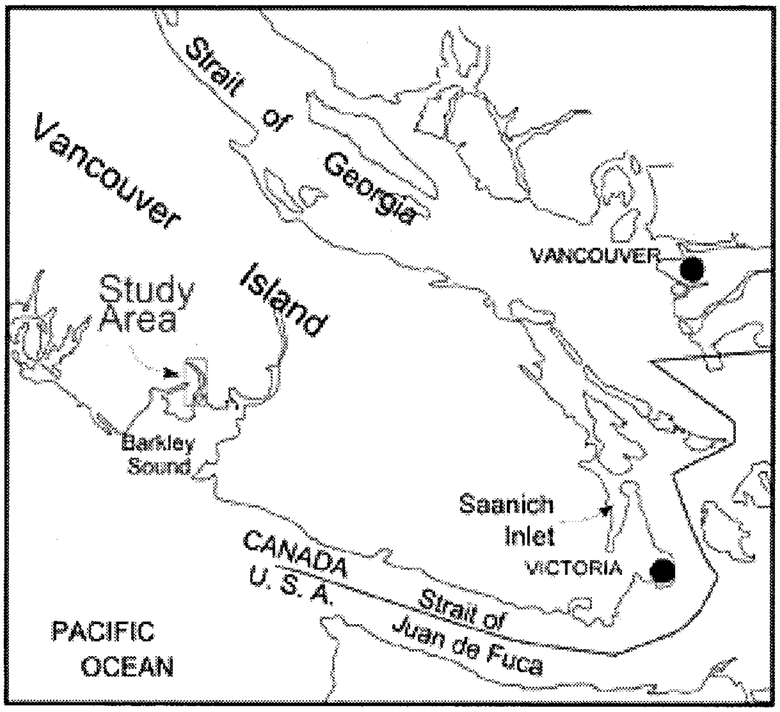
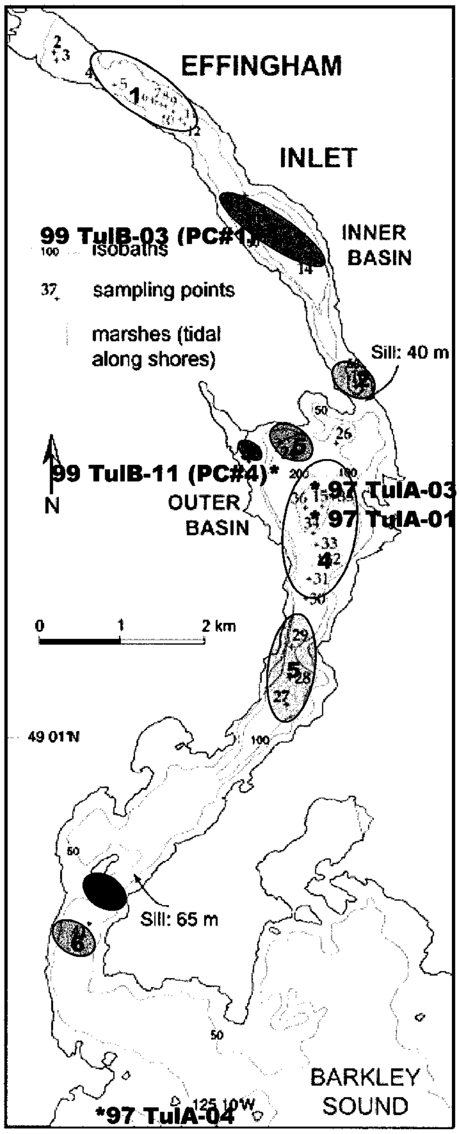


Figure 1.4. Location of Saanich Inlet, relative to Effingham Inlet, Vancouver Island (modified from Patterson *et al.* 2000).

Marsh foraminifera do represent an important part of the faunal assemblage, but only in samples near the salt marsh at the head of the inner basin. The predominant marsh form is *Miliammina fusca* (Brady); although this species can also occur subtidally in hyposaline estuaries (Murray 1991). The high bottom salinity conditions present at the head of the inlet (> 30 ppt) and the adjacent large tidal marsh there suggest that a large proportion of specimens of *M. fusca* found in the Inner Basin were most likely redeposited from the marsh (Patterson *et al.* 2000).

Patterson *et al.* (2000) found that in Effingham Inlet variable suboxic conditions result in characteristic assemblages, such as the *Stainforthia* and *Stainforthia-Bolivinella* biofacies that are remarkably similar to faunas observed in some Norwegian fjords under similar conditions (Figure 1.5; Alve, 1995a,b; *in press*). The apparent gradation between the *Stainforthia-Bolivinellina* Assemblage and the *Stainforthia* Assemblage is also significant as it suggests that a whole range of dysoxic/anoxic conditions should be detectable. Hence the future use of foraminifera as indicators of variable suboxia downcore appears to be possible, which is the hypothesis that set this project in motion. In addition, Patterson *et al.*'s (2000) results further indicate that the reworking of specimens should not complicate the further interpretation of samples from cores collected in either the Inner or Outer Basins. It was noted that in the Inner Basin redeposited tests were relatively more abundant, probably the result of the small size of the basin and the relatively small autochthonous population able to withstand primarily anoxic conditions (Patterson *et al.* 2000) (Figure 1.5).

Patterson *et al.* (2000) recognized seven foraminiferal assemblages whose primary controlling factor appears to be oxygen content, which is probably controlled, at least partially, by the proportion of organic matter in the sediment (Figure 1.5). The estuarine *Buliminella* Assemblage (#1) characterized well-oxygenated environments with high levels of terrestrial plant matter. This assemblage disappeared when the oxygen levels fell beneath suboxic levels of 40 μM/kg. The *Buccella* Assemblage (#2), dominated in part by attached forms and Islandiellids, is typical of well-oxygenated bank environments in the region. The *Psammosphaera* Assemblage (#4) is related to the lower salinity and variable conditions present in the shallow water where it occurs. The *Stainforthia* (= *Fursenkoina fusiformis*) - *Nonionella* Assemblage (#5) characterized one well-oxygenated environment outside the inlet. The *Stainforthia - Bolivinella* Assemblage (#6) is typical of suboxic/dysoxic conditions (10-40 μM/kg) in the Outer Basin. The *Stainforthia* (=*Fursenkoina fusiformis*) Assemblage is identified from dysoxic environments of deepest parts of the Outer Basin. A gradation between the *Stainforthia - Bolivinellina* Assemblage and the *Stainforthia* Assemblage is significant as a whole range of suboxic/dysoxic/anoxic conditions are detectable, potentially permitting the recognition of even subtle variations in paleoceanographic/atmospheric circulation. The *Stainforthia - Buccella* Assemblage (#7) was recovered from the least oxygenated area of Effingham Inlet under fully anoxic (with H_2S) conditions, and provided evidence that even the most isolated portions of Effingham Inlet are periodically oxygenated.



① *Buliminella* assemblage - estuarine, well O_2 but not suboxic, (60m) (*B. elegantissma*, *C. arctica*, reworked marsh species)

② *Bucella* assemblage - normal, shallow marine (55-72m), similar to open middle shelf/'bank' faunas - open shelf, oxic, near normal salinity (*Islandiella*, *Cibicides*, *Bolivina pacifica* = relict !)

③ *Psammosphaera* assemblage - related to lower salinity and variable conditions in shallow water (22m) (*M.fusca*, *S. atlantica*)

④ *Stainforthia* assemblage - dysoxic, deep part of basin (179-209m), 10uM kgO_2, (*S. feyling/F. fusiformis* 60-70%, *Trochammina* sp., *B. pacifica*, *L.catella/R.scottii*)

⑤ *Stainforthia-Bolivinella* assemblage - suboxic (20-30uM kgO_2). The % *S. feylingi* is a bit lower (18-57%), same % other species as *Stainforthia* assemblage but shallower waters.

⑥ *Stainforthia-Nonionella* assemblage - well oxygenated, + 100uM kgO_2 in 90m water, dominated by S. *feyingi* but moderate amounts of *Lobatula/Cibicides*, *Nonionella*, (&few *L.catelli/R.scottii*, *B. pacifica*, *Trochammina* spp.)

⑦ *Stainforthia-Buccella* assemblage -least oxygenated, under fully anoxic with H_2S conditions in Inner Basin at depth +100m. Some *Buccella* spp. = transported from upper slope. Indigenous deep water facies *S.feylingi*, *B. pacifica*, *Trochammina*, *L. catelli*, ~ existance of temporary oxic conditions.

Figure 1.5. Summary diagram of findings for 1997 Effingham Inlet foraminiferal assemblages from surficial sediments collected in 1997 (modified from Patterson *et al.* 2000).

The Significance of *Fursenkoina fusiformis*

Fursenkoina fusiformis (referred to as *Stainforthia fusifomis* by Patterson *et al.* 2000 and students) is a small, usually less than 250 μm, elongate, and thin-shelled, rotaliid, benthic foraminifer. Although its life cycle is not well known, there are lines of evidence suggesting that the reproduction of *F. fusiformis* may be entirely asexual or that its life cycle is metagenic (alternating generations) but without any significant test dimorphism (Alve, *in press*). It probably reproduces throughout the year and its life-history strategy seems to be highly opportunistic. It is also a facultative anaerobe opportunist, and has been found to be the most successful foraminiferal colonizer of formerly anoxic environments (Alve 1995a) as well as of new, recently established habitats (Alve 1999).

The areas strongly dominated by *F. fusiformis* have been grouped into three different environment categories - beneath hydrographic frontal areas, physically disturbed areas, and ephemerally dysoxic/anoxic basins (Alve, *in press*). Oxygen-depleted basins, such as Gullmarfjord in Sweden, are subject to pronounced phytoplankton blooms in addition to the stress caused by the oxygen depletion of the bottom waters (Gustafsson and Nordberg 2001). The increased organic flux to the sediments subsequent to the phytoplankton blooms, whether they occur in frontal zones or fjords, are likely to reduce the oxygen content in the sediment pore water where *F. fusiformis* actually lives. The fact that *F. fusifomis* strongly dominates the assemblages in the severely oxygen depleted fjords and not outside the sills, suggests that either it benefits and/or can tolerate the environmental conditions caused by the oxygen deficiency (Alve, *in press*). Of the five dominant genera in an experiment where benthic foraminifera were exposed to anoxic bottom-water conditions for 78 days, the densities of *Fursenkoina* (mainly *F. fusiformis*) and *Nonionella* were significantly higher under anoxic conditions (Moodley *et al.* 1997). On the other hand, significant decrease in densities of stained *F. fusiformis* under sulphidic treatments over a 66 day period, suggested that the species did not reproduce but that it's survival was enhanced by conditions created by the sulphidic treatment (although life-checks indicated that they were dead; Moodley *et al.* 1998). Furthermore, 13 weeks of exposure to hypoxic bottom-water conditions, of which the last five had dissolved oxygen concentrations

< 0.2ml/l, did not cause a convincing increased abundance of *F. fusiformis*, in either relative or absolute terms (Alve, *in press*). However, the dysoxia killed off the majority of the metazoans potentially competing with the foraminifera for food. This indicates that dysoxic conditions alone do not promote increasing abundance of *F. fusiformis*, while weeks of exposure to anoxia may do so, probably due to reduced competition and predation.

Alve (*in press*) concluded that the opportunistic life-strategy of *F. fusiformis* makes it highly adapted to cope with environmental stress and that this, rather than tolerance to a particular environmental parameter, causes it to dominate in areas subject to rapidly changing environmental conditions.

Fjords

The fjord systems of the world are all quite young geologically, and most were formed in the last 20 000 years. Fjords also offer opportunities that are unique among coastal systems (formerly glaciated coastal valleys) from a marine biological perspective. A number of these important fjord characteristics listed by Matthews and Heimdal (1979) are as following:

a) Topography - a glacially formed, deep basin connecting directly or indirectly with the open sea at one end over a relatively shallow sill, typically one half to one tenth the basin depth; and a length many times greater than its width. (This topography is restricted to cold temperate regimes because that is where glaciers occurred in the past.)

b) Climate and hydrography - pronounced seasonal change, particularly in temperature and fresh-water run-off, as found at middle and high latitudes; and the development of a halocline typically in the summer and autumn between brackish surface water and fully saline subsurface water.

c) Hydrodynamics - vertical mixing at certain times of the year, particularly the autumn; estuarine circulation driven by fresh water influx (precipitation and riverine input); tidal flow acting as a hydraulic pump; and density or wind-driven currents bringing water into the fjord over the sill or taking it out of the surface, in both cases with a corresponding counter-current. When the horizontal density difference is great enough, the inflowing water displaces the water in the deep basin.

Many fjords have large rivers discharging into them, usually at the head, and all have some fresh water inflow. They are estuaries – 'where the tides meet the sea', with estuarine circulation, according to the more formal definition of Cameron and Pritchard (1963). In this circulation, the fresh water from rivers or 'runoff' flows seaward in the upper layer, entraining salt water from below and carrying it out of the fjord (Pickard and Stanton 1979). As a result, to maintain the average salt content of the fjord, there must be an inflow of saline water from the sea, and this more dense water must enter below the out flowing low salinity layer (Pickard and Stanton 1979).

In the Norwegian language there is a more useful distinction between 'fjords' *sensu stricto* and smaller more enclosed systems known as 'polls' (Matthews and Heimdal 1979). Fjords have sills at 100 m depth or more, a deep basin or basins at several 100's of metres water depth and a total length of 10's to 100's of kilometres. Polls have shallow sills of a few metres water depth, basins perhaps 100 m deep but usually rather less, and a length of only a few kilometres. There are intermediate variations on these two definitions, but the important difference is the depth of the sill relative to the pycnocline (= density = salinity + temperature). A fjord's sill depth is deeper than the pycnocline, while a poll's sill depth is shallower than the pynocline (Matthews and Heimdal 1979). Under this definition, Effingham Inlet is a "poll" with its sill depths ranging from 45 to 60 m, and basinal depths of 120 and 210 m.

General topography

The Pacific fjord regions include the Coastal Mountains of Alaska and British Columbia, southern Andes of Chile, Southwest Tasmania and the Fjordland Mountains of the South Island of New Zealand (Pickard and Stanton 1979). The fjords extend along coastlines of lengths of about 550 km for Alaska, 850 km for mainland British Columbia, 300 km of Vancouver Island, 1500 km of Chile, and 230 km of New Zealand's coastline. The prevailing westerly airflow to all coasts brings copious precipitation, generally as rain to lower elevation and as snow to the higher ones. There are permanent snow-fields on the mountains of Vancouver Island, but no glaciers (Pickard and Stanton 1979).

One other topographic feature has a significant influence on the water characteristics of the fjord - the degree of access to the open ocean outside as the source of their saline water (Pickard and Stanton 1979). For the west side of Vancouver Island, the fjords all open directly to the ocean over sills of only tens of metres deep, but over a continental shelf of a few kilometres width. In addition, on Western Vancouver Island, the fjords are generally uninhabited by humans.

Morphology

Pacific fjords are generally long, narrow and deep, with one or more sills, although these are usually deeper than the halocline or pycnocline and rarely prevent sub-surface exchange with outside waters. Sharp bends (90°) are common, and in North American fjords, interconnections between fjords occur in many cases (Pickard and Stanton 1979).

In referring to fjords, the term 'head' is used for the inland end, where there is usually a major river bringing in fresh water, and the term 'mouth' for the seaward end. The position of the head is usually clearly defined, but the mouth is often less clear. In length, the fjords range from a few kilometres to nearly 400 km, and in width from 0.6 to 15 km.

Physiography

Freshwater input is probably the most important factor affecting surface water properties in fjords as precipitation (generally considered to be minor in comparison) and riverine flow (including seasonal snow melt). The deep waters are generally unaffected by the fresh water input (Pickard and Stanton 1979).

The Vancouver Island fjords show a wide range of density values for relatively short fjords that open directly onto the ocean, because of the relatively shallow sills, relatively low tidal inflow due to their short lengths (Pickard and Stanton 1979). As density is determined much more by salinity than by temperature in the fjords, particularly in the upper 100 to 200 m, the salinity profiles are similar to the density profiles. Salinity/depth profiles in fjords fall into two types: Type 1 (surface mixed or near mixed layer below which there is a marked halocline; indicating significant freshwater runoff); and Type 2 (the halocline starts at the surface; indicating little freshwater runoff). By this definition, Effingham Inlet with its highly stratified water column due to density differences would be a Type 1 fjord.

For dissolved oxygen, at depth, the range of values is much larger in fjords than in the ocean. There are several reasons for this. The majority of fjords have sills that are deeper than the upper, low salinity layer but nevertheless do restrict exchange with the ocean and in some cases there is more than one sill. Multiple sills create several basins with differing water column characteristics depending on their water exchange capacities. When there is little river runoff and therefore only a weak estuarine circulation, the basin water is not exchanged rapidly and oxygen depletion occurs. This is the case in many of the Vancouver Island fjords where inner basins often have lower dissolved oxygen values than the outer basins (Pickard and Stanton 1979).

Previous work on Late Holocene Sedimentology and Paleoclimatology of Effingham Inlet.

Regional setting

Bedrock geology

Effingham Inlet is located on the southwest coast of Vancouver Island, which is part of the Insular Belt of the Canadian Cordillera. The main allocthonous terrane underlying Vancouver Island is the Triassic series of rocks known as Wrangellia (Gabrielese *et al.* 1991; Dallimore 2001). The geologic elements of the Insular Belt were accreted to each other approximately 200 Ma, during the Middle Jurassic, and collided with the other terranes of the Cordillera to the west sometime during the Cretaceous. Accretion of the Cordillera terranes was accompanied by compression, which is expressed today in the Vancouver Island area by the great active, right lateral strike-slip fault located offshore Queen Charlotte Islands. This is known as the Queen Charlotte-Fairweather Transform Fault, which separates the Pacific and North American plates (Clague 1989a; Dallimore 2001).

Tectonics & Paleoseismicity.

Vancouver Island is located in close proximity to the junction of the Pacific, American, and Juan de Fuca plates, and 2 smaller blocks - the Explorer plate and the Winona Block. Seismic activity in the area is related to the subduction of the oceanic Juan de Fuca plate beneath the continental North American plate (Hyndman 1995; Dallimore 2001), and also to the displacement along the Queen Charlotte-Fairweather Transform Fault (Keen and Hyndman 1979).

Southwestern British Columbia is presently tectonically active and has experienced four moderate earthquakes during modern historic times; two on Vancouver Island 1918 (M = 7.0) and 1946 (M = 7.2), and two in Washington State 1872 (M = 7.4) and 1949 (M = 8.1) (Rogers 1994). The most recent significant earthquake, a M = 6.8, felt in the region occurred on February 28, 2001. The epicentre was near Olympia, Washington, just to the south of Vancouver Island. No significant damage was reported on Vancouver Island, although significant ground shaking was experienced throughout southern Vancouver Island (Dallimore 2001).

A great magnitude 9 (estimated), subduction earthquake occurred in the Vancouver Island area on January 27, 1700 AD - as recorded by the oral history of the Pachna Bay native peoples of west coast Vancouver Island and Japanese historical documents about the resulting tsunami and deposits (Hyndman 1995; Atwater *et al.* 1995; Clague and Bobrowsky 1994a, b, 1999; Dallimore 2001). In addition there are current investigations of coastal tsunami and submergence features on Vancouver Island and in northern Washington State (Atwater *et al.* 1995; Clague and Bobrowsky 1994a, b). It is postulated that the M = 9 earthquake was caused by a subduction rupture that occurred along the 900 km length of the thrust fault of the Juan de Fuca and North American plates, similar to the 9.2 Great Alaskan Earthquake of 1964 (Hyndman 1995; Plafker 1965). Further evidence for large prehistoric earthquakes has come from studies of massive and laminated sediment packages in anoxic Saanich Inlet, BC (Blais 1995); stratigraphic evidence of tsunami deposits and associated rapid sea-level change; sand dykes and blows resulting from seismically induced sediment liquefaction, and seismically triggered landslides (Dallimore 2001).

Laminated sediments that record seismic events are useful in extending the brief historic seismic record, particularly in attempting to determine the existence of moderate (M = 7) to large (M = 8/9) earthquakes in the prehistoric past (Blais 1995; Blais-Stevens *et al.* 1997, 2001; Blais-Stevens and Clague 2001). In the Saanich Inlet studies, debris flows expressed as massive muds and silts, intercalated within the anoxic laminated sediments, probably have a seismic origin, and an average recurrence interval of 150 years. This is close to the modeled return time of approximately 100 years for moderate to large earthquakes of Southern Vancouver Island (Rogers 1994; Dallimore 2001).

Regional Oceanography & Climatology.

The overall ocean-atmosphere climate system of the Pacific Ocean is controlled by relative shifts in the position of the atmospheric Aleutian Low (AL) and the North Pacific High (NPH) (Figure 1.6; Dallimore 2001). The position of these atmospheric systems responds to the location of the Jet Stream, especially in the winter when the variability in the Jet Stream is the highest (Roden 1989; Dallimore 2001). The surface currents of the Northwest Pacific Ocean are controlled by the position and intensity of the Aleutian Low and North Pacific High (Dallimore 2001). Strong winds associated with these systems are a major contributor to the three major oceanographic domains that characterize the West Coast of North America: Coastal Upwelling Domain (Baja California to North Vancouver Island), Coastal Transition Zone (North Vancouver Island to Dixon Entrance) and the Coastal Downwelling Domain (Alaska Coast and Panhandle) (Ware and Thomson 2000).

In addition, Vancouver Island is also located in the bifurcation region of the Subarctic Current and the West Wind Drift (Figures 1.2, 1.3). The north-south shifting of this point determines whether the cold California Current (upwelling) or the warm Alaskan Current (downwelling) will dominate the regional ocean climate (Trenberth and Hurrel 1994). Effingham Inlet is located at the apparent present day northern extreme of the southeast-flowing offshore California Current surface current, just at the bifurcation point with the northward-flowing offshore Alaska Current (Figure 1.2). The nearshore currents that flow over the Vancouver Island shelf are, however, strongly seasonally dependant and are of particular significance to periodic upwelling onto the continental shelf of deep (+150 m) slope waters (Figure 1.6; Thomson 1981; Patterson *et al.* 2000; Dallimore 2001).

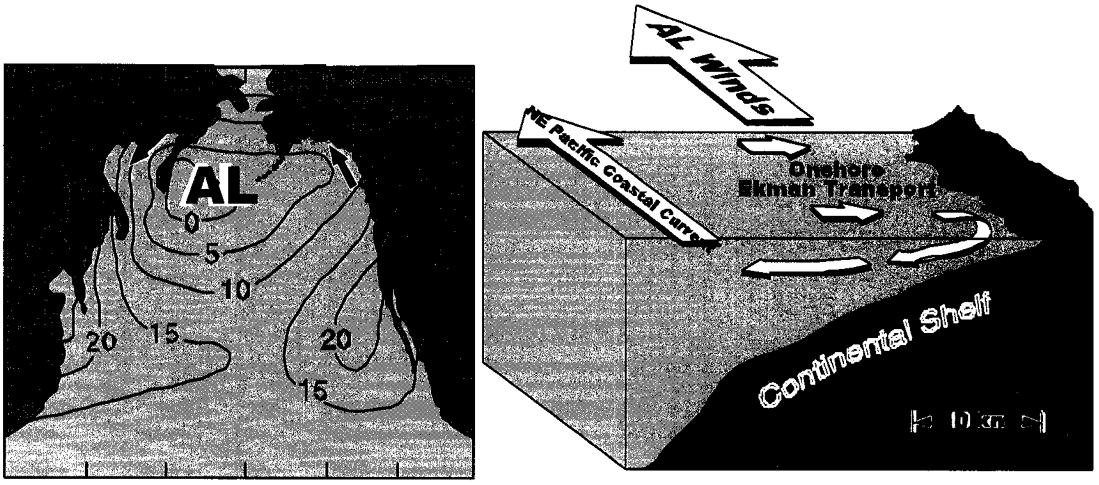
The southeastward flowing Shelf Break Current (SBC) dominates in the summer - it is driven by the prevailing clockwise circulating winds of the North Pacific Atmospheric gyre and is forced seaward/offshore by the Ekman transport effect (Figure 1.6). This creates 'space', and leads to the drawing up/upwelling of deep slope water onto the Vancouver Island Continental Shelf. These nutrient-rich waters are the source of a dramatic increase in primary productivity (plankton, diatom blooms). These waters are also known to traverse into adjoining inlets such as Effingham Inlet, leading to periods of enhanced productivity that can presumably be recognized in the fossil record (Thomson 1981; Patterson *et al.* 2000).

In contrast, the Vancouver Island nearshore shelf current reverses direction in the winter months under the influence of the Aleutian Low pressure gyre to the northwest-flowing

Northeast Pacific Coastal Current (NEPCC) and causes the downwelling of surface waters (Figure 1.6; Thomson and Gower 1998) reducing the productivity of the surface waters. The winds are poleward, and by Ekman's transport effect, the surface waters are drawn onshore and impinge on the coastline, forcing the surface waters down, or causing the downwelling of the surface waters.

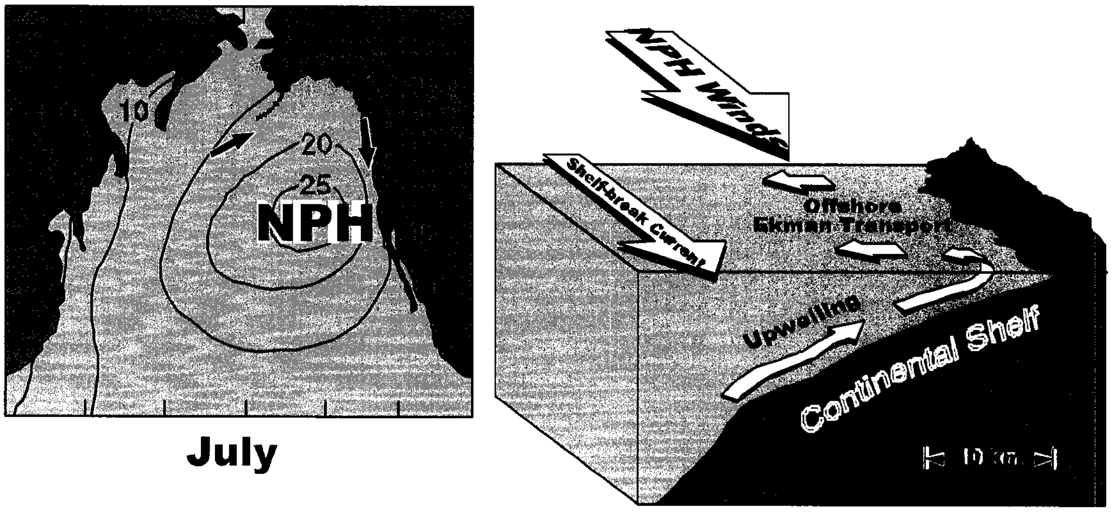
In the present day oceanographic region air and surface temperatures appear to fluctuate on a 2 to 8 year cycle in response to the episodic *El NiÑo* and Southern Oscillation oceanic events (ENSO) (Thomson 1981). These ENSO signals, as well as more periodic oscillations expressed at decadal scales can also be recognized in the instrumental climate record (Ware 1995) that exists for approximately the past 100 years. The last ENSO event was recognized as beginning in February 1997, and lasting until March of 1998 with the oxygenation of the bottom water of Effingham Inlet occurring in the last fall of 1998 (Canadian Press, Chronicle Herald, 10 October 2002; Dallimore 2001).

Therefore, the position of the AL determines whether there will be costly droughts or flooding on land. It also impacts coastal British Columbia fisheries because changes in the wind system influence mixed layer depth, coastal upwelling and offshore advection, which can result in modifications to plankton abundance and distribution (Mackas *et al.* 2001; Dallimore 2001).



January

Winter: Aleutian Low influenced coastal circulation off Vancouver Island.



July

Summer: North Pacific High influenced coastal circulation off Vancouver Island.

Figure 1.6. The main features of upwelling and downwelling wind conditions off the British Columbia coast, and consequent Ekman transport (from Patterson *et al.* 2000; modified after Thomson 1981).

Physiography of Effingham Inlet.

Effingham Inlet is a fjord located on the oceanward side of southwestern Vancouver Island, close to the Pacific Rim National Park. The fjord is open to the Pacific Ocean through the Imperial Eagle Channel, and then Barkley Sound (Figure 1.7). Effingham Inlet is 17-km long, 1-km wide fjord with 2 sills along its length that create two restricted basins (Figure 1.5). The Outer Basin is located near the mouth of the inlet behind the first sill (65 m water depth). The Inner Basin is located farther along the length of the fjord, behind a second sill (40 m water depth). The Outer Basin is the larger and deeper of the two basins with a maximum water depth of 210 m. The maximum water depth of the Inner Basin is 120 m. A narrow channel extends from the Inner Basin to a marsh at the head of the Inlet and is fed by the small Effingham River. Tidal marshes are also present on the shores of the Outer Basin, each fed by small, unnamed streams (Dallimore 2001).

The shores of the inlet are steep and rocky, and are surrounded by 900 to 1200 m high mountains comprised of Triassic and Lower Jurassic volcanic rocks (Patterson *et al.* 2000). The shores are heavily forested with coniferous trees and logging has occurred since about the 1970's on the upper slopes in the vicinity of the Outer Basin (photograph, Dallimore 2001; Figure 1.8). The photograph also shows the lack of beaches along the shores of the Inlet. There is a small marsh at the head of Effingham River that empties into the Inner Basin and two small beaches near the outlets of the two unnamed streams that empty into the Outer Basin. Most shorelines are sheer bedrock cliffs that plunge into the water. The intertidal zone is covered with barnacles and mussels. None of the streams flowing into the inlet can be called large and the overall watershed is only 56 km^2. Few roads access the inlet, and a handful of isolated fishers' cabins found at the mouth of the Inlet are the only signs of human habitation (Dallimore 2001).

Underwater slopes of the inlet nearshore are also steep and rocky, and seem to consist of out-cropping volcanic Mesozoic rocks and/or Quaternary glacial gravel (Patterson *et al.* 2000). Below 20 m water depth, the sediments of the basin floor are organic-rich, olive-grey mud with surface sediment a distinct, black organic-rich mud a few cm-thick. The bottom sediments at depth shallower than 70 m (Outer Basin, and head of Barkley Sound) are a firm grey marine mud and silt, with lower organic content then the olive grey muds.

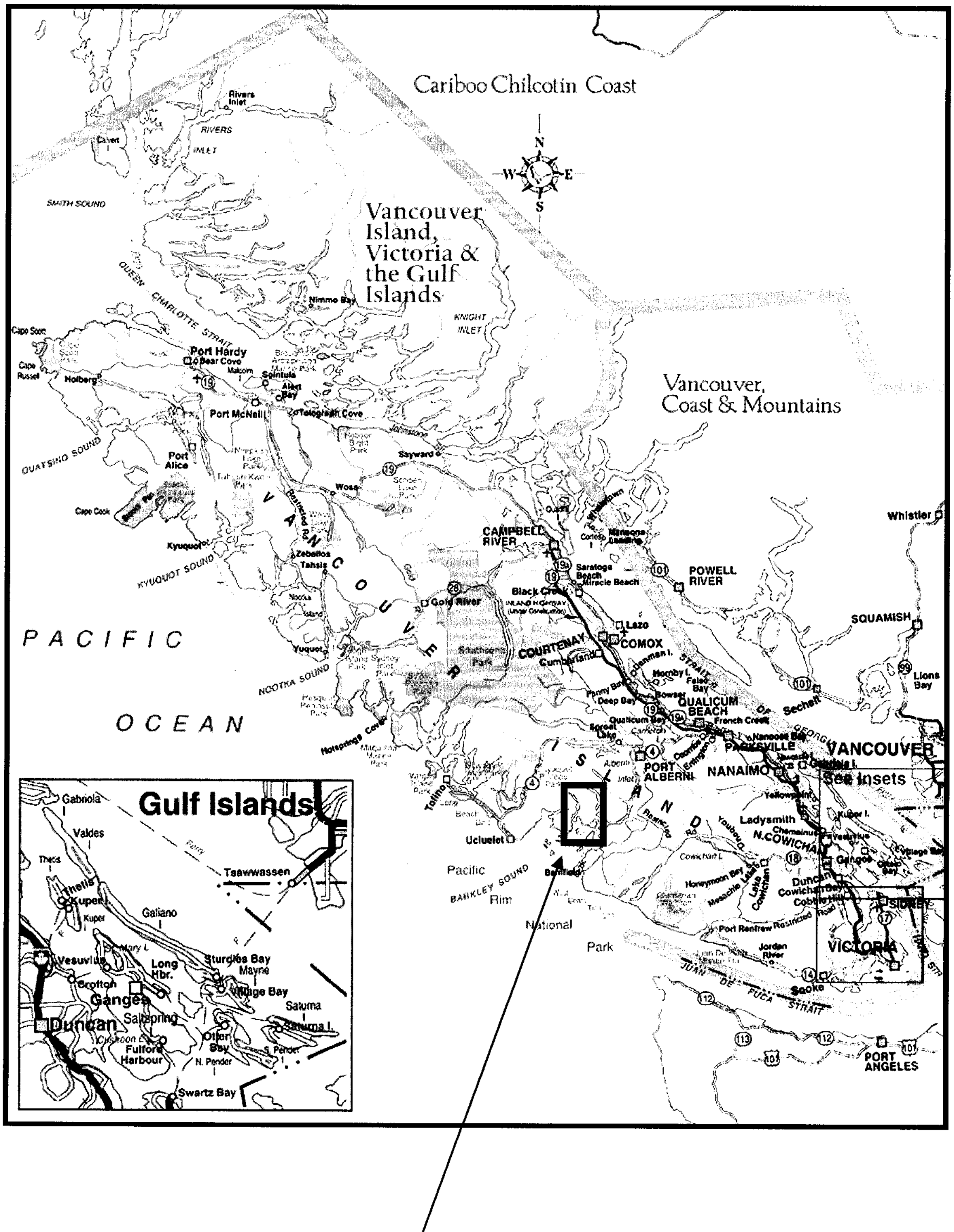


Figure 1.7. Regional location map of Effingham Inlet (as indicated and outlined by a box), Vancouver Island (From BC Tourism 2003, http://hellobc.com/bcescapes/maps)

Figure 1.8. Digital photograph, taken during the October 1999 J.P. Tully cruise to Effingham Inlet (Dallimore 2001); situated in the Outer Basin facing towards the Inner Basin and the head of fjord.

Oceanography of Effingham Inlet.

The physical oceanography of Effingham Inlet was investigated for the first time in October 1995, and again in March 1997 (Patterson *et al.* 2000). Water temperatures, salinity (salinity + temperature = density), oxygen and transmissivity profiles of the inlet were developed along a 20 station transect from Barkley Sound to the Inner Basin.

Salinity or density profiles of the Inlet reveal a well-developed, estuarine-type stratification of the water column (Figure 1.9). Salinities were higher at the bottom of the basin than at the sill depths, indicating a stable, stagnant water column in the basins, conditions conducive to low rates of turnover and subsequent conditions of anoxia and dysoxia in the bottom waters of the inlet (Dallimore 2001). The salinity profile of the Outer Basin reveals the movement of basin waters. The salinity of the Outer Basin is higher than at the Outer Sill, and it appears that higher salinity oceanic water occasionally crosses over the sill and enters the Outer Basin (Dallimore 2001). Additionally, without the periodic addition of higher salinity oceanic waters into the Outer Basin over time, basin salinity would eventually diminish from heat and salt diffusion (Patterson *et al.* 2000).

Oxygen profiles of the Inlet show a progressive decrease in oxygen with increasing water depth in both the Outer and Inner Basins, creating a highly uniform anoxic (Inner Basin) to dysoxic (Outer Basin) water column with depth (Figure 1.10). An anoxic water column contains no oxygen, while dysoxic waters contain some oxygen in gradients from suboxic ($O_2 < 40$ μm/kg) to low oxic (>100μm/kg). The suboxic/dysoxic bottom waters are approximately uniform in salinity and temperature while overlying waters exhibit a step-like transition zone in temperature and salinity. In the Inner Basin, bottom waters of 60 - 70 m depth and greater have oxygen values of zero or near zero, and H_2S appears (Dallimore 2001). Anoxic and dysoxic conditions are also exacerbated by high levels of influx of terrestrial and marine (during upwelling-induced and spring/summer diatom blooms) organic matter, the decomposition of which rapidly consumes any remaining oxygen in the water column (Dallimore 2001).

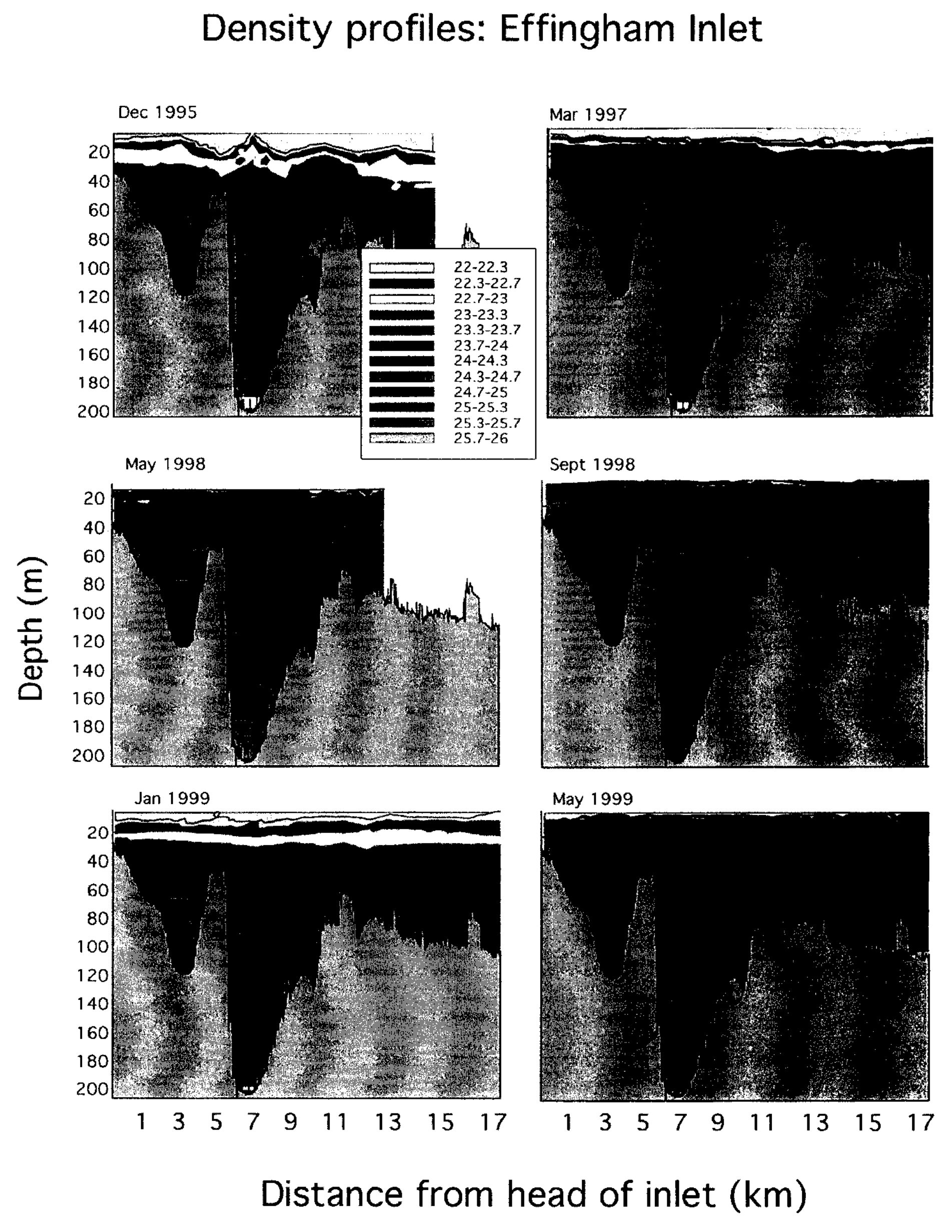


Figure 1.9. Density-bathymetry profiles of Effingham Inlet with density values ranging from 22 to 26 σ_t (after Dallimore 2001). The Inner Basin bottom waters at 3 km from the fjord head are slightly less dense (due to their stronger fluvial influence), than the Outer Basin waters with their stronger marine influence at 7 km from the fjord head.

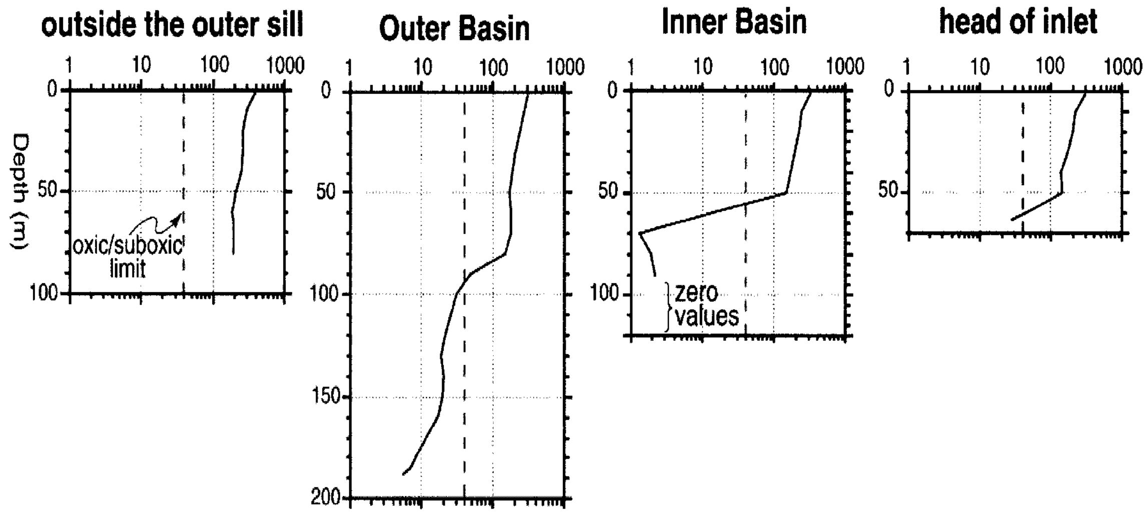


Figure 1.10. Dissolved oxygen concentration profiles (μM of O_2 per kg of seawater) of the waters of Effingham Inlet from selected stations (after Dallimore 2001).

During the January and June 1999 cruises to Effingham Inlet to monitor the oceanographic transect, an episode of oxygenation (low oxic) bottom waters in the Inner and Outer Basins was observed (Dallimore 2001). This confirmed the assumption from the salinity data that oxygenated upwelling waters are able to reach the inner basins of Effingham Inlet on occasion. Four months later, in October 1999, oxygen levels had again depleted significantly, suggesting that the characteristic anoxic/dysoxic conditions of the inlet had returned. This significant upwelling event has been attributed to the particularly strong 1997 - 1998 *El NiÑo* event in the southern Pacific Ocean, indicating the extent to which local oceanographic conditions are affected by global ocean phenomena (R. Thomson, in Dallimore 2001). Further foraminiferal evidence from surface sediments and sediment cores also confirmed that the event occurred in the most isolated and anoxic portions of Effingham Inlet which appear to have been periodically oxygenated by upwelling events (Patterson *et al.* 2000; Schell *et al.* 2001).

Tides are semidiurnal, and tidal variation in Effingham Inlet is relatively small (< 2 m). Tidal currents are weak except in constricted narrows in the vicinity of the shallow sills. Freshwater drainage into the basins from the surrounding basin cliffs is also more important than the streams. This was observed as chutes that geyser from the rock walls during a heavy rainfall (*J.P. Tully* cruise October 1999; Dallimore 2001).

Sedimentology of Effingham Inlet.

Fjords, such as Effingham Inlet, are useful in paleoceanographic research because in many cases, only strong oceanographic events are recorded in their inner basins, thus removing most of the background productivity (Timothy and Soon 2001; Thomson and Ware 1996). Fjords exhibit typical estuarine circulation, whereby a freshwater "wedge" from rivers at the fjord head flows outwards to the ocean, while saline water flows into the estuary at depth. In highly stratified estuary fjords with shallow sills and weak freshwater input, the inflow of saline water at depth can be interrupted and the bottom waters become stagnant (Tully 1949; Syvitski and Shaw 1996; Dallimore 2001). The resulting dysoxic (low oxygen) or anoxic (oxygen-poor) bottom waters aid in the preservation of annually laminated sediments since a thriving benthos cannot become established, and bioturbation (which destroys the laminated structure of the sediments) is at a minimum or completely absent (Kemp 1996; Anderson 1996). In highly productive fjords such as Effingham Inlet, the consumption of oxygen during the decomposition processes also contributes to the lack of oxygen, and a rapid consumption of any new influx of oxygen within the water column also occurs. Hence, lengthy packages of undisturbed laminae are easily preserved in the sediment record of anoxic basins and inlets (Kemp 1996; Patterson *et al.* 2000; Dallimore 2001).

The laminated sediments found in sediment and freeze cores taken from Effingham Inlet represent an annual record of deposition (Dallimore 2001; Figure 1.11). The sediments consist of light coloured laminae deposited under the rain of diatom frustules to the sediment from annual diatom blooms in spring and summer, which alternate with dark-coloured, organic-rich terrigenous and lithic laminae deposited during the rainy seasons of fall and winter (Dallimore 2001). One pair or couplet, of dark and light laminae, represent one year's deposition and are referred to as varves (Kemp 1996).

Laminated marine sediments in the geologic record represent one of the highest resolution, most continuous archives of past depositional, oceanic and climate conditions available. In marine environments, when they are preserved, laminated sediments represent a highly detailed record of seasonal variability in their alternating lithic and terrigenous-organic (dark) and biogenic, diatomaceous (light) laminae (Dallimore 2001). The dark, terrigenous laminae record annual and seasonal variations in precipitation, while the light diatomaceous laminae give an indication of annual oceanic productivity in the form of diatom blooms of the spring and summer seasons (Dallimore 2001). The variability of the diatomaceous laminae can in turn infer oceanographic and climatic conditions that were conducive to upwelling events, which bring in nutrient-rich waters to the surface of the coastal ocean (Kemp 1996; Sancetta 1996; McQuoid and Hobson 2001; Dallimore 2001).

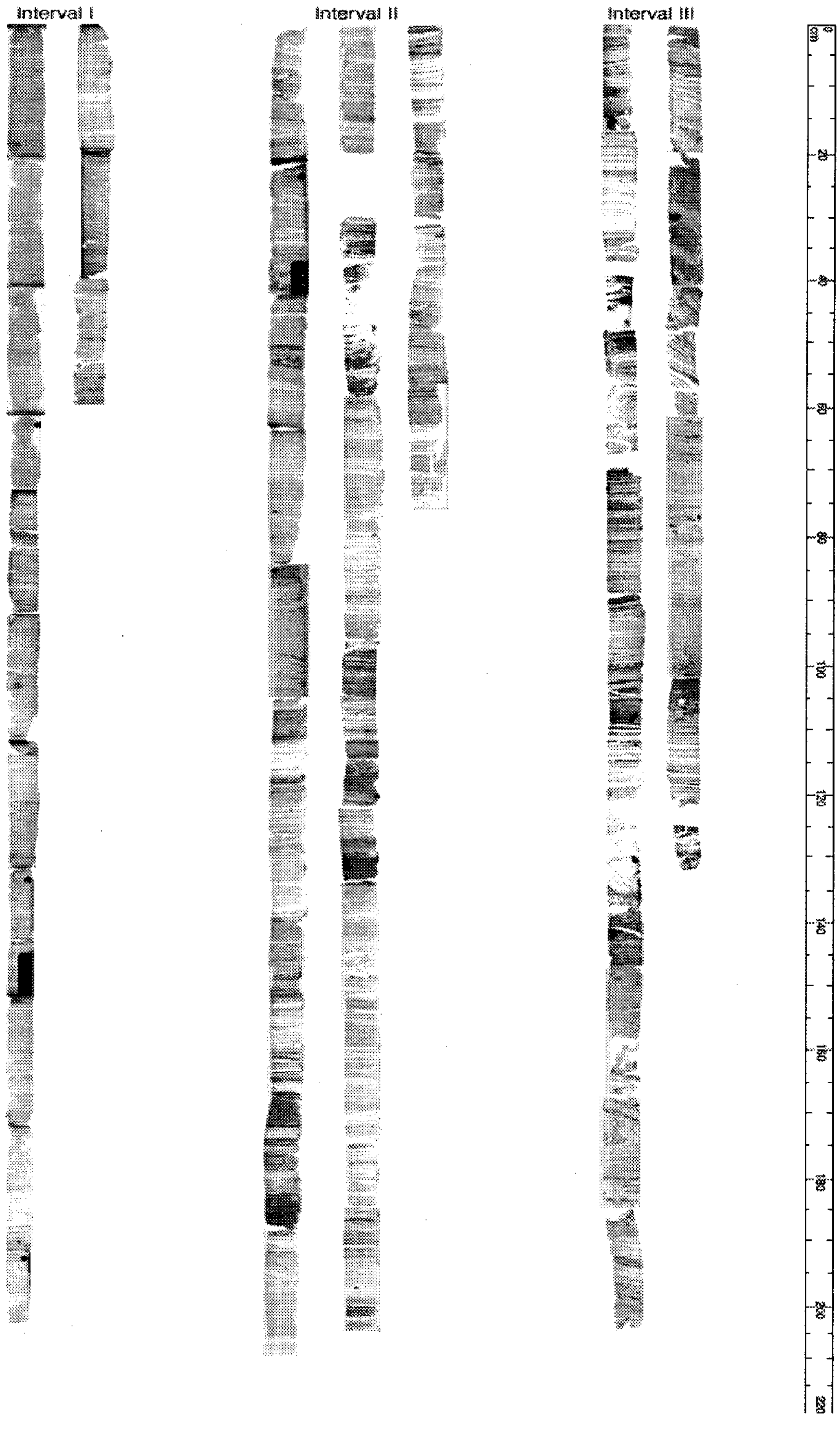


Figure 1.11. X-ray image of core 99TulB-03 showing the massive and laminated sediments (after Dallimore 2001).

Long time series of oceanographic and climatic conditions inferred from laminated sediments however, can be interrupted when events depart from the norm. These can include: years when exceptional rainfall obscures any productive event of the season, the complete failure of a primary productivity bloom in a certain year, and the obscuring of the annual record by bioturbation, scouring, debris flow and turbidite activity (Sancetta 1996; Dallimore 2001). In tectonically active settings, the record can also be obscured or expanded by the erosion or addition of sediment by debris flows and turbidites, resulting from sediment disturbance caused by seismic activity in the area (Anderson 1996; Blais-Stevens *et al.* 1997; Blais-Stevens and Clague 2001; Dallimore 2001).

Dallimore (2001) classified the cored sediments from Effingham Inlet into four main types (Figure 1.12, 1.13): laminated sediments, massive muds and silts, graded muds and silts, and rare sand beds. In general, the laminated sediments consisted of alternating laminae of olive to dark olive grey diatomaceous mud laminae and dark olive grey to black mud and silt laminae. Laminal thickness is highly variable, especially within diatomaceous lamina, and range from 1 mm to 150 mm. Sections of laminated muds are not commonly greater than 20 cm in length.

The massive muds and silts are intercalated within the laminated sediments of irregular intervals, dark olive grey to black in colour, with subtle fining upwards grading noticeably under x-radiography (as grain size or terrigenous organic fragments of humus-like material). Terrigenous organic fragments can also be from small pieces of twigs and bark up to several cm's in length. These beds are commonly less than 10 cm in thickness.

The graded muds and silts are dark olive grey to black in colour, with sharp-basal contacts, intercalated within the laminated sediments at irregular intervals. These fine upward from a coarse to fine sand, and occasionally shell fragments and gravel are found at the base, defined by grain size and by fine terrigenous organic fragments. These beds usually exhibit a light grey mud bed of 1 -2 cm in thickness near or at the top of the bed and are commonly less than 10 cm in length. The fourth type of sediment is rare beds of sand, several cm's in thickness that are the coarsest sediments found in the cores of the Inner and Outer Basins.

In general, the Inner Basin cores have more numerous, well-defined, terrigenous fragments. Inner Basin cores also contain deformed, wavy varves and "brecciated" varves where the laminae have been broken and disturbed on a millimetre and centimetre scale (Blais-Stevens *et al.* 1997). In the Outer Basin, ungraded massive beds are more common. All sediments were wet, and unconsolidated in the top two sections of the piston cores (~ 3 m).

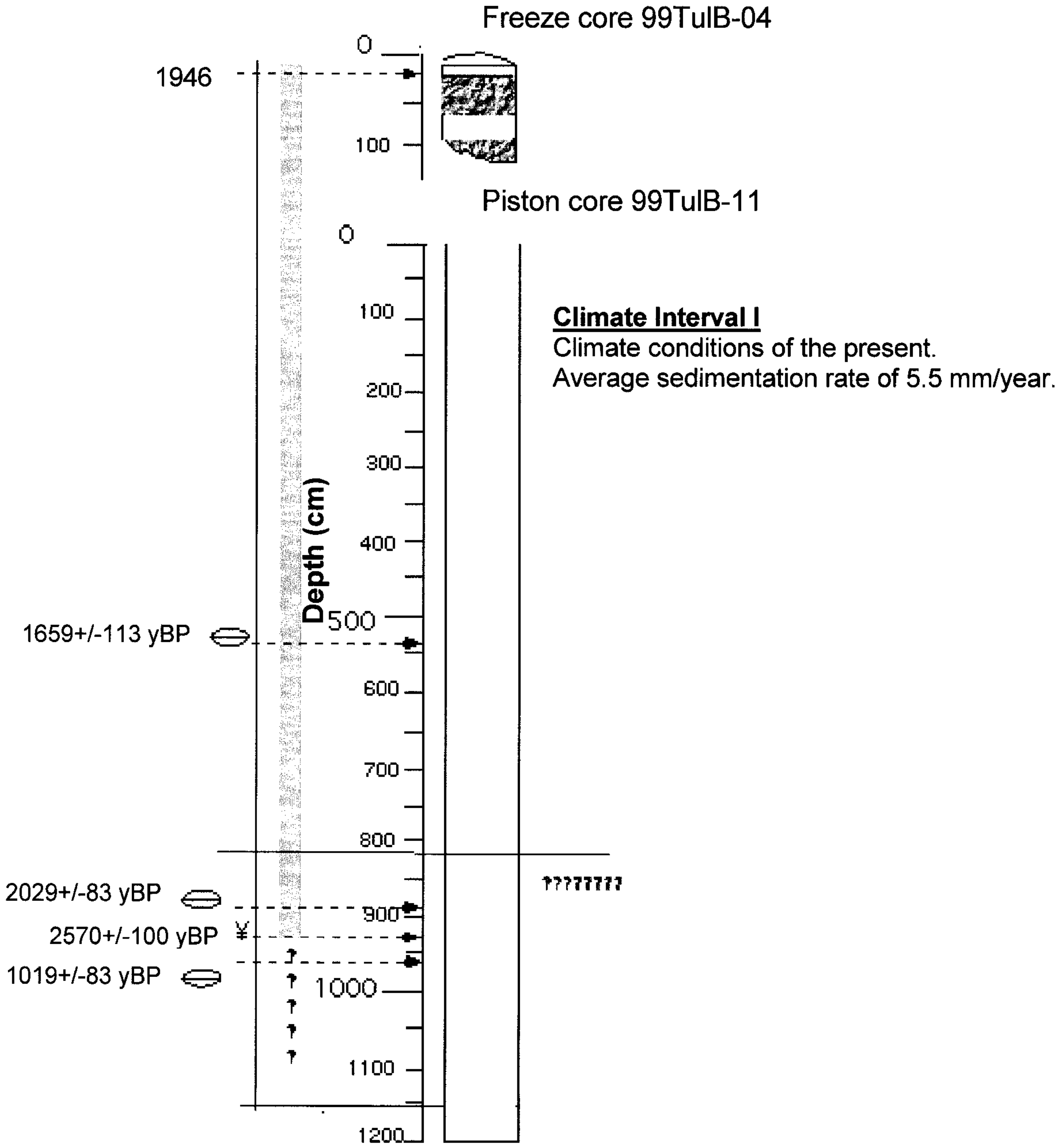


Figure 1.12. A composite diagram illustrating the Outer Basin sediment types of Effingham Inlet, from the description of X-ray images of cores 99TulB-04 and 99TulB-11. (Legend in following Figure 1.13; after Dallimore 2001).

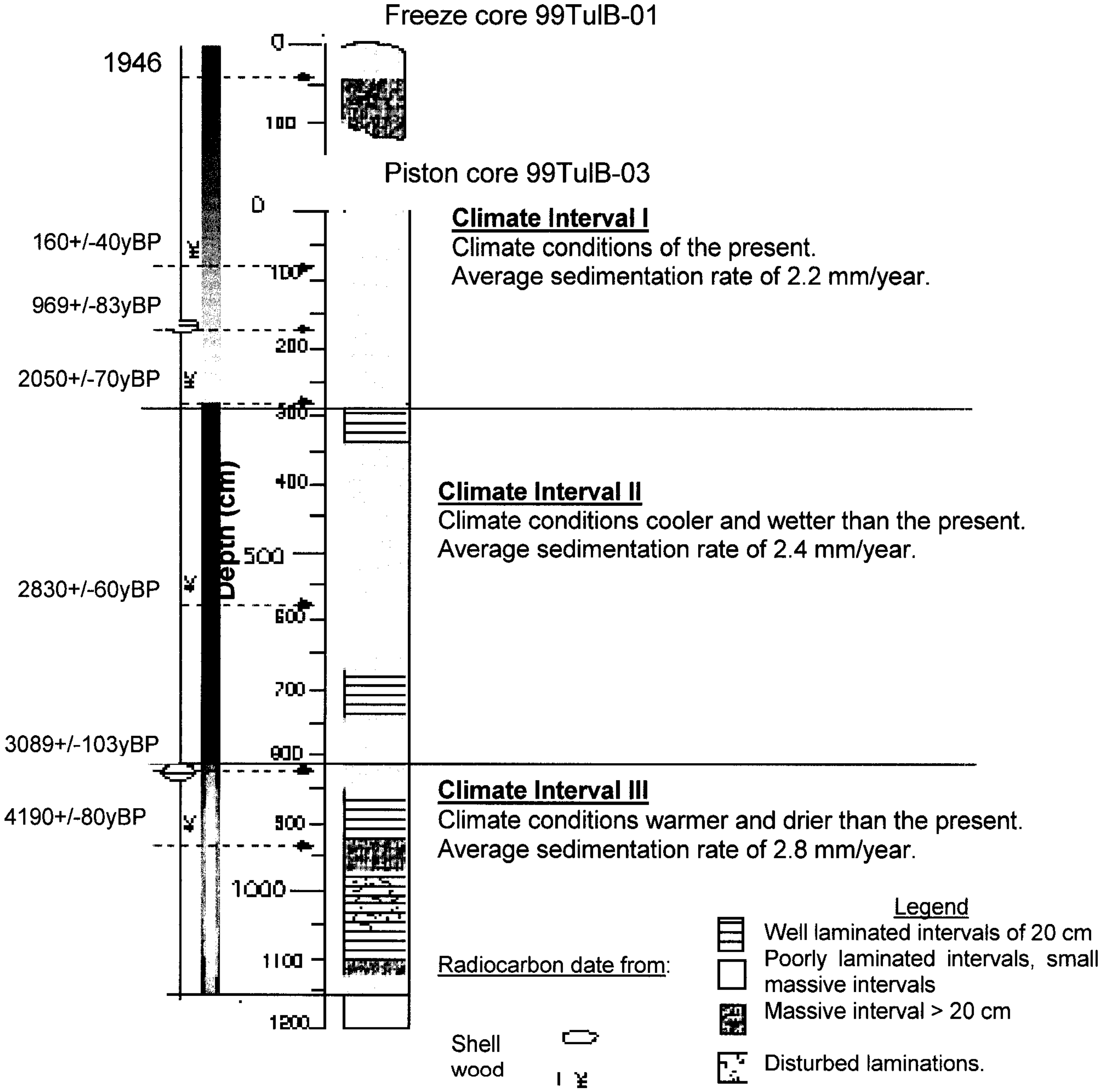


Figure 1.13. A composite diagram illustrating the Inner Basin sediment types of Effingham Inlet, from the description of X-ray images of cores 99TulB-04 and 99TulB-11. (after Dallimore 2001).

The TOC (total organic carbon; Rock Eval analysis) was done on the 1997 samples only - and was found to average at about 5 %, with slightly higher TOC levels recorded in the Inner Basin and decreasing oceanwards towards Barkley Sound (Dallimore 2001). The Rock Eval data also determined that the organic matter found in the cored sediments is of Type III; fresh, immature and terrestrially derived (low Hydrogen index, high Oxygen index). Dallimore (2001) also noted that the samples are of Holocene age, and therefore the results are somewhat speculative because they have not had significant burial time. Continuous down core grain size analysis was carried out on only two cores – 99TulB13 (Inner Basin) and 99TulB11 (Outer Basin). Dallimore (2001) found the sediments were predominantly silt sized with only a few samples containing some very fine sand. The Outer Basin sediments were also marginally coarser grained with more samples falling within a very fine sand.

X-ray images indicate that sedimentary features were more numerous and well-defined in the Inner Basin (Dallimore 2001). The laminated, massive graded bedding indicate anoxic and oxic conditions. The ungraded beds indicate bioturbation. The disturbed laminations (smeared in appearance) possibly indicate dewatering due to seismic shaking. Dallimore (2001) also calculated sedimentation rates by varve counting in the laminated intervals (Figure 1.14). The varve counting yielded average sedimentation rates of 2.2mm/year for the Inner Basin, and 5.5 mm/year for the Outer Basin.

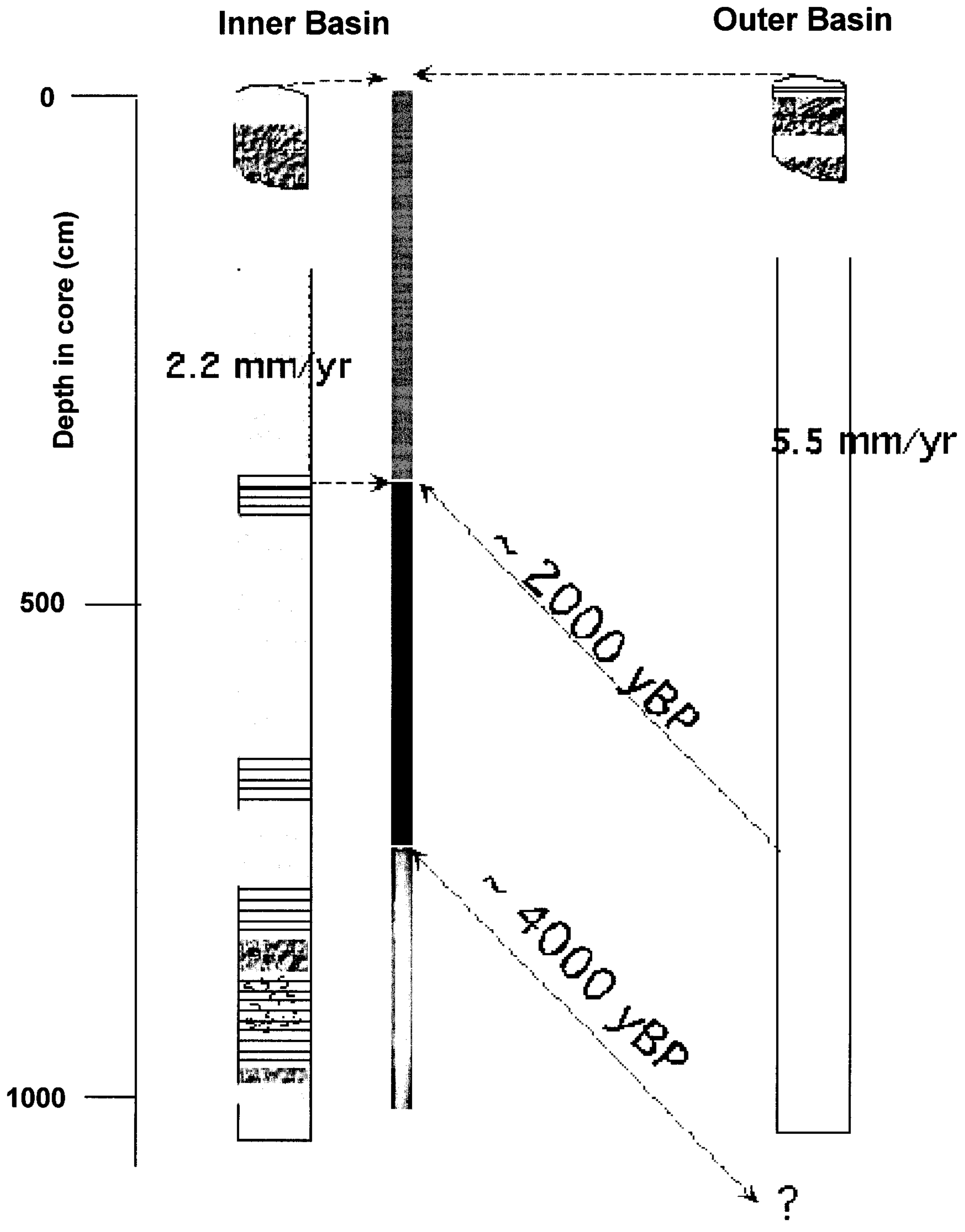


Figure 1.14. Comparative sedimentation rates between the Inner and Outer Basins, Effingham Inlet (Legend in previous Figure 1.13; after Dallimore 2001).

Quaternary Glacial History and Post-Glacial Sea Levels.

The landscape of British Columbia was last affected by glaciers ~ 15 000 cal yBP Armstrong 1969; Dallimore 2001). A massive ice sheet of interconnected mountain ice sheets and valley and piedmont glaciers - known as the Cordillera Ice Sheet, has carved the Canadian Cordillera and Vancouver Island several times during the Pleistocene. Its most recent advance during, the Late Wisconsinan time, is known as the Fraser Glaciation (Clague 1989b, c). Throughout the Pleistocene and early Holocene, glacial advance and retreat was controlled by global climate, and other more local effects such as sea-level lowering, ocean cooling and changes in atmospheric circulation during glacial periods (Clague 1989d).

Ice in the coastal sectors of Vancouver Island covered large areas of the continental shelf after reaching the sea through fjords and valleys (Luternauer and Murray 1983). The last glacial ice sheet rapidly retreated from Vancouver Island coastal areas approximately 15 000 cal yBP and from higher elevations on the island about 12 000 cal yBP Clague 1980, 1981; Dallimore 2001). Remnants of the last glaciation still exist in the permanent mountain glaciers of the highest Vancouver Island peaks.

The coastline is deeply indented with fjords, such as Effingham Inlet, which is located at the oceanward end of a glacially carved valley. Glacial till is the most common and extensive surficial material on Vancouver Island. Massive to stratified marine mud with a gravel component of < 5% gravel-sized material is the most common marine deposit of glacial origin (Clague 1989c). During the Fraser Glaciation, present coastal lowlands were submerged due to an isostatically-depressed crust. As the Cordilleran Ice Sheet decayed - and retreated northeast, from coastal areas - marine glacial sedimentation ceased as the crust rebounded isostatically (Luternauer and Murray 1983; Clague 1989c; Dallimore 2001).

Controls on the Quaternary sea-level history of Vancouver Island is attributed to a complex interplay of diastrophism, eustasy, isostasy, sediment supply, wave action and tidal current energy (Clague 1989e; Huntley *et al.* 2001; Tunnicliffe *et al.* 2001). In summary, the west coast of Vancouver Island appears to have experienced an initial regression, then a rapid transgression at the onset of the Fraser Glaciation about 25 000 cal yBP. The Cordilleran Ice Sheet retreated from the lower Vancouver Island area at the end of the Pleistocene (Booth 1987; Huntley *et al.* 1998; Tunnicliffe *et al.* 2001). Shortly afterwards the effects of the summer perihelion in the Earth's orbit resulted in a warming trend from about 11 000 cal yBP to 7000 cal yBP characterized by higher summer temperatures and lower rainfall (Heusser *et al.* 1985). A thermal maximum existed in southern British Columbia from about 9000 to 7500 cal yBP exceeding current mean annual temperatures by 2 to 4 °C (Clague and Mathewes 1989; Hebda 1995; Tunnicliffe *et al.* 2001). The cooler, wetter conditions of the later Holocene after 5000 cal yBP are reflected in the vegetation shifts recorded in pollen from sediment cores (Hebda 1995; Tunnicliffe *et al.* 2001). After deglaciation about 10 000 cal yBP, a similar regression-transgression cycle related to the mantle lithosphere forebulge occurred (Cathles 1975). Present day sea level was established on southern Vancouver Island early in deglaciation but a regression appears to be continuing in Effingham Inlet to the present day as a result of crustal rebound (Dallimore 2001). Sea-level history of the area is poorly known but the continuously laminated sediments older than 4000 cal yBP may indicate a lower sea level, effectively isolating the Inner Basin from ocean waters at that time (Dallimore, pers. comm. 2002).

Climate and Paleoclimate.

Vancouver Island is part of the Pacific Canada broad climate region (Hare and Thomas 1979) that is characterized by cool temperate and very wet, mild Pacific air that is conducive to the growth of Western Hemlocks and Douglas Firs. This cool, moist climate creates a mild, cloudy wet winter and a moderate; relatively dry summer with the highest annual precipitation in Canada of 2500 mm/yr (Dallimore 2001). The high levels of precipitation occur mainly in the winter and are the result of both successive frontal systems from the Pacific and an enhancement of the precipitation by local orographic effects, giving higher levels of precipitation with elevation (Ryder 1989). Air temperatures on Vancouver Island vary on a range of 1 - 5 °C, both on a daily and seasonal basis. The mean annual temperature ranges between summer and winter temperatures is 10 - 15 °C, the lowest in Canada (Ryder 1989; Dallimore 2001).

The climate history of British Columbia has not been well studied compared with the other provinces, however Hebda (1995) did provide a synthesis of the paleoclimate data available and his pollen work provides a general Holocene paleoclimate model. The Holocene climate record he interpreted is inferred from pollen data taken from ten sites on Vancouver Island, including one in Barkley Sound - at the mouth of Effingham Inlet. Temperature projections made from this pollen record however, are complicated by plant migrational and successional factors. In British Columbia pollen record interpretations by Hebda seem to indicate an increase in climate moisture linked to an increase in Western Hemlock, descending lower tree lines, relatively full lakes, and reduced fire frequency.

Hebda (1995) interprets the Holocene climate conditions for west coast Vancouver Island as a warmer and drier climate from 4000 - 10 500 cal yBP (Climate Interval III), a cooler and wetter climate than today's from 2000 to 4000 cal yBP (Climate Interval II), and modern climate conditions from the present to 2000 cal yBP (Climate Interval I) (Figures 1.12, 1.13, 1.14). The exact start and end times for these climate trends are difficult to determine from region to region. The cooling at about 4000 cal yBP, to cooler and wetter, from a previous state of warmer and drier than present, has clear indications along the west coast with observed changes in vegetation and no further glacial ice advances (Hebda 1995). This also coincides with a global cooling after the mid-Holocene (Houghton *et al.* 1990)

Climate, Paleoclimate, and Sedimentology.

Based upon ^{14}C dates and the timing of these three climate intervals as discussed by Hebda (1995), Dallimore (2001) found the most recent climate interval represented in the three cores in the Outer Basin, while the Inner Basin core appears to record Climate Intervals I, and II in their entirety, and the beginning of Climate Interval III (Figure 1.14). Dallimore (2001) also noted the general trend in lithology; with decreasing amounts of lamination towards the present, therefore possibly indicating an increasing numbers of oxic events.

The oldest Climate Interval, III, at 10 000 cal yBP to 4000 cal yBP is characterized by a paleoclimate warmer and drier than present. Climate Interval III has well-laminated sediments with no short graded or ungraded massive mud intervals which were likely deposited under anoxic conditions. Climate Interval II, from 4000 cal yBP to 2000 cal yBP is thought to be cooler and wetter than the present climate, and is represented by frequent massive, ungraded mud intervals with poorly to well defined laminations in thin units indicating frequent oxic conditions alternating with anoxic/dysoxic conditions. The most recent interval, Climate Interval I from 2000 cal yBP until present, is represented by poorly to well laminated muds deposited under anoxic/dysoxic conditions with infrequent oxic conditions (Dallimore 2001).

Dallimore (2001) interpreted the massive units as indicators of oxygenated depositional environment, while the laminated units are deposited under anoxic to dysoxic conditions. The laminated diatomaceous muds of the Inner Basin are preserved free of bioturbation under anoxic conditions (Dallimore 2002). The massive muds are interpreted to be the result of the deposition by and/or the resuspension and redeposition of laminated muds by low velocity density currents entering the inlet from the ocean and/or are the result of bioturbation under low oxic or oxic conditions. In either scenario, the ungraded muds represent oxygenation (flushing) of the bottom waters on the Inlet by upwelled cold, saline and therefore dense oxygenated ocean waters advecting over the sills (Dallimore 2002). Therefore where the massive units predominate, it may be an indication that upwelling events may be more frequent, and massive units become more dominant in Climate Intervals II and I.

Objectives of Research.

1. To determine the foraminiferal (as well as thecamoebian) species associations present in several cores along the length of fjord - from the mouth of the inlet at the Sound, to the head of the fjord.
2. To assess the relationships between foraminiferal species, sediment core lithology and the depositional environment (massive units versus the varved intervals).
3. To determine if the associations are indicative of paleoenvironmental changes, such as periods of time when there was an increase in local upwelling or productivity, or earthquakes.
4. Based upon the foraminiferal assemblages discovered, discuss what interpretations can be made about the paleoceanography and paleoclimatology.
5. Compare paleoclimatic interpretations based on the foraminiferal assemblage proxy data with the other proxies: diatoms, palynology, and fish scale abundance data.
6. Determine if there is a periodicity of oceanic events similar to or different from the historic records.

Chapter 2

METHODS

Site Selection

Several restricted, dysoxic to anoxic fjords along the western coast of Vancouver Island, British Columbia, were originally selected due to their physiography and location to nearby historical fisheries. Of these, Effingham Inlet, a 17-km long and just over one kilometre wide fjord on the eastern side of Barkley Sound, was chosen as a primary site for this study (Figure 1.5). Effingham Inlet was chosen due to its location at the apparent northern extreme of the California Coastal Current, its isolated location from human influence, its anoxic to microxic bottom basin waters and its laminated sediments.

The oxygen-depleted bottom waters of these types of basins are important in enhancing the preservation potential of the proxies for the climate signal by deterring bioturbation and thus preserving the delicate varves, and fragile fish scale material. Sills located near the fjord mouths will also provide a baffle and thus filter out the smaller, high frequency oceanographic signals (Patterson *et al.* 2001). Effingham Inlet has a silled interior basin that maintains anoxic bottom waters that prevent the bioturbation and destruction of delicately varved sediments in the Inner Basin. Additionally there is a dysoxic (or nearly deoxygenated) central basin (Figures 1.9, 1.10).

Fieldwork and equipment

Several one-week oceanographic cruises originating from the Institute of Ocean Sciences-Pacific Geoscience Centre, Sidney, British Columbia were used to collect data. Effingham Inlet was sampled in October 1995 (predominately physical oceanography), March 1997, and October 1999 with *CCGS J.P. Tully* (Captain P. Frost). Piston, box and freeze coring, CTD, dissolved oxygen, current drogues and seismic surveys were carried out at each of the selected.

study sites. In 1999, a suite of cores (1 boxcore, paired with a piston and freeze core) were examined in each of the main physiographic areas of the basin – mouth of the Inlet, Outer Basin and Inner Basin at the head of the fjord. Material examined in this thesis was subsampled from 4 piston cores - 3 from the Outer Basin, and 1 from the Inner Basin (Table 2.1, Figure 2.1).

Piston coring and seismic surveys were conducted with the aid of two staff members of the Geological Survey of Canada – Pacific. The coring sites are located in areas of thick, relatively undisturbed sediment packages, and chosen based on results of the 3.5 kHz seismic system survey (Figure of seismic section, 2.2)

In 1999, Project investigators provided funds along with in-kind support from the Canadian Coast Guard to refit the *CCGS J.P. Tully* with an A-frame for the starboard aft deployment of the larger 10 cm diameter piston coring system to provide for a greater penetration and recovery depth of up to 13 – 14 m. A greater depth of penetration was needed to extend the record to include the most of the Holocene record, and also a larger volume of material was required for various types of sample analysis. Kasten box cores were deployed to recover the upper 2-3 metres of sediment, and are stored within square box liners due to the soft, soupy, unconsolidated nature of the upper 2-3 m of the basin sediments. In addition Pederson freeze cores were collected to document the upper 1.5 m of the unconsolidated material.

The box core, Seabird CTD (Conductivity which indicates the salinity in PSUs, practical salinity units, Temperature and Depth) rosette, current drogues (to indicate modern water flow patterns) and dissolved oxygen analysis kit are the property of R. Thomson, Physical Oceanography group, Fisheries and Oceans Canada, Institute of Ocean Sciences. The freeze core is the design of T. Pederson, University of Victoria. In addition, in May 1999 M. Bertram, NOAA, deployed a sediment trap at Effingham Inlet that was recovered in September 1999.

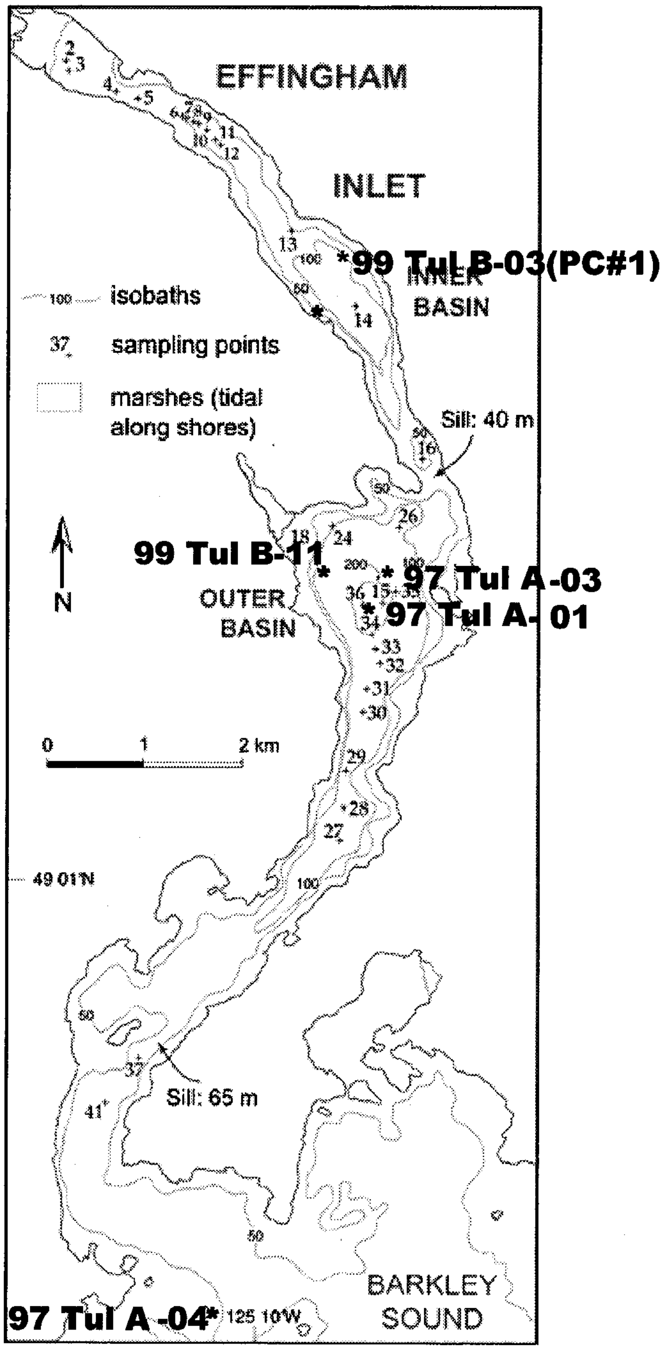


Figure 2.1. Location of coring sites for 1997 and 1999 cores (after Patterson *et al.* 2000).

Core Identification	**Location**	**Water depth**	**Core length**
BARKLEY SOUND			
97TulA-04	48º57.57 125º10.39	50 m	?
OUTER BASIN			
97TulA-01	49º02.550 125º09.13	200 m	892 cm
97TulA-03	49º02.570 125º09.12	~199 m	883 cm
99TulB-11	49º02.632 125º09.23	205m	1016 cm
INNER BASIN			
99TulB-03	49º04.275 125º09.359	120 m	1130 cm

Table 2.1 Location of piston cores.

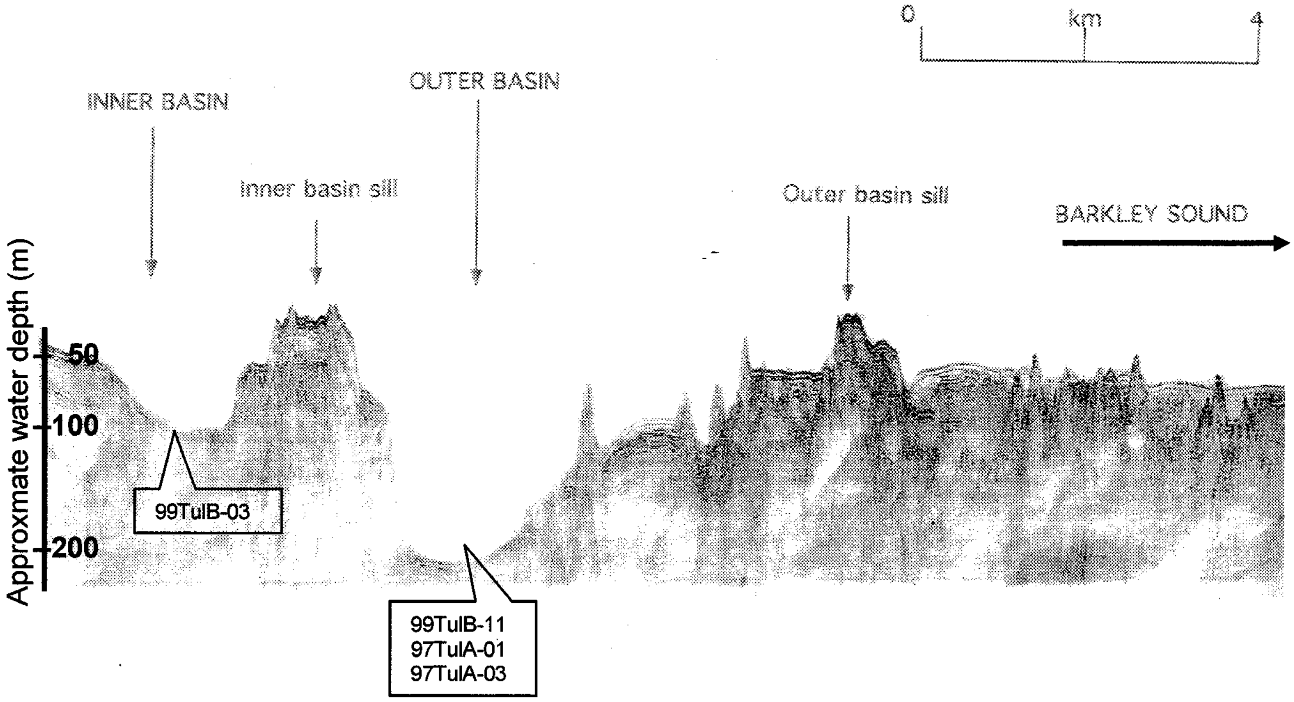


Figure 2.2. Seismic section, 3.5 kHz airgun profile of the seafloor and subsurface features of Effingham Inlet (vertical exaggeration of ~ 50x; after Dallimore 2001). The approximate locations of the 4 study cores are indicated.

Sample selection and preparation

The working half of piston cores selected (approximately 13 m in length) were subsampled at 10 cm intervals along the length of the core, and in addition, from sediment units of interest where lithological boundaries occurred. The sediment subsamples for the 1999 cores were 10 cm^3 (ml), while the 1997 core sediment subsamples were often smaller volumes due to the demand on limited material among several researchers. In addition, surficial samples were scraped from the top 5 cm of the undisturbed boxcores. Core descriptions, photography, century and millennial scale chronology (respectfully - ^{210}Pb and ^{14}C) were prepared by A. Dallimore, Pacific Geoscience Centre – Geological Survey of Canada/Carleton University.

Laboratory methods

The methods of foraminiferal separation and concentration as documented by Scott *et al.* (2001) were followed. All sediment samples were volumetrically determined and wet-sieved through a set of three sieves (500, 63 and 45 μm) to allow for ease of counting. The >500 μm sample was examined with a binocular transmitted light microscope (up to 80x) and a general description of contents was done. Fish scales and bones were removed, and allowed to air dry. Once dried, the bone material was sent to McMaster University for Sr-isotope analysis to determine paleosalinities (if the volume of material is adequate for analysis), and the fish scales to University of British Columbia for identification. The other two smaller size fractions, >63 and >45 μm, were handled following standard foraminiferal micropaleontological lab procedure (Scott *et al.* 2001). Sample storage of the processed material was in distilled water and ethanol, in scintillation vials. The 'living material' sampled from the surface of the core was stained for 12 hours in a mixture of Rose Bengal and formalin, and then rinsed and stored in distilled water and formalin. Both sample storage types are in tightly sealed 120 ml plastic containers until further analysis; after enumeration final sample storage was done in scintillation vials of ethanol and distilled water.

Micropaleontology, Data Analysis and Paleoceanographic reconstruction

Foraminiferal species were identified to the genus and species level where possible, using several papers published on West coast faunas, in particular Patterson *et al.* (1998, 2000) and the collection of the Centre for Environmental and Marine Geology micropaleontology laboratory at Dalhousie University. Standard counting procedures using the wet splitting method, as outlined by Scott and Hermelin (1993), were employed. The enumeration of the 500-63 μm and 63-45 μm samples was determined with a binocular reflected light microscope (magnifications up to 50x).

Species percentages and assemblages were calculated from the raw results. Standard diagrams were used to display the results and define the assemblage associations. The associations have been interpreted and used to define the local paleoceanographic regimes. Foraminiferal assemblage distributions are strongly correlated with environmental parameters such as relative depths, salinities, water temperatures and substrate characteristics (Scott *et al.* 1980, 2001). In addition my proxy data will be compared to that of collaborating researchers investigating diatoms, palynology, and sedimentology.

Radiocarbon Analysis

The selection and submission of wood fragments and shell valves for radiocarbon dating to Isotrace Laboratories (University of Toronto) was done by A. Dallimore (2001) for most of the 1999 and 1997 cores - what follows is a summary of her results. An additional three samples of wood fragments from the 97TulB-03 core were submitted for this thesis to Geochron Laboratories (www.geochronlabs.com), Appendix 2.

Suitable material for radiocarbon dating was found to be scarce in the cores in the laminated sequences of the sediment cores from Effingham Inlet. Material was present in the massive intervals, but due to the likelihood that these specimens may have been redeposited and not found 'in situ', they were not sampled for age dating. In total, 15 dates are available - 6 from the Inner Basin core, and 9 from the 3 Outer Basin cores.

Calibration of the radiocarbon results are given in Table 3.1 (from Dallimore 2001), with the addition of the three new dates from 97TulA-03. The results are given in years before present (BP), as well as calibrated years BP (cal yBP). The terrestrially derived material is calibrated with the INTCAL98 data set from Isotrace at University of Toronto. The marine derived material is calibrated using the currently accepted model of Stuiver and Braziunas (1993) that takes into account the oceanic reservoir effect of CO_2 (that is not in equilibrium, like the atmospheric/terrestrial realm). The Stuiver and Braziunas (1993) model produces a reservoir correction R assuming that the CO_2 exchange with the atmosphere and vertical diffusion of CO_2 in the ocean are location independent, but are age dependent with respect to atmospheric exchange. Their reservoir correction R, is a function of age and depth and is part of the INTCAL 98 database. The range of R is approximately 200 to 400 years.

The shell material of this study was calibrated using the marine data set MARINE 98 (Stuiver *et al.* 1998) which gives a local reservoir correction, Delta-R, of + 390+/- 25 years for the ocean waters west of Vancouver Island. This figures yields a rough correction of - 801 +/- 23 years 'too old' for marine samples for this location. Dallimore (2001) calculated a local reservoir correction from the one marine/terrestrial contemporaneous pair from the Outer Basin core 99TulB-11 at ~ 900 cm, and this yielded a Delta-R of -120+/- 45 years for Effingham Inlet which is very different from the Delta-R of + 390 years currently accepted for waters west of Vancouver Island (see **Calib4.3** website for the list of currently recorded reservoir corrections). The local Delta-R however, assumes that the ocean current regime in place at the time of the shell-terrestrial pair, has been 'open' and the same throughout time - which is further complicated by the restricted nature of the silled fjords and inlets.

Three new dates were collected from wood fragments retrieved from the Outer Basin core 97TulA-03, and sent for ^{14}C analysis to Geochron. The reported dates were calculated by **Calib 4.3** (Stuiver *et al.* 2003), and the reported age ranges are the maximum of all 2-sigma error ranges (note the 1-sigma maximum error ranges also fall within the 2-sigma ranges given). These were the only corrections necessary because the sample material is thought to be of terrestrial nature.

Statistics

Correspondence Analysis and Cluster Analysis (r-mode, Raup-Crick).

To perform the statistical analysis, the large data sets were simplified by the removal of samples containing less than 50 individuals/10 cm^3, (a common practice – Patterson *et al.* 2000; Hendy and Kennett 2000). The statistical package used was PAST – Paleontological Statistics, version 1.08, a freeware statistical package specifically designed for paleontological studies developed by O. Hammer, D.A.T. Harper and P.D. Ryan (released May 16, 2003). The PAST homepage is http://folk.uio.no/ohammer/past.

Multivariate statistics were done with Correspondence Analysis (CA) – similar to that of Principle Component Analysis (PCA) another ordination method, but for counted data and is used for comparing associations (columns) containing counts of taxa, or counted taxa (rows) across associations, CA is the more appropriate algorithm. The algorithm is taken from Davis (1986; Hammer *et al.* 2003).

The Correspondence Analysis (CA) routine finds the eigenvalues and eigenvectors of a matrix containing the Chi-squared distances between all data points. The eigenvalues, giving a measure of the similarity accounted for by the corresponding eigenvectors, are given by the first four most important eigenvectors (or fewer if there are fewer than four variables). The percentages of similarity accounted for by these components are also given (Hammer *et al.* 2003).

Correspondence Analysis proceeds by operating on a matrix derived from a contingency table that has been transformed so that the elements of the table can be regarded as conditional probabilities (Davis 1986). Because of the nature of the transformations (actually in a form of scaling) relationships between rows and columns of the transformed table are the same as those within the original data matrix. The row data matrix [x] has n rows that represent observations and m columns of variables. The elements themselves are tallies. Because of the Eckart-Young theorem, and the fact that the scaling of the original data matrix affected both rows and columns of the original data matrix [x] in the same manner, there is a direct relationship between the r-mode and q-mode solutions (Davis 1986). In other words the q-mode correspondence loadings are equal to the r-mode correspondence scores, divided by the appropriate singular values (Davis 1986).

The 'scatter plot' is a view of all the data points plotted in a co-ordinate system given by the CA. The variables are columns and associations can be plotted in the same co-ordinate system (Q-mode) by including the column labels. Each data point is plotted with CA first-axis row scores on the vertical axis, and the original data point value (abundance) in the given column on the horizontal axis (Hammer *et al.* 2003).

Cluster Analysis is a hierarchical clustering routine that produces a dendrogram showing how data points (rows) can be clustered (Hammer *et al.* 2003). For 'r-mode' clustering, putting weight on grouping of taxa, taxa should go in rows. It is also possible to find groupings of variables or associations (q-mode) by entering the taxa in columns (Hammer *et al.* 2003). For this study, the species associations were examined within the cores, using the Unweighted Pair - Group Average and the Raup-Crick index for absence-presence data, as recommended by (Hammer *et al.* 2003). This index (Raup and Crick 1979) uses a randomization ("Monte Carlo") procedure comparing the observed number of species occurring in both associations with the distribution of co-occurrences from 200 random replicates.

Chapter 3

DATA AND RESULTS

Core descriptions and sedimentology

The sediment sample intervals represent several years of sedimentation; for the 1997 cores, a 2 centimetre thickness was necessary to achieve the required sample volume (due to the smaller core barrel diameter), whereas in the 1999 sediment samples 1 cm thickness were sufficient due to the larger core barrel diameter, therefore yielding time averaged slices of 1.8 years in 1 cm, 3.6 years in 2 cm (calculated from a 5.5mm/year average sedimentation rate) in the Outer Basin; and 4.5 years in 1 cm, 9.1 years in 2 cm (calculated from a 2.2mm/year average sedimentation rate) in the Inner Basin.

Sediment samples were taken at approximately 10 cm intervals, therefore yielding a temporal resolution of a sample approximately every 18 years in the Outer Basin, and one sample every 45 years in the Inner Basin (as calculated with the average annual sedimentation rates determined from the varved sediment intervals by A. Dallimore (2001)).

The total length of core 97TulA-01 is 892 cm (Figure 3.1). The core is composed of decimeter scale units of massive to graded and ungraded olive grey silty muds, faintly laminated muds and laminated dark olive grey muds, in about equal amounts. There are 3 centimetre scale sand layers. Organic or woody fragments are found in all sediment types except the sand layers. Two samples were recovered for ^{14}C analysis; a shell fragment at 192 cm, and a wood fragment at 325 cm.

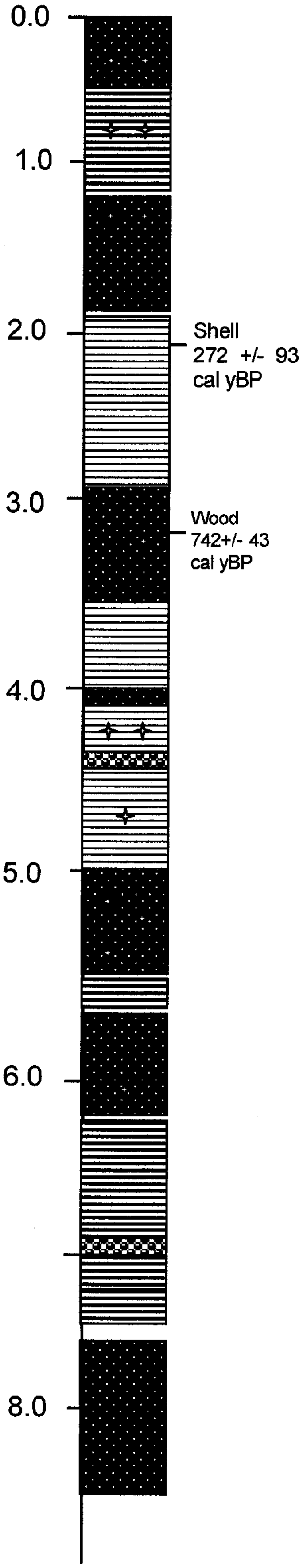
The total length of core 99TulB-11 is 1016 cm (Figure 3.2). The core is composed of decimeter scale units, predominantly of dark olive grey, silty massive muds, faintly laminated muds and minor amounts of laminated muds. There are 7 noticeable centimeter scale sand to silty sand beds. Organic/woody fragments are found in minor amounts in all sediment types. Fish remains are found at 501 cm. Four samples were recovered for ^{14}C analysis – a shell fragment at 531 cm, a paired bivalve at 898 cm, a wood fragment at 939 cm, and a paired bivalve at 969 cm.

The total length of core 97TulA-03 is 883 cm (Figure 3.3). The core is composed of decimeter scale units of predominantly dark olive brown laminated muds (at least 2/3), followed by faintly laminated olive grey muds and minor amounts of dark brown silty massive muds. There are 5 sand units of several centimeters. Organic/woody fragments are found in minor amounts in the massive muds, laminated muds, and one sand bed. Three wood fragment samples were recovered for ^{14}C analysis at 68 cm, 327 cm, and 721 cm.

The total length of core 99TulB-03 is 1130 cm (Figure 3.4). The core is composed of decimeter to centimeter scale units of approximately equal amounts of dark olive grey faintly laminated muds and massive muds, with lesser amounts of laminated muds. There are 5 noticeable sand units of several centimeters. Organic/woody fragments are found in minor amounts in a few sediment units of all types. Fish remains are found at 407 cm. Six samples were recovered for ^{14}C analysis – a wood fragment at 97 cm, a paired bivalve at 169 cm, a twig at 286 cm, a twig at 553 cm, shell fragments at 822 cm and wood fragment at 937 cm.

Figure 3.1. Core description for 97TulA-01, Outer Basin of Effingham Inlet. Core description by A. Dallimore (06/99; 2001) after K. Conway (03/97), drafting by T. Schell. The ^{14}C dates reported are the corrected and calibrated midpoint values of the calculated age ranges.

Core Description for 97TulA-01, Outer Basin



Massive, dark olive grey mud with abundant disseminated terrigenous organics, with no preferred orientation. Organic pieces 1 to 12 mm in length, 1 mm in width. Abrupt contact to massive dark olive grey mud at 0.29 m. Terrigenous organics orientated perpendicular to core barrel.(0-30 cm)

Massive to faintly laminated very dark grey mud. Laminations alternate between black diatom-rich terrigenous and olive diatom-rich layers. Each couplet makes up a varve. About 9 varves/cm. Indistinct contact to faintly laminated very dark grey mud. Disseminated organics without preferred orientation. Laminated very dark grey mud. More well defined laminations (8 varves/cm). (30-115 cm)

Abrupt upper contact to massive very dark grey mud. Disseminated organics without preferred orientation. (115-140 cm)

Indistinct upper contact to massive dark olive grey silty mud.
(140-190 cm)

Faintly laminated dark olive grey mud.
(190-290 cm)

Massive, very dark olive grey silty mud with very fine unorientated disseminated organics. Diatom-rich layer at top of interval, 2.950-2.955 m; appears as pale olive mud.(290-360 cm)

Massive, very dark olive grey silty mud with faint laminations. Black laminae 1 - 2 mm in width with irregular spacing 1-6 mm apart.
(360-410 cm)

Sharp upper contact to massive olive grey silty mud. Diatom-rich layer at top, fine-grained grey sand at base.(410-420 cm)

Faintly laminated dark olive grey silty mud. Black laminations 1-5 mm in width, 2 mm's to cm's apart. Infrequent organics aligned with laminations.(420-451 cm)

Faint, gradational upper contact to massive grey, silty sand, fining upwards from basal layer of woody fragments 2-3 cm long and 2-4 mm wide. Brown sand at base 4.63-4.65 m.(451-461 cm)

Very faintly laminated dark olive grey mud. Black laminae 2-3 mm in width, mm's to cm's apart. Some rare organics.(461-510 cm)

Indistinct contact to dark olive grey massive mud with frequent terrigenous organics without preferred orientation. Dark olive grey mud with some sand particles and shell fragments at the base, 5.65-5.66 m.(510-569 cm)

Dark olive grey mud with laminations, 2-4 cm in width and about 2 cm apart.(569-582 cm)

Massive, dark olive grey mud with rare terrigenous organics fragments. Light grey mud grading to grey sand at base.(582-619 cm)

Massive olive grey mud.(619-621 cm)

Laminated dark olive grey mud. Black terrigenous laminations about 2 mm in width, regularly spaced about 2 mm apart.(621-690 cm)

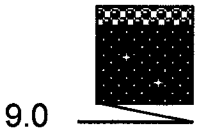
Sand layer at base, 6.96- 6.95 m.

Laminated dark olive grey mud as above.(695-720 cm)

Massive dark olive grey mud. Diatom-rich layer at top, 7.165-7.170 m.(720-730 cm)

Laminated dark olive grey mud, 2 mm wide laminations about 2 mm apart, regularly spaced.(730-740 cm)

Massive dark olive grey mud.(740-830 cm)

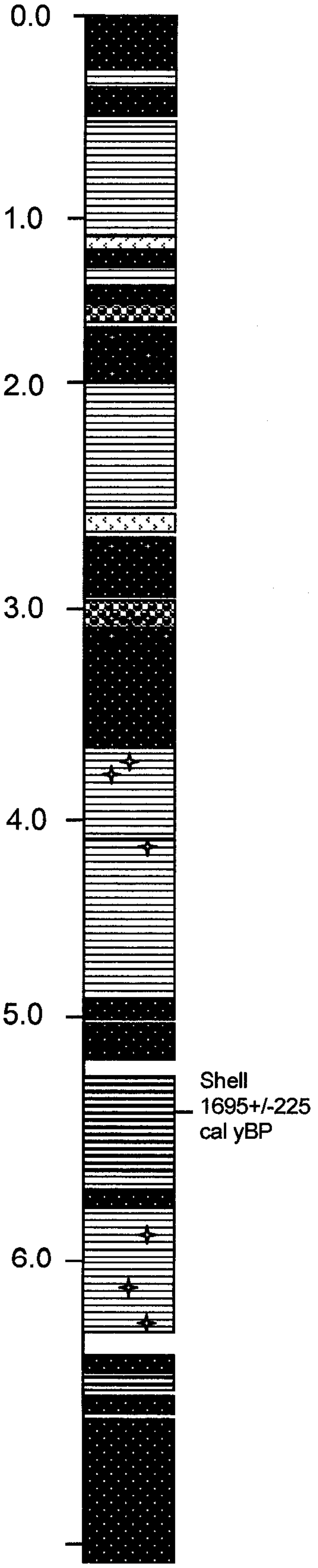


Indistinct contact to dark olive grey mud, fining upwards sequence. Sand at the base, many terrigenous organics in lower part.(830-840 cm)
Sharp contact to massive dark olive grey mud with frequent terrigenous organics without preferred orientation.(840-892 cm). End of core at 892 cm.

■	Massive mud
▤	Laminated mud
≡	Faintly laminated mud
▩	Sand
✦	Organic fragments

Figure 3.2. Core description for 99TulB-11, Outer Basin of Effingham Inlet. Core description by A. Dallimore (2001), drafting by T. Schell. The ^{14}C dates reported are the corrected and calibrated midpoint values of the calculated age ranges.

Core Description for 99TulB-11, Outer Basin



Olive massive mud, turns black upon scraping of surface sediments with a spatula. (0 - 3 cm)

Black massive mud with very faint traces of laminations especially at the base. (3-45 cm)

Pale olive massive mud. (45-47 cm)

Abrupt color change to very dark grey to dark olive grey massive mud with faint lamination. (47-112 cm)

Core lost on recovery. (112 - 141 cm)

Olive to black massive mud, with faint laminations visible on scraping of top sediments. (141-179 cm)

Olive massive mud, sand at base. (179-184 cm)

Very dark grey mud, fining up defined by small terrigenous organics and shell fragments. (184-188 cm)

Olive massive mud with small terrigenous organics. (188-195 cm)

Dark olive grey very faintly laminated mud. (195-265 cm)

Core is broken. (265-272 cm)

Olive grey massive mud, some very faint terrigenous (dark colored) laminae, small terrigenous organics up to 2 cm. (272-285 cm)

Black mud, fining upwards from sand at the base is defined by terrigenous organics, shell and wood fragments up to 6 cm in length. (285-316 cm)

Olive grey massive mud with very faint terrigenous laminations and organics.(316-323 cm)

Olive grey massive mud, light olive mud at top, some terrigenous organics. Black mud, fining up defined by terrigenous organics up to 3 cm in length, thin 2mm sand and shell at base. Wood piece at 268 cm (232-360 cm)

Olive grey massive mud with faint terrigenous (dark) laminae traces. (360-405 cm)

Dark olive grey massive mud with faintly defined terrigenous (dark) laminae. Some dark laminae up to 1 cm thick. (405-491 cm)

Dark olive grey massive mud, light olive mud layers at top and base.(491-497 cm)

Dark olive grey massive mud, light olive layer at top. Fish remains at 501 cm.(497-524 cm)

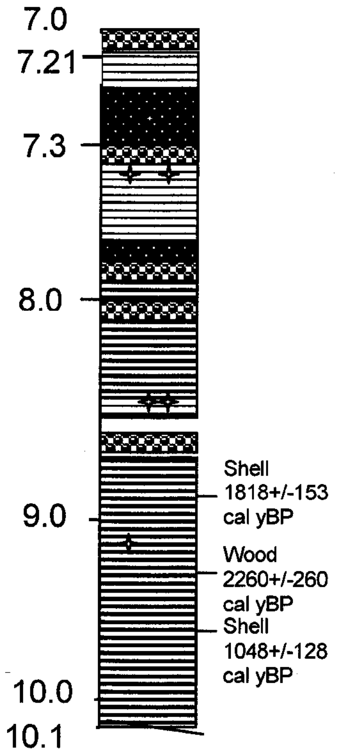
Dark olive grey laminated mud, thick terrigenous laminae, ~ 2 varves/cm. (524-559 cm)

Dark olive grey massive mud with faintly developed terrigenous (dark) laminations. Some terrigenous organics but much fewer than above sections. (559-642 cm)

Distinct color change to olive massive mud. (642-645 cm)

Dark olive grey laminated mud. (645-647 cm)

Olive mud, faint fining up from base, no terrigenous organics, grain sorting only. (647-653 cm)

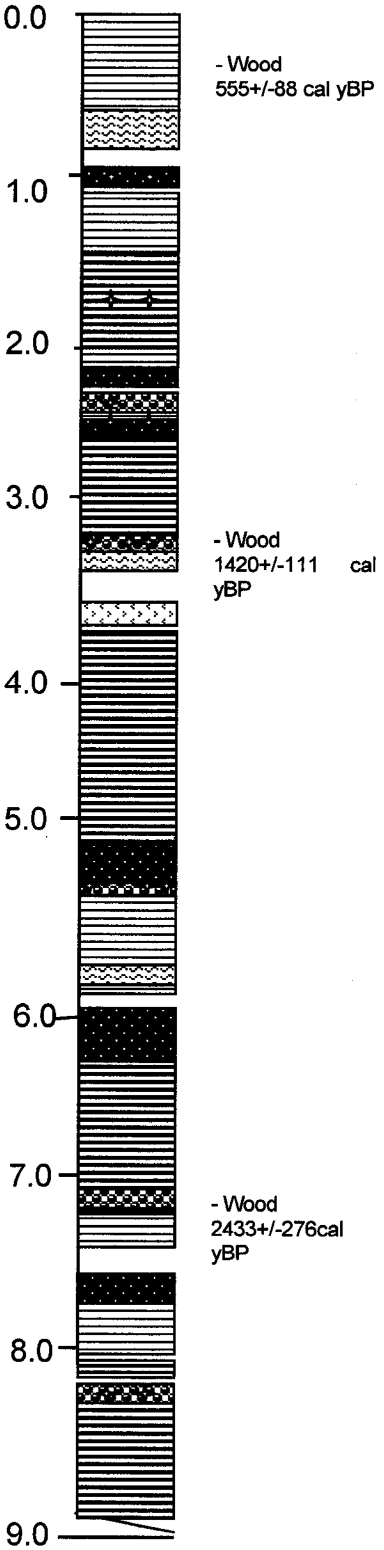


Olive massive mud, light olive 1.5 cm thick bed at top. Very consolidated. (653-709 cm)
Olive faintly laminated mud, no terrigenous organics. (709-721 cm)
Olive massive mud with sand grains and shell fragments; black mud fining up from base defined by terrigenous organics. (721-728 / 728-734 cm)
Dark olive grey mud fining up defined by terrigenous organics, from sand at base, 2 cm thick. (734-741 cm)
Olive grey massive mud, very faintly defined terrigenous (dark) laminations. (741 -755 cm)
Olive grey massive mud, some faint traces of laminae. (755 - 760 cm)
Olive massive mud, slightly more distinctive terrigenous (dark) laminations, some sand at 786 and 801 cm. (760-851 cm)
Dark olive grey massive mud, faint terrigenous (dark) laminations. (851-856 cm)
Very dark grey mud, fining up from sand at base defined by terrigenous organics.(856-861 cm); then a dark olive grey mud fining up from sand at base defined by terrigenous organics. (861-865 cm)
Dark olive grey faintly to distinctly laminated mud, ~ 3 varves/cm where countable. Wood piece at 907 cm, sand at 949, 969, 990 cm. (865-1016 cm) End of core 1016 cm.

■	Massive mud	▒	Bioturbation ?
☰	Laminated mud	⁘	Missing section
☰	Faintly laminated mud	✦	Organic fragments
▩	Silt, sand		

Figure 3.3. Core description for 97TulA-03, Outer Basin of Effingham Inlet. Core description by T. Schell (10/97) of 1997 cores collected by K. Conway (03/97). The ^{14}C dates reported are the corrected and calibrated midpoint values of the calculated age ranges.

Core Description for 97TulA-03, Outer Basin



Faintly laminated, olive grey mud with minor silt and dark brown specs.

Olive grey clay (0-61 cm)

Dark brown silty mud, wavy or convoluted - disturbed or bioturbated (61-66 cm)

Dark brown clay, wood fragments (66-83 cm)

Faintly laminated, darker olive grey muddy silt. Laminae are darker brown. Darker olive grey silty mud. (83-89 cm)

Finely laminated dark olive brown mud.
Pulpy interval.
Laminae begin to fade towards the base. (89 – 200 cm)

Finely laminated, dark brown mud. (200-206 cm)

Dark brown silt. (206-220 cm)

Olive brown mud.(220-250 cm)

Finely laminated olive brown mud. (250-322 cm)

Dark brown muddy silt, with organic fragments/pulp. (322-326 cm)

Dark brown mud, highly disturbed. (326-334 cm)

Missing section of sediment (334-357 cm)

Dark olive brown mud, finely laminated.
(357 - 428 cm)

Dark olive brown mud, laminated.
(428-558 cm)

Beige laminae about 0.5 cm thick.

Olive brown mud, homogenous (558-569 cm)

Graded bedding, fining upwards; organic fragments at the base.(569-573 cm)

Faintly laminated, dark olive brown mud; disturbed at base.(573-581 cm)

Dark olive brown mud, finely laminated
Beige laminae, about 0.5 cm thick. (581- 616 cm)

Finely laminated, dark olive brown mud. (616- 718 cm)

Dark brown muddy silt, fining upwards. (718 - 724 cm)

Faintly laminated, dark olive brown mud. (724 -739 cm)

Dark olive brown mud, massive. (739-768 cm)

Faintly laminated, dark olive brown mud. (768- 792 cm)

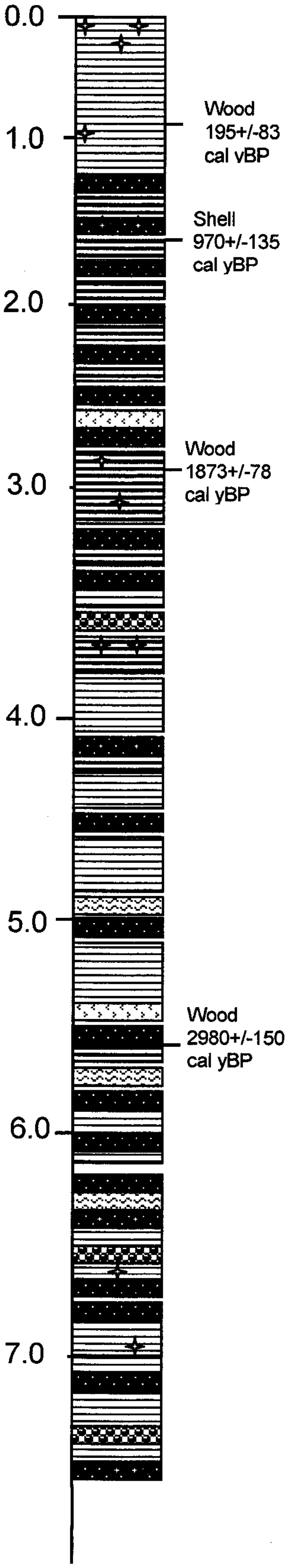
Laminated, dark olive brown mud. (792-834 cm)
Dark brown silt, with organic fragments. (833.5-838 cm)

Laminated, dark olive brown mud. (838 - 883 cm)
End of core at 883 cm.

▩	Massive mud	▦	Silt
▤	Laminated mud	≋	Disturbed section
☰	Faintly laminated mud	✛	Organic/plant fragments

Figure 3.4. Core description for 99TulB-03, Inner Basin of Effingham Inlet. Core description by A. Dallimore (2001), drafting by T. Schell. The ^{14}C dates reported are the corrected and calibrated midpoint values of the calculated age ranges.

Core Description for 99TulB-03, Inner Basin



Dark olive grey, faintly laminated mud; abundant terrigenous organic fragments (1-12 cm)

Dark olive grey to black, faintly laminated mud; wood fragment at 97 cm. (12-97 cm)

Dark olive grey, faintly laminated mud. ~ 4-6varves/cm. (104-154 cm)

Massive mud (154-169 cm)

Laminated mud, ~ 4-6varves/cm. (169-179 cm)

Olive mud fining up defined by terrigenous organics. (179-183 cm)

Laminated mud; then an olive brown massive mud. (183-185/185-187 cm)

Dark olive grey laminated mud, ~ 4-6 varves/cm.; then an olive massive mud.

(187-207/207-215 cm)

Laminated mud,4-6 varves/cm.; then an olive, massive mud. (215-237/ - 239cm)

Core lost on recovery.(239-245 cm)

Dark olive grey massive mud, faint traces of laminae. (245-255 cm)

Dark olive grey laminated mud, ~ 3-6 varves/cm. Large twigs at 286 and 303 cm. (255-326 cm)

Massive mud.(326 - 330 cm)

Laminated mud, and then a Massive mud. (330-337/337-345 cm)

Faintly laminated mud, ~ 5-6 varves/cm. (345-349 cm)

Mud, fining up defined by terrigenous organics, sand at base. (349-357 cm)

Laminated mud, ~ 3-5 varves/cm. (357-387 cm)

Very dark grey faintly defined laminated mud, ~ 4-5 varves/cm. Fish bones at 407 cm, stone at 390 cm. (387-410 cm)

Very dark grey massive mud with terrigenous organics. (410-414 cm)

Laminated mud, then a dark olive grey massive mud. (414-430 /430-435 cm)

Poorly defined laminated mud, then a very dark grey massive mud. (435-472cm)

Poorly defined laminated mud, and a yellow diatom laminae at 480 cm (472-481cm)

Poorly defined laminations, bioturbation ?(481-500 cm)

Very dark olive grey massive mud, no terrigenous fragments, some coarse grains at base, subtle fining up defined by grain size only. (500-507 cm)

Poorly defined laminations, ~ 7 varves/cm where countable. (507-541 cm)

Core lost on recovery (541-543 cm); Very dark olive grey massive mud. (543-553cm)

Laminated mud, ~ 8 varves/cm where countable, bioturbation?(553-577 cm)

Massive mud, then a faintly laminated mud. (577-583/583-601 cm)

Very dark grey massive mud, then a faintly laminated mud. (601-604/604-610 cm)

Massive mud, then a laminated mud, ~ 3-5 varves/cm, bioturbation? (610-614/614-622 cm)

Black mud, fining up defined by terrigenous organics, stone at 628 cm. (622-631 cm)

Poorly defined laminated mud, some distinctive white laminae, ~5-10 varves/cm.

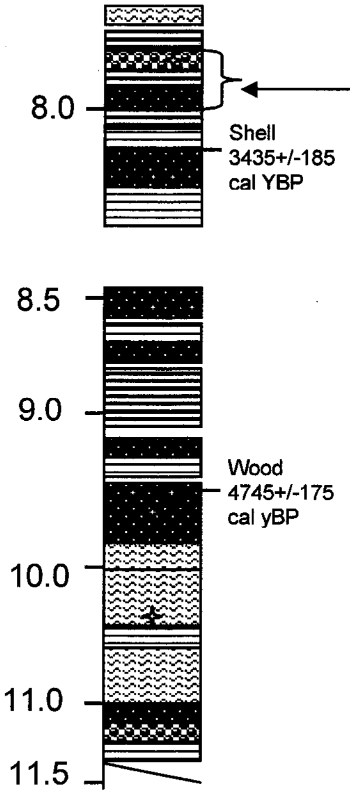
Dark olive grey massive mud, some sand grains at base. (641-652 cm)

Poorly defined laminations, ~ 5-6 varves/cm where countable; then dark olive grey mud with fining up defined by terrigenous organic fragments. (652-668 cm)

Laminated mud, then a massive mud. Laminated to poorly laminated mud, ~ 4-6 varves/cm. Twig at 695 cm. (668-671/ 671-674/ 674-698 cm)

Dark olive grey poorly defined laminated mud. Very dark grey massive mud, light grey layer at 716 cm. (698-712/ 712-717 cm)

Poorly defined laminated mud, then a massive mud with some sand at base. (717-737/737-741cm)



Laminated mud, then mud with terrigenous organic fragments. (741-743/ - 751 cm)
Laminated mud, ~ 5-8 varves/cm, thick terrigenous (dark) laminae. Bioturbation at top. (751-771 cm)
Very dark grey massive silty mud, shell fragments at base, defined by terrigenous organics, light grey layer at top; then a laminated mud, thick diatom varves, ~ 4-6 varves/cm. Very dark grey massive mud, some sand grains at base, laminated mud. Then massive mud with some sand grains at base; followed by a laminated mud. (775-780/780-783/783-789/789-792/792-793 cm)
Laminated to poorly laminated mud, ~ 4-6 varves/cm.(793-815 cm); Mud, fining up defined by faint terrigenous organics. (815-823 cm); Poorly defined laminations, wood piece at 822cm, distinctive white laminae at 844cm (823 - 850 cm)
Very dark grey mud, fining up defined by terrigenous organics.(850-856 cm)
Poorly laminated mud, ~ 8-9 cm. (856-868 cm)
Massive mud. (863-870 cm)
Laminated mud, ~ 4-8 varves/cm. (870-910 cm)
Massive mud, then a poorly defined laminated mud. (910-913/ 913-920 cm)
Very dark grey massive mud, thick light grey layer at 922 cm, some large terrigenous organic fragments throughout. Large wood fragments at 949, 953cm. (920-970 cm)
Disturbed laminated mud, then laminated mud ~ 5-6 varves/cm. (970-981/981-990 cm)
Disturbed laminae, ~ 5-10 varves/cm. To very dark grey massive mud, and some terrigenous organic fragments. (990-1030/1030-1042 cm)
Disturbed laminated to poorly laminated mud. (1042-1098 cm)
Very dark grey mud, fining up defined by terrigenous organic fragments, some sand at the base. (1098-1117 cm)
Laminated mud, ~ 5-6 varves/cm. (1117-1130 cm) End of core 1130 cm.

■	Massive mud	▨	Bioturbation?
☰	Laminated mud	⁘	Missing section
≡	Faintly laminated mud	✧	Organic fragments
▩	Silt, sand		

Radiocarbon Age dating

The chronological control on the Outer Basin was found to be much less accurate than that for the Inner Basin, due to the material analyzed for those 6 radiocarbon dates. Four of the radiocarbon dates are from shell material and thus the calibration is more complicated (Dallimore 2001). Only one of the six dates is out of stratigraphic sequence with the overlying dates. This date anomaly may be explained by its location. The dated material (a shell) was found at the base of a massive (or resedimented) interval. In addition, the youngest date found near the top of an Inner Basin core, falls within the last 500 years. This is the time period for which the calibration curve for ^{14}C is flat due to the introduction of atmospheric burning of fossil fuels that 'clouds' the matching of the INTCAL '98 dendrochronologically derived calibration curve (Dallimore 2001). In 2003, 3 new samples for ^{14}C dates were extracted from wood bits from the 97TulA-03, the third Outer Basin core, and sent to Geochron Laboratories for analysis (Appendix 2). All of the radiocarbon results are given in the following Table 3.1. The results are given in years before present (BP), as well as corrected and calibrated years BP (cal yBP).

In addition, the midpoint values of the corrected and calibrated dates have been calculated from the calibrated date range. It will be this midpoint number that will be referenced in this thesis.

Core	Sample #	Depth in core (cm)	yBP	YBP 801+/-23y	$\delta^{13}C$ PDB (ppt)	Cal yBP	Cal yBP mid point	Dated material
Outer Basin								
99TulB-11	TO-8683	531	2460+/-90	1659+/-113		1470-1920	1695+/-225	Shell fragment 46 mg
	TO-8684	898	2830+/-60	2029+/-83		1665-1970	1818+/-153	Paired bivalve 24 mg
	TO-8685	939	2570+/-100			2400-2920	2260+/-260	Wood 291 mg
	TO-8686	969	1820+/-60	1019+/-83		920-1175	1048+/-128	Paired bivalve 82 mg
97TulA-01	TO-8126	192	990+/-40	189+/-63		179-364	272+/-93	Shell fragment 89 mg
	TO-8127	325	730+/-50			699-784	742+/-43	Wood 240 mg
97TulA-03	GX-30167	68	500+/-50		-27.4	467-643	555+/-88	Wood
	GX-30168	327	1530+/-60		-26.5	1309-1530	1420+/-111	Wood
	GX-30169	721	2350+/-60		-24.3	2157-2709	2433+/-276	Wood
Inner Basin								
99TulB-03	TO-8671	97	160+/-40			45-345	195+/-150	Wood 476 mg
	TO-8672	169	1770+/-60	969+/-83		835-1105	970+/-135	Paired bivalve, 88 mg
	TO-8673	286	2050+/-70			1795-1950	1873+/-78	Twig 135 mg
	TO-8674	553	2830+/-60			2830-3130	2980+/-150	Twig 545 mg
	TO-8675	822	3890+/-80	3089+/-103		3250-3620	3435+/-185	Shell fragments 355 mg
	TO-8676	937	4190+/-80			4570-4920	4745+/-175	Wood 562 mg, massive interval

Table 3.1: Results of radiocarbon dates and calibration from Effingham Inlet cores (from Dallimore 2001) except for the 3 dates from 97TulA-03, (GX30167, 68, 69) are new dates collected for this thesis and the lab report is included in Appendix 2.

Inner and Outer Basin core correlation.

Correlation of the cores and their stratigraphy between the Inner and Outer Basin was not presented in Dallimore (2001). Dallimore (2001) does provide a good correlation of cores within the Inner Basin in her thesis figure 66, page 258 but that is the extent of the correlation of fjord stratigraphy with the exception of mentioning that a sand bed occurs at approximately 2000 cal yBP. This particular shelly sand bed may be traced from the Inner and Outer Basins, to the Barkley Sound core. This shelly sand bed is thought to be the remnant of a tsunami deposit because of its coarseness. If this is a contemporaneous horizon, then the 2000 cal yBP tsunami deposit also provides a datum for the approximate ending of Hebda's Climate Interval II and beginning of the present day climate regime (or Hebda's Climate Interval I).

From Dallimore's (2001) Inner Basin correlation diagram, for core 99TulB-03; a gravel and shell bed is found at ~ 350 cm, or ~ 100 cm below a radiocarbon date on a wood fragment of 1873+/- 78 cal yBP. My description of the core is based upon Dallimore's x-ray description notes, in which that gravel and shell bed is described as a muddy graded sand unit at ~357 cm.

In the Outer Basin, core 99TulB-11 has 5 sand beds occurring between a shell date of 1695+/- 225 cal yBP at 531 cm, and another shell date of 1818 +/- 153 cal yBP at ~ 898 cm. Only the first sand bed at ~ 721 to 728 cm contains shell fragments. Core 97TulA-01 is poorly dated, with only two radiocarbon dates, with the deepest occurring at 325 cm (742+/- 43 cal yBP) on a wood fragment. There are 3 sand units following that occur at ~ 440 cm, 790 cm, and 850 cm, but none noted to contain shelly fragments. The final Outer Basin core, 97TulA-03, has much better dating coverage with a wood date of 1420 +/- 111 cal yBP at 327 cm, and another wood date of 2433+/-276 cal yBP at 721 cm. There is one sand unit between these two dates at ~ 560 cm and it contains organic fragments but no noted shell fragments. A second muddy silt is found at 718 to 724 cm.

The best way to check on unit uniformity would be to line up the actual sections of sediment core adjacent to each other, but unfortunately the 1999 cores were not archived by the

Principle Investigator responsible for this research project. The x-ray photographs of thin surface slabs of the halved cores are only available for the 1999 cores, and color photographs of the 1999 cores were also taken but the color is not true (see images in Appendices C – G, Dallimore (2001)).

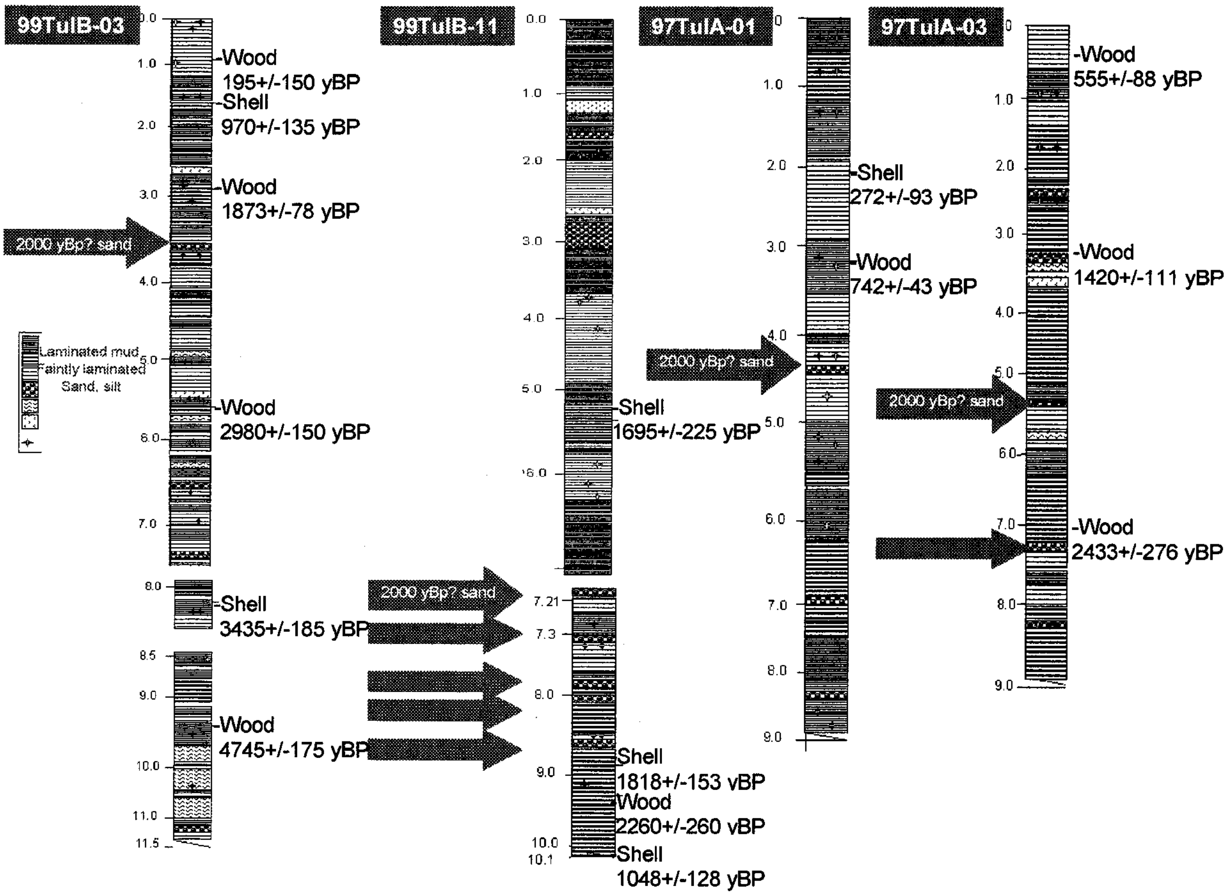


Figure 3.5. A stratigraphic correlation diagram of the Inner Basin core 99TulB-03, and the three Outer Basin cores 99TulB-11, 97TulA-01 and 97TulA-03. The radiocarbon ages are given in calibrated yBP. The arrows highlight the locations of the possible 2000 yBP tsunami sand.

Inner Basin

Core 99TulB-03

TOC

The Total Organic Carbon (provided by M. Hay, analysis performed by S. Calvert, UBC Geochemistry) as shown in Figure 4.1 shows a range of 6 to 10 %, with the average value at just above 6 %.

Foraminiferal Associations

The total number of specimens (all three size fractions, >45, >63, >500 μm) per 10 cubic centimetres (10 cm^3) was found to range from 0 to 625 specimens (Figure 3.6 - 3.8). The uppermost 200 cm (~ 2000 cal yBP; Climate Interval I) had elevated numbers of specimens with numbers greater than 200 specimens/10 cm^3 and below 200 cm the abundance is less than 100 specimens/10 cm^3, except for a peak in abundance at roughly 600 and 750 cm core depth (~3000 to 4000 cal yBP; Climate Interval II). The raw data and descriptions are found in Appendix 1.

In addition, a comparison or ratio of the size fractions examined was calculated to compare the % of specimens found in the smaller > 45 μm size fraction. On average, the smaller size fraction comprised less than 25% of the specimens counted from 0 to 750 cm (Climate Intervals I and II). However, between 750 to 1000 cm core depth (~ 3500 cal yBP to 4200 cal yBP, Climate Interval II to III), the % abundance increases to 50, and 100% at approximately ~1080 cm, after which the proportion of the smaller sizes declines (Figure 3.6). This is associated with a change in lithology from a disturbed laminated mud, to one bearing terrigenous organic fragments, and then a disturbed, laminated to poorly laminated mud (core description, Figure 3.4). This depth in core is thought to be within the Climate Interval III, with the change occurring well above at ~ 820cm.

Species diversity ranges from 0 to 35, with the majority of the samples containing less than 10 species (Figure 3.6 – 3.8). In general, species diversity is relatively constant from 0 to 600 cm down core (~3000 cal yBP; Climate Intervals I and II); from 600 to 800 cm there are dramatic increases from 10 to 35 species per sample (~ 3000 to 3800 cal yBP; Climate Interval II). From 800 to almost 875 cm there is a lack of species (~3800 to 4000 cal yBP; Climate Interval II), occurring towards the end of Climate Interval II, and from 875 cm (~ 4000 cal yBP; Climate Interval III) until the end of the core the number of species found rebounds from 10 to 30.

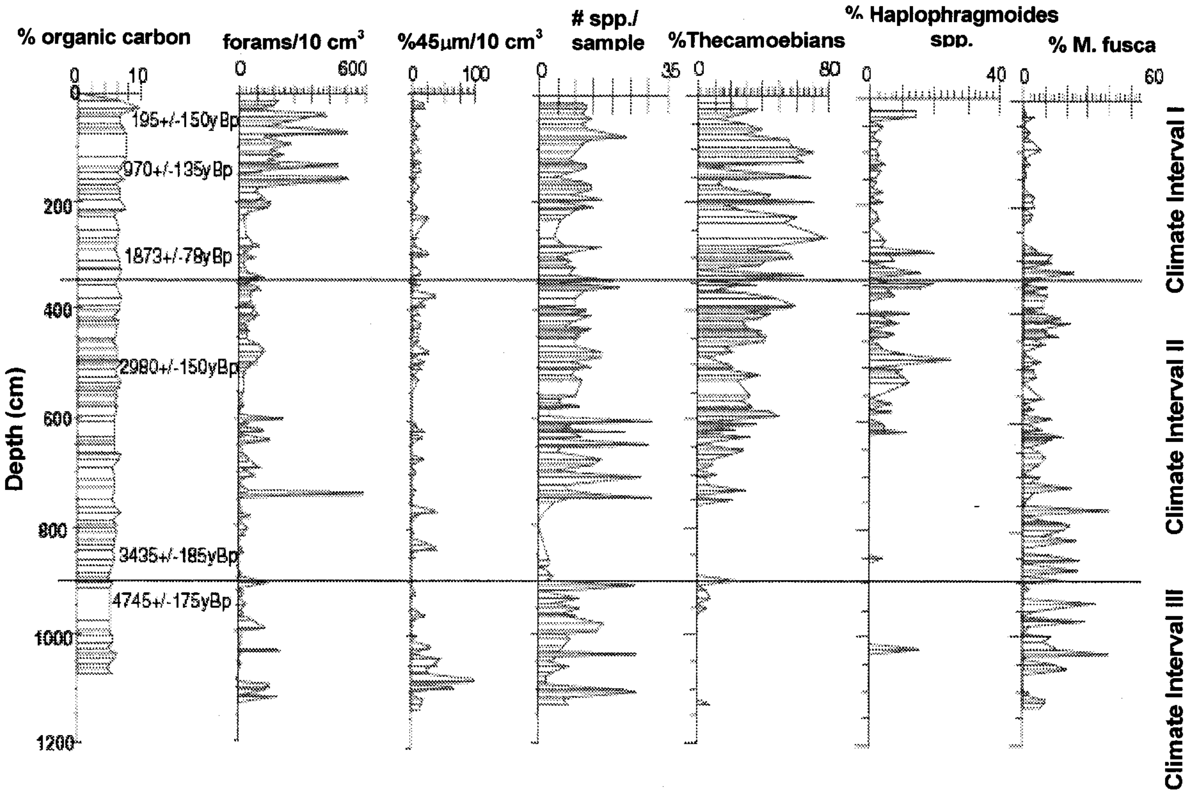


Figure 3.6. 99TulB-03, Inner Basin - plots of the % organic carbon and calibrated ^{14}C dates, the total foraminiferal count per 10 cm^3, the ratio of the counted size fraction smaller than 63 µm, the number of species per sample, followed by the downcore plots of the relative abundance of thecamoebians, *Haplophragmoides* spp., and *Miliammina fusca* found (the carbon analysis was done by S. Calvert, UBC Geochemistry).

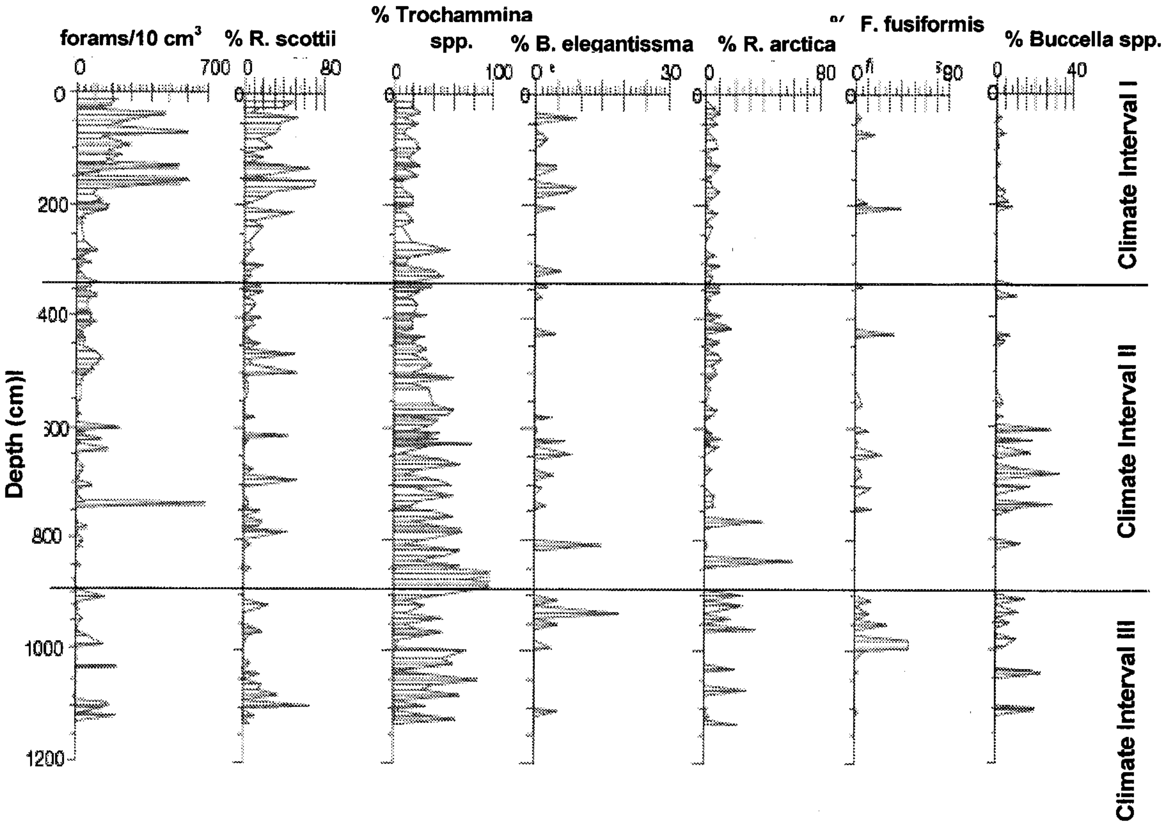


Figure 3.7. 99TulB-03, Inner Basin plots of the total count of foraminifera per sample of 10 cm^3, followed by downcore plots of the relative abundance of *Reophax scottii*, *Trochammina* spp., *Buliminella elegantissma*, *R. arctica*, *Fursenkoina fusiformis*, and *Buccella* spp.

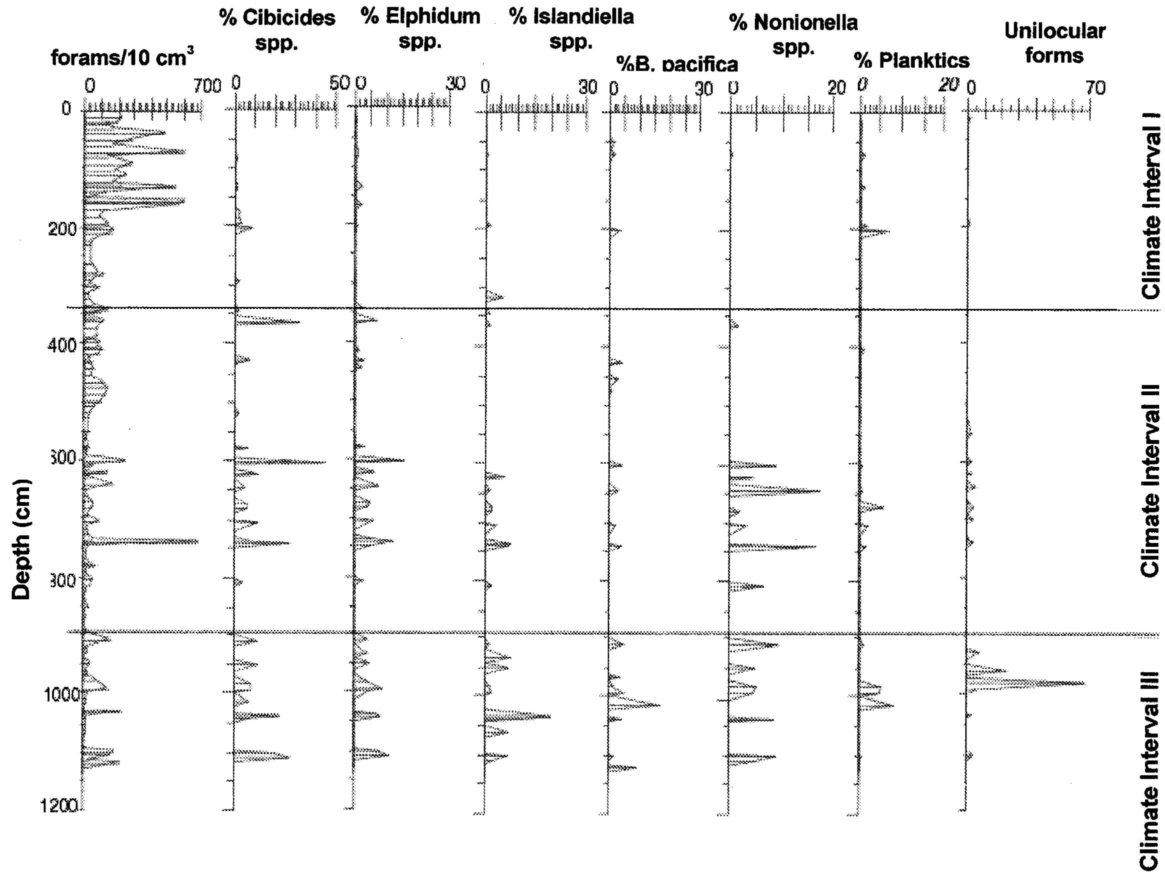


Figure 3.8. 99TulB-03, Inner Basin plots of the total count of foraminifera per sample of 10 cm^3, followed by downcore plots of the relative abundance of *Cibicides* spp., *Elphidium* spp., *Islandiella* spp., *Bolivina pacifica*, *Nonionella* spp., Planktic species and Unilocular forms.

Statistics

The original data set for 99TulB-03 included 135 samples, but only 66 samples contained abundances of > 50 individuals/10 cm^3, and were submitted for statistical analysis.

Correspondence Analysis

The first two eigenvalues, or factors account for 46.2 % of the similarity, and the cumulative similarity for the first four factors is 68.4 %.

	Value	**% Similarity**
Eigenvalue 1	0.66296	32.836
Eigenvalue 2	0.29697	14.709
Eigenvalue 3	0.265589	13.154
Eigenvalue 4	0.191848	9.5021

Table 3.2. Results of Correspondence Analysis for the foraminiferal species abundances for 99TulB-03.

The scatter plot of the CA factors, has placed the species associations in four quadrants as shown in Figure 3.9, and summarized in Table 3.3 below.

Group 2	Group 1
-+ *Reophax scottii* *Reophax arctica*	++ Unilocular forms *Fursenkoina fusiformis* Planktics *Buliminella elegantissma*
-- *Haplophragmoides* spp. Thecamoebians *Trochammina* spp.	+- *Bolivina pacifica* *Nonionella* spp. *Islandiella* spp. *Elphidium* spp. *Cibicides* spp. *Buccella* spp.
	Group3
	Miliammina fusca

Table 3.3. Summary of the scatter plot produced by correspondence analysis given in Figure 3.9.

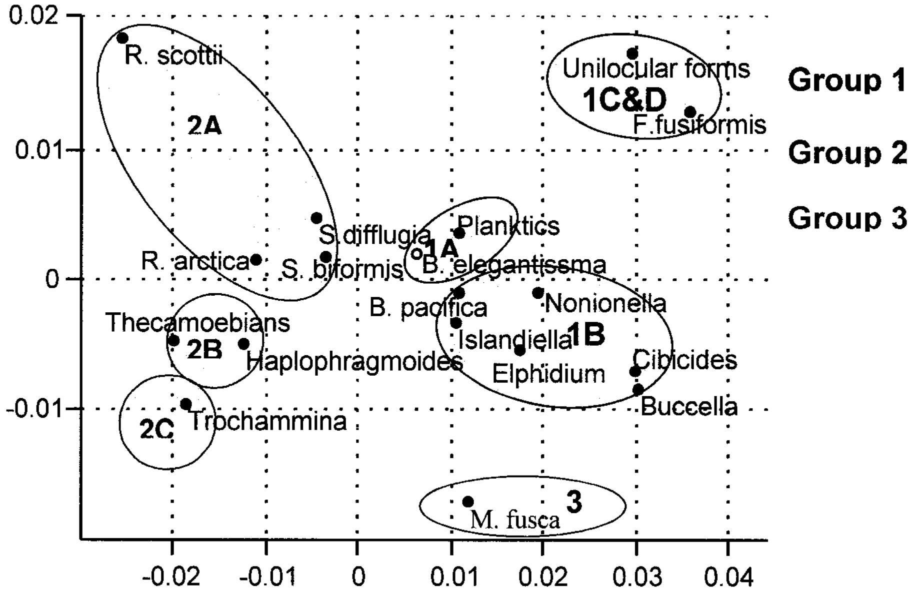


Figure 3.9. Correspondence analysis scatter plot of foraminiferal associations for 99TulB-03.

The distinction of species associations along the x-axis is the dominant feature between the '-' group (2A,B,C,D) including *Reophax arctica*, Thecamoebians, *Trochammina* spp., *Haplophragmoides* spp., *Reophax scottii*, followed by the '+' group (1A,B,C,D) that includes *Buliminella elegantissma*, *Islandiella* spp., Planktics, *Bolivina pacifica*, *Miliammina fusca (*Group 3*)*, *Elphidium* spp., *Nonionella* spp., Unilocular spp., *Cibicides* spp., *Buccella* spp., and *F. fusiformis.*

Group 1A – Planktics and *B. elegantissma* are present the length of the core in minor amounts at sporadic, but discrete intervals similar to Group 1B.

Group 1B – *Bolivina* spp., *Nonionella* spp., *Islandiella* spp., *Elphidium* spp., *Cibicides* spp., and *Buccella* spp., are present sporadically through out the length of the core at similar discrete intervals in minor to abundant amounts.

Groups 1C and 1D – Unilocular forms, that include *Lagena* spp., *Fissurina* spp. and *Oolina* spp.; and *F. fusiformis* are found present in beginning and ends of the core, and sporadically in between; and are particularly abundant with depth.

Group 2A – *R. scottii*, and *R. arctica* – both present the continuous length of the core, with *R. scottii* being particularly abundant at the top and *R. arctica* in lesser amounts.

Group 2B – Thecamoebians and *Haplophragmoides* spp. are continuously present from the beginning to the middle of the core, and two discrete intervals below - and are often a dominant species.

Group 2C – *Trochammina* spp. is present the length of the core, but is particularly abundant at depth or towards the bottom of the core.

Group 3 – *M. fusca* is found present the length of the core in discrete to continuous intervals and its relative abundance increases with depth.

Cluster Analysis

The Raup-Crick (R-mode) analysis yielded the following dendrogram (Figure 3.10) and at 0.5 Similarity there are essentially two cluster groups demonstrated by level of association the two main association Groups 1 and 2, splitting at 0.3, and further at 0.5 Similarity and subgroups occurring below with *M. fusca* (Group 3) occurring at the end of Group 1, and next to Group 2 assemblages. One includes *Islandiella* spp., Planktics *F. fusiformis*, *Bolivina pacifica*, *Cibicides* spp., *Nonionella* spp., Unilocular spp., *Buccella* spp., *B. elegantissma, Elphidium* spp., and *M. fusca.* The second group includes *Haplophragmoides* spp., *R. scottii*, Thecamoebians, *Reophax arctica*, and *Trochammina* spp. The two groups are similar to the divisions found using the Correspondence analysis (Q-mode).

The Raup-Crick (Q-mode) analysis yielded the following dendrogram (Figure 3.11) and at 0.5 Similarity there are essentially two cluster groups demonstrated by level of association of the assemblages with depth in the core. Again the two main association Groups 1 and 2, split at 0.3 and further at 0.4 Similarity and subgroups occurring below.

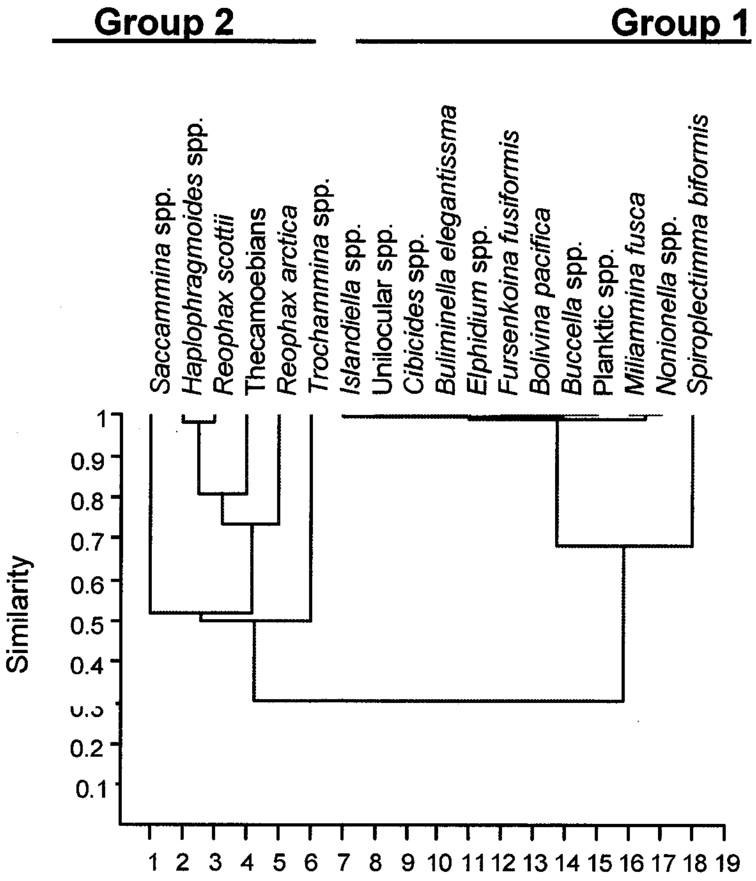


Figure 3.10. Raup-Crick r-mode cluster analysis dendrogram of related foraminiferal groups of 99TulB-03.

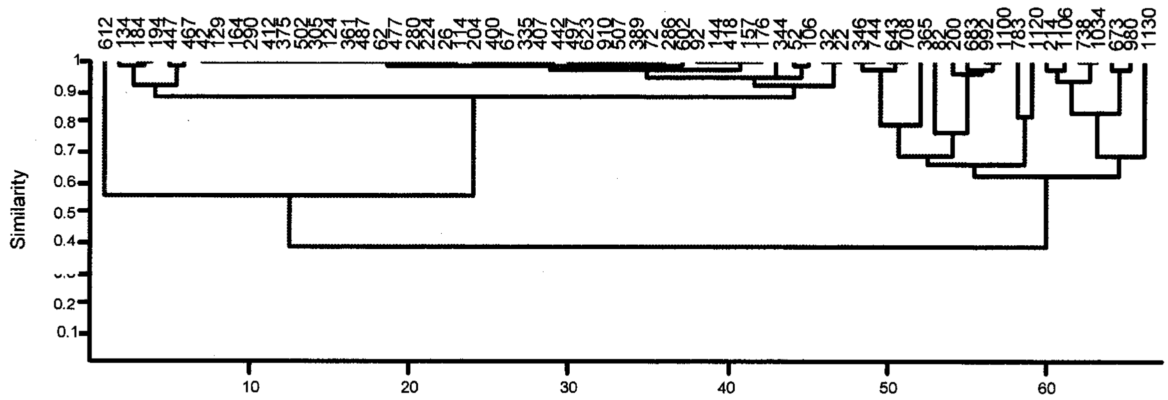


Figure 3.11. Raup-Crick q-mode cluster analysis dendrogram of related sample depths by foraminiferal groups of 99TulB-03.

Summary: Inner Basin

Benthic foraminifera are present the length of the core, but are most abundant from 0 to ~190 cm during the most recent Climate Interval I. At these core depths the lithology is a faintly laminated and a massive dark olive grey mud. The smaller size fraction of benthic foraminifera (45 to 63 μm) is particularly abundant near the bottom of the core from 1000 to 1100 cm during Climate Interval III - in a section of laminated but disturbed dark olive grey muds that contain organic fragments (Figures 3.4 and 3.6). The disturbance of the laminations in the bottom units of the core may be caused by the suction of the piston core.

Species diversity is abundant during the warmer and drier Climate Interval III, from 1130 cm until ~900 cm, and is then noticeably absent from 900 to 790cm (4000 to ~3800 cal yBP), during the ending of Climate Interval III and onset of Climate Interval II (cooler and wetter). Species diversity is the highest at 600 to 790 cm, during the earlier half to the middle of Climate Interval II (located within a massive and faintly laminate olive grey muds) (Figure 3.4; 3.5).

The shelf and low oxygen tolerant foraminifera of the Group 1 (A,B,C & D) species associations appear the length of the core, in all three Climate Intervals, but are particularly abundant during ending of the drier and warmer Climate Interval III, and the middle of cooler and wetter Climate Interval II, but are more absent during Climate Interval I. *Fursenkoina fusiformis*, 1D, a low oxygen tolerant foraminifera, tends to be associated with the massive mud units, *i.*e., 950 to 1000 cm core depth within Climate Interval III.

A striking pattern in distributions of the foraminiferal faunas occurs from 600 to 750 cm. At this depth interval, most if not all of the Group 1 or exotic 'blue water' shelf species and the more estuarine oxygen-limited tolerant species are both present and disappear together at the same sediment core depths. There are peaks in abundances of *F. fusiformis*, *B. elegantissma*, *Buccella* spp., *Cibicides* spp., *Elphidium* spp., *Islandiella* spp., *Bolivina pacifica*, *Lagena* spp., *Nonionella* spp., *Oolina* spp., and planktic foraminifera– all associated with intervals of massive mud deposits, in Climate Interval II. This 'package' occurs again from 950 to 1050 cm, which falls within the speculated Climate Interval III. And this 'package' occurs to a lesser extent from 350 to 400 cm, associated with massive intervals, falling within the earlier part of Climate Interval II. These areas of 'peaks' are also shown to occur with increases in foraminiferal diversity, often as 2-fold increases. The first figure (3.6), containing the 'reworked' and marsh species shows abundant amounts of *Haplophragmoides* spp. and thecamoebians in the upper 600 cm through the massive and faintly laminated muds of Intervals I and II, whereas *Milammina fusca* becomes dominant approaching Climate Interval III.

Reophax scottii, a member of the Group 2A species association is abundant periodically in Climate Intervals III and II in laminated and massive mud units, but is particularly above 250 cm within Climate Interval I, indicating dominate estuarine conditions with abundant productivity. While *R. arctica*, the other Group 2A species, is present the length of the core but more abundant in Climate Intervals III and II.

Thecamoebians are present at the approximate ending of Climate Interval III, and become a dominant presence during the middle of Climate Interval II, through to the top of Climate Interval I. *Haplophragmoides* spp. have a very similar appearance to the thecamoebians in this Inner Basin core, appearing during the middle of Climate Interval II and continuing to the top of Climate Interval I. Both of these Group 2B species indicate in increasing amount of fresh water input into the basin, which would be expected with the increase in precipitation levels of Climate Intervals II and I.

The Group 2C species - *Trochammina* spp., is present the length of the core and is particularly abundant in the drier Climate Interval III, and beginning of Climate Interval II, when the sediments are laminated to faintly laminated. *Miliammina fusca* is present the length of the core from Climate Intervals III to I, and is particularly abundant in Climate Interval III and the beginning of Climate Interval II. This Group 3 species indicates more resedimentation may be occurring from the shoreline areas, under marine conditions, without increased precipitation during the drier Climate Interval III.

Outer Basin

Core 99TulB-11

TOC

The total organic carbon (provided by M. Hay, analysis performed by S. Calvert, UBC Geochemistry) as shown in Figures 3.12 – 3.14 show a range of 4 to 6 %, with the average value at just above 5 %.

Foraminiferal Associations

The total number of specimens (all three size fractions, >45, >63, >500 μm) per 10 cm^3 was found to range from 0 to 2700 specimens (Figures 3.12 – 3.14). In general total counts were less than 100 specimens per sample with several peaks or increases in abundance. From 0 to 475 cm (~0 to 1775 cal yBP; Climate Interval I) there are less than 300 foraminifera counted per sample (with the exception of a peak to 1200 individuals at 60 cm and 320-340 cm). Then from 475 cm to 750 cm (~1775 to 2000 cal yBP; Climate Interval I) there are numerous peaks from 300 to 3000 individuals per sample, and after 760 cm (~2000 cal yBP+; Climate Interval II) there are very few specimens present (*i.e.*, less than 100/cm^3). The raw data and descriptions are found in Appendix 1.

A comparison or ratio of the size fractions examined was calculated to compare the % of specimens found in the smaller or >45 to >63 μm size fraction. The smaller size fraction counted dominated the length of the core with the % of the foraminiferal census ranging from 40 to 60% except from ~ 760 cm to 810 cm (~1900 to 2000 cal yBP; end of Climate Interval I) when it was only 20 % (Figure 3.12).

The number of species present ranges from 2 to 33, (Figure 3.12) with most samples having less than 10 species. In general there are numerous peaks in species diversity from 5 to 33 from 0 to 775 cm (~1775 to 2000 cal yBP; Climate Interval I), and after 760 cm (~2000 cal yBP+; Climate Interval II) the number of species found ranges from 0 to 15.

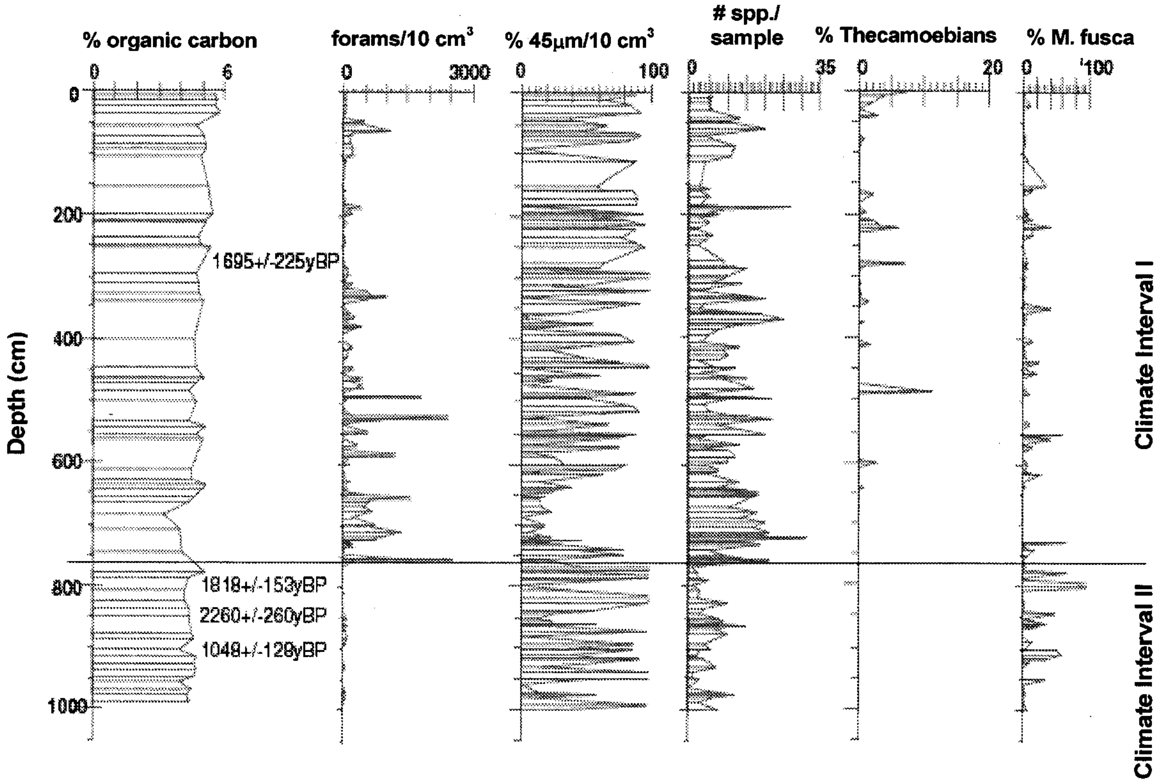


Figure 3.12. 99TulB-11, Outer Basin – plots of the % organic carbon, the total foraminiferal count per 10 cm^3, the ratio of the counted size fraction smaller than 63 µm, the number of species present, followed by downcore plots of the relative abundance of Thecamoebians, and *Milammina fusca* (the carbon analysis was done by S. Calvert, UBC Geochemistry).

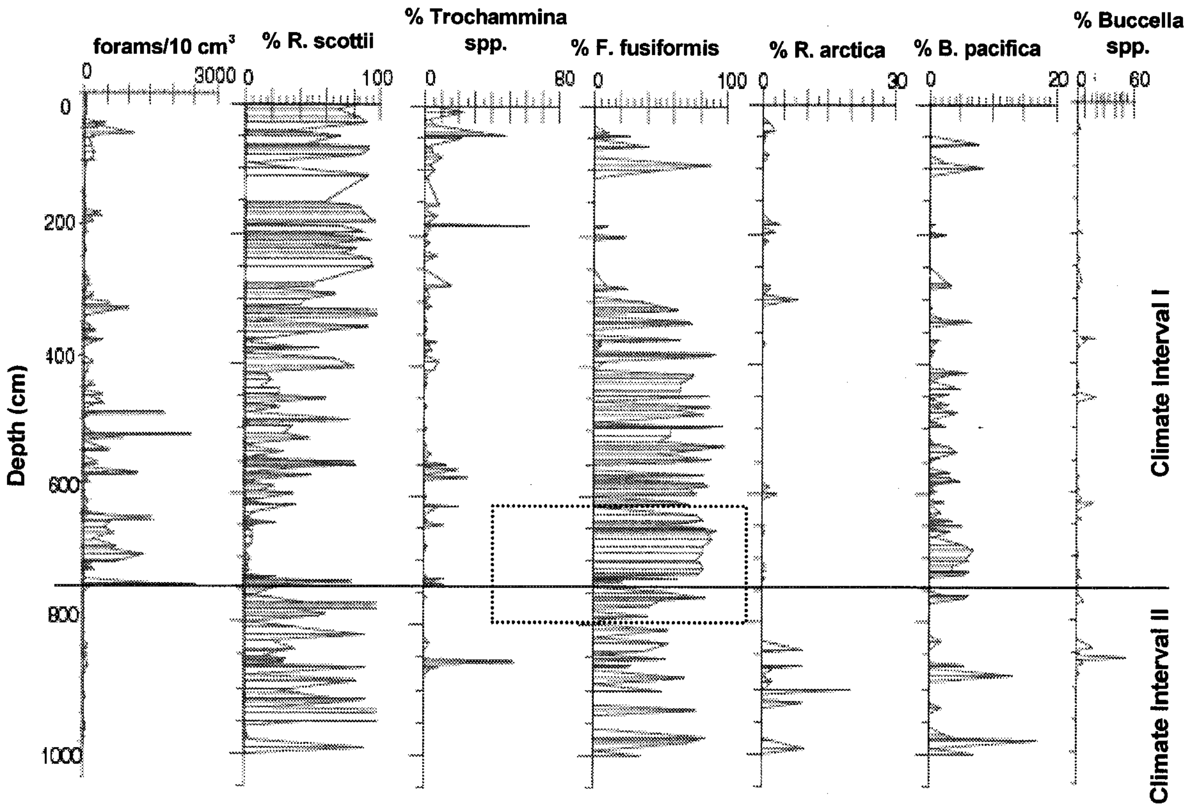


Figure 3.13. 99TulB-11, Outer Basin plots of the total count of foraminifera per 10 cm^3 sample, followed by downcore plots of the relative abundance of *Reophax scottii*, *Trochammina* spp., *Fursenkoina fusiformis*, *Reophax arctica*, *Bolivina pacifica* and *Buccella* spp. Located within the dotted-line box, is an an example of the foraminiferal fauna succession, with the following Figure 3.14.

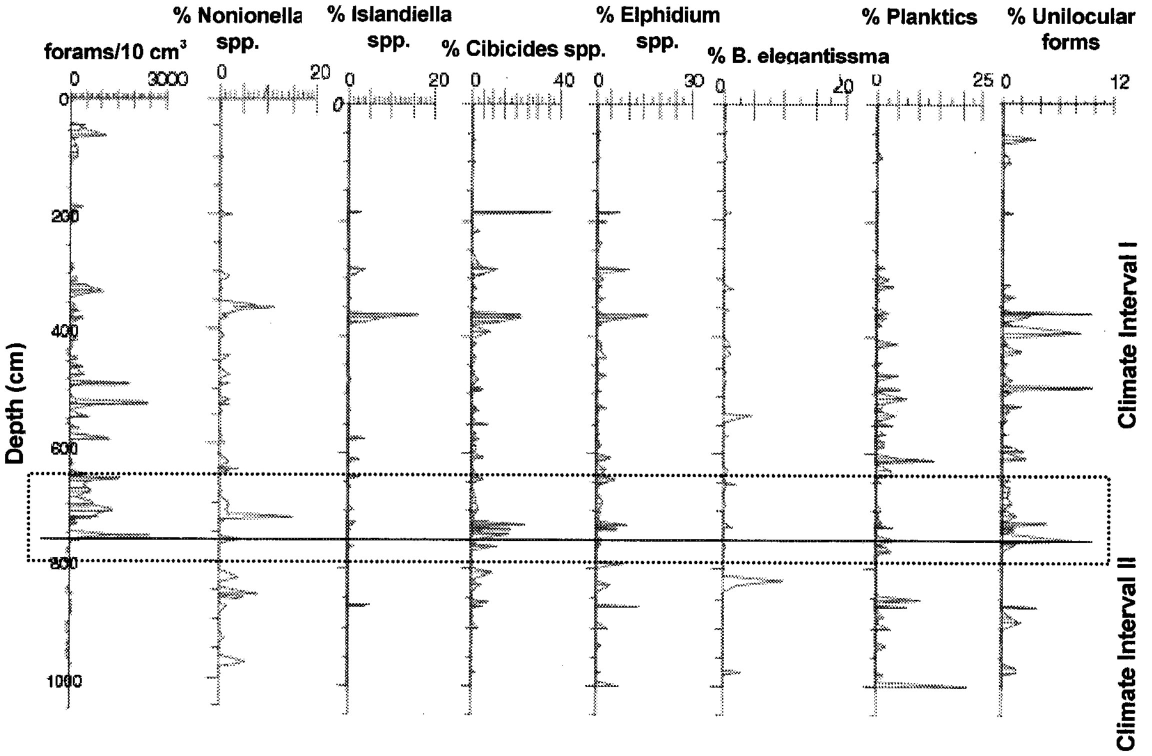
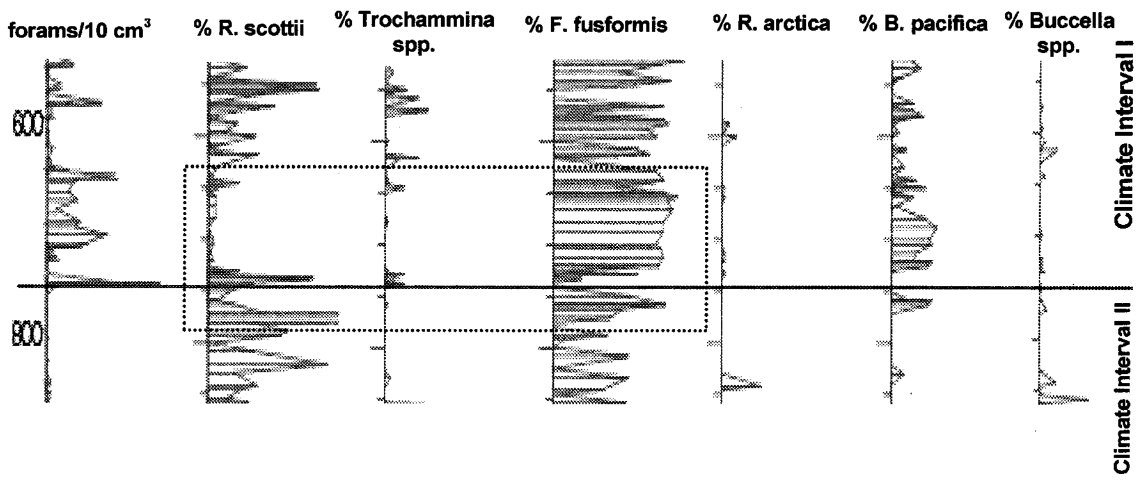


Figure 3.14. 99TulB-11, Outer Basin plots of the species diversity as the number of species per sampled, followed by downcore plots of the relative abundance of *Nonionella* spp., *Islandiella* spp., *Cibicides* spp., *Elphidium* spp., *Buliminella elegantissma*, Planktic species and Unilocular forms. Located within the dotted-line box, is an an example of the foraminiferal fauna succession, with the previous Figure 3.13.

Groups 2AC and Group 1D



Groups 1A-C

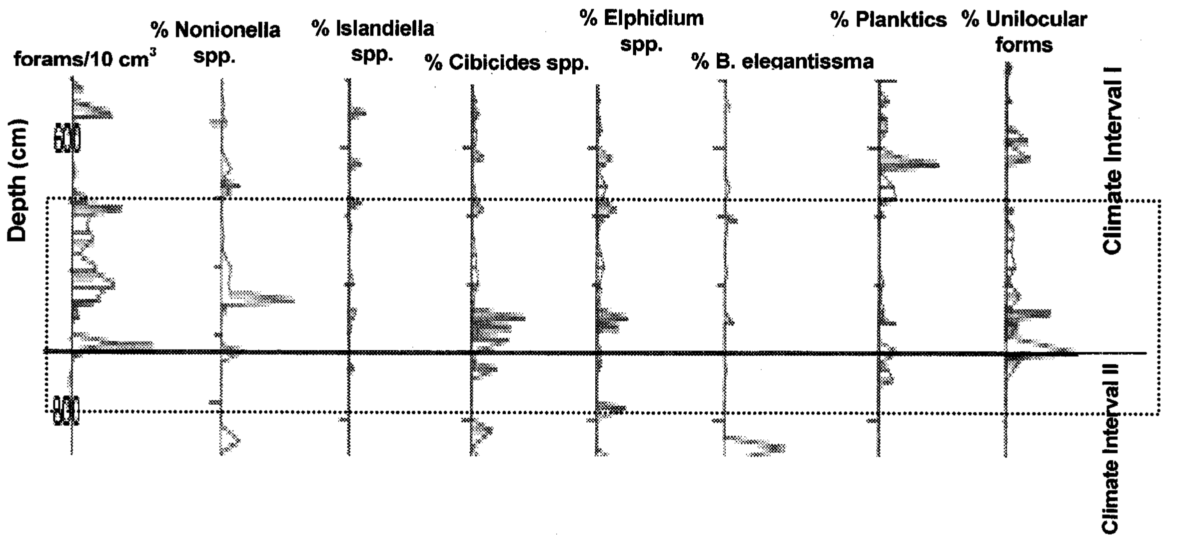


Figure 3.14a. A close-up view of Group 1 to Group 2 foraminiferal successions indicating marine incursions from the 99TulB-11, Outer Basin core (from the previous Figures 3.13, 3.14.) The Group 1A-C shelf foraminifera appear first, with the presence and eventual persistence of the low oxygen tolerant foraminifera (Group 1D) beyond the basin ventilation event, and the Group 2A, C the resident deep water estuarine benthic foraminifera.

Statistics

The original data set for 99TulB-11 included 160 samples, but only 98 samples contained abundances of < 50 individuals/10 cm^3, and were submitted for statistical analysis.

Correspondence Analysis

The first two eigenvalues, or factors account for 54.5 % of the similarity, and the cumulative similarity for the first four factors is 84.2 %.

	Value	**% Similarity**
Eigenvalue 1	0.6143	34.341
Eigenvalue 2	0.36265	20.273
Eigenvalue 3	0.28487	15.925
Eigenvalue 4	0.2477	13.847

Table 3.4. Results of Correspondence Analysis for the foraminiferal species abundances for 99TulB-11.

The scatter plot of the CA factors, has placed the species associations in four quadrants as shown in Figure 3.15, and summarized in Table 3.5 below.

Group 1	Group 2
-+ *Cibicides* spp. *Islandiella* spp. *Elphidium* spp. *Buccella* spp. *Nonionella* spp. Unilocular forms Planktics *Buliminella elegantissma*	++ *Trochammina* spp. *Reophax arctica*
	Group 3 *Milammina fusca*
-- *Bolivina pacifica* *Fursenkoina fusiformis*	+- *Reophax scottii* Thecamoebians

Table 3.5. Summary of the scatter plot produced by correspondence analysis given in Figure 3.15.

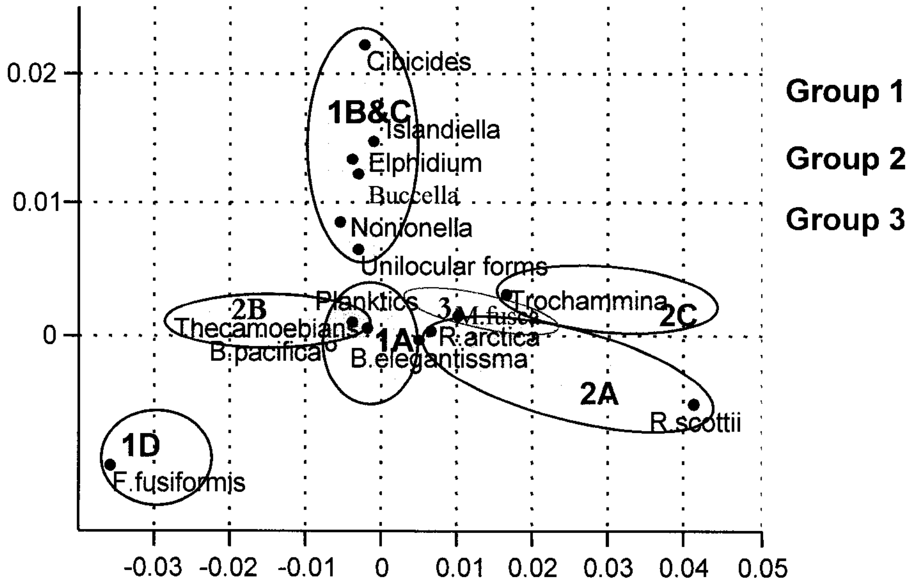


Figure 3.15. Correspondence analysis scatter plot of foraminiferal faunal associations grouped along gradients for 99TulB-11.

The distinction of species associations along the x-axis being the dominant feature between the '-' group (Groups 1A-D*)* including *F. fusiformis*, *B. pacifica*, *Nonionella* spp., *Elphidium* spp., planktics, *Buccella* spp., Unilocular forms, *Cibicides* spp., *B elegantissma,* and *Islandiella* spp. followed by the '+' group (Groups 2A-D, and 3) that includes Thecamoebians, *Reophax arctica, Miliammina fusca, Trochammina* spp., and *Reophax scottii.*

Group 1A – Planktics and *B. elegantissma*, are present the length of the core in minor amounts at sporadic, but discrete intervals similar to Group 1B.

Group 1B – *Bolivina* spp., *Nonionella* spp., *Islandiella* spp., *Elphidium* spp., *Cibicides* spp., and *Buccella* spp., are present sporadically throughout the length of the core at similar discrete intervals in minor to abundant amounts, and are particularly abundant from 180 cm until 900 cm.

Groups 1C and 1D – Unilocular forms, that include *Lagena* spp., *Fissurina* spp. and *Oolina* spp.; and *F. fusiformis* are found present sporadically the length of the core, and are particularly abundant between 200 cm and 800 cm.

Group 2A – R. *scottii*, and R. *arctica* – both present the continuous length of the core, with *R. scottii* being particularly abundant at the beginning and ends of the core, and *R. arctica* in much lesser amounts, mostly below 800 cm in Climate Interval II.

Group 2B – Thecamoebians are present in discrete intervals of minor amounts from the beginning to the middle of the core (~ 650 cm) and absent from Climate Interval II.

Group 2C – *Trochammina* spp. are present the length of the core in minor amounts, but are particularly present in the upper 400 cm, from 550 to 570 cm, and 850 to 860 cm.

Group 3 – *M. fusca* is found present the length of the core in discrete to continuous intervals and its relative abundance increases with depth particularly after 750 cm.

Cluster Analysis

The Raup-Crick (R-mode) analysis yielded the following dendrogram (Figure 3.16) and at 0.5 Similarity there are essentially two cluster groups demonstrated by level of association the two main association Groups 1 and 2, splitting at 0.4 Similarity and subgroups occurring below. One includes Planktics *Cibicides* spp., *Buccella* spp., *Bolivina pacifica*, *Nonionella* spp., Unilocular spp., *B. elegantissma, Elphidium* spp., *F. fusiformis*, and *Islandiella* spp. The second group includes *Reophax scottii*, *Trochammina* spp., *M. fusca*, Thecamoebians, *R. arctica*, and. The two groups are similar to the divisions found using the Correspondence analysis (Q-mode).

The Raup-Crick (Q-mode) analysis yielded the following dendrogram (Figure 3.17) and at 0.5 Similarity there are essentially two cluster groups demonstrated by level of association the two main association Groups 1 and 2, splitting at 0.1, and further at 0.4 Similarity and subgroups occurring below.

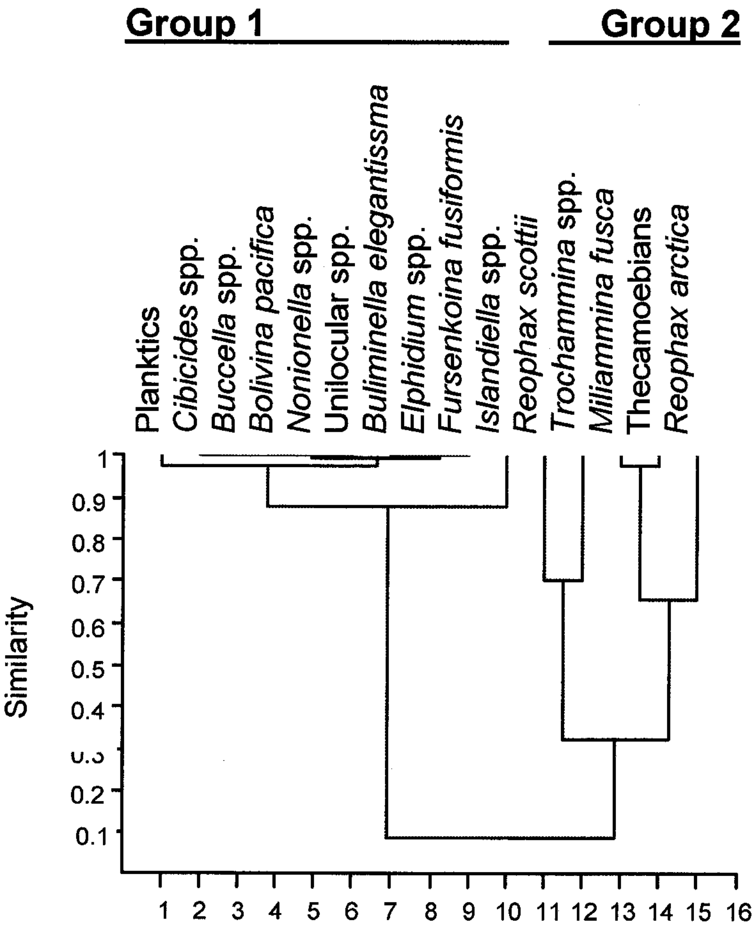


Figure 3.16. Raup-Crick r-mode cluster analysis dendrogram of the foraminiferal species associations of 99TulB-11.

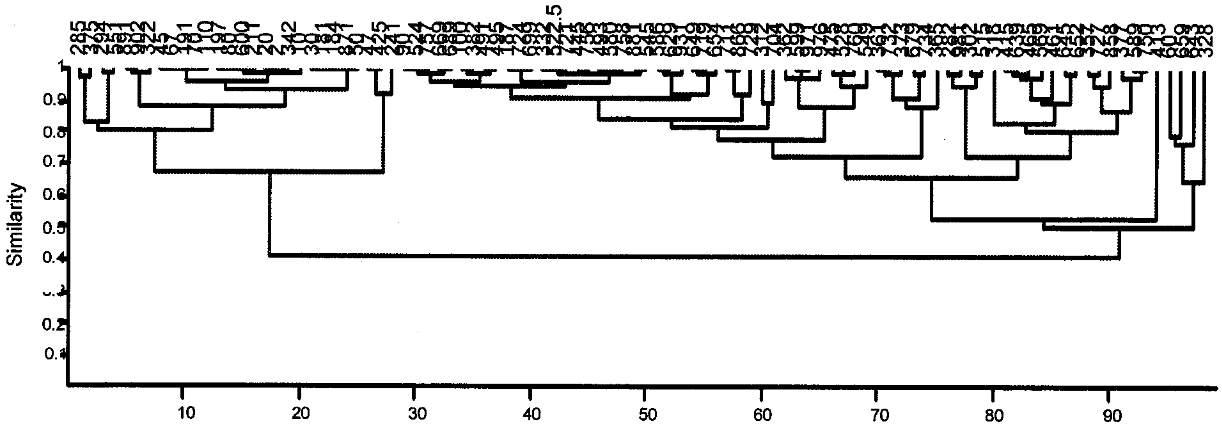


Figure 3.17. Raup-Crick q-mode cluster analysis dendrogram of sample depths related by the foraminiferal species associations of 99TulB-11.

Summary: Outer Basin core #1

Benthic foraminifera are abundant from the beginning of Climate Interval I and decrease until present, and have peaks associated with darkly colored massive to faintly laminated olive grey muds at 750 cm, 510 cm, 490 cm, 390 cm, 275 cm, 50 cm. From 740 to 650 cm (Figure 3.2) is a period where the greatest total numbers occur, and the lowest amount of the 45 to 63 μm size fraction occurs; *Reophax scottii* is also at its lowest abundance during this interval.

The exotic, blue water species and low oxygen-tolerant species of Groups 1 A-D are present in generally minor amounts the length of Climate Intervals II and I, with a peak in abundance occurring about the boundary of Climate Intervals. Group I includes *Buliminella elegantissma*, *Bolivina pacifica*, *Buccella* spp., *Cibicides* spp., *Elphidium* spp., *Nonionella* spp., *Oolina* spp., *Fissurina* spp., *Islandiella* spp., and planktic species tend to be abundant throughout the middle 2/3 of the core from approximately 200 cm until 800 cm (Climate Interval I); again over all lithology types, especially the massive and laminated muds. In contrast, *Fursenkoina fusiformis,* from Group ID is the dominant foraminifera particularly in the beginning of Climate Interval I and is absent from approximately 100 to 250 cm. The dominance of *F. fusiformis* may indicate that low-oxygen conditions, and higher productivity are more prevalent in the Outer Basin during the onset of Climate Interval I.

Figure 3.14a shows an excerpt at the onset of Climate Interval I (~650 to 800 cm), demonstrating the benthic foraminiferal fauna successions that characterize basin ventilations by events of marine incursions. The exotic, shelf foraminifera of Groups 1A-C appear first, with the low oxygen tolerant foraminifera, *F. fusiformis* (Group 1D). *F. fusiformis* persists throughout the deoxygenation of the basin waters, even past the appearance of the deep estuarine benthic foraminifera of Groups 2A, C.

In comparison, the Group 2A species associations of *R. scottii*, and estuarine species that favours highly organic rich waters (indicating high productivity as well) is abundant at the ending of Climate Intervals II and I, and not while *F. fusiformis* is abundant. The second 2A species, *R. arctica*, is slightly more abundant during the ending of Climate Interval II.

The Group 2B, thecamoebian presence in this first Outer Basin core is much reduced compared to the Inner Basin core, therefore indicating an overall decrease in the influence of river influx in the Outer Basin/increasing marine sedimentation, and is sparsely present in the latter portion of Climate Interval I, therefore indicating a increasing river influx towards the Recent. *Trochamminna* spp., or Group 2C the marsh benthic foraminiferal species, are sparsely present the length of the core, with abundance slightly increasing towards the Recent. Their increasing presence may be a reflection of increasing precipitation or run-off drawing shoreline sediments into the deeper basin.

Miliammina fusca, from the Group 3 association, is also present through Climate Intervals II and I, indicating resedimention from the surrounding marsh areas into the deeper basins is occurring. A slight peak in *M. fusca* appears to occur at the border between the two Climate Intervals, possibly an indication of increased shallow water sediment transport, although the dominant lithology is laminated mud.

Core 97TulA-01

TOC

This core was sampled in low resolution for Total Organic Carbon (provided by A. Dallimore, Rock Eval analysis performed by L. Snowdon, GSC-Ottawa, Figure 3.18) shows a range of 1 to 6 % carbon content, with an average value just above 4% and a sharp decrease to 2 % at ~ 410 cm. The age/depth control on this core is not very good. The upper ^{14}C date is a shell date, with the problem of choosing the appropriate marine reservoir correction, while the lower date is from a wood fragment sampled from a massively deposited sediment interval, and yields a younger uncalibrated ^{14}C date. When calibrated, the two dates do fall in stratigraphic sequence at 179-364 cal yBP and 699-784 cal yBP respectively; but as for assigning approximate locations of the Climate Intervals at depth in the core, this is not as easily done as with the previous cores. Dallimore (2001) mentions a shelly sand unit as being deposited around 2000 cal yBP as a remnant of a tsunami as a possible marker horizon across several cores. 97TulA-01 has sand units at roughly 425 cm and 780 cm, but there is no further age control at these depths.

Foraminiferal Associations

The total number of specimens (all three size fractions, >45, >63, >500 μm) per 10 cm^3 was found to range from 0 to 1500 specimens (Figures 3.18 – 3.20). In general total counts were less than 400 specimens per sample with several peaks or increases in abundance occurring at 20cm (1500 specimens), 55 cm (1250 specimens), 220 and 240 cm (1000 specimens), 390 to 420 cm (1450 specimens), 500 cm (1500 specimens), 510 to 560 cm (1000 to 1500 specimens), 610 cm (1000 specimens), 650 to 670 cm (500 to 700 specimens), 750 to 780 cm (700 specimens) and 820 to 870 cm (1000 specimens). The raw data and descriptions are found in Appendix 1.

A ratio of the size fractions examined was calculated to compare the % of specimens found in the >45 μm size fraction. The smaller size fraction dominated the count, and comprised 60 to 80 % of the specimens counted, with a very abrupt decline to 10 % at ~110 and ~480 cm (Figures 3.18 – 3.20).

The number of species ranges from 5 to 25 species per sample, with most samples having less than 15 different species. Peaks greater than 15 occur at 250 to 350 cm, 410 to 420 cm, 450 cm, and 750 to 840 cm (Figures 3.18 – 3.20).

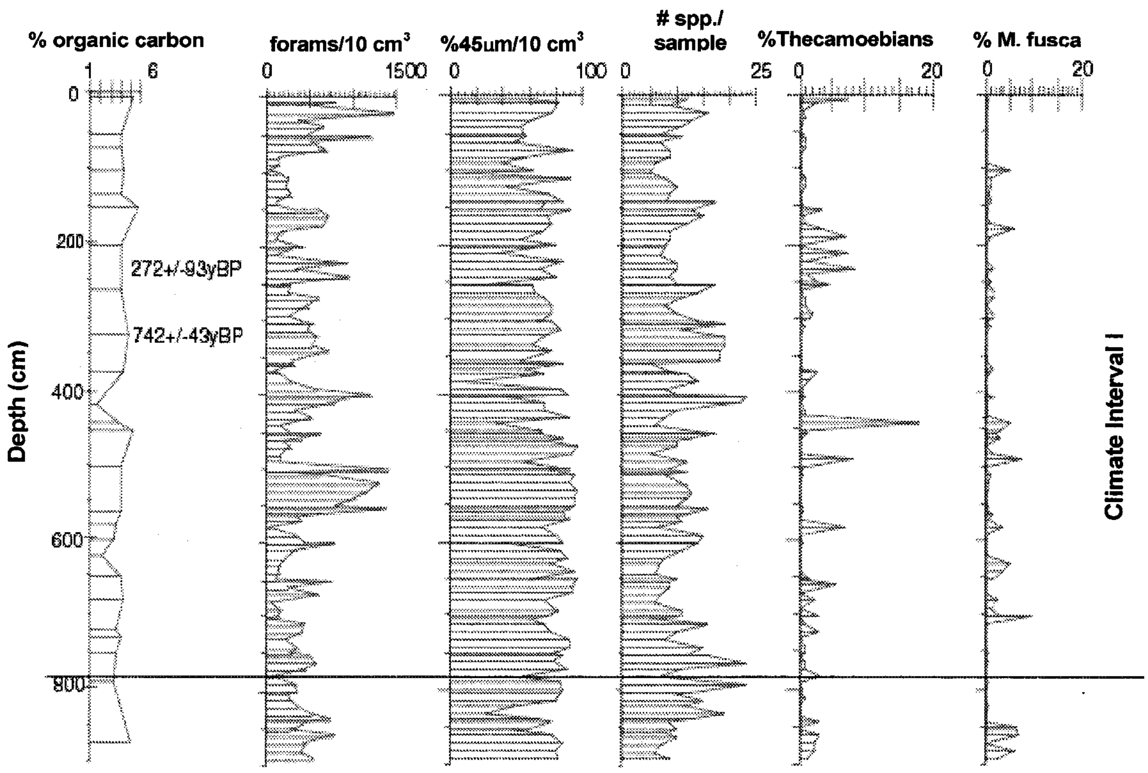


Figure 3.18. 97TulA-01, Outer Basin - plots of the % Organic Carbon, the total foraminiferal count per 10 cm^3, the ratio of the counted size fraction smaller than 63 μm, the number of species found per sample, and the relative abundances of Thecamoebians and *Miliammina fusca* (the carbon analysis was done by L. Snowdon, GSC - Rockeval).

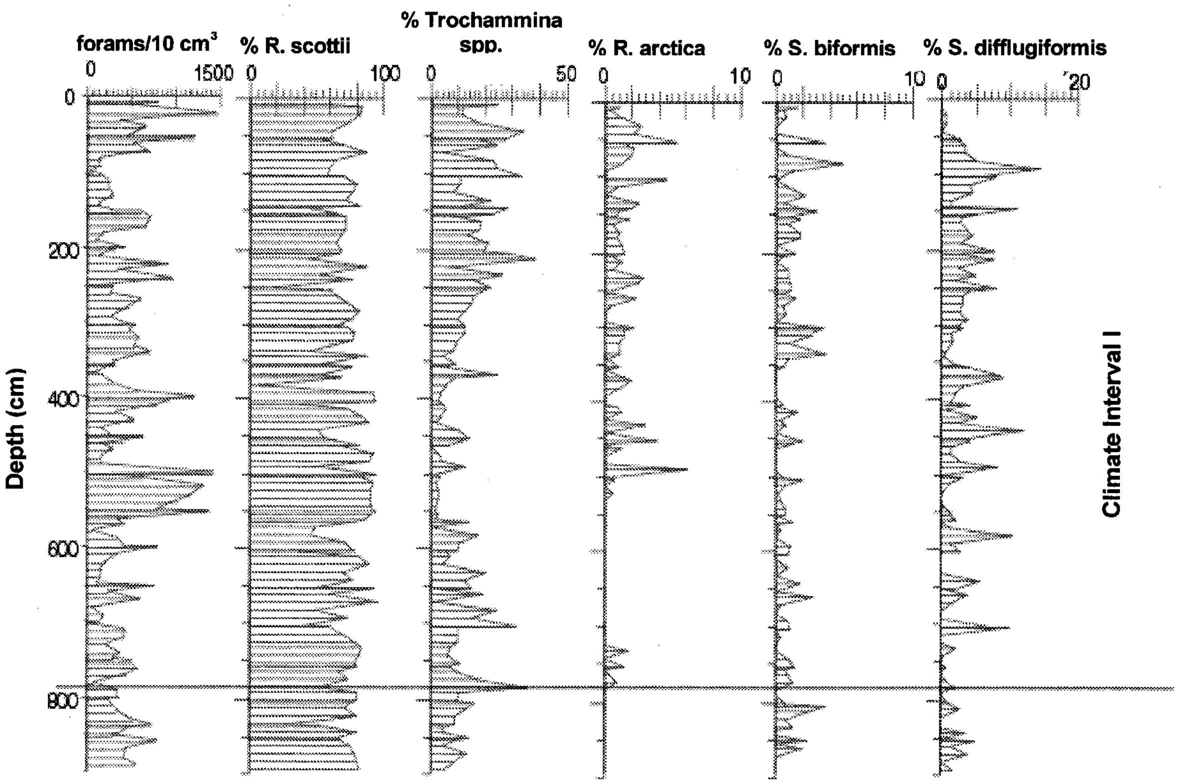


Figure 3.19. 97TulA-01, Outer Basin plots of the total count of foraminiferal per 10 cm^3, followed by downcore plots of the relative abundance of *Reophax scottii, Trochammina* spp., *Reophax arctica, Spiroplectamma biformis, and Saccamina difflugiformis.*

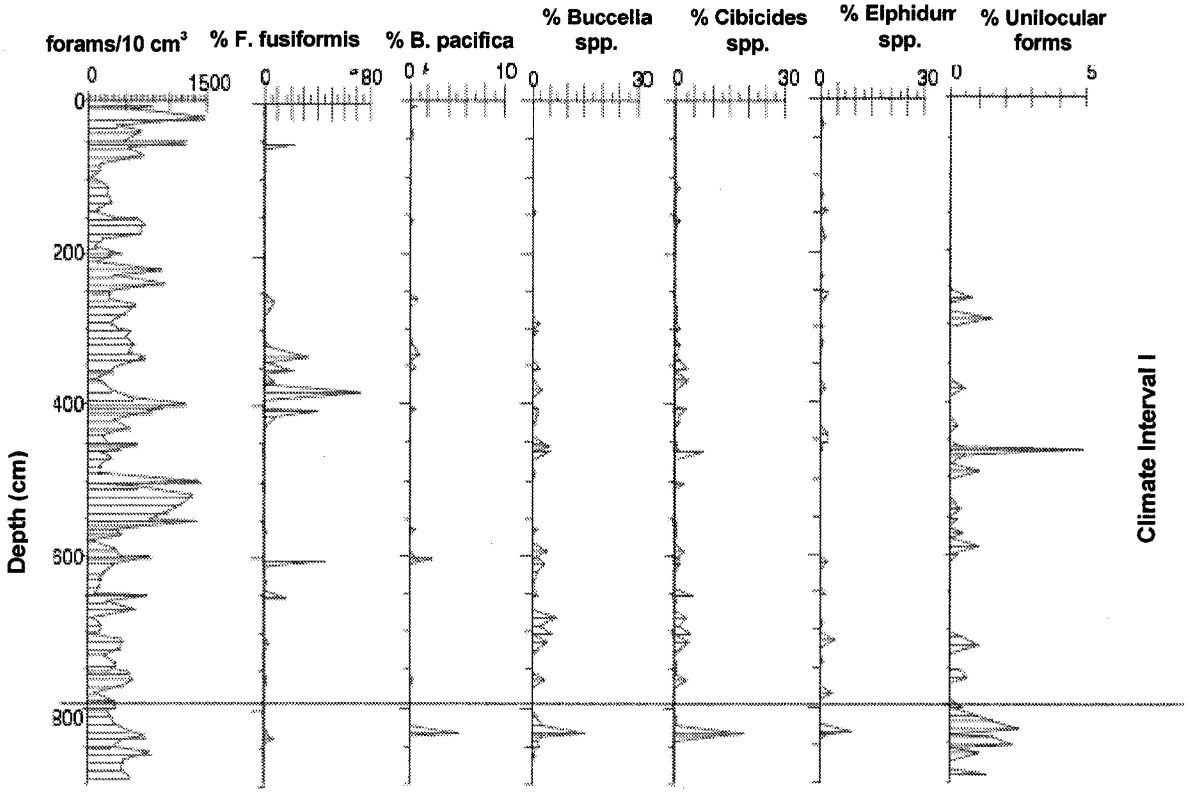


Figure 3.20. 97TulA-01, Outer Basin plots of the total number of foraminifera per 10 cm^3 sample, followed by downcore plots of the relative abundance of *Fursenkoina fusiformis*, *Bolivina pacifica, Buccella* spp., *Cibicides* spp., *Elphidium* spp, and Unilocular forms.

Statistics

The original data set for 97TulA-01 included 111 samples, but only 109 samples contained abundances of < 50 individuals/10 cm^3, and were submitted for statistical analysis.

Correspondence Analysis

The first two eigenvalues, or factors account for 65.9 % of the similarity, and the cumulative similarity for the first four factors is 86.3 %.

	Value	**% Similarity**
Eigenvalue 1	0.38087	48.702
Eigenvalue 2	0.13064	16.704
Eigenvalue 3	0.111046	14.2
Eigenvalue 4	0.0456966	5.8431

Table 3.6. Results of Correspondence Analysis for the foraminiferal species abundances for 97TulA-01.

The scatter plot of the CA factors, has placed the species associations in four quadrants as shown in Figure 3.21, and summarized in Table 3.7 below.

Group 2	Group 1
-+ Unilocular forms	++ *Cibicides* spp. *Buccella* spp. *Elphidium* spp. *Bolivina pacifica* Unilocular forms
-- *Spiroplectamma biformis*	+- *Fursenkoina fusiformis*
Group 3 *Miliammina fusca*	
Trochammina spp. *Reophax arctica* Thecamoebians *Saccammina difflugiformis* *Reophax scottii*	

Table 3.7 Summary of the scatter plot produced by correspondence analysis given in Figure 3.21.

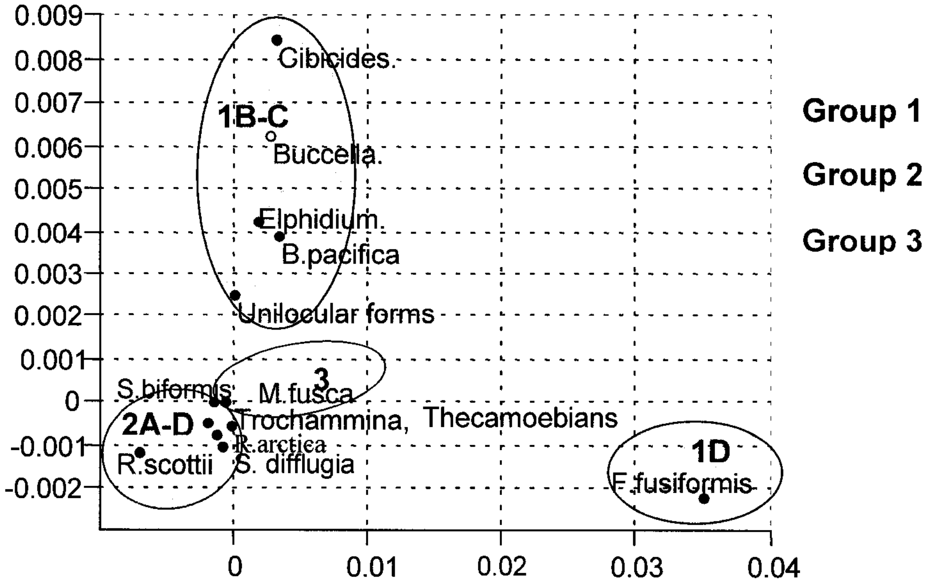


Figure 3.21. Correspondence analysis scatter plot of foraminiferal associations grouped along gradients for 97TulA-01.

The distinction of species associations along the x-axis is the dominant feature between the '+' group (Groups 1A-D*)* including *Cibicides* spp., *Buccella* spp., *Elphidium* spp., *Bolivina pacifica,* and Unilocular forms, followed by the '-' group (Groups 2A-D, and 3) that includes *Reophax arctica, F. fusiformis, Spiroplectammina biformis, Miliammina fusca, Trochammina* spp., Thecamoebians, *Saccamina difflugiformis* and *R. scottii.*

Group 1A – Planktics and *B. elegantissma*, are not found present in sufficient quantities to graph.

Group 1B – *Bolivina* spp., *Cibicides* spp., *Buccella* spp. and *Elphidium* spp. are present sporadically the length of the core at similar discrete intervals in minor amounts. *Buccella* spp. and *Cibicides* spp. are significantly present from 250 until 850 cm; and *Elphidium* spp. in minor amounts the length of the core.

Groups 1C and 1D – Unilocular forms, that include *Fissurina* spp. and *Oolina* spp.; and *F. fusiformis* are found present sporadically the length of the core, and are significantly present between 250 and 800 cm.

Group 2A – R. *scottii*, and R. *arctica* – R. *scottii* is abundant the length of the core and is a dominant species. *R. arctica* is present in much lesser amounts, and particularly in the upper 550 cm.

Group 2B – Thecamoebians are present in discrete intervals of minor amounts the length of the core.

Group 2C – *Trochammina* spp., *S. biformis* and *S. difflugiformis* are present the length of the core in minor amounts, but are particularly present in the upper 400 cm, and in addition for *Trochammina* spp. from 580 to 900cm.

Group 3 – *M. fusca* is found present in minor amounts the length of the core.

Cluster Analysis

The Raup-Crick (R-mode) analysis yielded the following dendrogram (Figure 3.22) and at 0.3 Similarity there are essentially two cluster groups demonstrated by level of association the two main association Groups 1 and 2, and further at 0.5 Similarity with subgroups occurring below. Group 1 includes Unilocular forms, *B. pacifica*, *F. fusiformis*, *Cibicides* spp., *Buccella* spp., and *Elphidium* spp. The second group includes *Trochammina* spp., *Reophax scottii*, *M. fusca*, Thecamoebians, *R. arctica*, *S. difflugiformis* and *S. biformis*. The two groups are similar to the divisions found using the Correspondence analysis (Q-mode).

The Raup-Crick (Q-mode) analysis yielded the following dendrogram (Figure 3.23) and at 0.4 Similarity there are essentially two cluster groups demonstrated by level of association the two main association Groups 1 and 2, and further at 0.5 Similarity with subgroups occurring below.

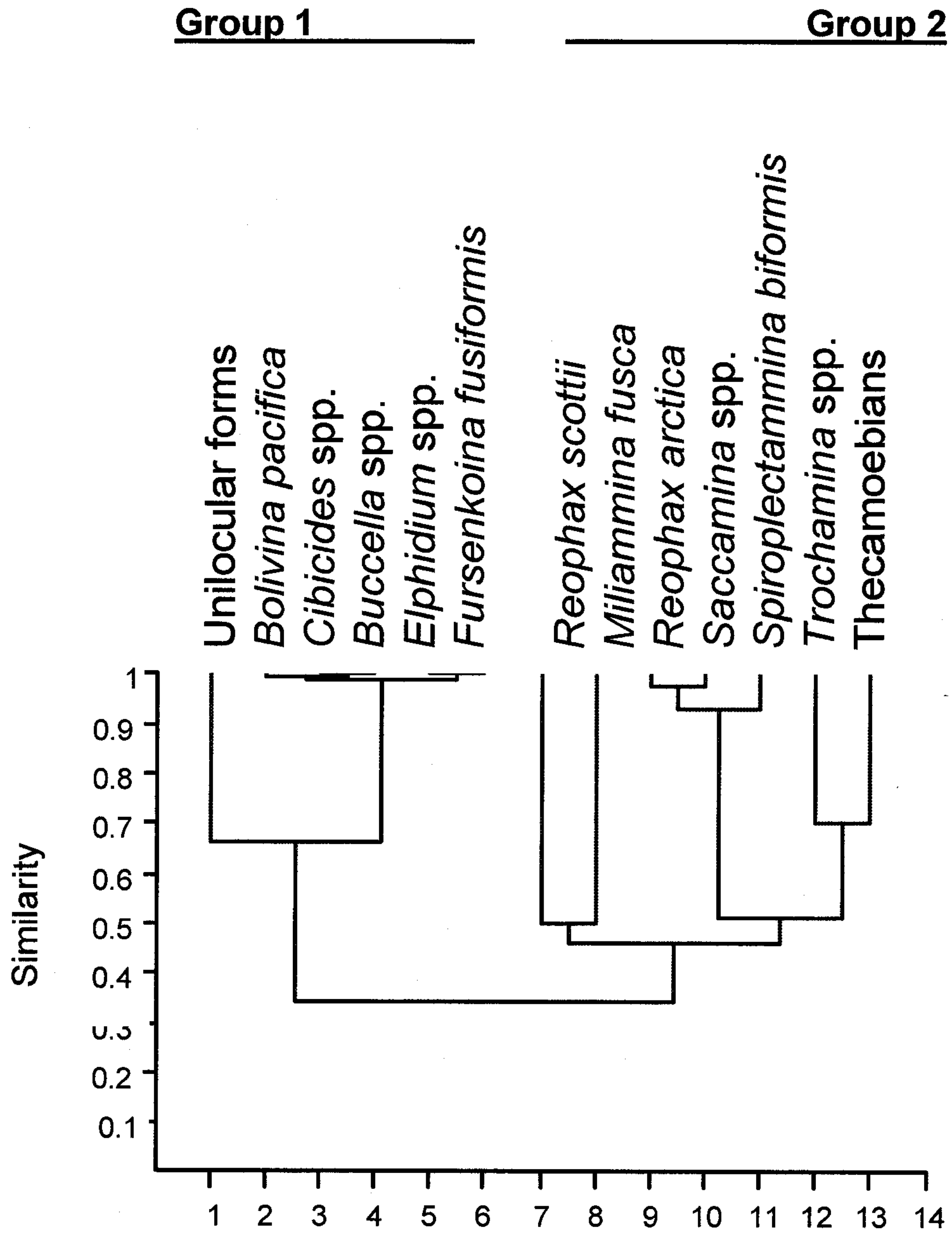


Figure 3.22. Raup-Crick cluster r-mode analysis of foraminiferal associations from 97TulA-01.

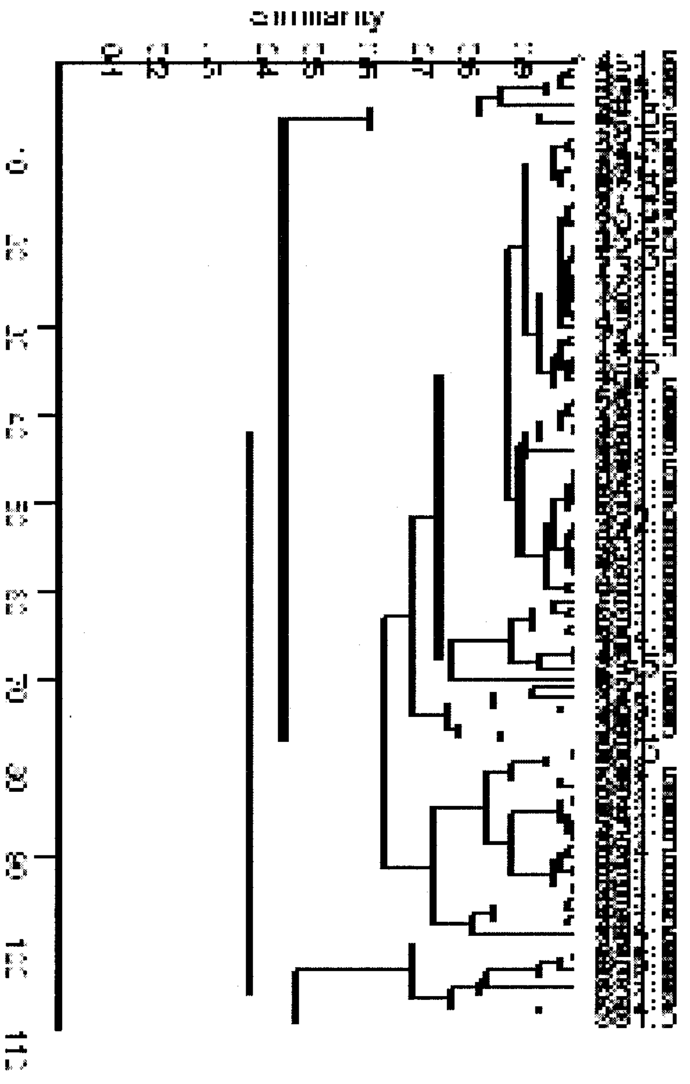


Figure 3.23. Raup-Crick cluster q-mode analysis of related sample depths by foraminiferal associations from 97TulA-01.

Summary: Outer Basin core #2

The highest abundance of benthic foraminifera occurs in the middle of Climate Interval I, until the Recent at depths of 550 to 500 cm, 400 cm, and 50 to 0 cm. These peaks in abundance are associated with massive to faintly laminated dark olive grey muds (with some organic fragments) (Figure 3.1). The amount of 45 to 64 μm size foraminifera counted is generally 80 %. The species diversity is fairly constant from Climate Intervals II to I, with a slight increase straddling the boundary between the two Climate Intervals. The Total Organic Carbon (TOC) is too coarsely sampled to compare direct values with the micropaleontology samples, which were done at a much finer resolution. An estimation of the duration of the Climate Interval I is ~775 to 0 cm, but ^{14}C dates (or dateable materials) are not found at depth. Very little of Climate Interval II has been cored in this Outer Basin core.

In this second Outer Basin core, the Group 1 exotic blue water shelf species and low-oxygen tolerant foraminifera are lacking a significant representation of Group 1A – the planktic species and *Buliminella elegantissma.* The Group 1B species *Bolivina* spp., *Buccella* spp., *Cibicides* spp., and *Elphidium* spp., also indicating marine incursions are present at the ending of Climate Interval II, and through to the upper portion of Climate Interval I. They are less abundant towards the most Recent, possibly indicating a waning of marine incursions into the Inlet towards the present. Group 1C include the Unilocular forms (*i.e.*, *Fissurina* spp., *Oolina* spp.), also shelf foraminifera species and are present in small amounts at the same depths at the 1B species, and again represent marine incursions into the Inlet. Group 1D, the low-oxygen tolerant/high productivity favoured foraminifera *Fursenkoina fusiformis* has a dominant presence only in the middle of Climate Interval I, from ~ 450 to 300 cm, and has a minor appearance elsewhere.

The estuarine foraminiferal Group 2A including *Reophax scottii* and *R. arctica* are abundant, through Climate Intervals II and I. *R. scottii* is equally abundant the length of the core indicating high productivity , while *R. arctica* appear at the beginning of Climate Interval I, and then from the middle of Interval I (~550 cm) until present.

Thecamoebians, Group 2B, are present through out this Outer Basin core but in greatly reduced amounts compared to the Inner Basin. Thecamoebians have the greatest abundance during the middle of Climate Interval I, thus indicating an increase in fluvial influx into the deep basin, probably due to an increase in precipitation during the middle of Climate Interval I.

The shallow water, shoreline foraminiferal species of Group 2C for this second Outer Basin core include *Trochammina* spp., *Spiroplectammina biformis* and *Saccamina difflugiformis,* and *Miliammina fusca*, a marsh or Group 3 foraminifera. All four are present the length of the core in varying amounts, but have a gross decreasing trend in the onset of the middle of Climate Interval I (especially noticeable in *Trochammina* spp.), and increase towards present. Again, the presence of these species in the deep water basin sediments indicates a flux of shallow water sediments into the basin, probably due to sediment instability and/or increased precipitation.

Core 97TulA-03

TOC

The Total Organic Carbon (combustion analysis performed by C. Younger, Centre for Marine and Environmental Geology, Department of Earth Sciences, Dalhousie University), as shown in Figure 3.24, shows a range of 14.3 % to 22.8 %, with the average value of 17.7 %. This is a different method than the Rock Eval analysis that may contribute to the much higher TOC in this core.

Foraminiferal Associations

The total number of specimens (all three size fractions, >45, >63, >500 μm) per 10 cm^3 was found to range from 0 to 1000 specimens (Figures 3.24 – 3.26). Generally the counts were around 50 individuals per 10 cm^3, with two peaks of 400 individuals at ~ 0 to 30 cm, and 190 to 200 cm (~ 0 to 1000 cal yBP; Climate Interval I), and the largest peak of ~ 1000 individuals per 10cm^3 sample at ~560 – 580 cm (~2500 cal yBP; Climate Interval II). The raw data and descriptions are found in Appendix 1.

The number of species ranges from 0 to 25 species per 10 cm^3, with most samples having less than 5 species. The species diversity is greatest from 0 to ~90 cm, ~180 to 200 cm with 13 species (~0 to 1000 cal yBP; Climate Interval I), and from ~560 to 580 cm with 25 species (~ 2500 cal yBP; Climate Interval II) (Figure 3.24).

A ratio of the size fractions examined was calculated to compare the % of specimens found in the >45 μm size fraction. On average, the smaller size fraction comprised generally at least 40 % of the individuals counted, with only 4 intervals amounts to less than 20 % of the composition; these occur at ~60 cm, ~360 to 380 cm (~0 to 2000 cal yBP; Climate Interval I), and ~560 to 580 cm ,~650 cm (~2400 cal yBP; Climate Interval II) (Figure 3.24).

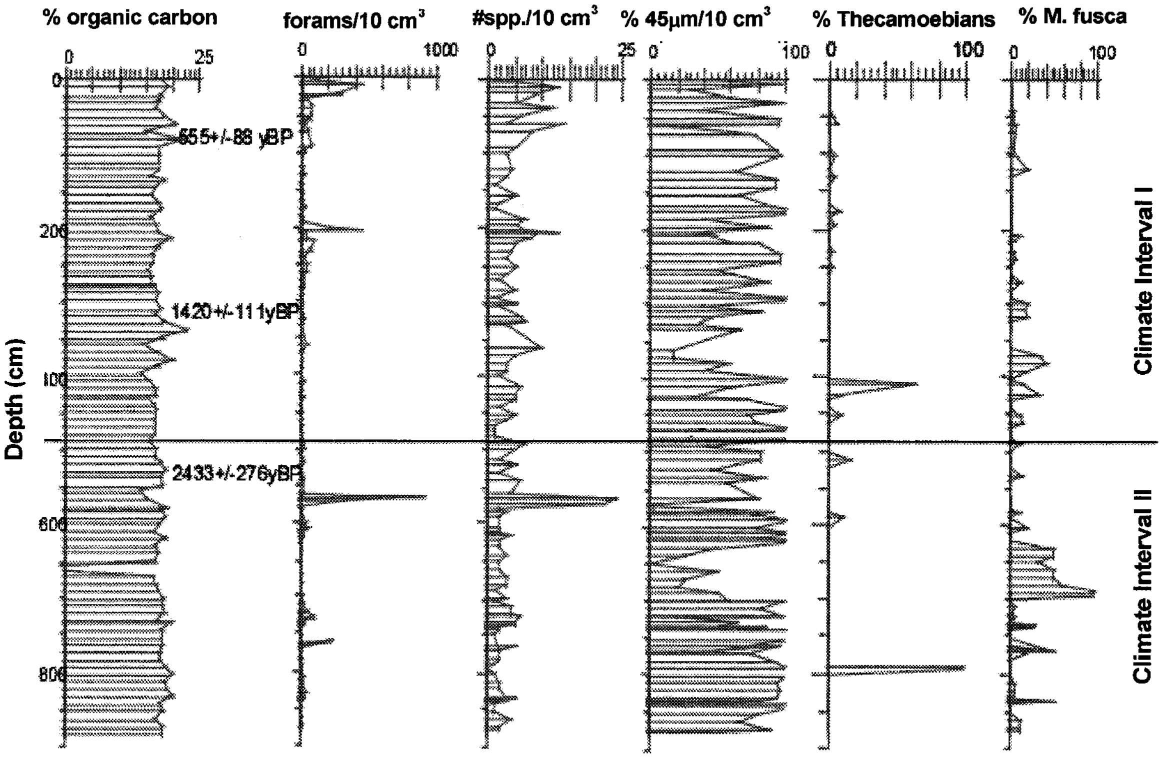


Figure 3.24. 97TulA-03, Outer Basin - plots of the % TOC, the total foraminiferal count per 10 cm^3, the ratio of the counted size fraction smaller than 63 μm, and the relative abundances of Thecamoebians and *Miliammina fusca* (the carbon analysis was done by C. Younger, Centre for Environmental and Marine Geology, Dalhousie University).

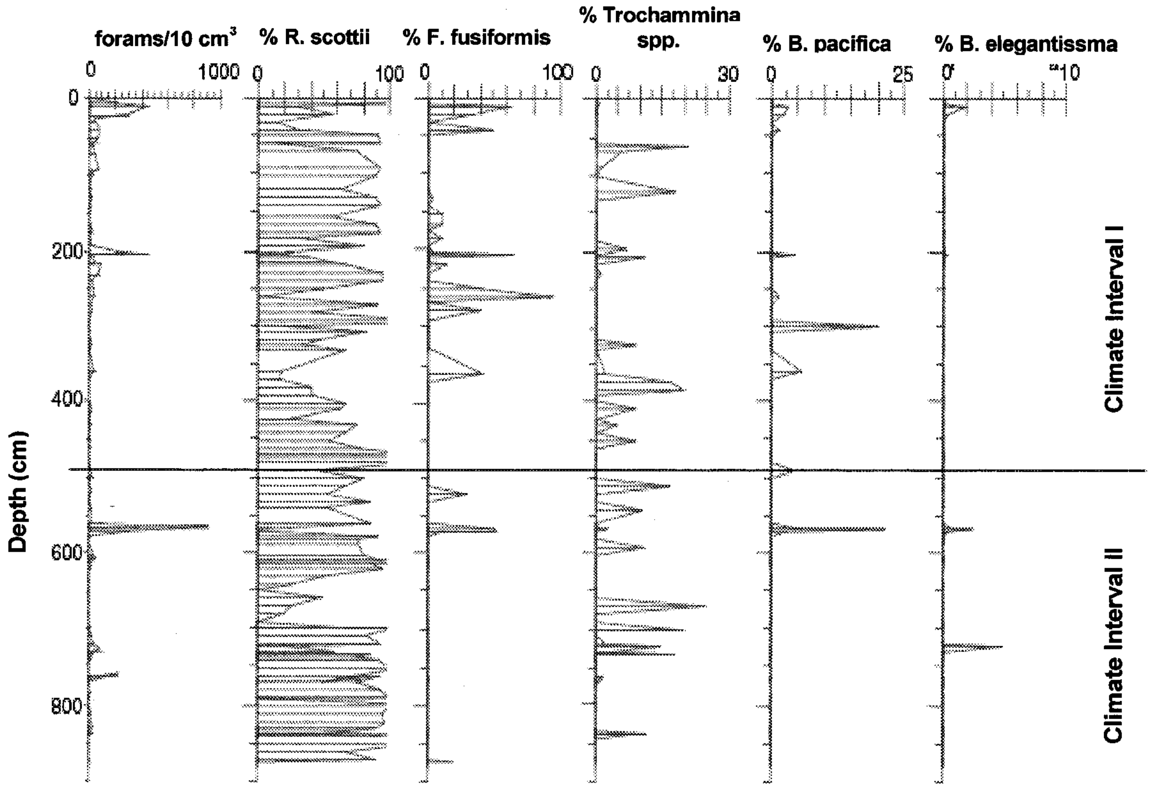


Figure 3.25. 97TulA-03, Outer Basin plots of the total count of individual foraminifera per 10 cm^3, followed by downcore plots of the relative abundance of *Reophax scottii*, *Fursenkoina fusiformis*, *Trochammina* spp., *Bolivina pacifica*, and *Buliminella elegantissma*.

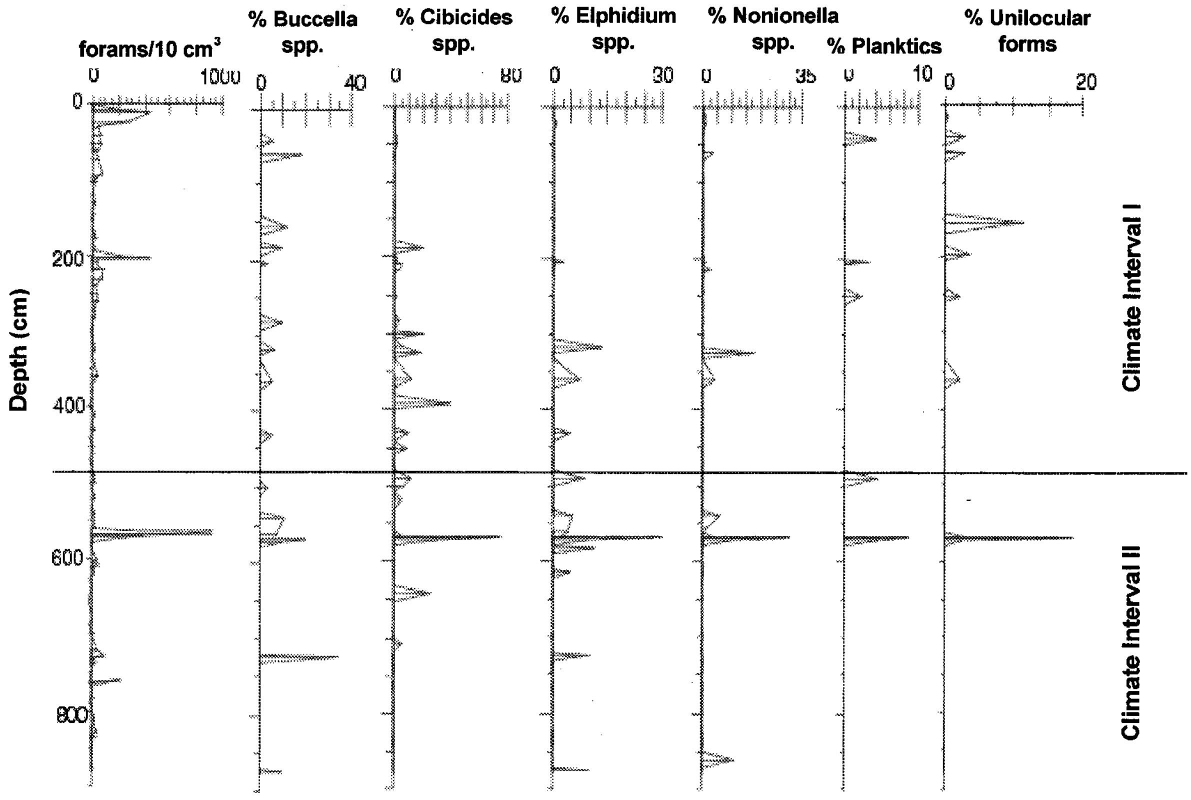


Figure 3.26. 97TulA-03, Outer Basin plots of the total count of individual foraminifera per 10 cm^3, followed by downcore plots of the relative abundance of *Buccella* spp., *Cibicides* spp., *Elphidium* spp., *Nonionella* spp., Planktic species and Unilocular forms.

Statistics

The original data set for 97TulA-03 included 141 samples, but only 21 samples contained abundances of < 50 individuals/10 cm^3, and were submitted for statistical analysis.

Correspondence Analysis

The first two eigenvalues, or factors account for 89.7 % of the similarity, and the cumulative similarity for the first four factors is 94.3 %.

	Value	**% Similarity**
Eigenvalue 1	0.74966	57.957
Eigenvalue 2	0.44062	34.064
Eigenvalue 3	0.0324284	2.507
Eigenvalue 4	0.0190725	1.4745

Table 3.8. Results of Correspondence Analysis for the foraminiferal species abundances for 97TulA-03.

The scatter plot of the CA factors, has placed the species associations in four quadrants as shown in Figure 3.27, and summarized in Table 3.9 below.

<table>
<tr><th>Group 2</th><th>Group 1</th></tr>
<tr><td>-+
<i>Reophax scottii</i>
<i>Trochammina</i> spp.</td><td rowspan="3">++
<i>Cibicides</i> spp.
<i>Nonionella</i> spp.
<i>Elphidium</i> spp.
Unilocular forms
<i>Buccella</i> spp.
Planktics
<i>Bolivina pacifica</i>
<i>Buliminella elegantissma</i></td></tr>
<tr><td>Group 3
<i>Miliammina fusca</i></td></tr>
<tr><td></td></tr>
<tr><td>--
Thecamoebians</td><td>+-
<i>Fursenkoina fusiformis</i></td></tr>
</table>

Table 3.9 Summary of the scatter plot produced by correspondence analysis given in Figure 3.27.

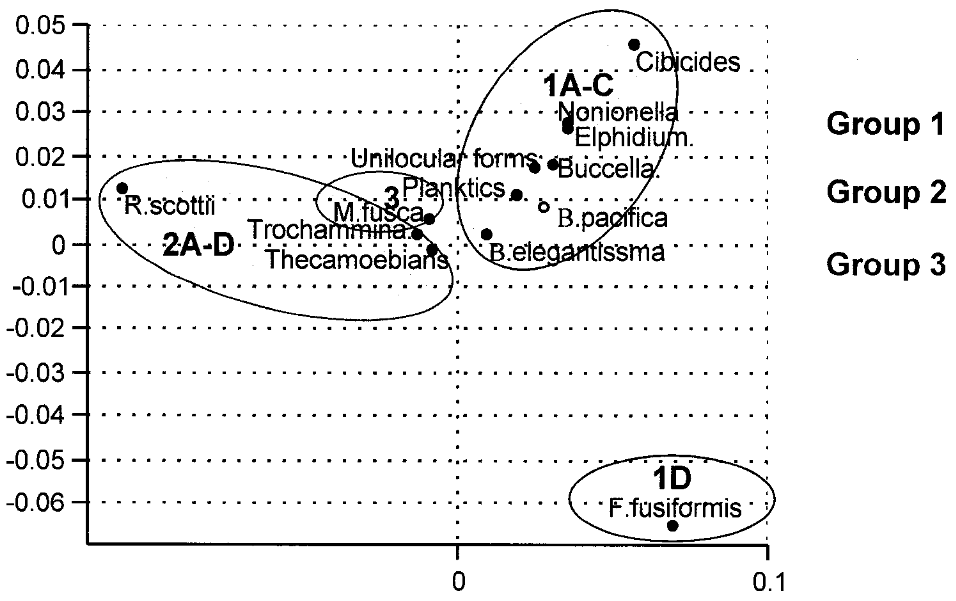


Figure 3.27. Correspondence analysis scatter plot of foraminiferal associations grouped along gradients for 97TulA-03.

The distinction of species associations along the x-axis is the dominant feature between the '+' group (Groups 1A-D*)* including *Cibicides* spp., *Nonionella* spp., *Elphidium* spp., *Buccella* spp., Unilocular forms, *F. fusiformis*, planktics, *B. pacifica*, and *B elegantissma,* followed by the '-' group (Groups 2A-D, and 3) that includes *Reophax scottii*, *Miliammina fusca, Trochammina* spp., and Thecamoebians.

Group 1A – Planktics and *B. elegantissma*, have 4 occurrences the length of the core in minor amounts at discrete intervals similar to Group 1B.

Group 1B – *Bolivina* spp., *Nonionella* spp., *Elphidium* spp., *Cibicides* spp., and *Buccella* spp., are present sporadically throughout the length of the core at similar discrete intervals in minor amounts.

Groups 1C and 1D – Unilocular forms, that include *Lagena* spp., *Fissurina* spp. and *Oolina* spp. and *F. fusiformis* are found sporadically the length of the core.

Group 2A – R. *scottii* is present the length of the core, and is the dominant species except at ~ 20 cm, 40 cm, 350 cm, 650 cm and 700 cm.

Group 2B – Thecamoebians are present in discrete intervals of minor amounts the length of the core with peaks at ~ 400cm and 790 cm.

Group 2C – *Trochammina* spp. is present the length of the core in discrete intervals.

Group 3 – *M. fusca* is found present the length of the core in discrete to continuous intervals and its relative abundance increases with depth particularly between ~ 620 cm and 700 cm.

Cluster Analysis

The Raup-Crick (R-mode) analysis yielded the following dendrogram (Figure 3.28) and at 0.2 Similarity there are essentially two cluster groups demonstrated by level of association the two main association Groups 1 and 2, splitting at 0.3, and further at 0.4 Similarity and subgroups occurring below. One includes Planktics, Unilocular spp., *F. fusiformis, Bolivina pacifica*, *B. elegantissma, Nonionella* spp., *Cibicides* spp., *Buccella* spp., and *Elphidium* spp. The second group includes *Trochammina* spp., *M. fusca*, Thecamoebians, and *Reophax scottii.* The two groups are similar to the divisions found using the Correspondence analysis (Q-mode; Figure 3.29)

The Raup-Crick (Q-mode) analysis yielded the following dendrogram (Figure 3.29) and at 0.4 Similarity there are essentially two cluster groups demonstrated by level of association, and further at 0.6 Similarity and subgroups occurring below.

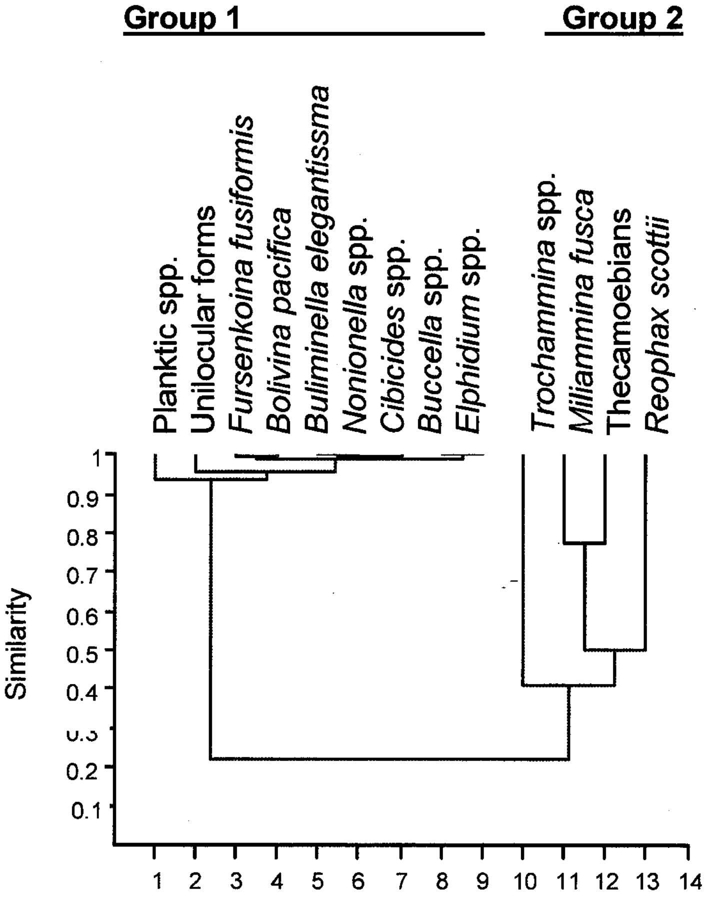


Figure 3.28. Raup-Crick cluster r-mode analysis of foraminiferal association groups in 97TulA-03.

Summary: Outer Basin core #3

Benthic foraminifera are abundant in four, discrete peaks. Two peaks occur in the cooler and wetter than present Climate Interval II at ~ 750 cm, and ~550 cm. Two peaks occur in the present Climate Interval I – at ~ 200 cm and 50 cm until present. The peaks in abundance also occur when the lithology is predominantly faintly laminated muds (Figure 3.3), and at those depths there is a decrease in the amount of smaller size foraminifera.

In this third (and last) Outer Basin core, the exotic blue water or shelf foraminiferal species of Group 1A, Planktics and *Buliminella elegantissma* are present in both Climate Intervals II and I. *B. elegantissma* has 2 peaks at the end of the warmer and drier than present Climate Interval II, and one peak at the end of the present day - Climate Interval I at the top of the core. The Planktic forms have 5 peaks, with two occurring in the late Climate Interval II, and 3 peaks in the latter half of Climate Interval I.

The Group 1B shelf foraminiferal species for this third Outer Basin core include *Bolivina* spp., *Buccella* spp., *Cibicides* spp., *Elphidium* spp. and *Nonionella* spp., and are present in both Climate Intervals with an increasing presence around the boundary between the two intervals. *Elphidium* spp., *Nonionella* spp., and *Cibicides* spp. are more abundant from the ending of Climate Interval II, until the middle of Climate Interval I, while *Buccella* spp. have appearances until present.

The Unilocular forms of Group 1C, more shelf foraminiferal species, have similar appearances to the other Group 1 associations with a peak towards the end of the cooler and wetter Climate Interval II, and several peaks occurring from the middle of Climate Interval I until present. The combination of Groups 1A-C in this third Outer Basin core tend to support the hypothesis of an increasing amount of marine incursions from the waning of Climate Interval II and onset of Climate Interval I. But note, that only one age date was available from Climate Interval II, so it is not accurately known how much of that earlier cooler and wetter than present climate interval has been sampled.

The low-oxygen tolerant foraminifera of Group 1D, *Fursenkoina fusiformis*, is found in several discrete intervals with two peaks occurring towards the ending of cooler and wetter conditions of Climate Interval II, followed by a greater abundance in the middle of Climate Interval I and then increasing towards the present. The appearance of *F. fusiformis* in this Outer Basin core is preceded by the appearance of the exotic shelf foraminiferal species of Groups 1A-C (Figures 3.25 – 3.26).

This succession of species associations suggests a procession of events recording events of basin ventilations from marine incursions of shelf waters into the Inlet. The Group 1A-C foraminiferal species, such as the planktics and *Buccella* spp., arrive first into the Inlet with abundant oxygen and nutrients – to encourage high productivity in the Inlet waters. The increase in biological activity then stresses the finite amount of introduced oxygen that is available in the deep basin waters of the Inlet, leading to oxygen deprivation, the death of the shelf species and the persistence of the Group 1D foraminiferal faunas able to tolerate the low oxygen conditions, such as *F. fusiformis.*

In contrast for this last Outer Basin core, the estuarine foraminifera of Group 2A is comprised of only *Reophax scottii*, which is dominant and abundant the length of core with the exception of three intervals – from ~ 700 to 680 cm in Climate Interval II, and ~360-350 cm and ~ 50 cm in Climate Interval I. The dominance of *R. scottii* indicates that strong estuarine conditions persist with abundant productivity. Also the thecamoebians of Group 2B, the river influx indicators m, are present in minor amounts with only two large peaks occurring, one near the bottom of the core in the cooler and wetter Climate Interval II at ~ 750 cm. And a few smaller peaks occurring around the boundary of Climate Intervals II to I, with the second large peak occurring in the onset of Climate Interval I at ~ 460 cm. The decrease in Group 2B, indicates an overall decline in river or fresh water input into the deep Outer Basin compared with the Inner Basin. And their increased presence about the boundary of the two Climate Intervals may indicate an increase in precipitation, and river runoff with the onset of the present day Climate Interval I.

Finally the foraminifera of the shallow water species of Group 2C (*Trochammina* spp.), and the marsh species of Group 3 (*Miliammina fusca*) are both present in approximately equal amounts in both Climate Intervals. Their presence indicates that shallow water and shore line material has been transported into the deeper basin waters, possibly due to increased precipitation during Climate Interval II and sediment instability (debris flows), and/or marine incursions causing turbidity flows.

Barkley Sound

97TulA-04

Foraminiferal Abundances

J.P. Guilbault, examined the foraminiferal faunal data for this core under contract to Dr. T. Patterson, and here are the notes that he has provided. In comparison, he examined the foraminiferal faunas of 12 samples (of the size fraction greater than 63 μm, 40-50 cm^3, that were wet split, dried and 'floated') from the lower portion of the 1997 TulA-04 Barkley Sound core starting at 480 cm. A radiocarbon date from a paired bivalve shell has provided an age of 1580+/-50 yBP (uncalibrated) at 249 cm.

"*These samples are generally poor. I never had to split and the maximum number of specimens I determined was about 480. There are only 4 samples with more than 100 specimens. The number of species is quite high considering the number of specimens. If you plot the number of species as a function of the log of the number of specimens you will find an approximate straight line that suggests comparable diversities throughout. The composition is rather monotonous: whenever the calcareous species are present, the main species are Buccella frigida, Nonionellina labradorica and other common west coast nonionellids. Stainforthia feylingi is common but much less than in the inlet and cannot (I feel) be taken as an indicator of water column anoxia. There are a few representatives of the "blue fauna" in Dixon Entrance, but always in very small numbers. In summary, this represents a fairly open marine conditions, more than in the Inlet and more than in the Quaternary samples I have seen from northern Strait of Georgia, though not more than in the Quaternary of Dixon Entrance. It is difficult to compare with modern conditions on the west coast due to lack of data but it is certainly more marine than in the northern Strait of Georgia samples of Cockbain (1963). The nonionellid assemblage is suggestive of a soft mud (infaunally living species) and suboxia/anoxia within the sediment (Kitazato, 1994). The main arenaceous species are Trochammina gr. squamata, Eggerella advena and Spiroplectammina biformis. This is about as cosmopolitan as one can get and it is not even an indication of anoxia/suboxia.*

I noted a slight difference in the outlook of the trochamminids in the two lowermost samples (835-840, 875-880). There are also calcareous forms, which I don't see above: Seabrookia, Discorbis sp. and Bolivina decussata. These samples are situated below the sand layer reported by Audrey Dallimore. watch carefully what happens at this level.

The large variations in the calcareous fraction could be the result of poor preservation. The number of arenaceous per sample does not vary much: from a maximum of 60 to a minimum of 19 specimens per sample. " (J.P. Guilbault, pers. com.)

Note: the percentage of 45 to 63 μm individuals is not counted, and this size fraction was found to be particularly abundant in the Outer Basin cores that were examined, especially *F. fusiformis* and *R. scottii*. So the data from this core may be unrepresentative. This is a good core to compare different types of results that may occur due to sample processing differences – both wet versus dry, and size fractioning.

Summary

Foraminiferal species assemblage groups of the Inner Basin (99TulB-03)

Groups 1A, 1B and 1C (exotic or "blue water shelf" Foraminiferal Assemblage): These species prefer bank environments, and their presence indicates that fresh marine waters have overbanked the fjord sills and new oxygen-rich saline-rich (= highly dense) waters have entered the Inlet (Patterson *et al.* 2000). They include planktic species such as *Globergerina* spp., and *Buccella* spp., *Cibicides* spp., *Islandiella* spp., *Bolivina pacifica, Elphidium* spp., and unilocular forms. They appear throughout the length of this Inner Basin core but are particularly abundant with increasing depth in core, again in the middle and lower third of the core (Climate Intervals II and III). These species appear to occur in concert with the fauna associated with Group 1D, and perhaps slightly preceding those.

Group 1D (Opportunistic Low Oxygen Foraminiferal Assemblage): The species associated with this group can persist in estuarine, low oxygen environments (microoxic (dysoxic), to anoxic) and rapidly reproduce to their advantage as well (Patterson *et al.* 2000; Alve 1995a, b, 2000, *in press*; Bernhard and Reimers 1991). They include *Buliminella elegantissma* and *Fursenkoina fusiformis*. In the Inner Basin core they are also abundant throughout the core but more so as discrete versus continuous relative abundance peaks, particularly *F. fusiformis*.

Groups 2A & C (Deep Water Estuarine Foraminiferal Assemblage): The species associated with this group prefer an environment with a high input of organic matter (Alve 1995a, b, 1999, 2000; Blais-Stevens and Patterson 1998; Patterson *et al.* 2000; Scott *et al.* 1980, 2001). They include *Reophax scottii*, *R. arctica* and *Trochammina* spp. *R. scottii* abundance zones are also reflected in the total abundance counts, particularly in the last 200 cm or ~ 1770 +/- 960 cal yBP. *Trochammina* spp. also have a constant presence throughout the core with several peaks in relative abundance where it forms a monospecific assemblage, but also noted at these particular depths – the total individual foraminifer counts were extremely low.

Groups 2B and 3 (the 'Reworked' Assemblage): This group includes foraminiferal species and their allies that inhabit adjoining environments and have been transported into the sediments of the deep basins (Patterson *et al,* 2000; Scott *et al.* 2001). This group includes Thecamoebians, *Haplophragmoides* spp., and *Miliammina fusca.* Thecamoebians are protists that inhabit freshwater systems, and their presence in the marine core of the deep basin indicates fresh water flux (Scott *et al.* 1980). They are abundant in the upper 2/3 of this Inner Basin core or during Climate Intervals II and I. *Haplophragmoides* spp. and *M. fusca* are both shallow marine to brackish water, marsh foraminifera; therefore their presence indicates some resedimentation of nearshore sediments into the deep basin. *Haplophragmoides* spp. tend to inhabit a higher marsh area than *M. fusca,* which is more of a generalist. *Haplophragmoides* spp. is abundant in the upper 2/3 of this core, or during Climate Intervals II and I. *M. fusca* is present through out this core, but becomes particularly abundant with depth during the last third of the core, or during Climate Interval III.

Foraminiferal species assemblage groups of the Outer Basin
(99TulB-11, 97TulA-01, 97TulA-03)

Groups 1A, 1B and 1C (the exotic or "blue water shelf" Foraminiferal Assemblage): These species are mostly the same as the Inner Basin core 99TulB-03, and indicate the same conditions. In the first Outer Basin core (99TulB-11) this group includes planktics (*Globirgerina* spp.), *Buccella* spp., *Cibicides* spp., *Elphidium* sp., *Islandiella* spp., *Nonionella* spp. and unilocular forms. They appear throughout the length of core 99TulB-11 but are abundant from ~ 350 cm to 850 cm the ending of Climate Interval II, and onset of Climate Interval I.

In the second Outer Basin core, 97TulA-01, this group includes *Buccella* spp., *Cibicides* spp., *Elphidium* sp., and unilocular forms. They appear in minor amounts throughout the length of core, particularly from 250 cm until the base of the core; or during Climate Interval I .

In the third Outer Basin core, 97TulA-03, this group includes the planktics (*Globergerina* spp.), *Buccella* spp., *Cibicides* spp., *Elphidium* sp., *Nonionella* spp. and unilocular forms. The relative amounts of *Buccella* spp., *Cibicides* spp., *Elphidium* spp., and *Nonionella* spp. are abundant during the ending of Climate Interval II, and through the onset of Climate Interval I. The planktic species and unilocular forms appear from ~ 580 cm to 10 cm, during the onset of Climate Interval I, as 5 and 7 peaks respectively.

Group 1D (Opportunistic Low Oxygen Foraminiferal Assemblage): These species has similar characteristics as those described for the Inner Basin core. In the first Outer Basin core, 99TulB-11, this group includes *Fursenkoina fusiformis* and *B. elegantissma. Buliminella elegantissma* is present the length of core as minor discrete peaks in abundance at similar depths as Groups 1A-C. *F. fusiformis* is particularly dominant and often composes 100% of the count.

In the second Outer Basin core, 97TulA-01, this group includes *Fursenkoina fusiformis,* and is present the length of core as discrete minor abundance peaks at similar depths as Groups 1B-C. *F. fusiformis* is the dominant species from ~300 cm until 410 cm during the onset of

Climate Interval I.

In the third Outer Basin core, 97TulA-03, this group includes *Fursenkoina fusiformis* and *Buliminella elegantissma*. *B. elegantissma* is present the length of this core as discrete minor abundance peaks at similar depths as Groups 1A-C. *F. fusiformis* is particularly dominant from 350cm and onwards during Climate Interval I.

Groups 2A, and 2C (Deep Water Estuarine Foraminiferal Assemblage): These species have similar characteristics to those previously described for the Inner Basin core. In Outer Basin core, 99TulB-11, this group includes *Reophax scottii*, *R. arctica* and *Trochammina* spp. *R. scottii* is present the length of core and is abundant in the upper 2/3 of the core during Climate Interval I. *Trochammina* spp. also has a constant presence throughout the core with several peaks in relative abundance where it consists of ~80 % of the sample and in contrast at these same particular depths the total individual foraminiferal counts were extremely low.

In the second Outer Basin core, 97TulA-01, this group includes *Reophax scottii*, and *R. arctica; Trochammina* spp., *S. biformis* and *S. difflugiformis*. *R. scottii*, *Trochammina* spp., *S. biformis* and *S. difflugiformis* are present the length of the core through Climate Intervals II and I, while *R. arctica* appears in the upper 550 cm, during Climate Interval I.

In the third Outer Basin core, 97TulA-03, this group includes *Reophax scottii* and *Trochammina* spp. *R. scottii* is present the length of this core and is abundant with the exception of four intervals ~690 cm, ~650 cm, ~360 – 370cm, and 35-40 cm. In contrast, at most of these specified intervals both the total number of foraminifera counted and the species diversity increase. *Trochammina* spp. also have a fairly constant presence throughout the core with several greater peaks in relative abundance.

Groups 2B and 3 (the 'Reworked' Assemblage): These species of this assemblage have similar characteristics to those described for the Inner Basin core 99TulB-03. This group includes Thecamoebians and *M. fusca*. Thecamoebians are abundant in the upper 2/3 of this Outer Basin core during Climate Intervals II and I. *M. fusca* is present throughout this core and becomes particularly abundant with depth after 720 cm at ending of Climate Interval II and the onset of Climate Interval I.

In the second Outer Basin core, 97TulA-01, this group includes thecamoebians and *M. fusca*. Both thecamoebians and *M. fusca* are present the length of this core, and peak in abundance at 580 cm, 440 cm and 150 to 250 cm during Climate Intervals II and I.

In the third Outer Basin core, 97TulA-03, this group includes Thecamoebians and *M. fusca*. Thecamoebians are present the length of this Outer Basin core in minor amounts with two peaks occurring at ~ 790 cm and 410 cm *M. fusca* is present the length of the core and is the dominant species from ~ 620 cm to 700 cm (~ ending of Climate Interval II).

Chapter 4

DISCUSSION

Based upon the surface sample work done by Patterson *et al.* (2000), the benthic foraminiferal assemblages described are composed of opportunistic species that are able to function, or tolerate an oxygen depleted environment for a period of time. It is also possible to infer that an opportunistic anoxic to dysoxically favoured foraminiferal community (Group 2, Figure 4.1) has persisted over time (at least the last 4000 years); this is interrupted by intervals of more cosmopolitan foraminifera associations that indicate a more oxygenated and open marine setting (Group 1). Therefore the trend in relative abundance distribution patterns reflect changing and often punctuated oceanographic conditions over the last 4000 years.

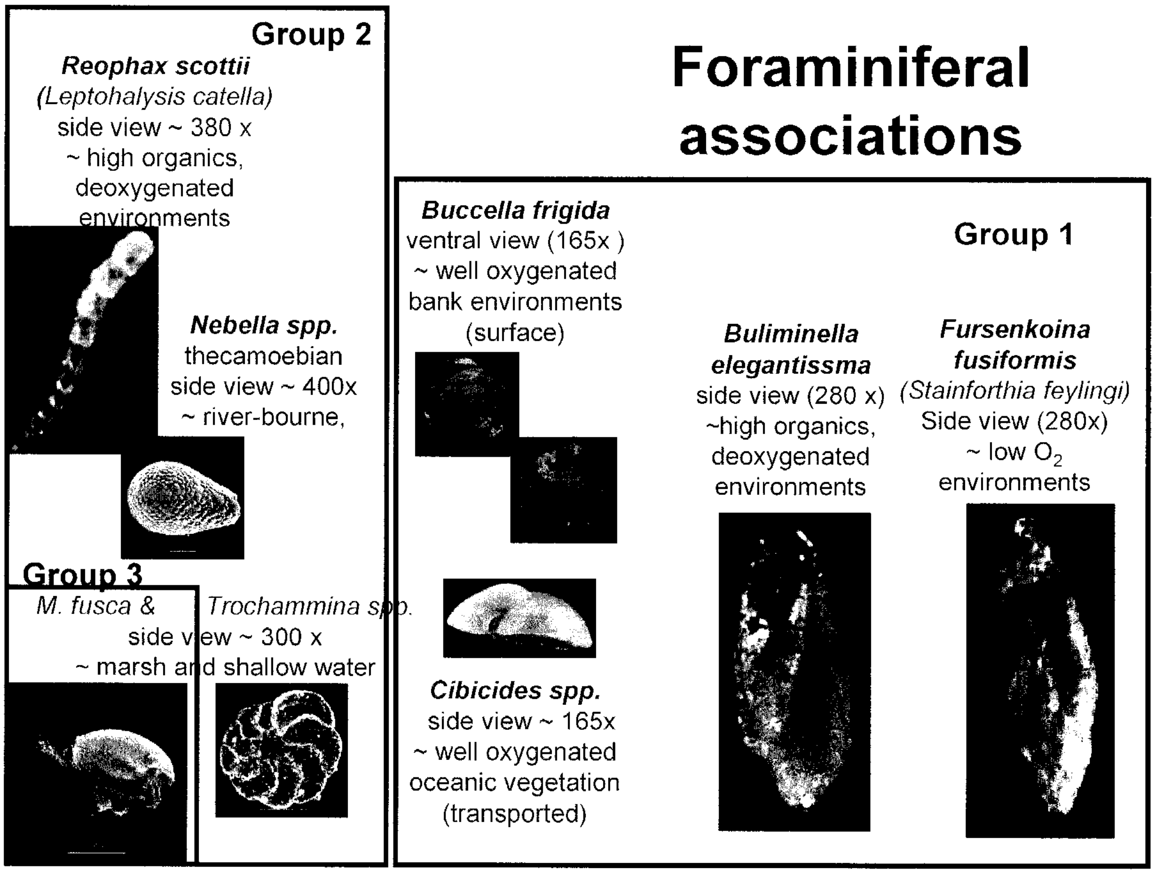


Figure 4.1. A summary picture of the 3 groups of benthic foraminiferal associations.

The Benthic Foraminifera

The Inner Basin.

In summary, the Inner Basin core had fewer but comparatively larger foraminiferal specimens than the Outer Basin cores (Figure 3.6). The average counts were 100 to 200 specimens per count, with some as high as 700 specimens per 10 cm^3 sample (Figure 3.6, 4.2); these contained 10 to 35 species. The peaks in the foraminiferal abundance and species diversity were associated with the faintly laminated sediment units. Also 20 % of the time, the samples were dominated by the < 63 μm fraction, and at times up to 80 % thecamoebians.

It was expected that Effingham River would increase the amount of sediments received in the Inner Basin, and the Inner Basin would have a higher sedimentation rate than the Outer Basin. Surprisingly, Dallimore (2001) calculated a much lower average sedimentation rate for the Inner Basin of 2.2 mm/year, which is half the amount received in the Outer Basin; this may account for the high numbers of thecamoebians not being diluted by sedimentation. The bottom waters of the Inner Basin are also dysoxic and anoxic at the sediment/water interface such that hydrogen sulfide is present. At times, some of the foraminifera examined were infilled with pyrite, especially the agglutinated foraminifer – *Reophax scottii*. The anoxia of the Inner Basin bottom waters may have provided better fossil preservation due to inhibition of bioturbation by meiofauna, and the alkalinity of the bottom waters (caused by the sulfides being produced) also provides a buffer to prevent the dissolution of the calcareous foraminifera shells.

Even with the sedimentation rate of 2.2 mm/year, a rapid sedimentation rate, the quick burial alone may be enough to provide protection from dissolution of the calcareous foraminiferal tests in the Inner Basin. Patterson *et al.,* (2000) characterized the Inner Basin surficial foraminiferal assemblage as being the *Stainforthia-Buccella* assemblage (#7, on Figure 1.5) as being the least oxygenated environment and under full anoxia with H_2S conditions. But yet, the presence of *Buccella* spp. indicates that fresh marine (shelf) waters do enter into the Inner

Basin.

The foraminiferal assemblages and their distribution patterns provide an interesting oceanographic story of Effingham Inlet. For instance, *Reophax scottii* often comprises up to 80 % of the foraminiferal assemblage during the ending of drier Climate Interval III and onset of the wetter Climate Intervals II, through Climate Interval I (Figure 4.2). *R. scottii* is an agglutinated, uniserial foraminifer indicative of deep, estuarine marine waters (Scott *et al.* 1980; Patterson *et al.* 2000; Scott *et al.* 2001), and represents Groups 2A and 2B in the following Figure 4.2. It prefers muddy habitats, with a large supply of organic matter. The dominant presence of *R. scottii* indicates an abundant supply of organic matter and nutrients to the fjord by either river runoff (terrestrial inputs) or marine incursions. This implies that production of organic matter (either terrestrial or marine) was greater during the ending of Climate Interval III or the onset of Climate Interval II and during Climate Interval I.

In addition, the river-borne thecamoebian population (Group 2C) preserved in the core is abundant during the ending of Climate Interval II and through Climate Interval I (or approximately the last 4000 cal yBP), again suggesting a high input of river flow and terrestrial material (Scott and Medioli 1980). According to Hebda (1995), Climate Interval II was cooler and wetter than present, suggesting abundant precipitation and this appears to be supported by the abundant presence of river-borne thecamoebian found in the deep basin sediments. Climate Interval I, the present climate regime is still quite wet, as indicated by the continued abundance of the river-borne thecamoebians. A global cooling and increased precipitation trend is noted to have occurred over the last 3000 years according to the 1990 IPCC Scientific Assessment of climate change (Houghton *et al.*, 1990).

In contrast, the second group of benthic foraminifera containing the shelf and low-oxygen tolerant fauna, (or Group 1A-D), have a periodic presence in the Inner Basin (Figure 4.2). These are the 'blue water' or more cosmopolitan oceanic shelf species such as *Buccella* spp, *Cibicides* spp., *Fissurina* spp, *Lagena* spp. *Islandiella* spp. and others. The pulses in appearance of the shelf or 'blue water', exotic species demonstrate a record of marine incursion events into the fjord. These Group 1A-C benthic foraminifera prefer the oxygen-rich yet high organic matter content waters that are found in the shelf environment, outside the fjord. Their presence in the restricted fjord indicates a change in the paleooceanography of the Inner Basin from an anoxic to dysoxic bottom waters to a micro-oxic environment (Patterson *et al.* 2000). The Group 1A-C foraminifera occur in discrete intervals, at similar core depths in predominantly the massive sediment units (= oxygenated depositional environments, or turbidity flows generated by the marine incursions) of Climate Intervals II and I.

The concurrent species abundance peaks Group 1A-C reinforce the hypothesis that periodic influxes of 'fresh' oxygenated fully marine waters carrying these exotic foraminiferal associations are introduced into the restricted estuarine/brackish Effingham Inlet waters throughout the entire length of the fjord, over topping two fjord sills up to the innermost reaches. The appearance of the exotic 'blue water' Group 1A-C shelf species – planktic species, and *Buccella* spp., followed, almost immediately, by a flourish in the population of the opportunistic foraminiferal species – *Buliminella elegantissma*, *Nonionella* spp., and *Fursenkoina fusiformis* (Figure 4.2). *F. fusiformis*, in particular is the most persistent and abundant low-oxygen tolerant benthic foraminifera in Effingham Inlet (Group 1D) (Figure 4.2). *F. fusiformis* is able to inhabit the microxic environment (and may even be carried in with the other Group 1A-C benthic foraminifera), and as the oxygen content of the introduced waters dissipates (through diffusion, or Biological Oxygen Demand (BOD) of the organic matter), they outlast/survive the 'blue water' species and persist into the dysoxic habitat. Alve (1995a, b) has indicated that *F. fusiformis* is the most resistant species to low oxygen levels in Norwegian fjords, and it has been found to have a similar distribution in the highly polluted Halifax Harbor (Nova Scotia, Canada) (Scott *et al.* 2002).

Hence there is a pattern of dysoxia (the resident bottom water condition of the fjord basins), a marine incursion of oxygenated shelf water containing the exotic 'blue water' Group 1A-D benthic foraminifera. The introduced oxygen and nutrients cause an increase in biological production in the highly stratified basin waters that eventually taxes the available dissolved oxygen, and is then followed by dysoxia and finally anoxia. These patterns can used to develop a crude periodicity; crude because of the lack of good chronology, stratigraphic correlation between the basins, and average sediment sampling interval of one micropaleontological sample every 10 cm.

Dallimore (2001) estimates a frequency of one incursion event of shelf water into the fjord approximately every 20 years during Climate Interval II, from the appearance of graded and ungraded massive mud units. Using the calculated sedimentation rate of 2.2 mm/y and the number of peaks of Group 1 shelf foraminifera, I find an incursion of marine waters of two to three events per 50 cm in the Inner Basin, or a marine incursion approximately every 76 to 113 years, during Climatic Intervals II and I. So not every marine incursion event may have been selected during sampling, but a representation of these incursions is visible.

The ~76 year resolution is similar to that of the North Pacific Decadal Oscillation (NP-DO) that occurs on a 30 to 50 year cycle, such that I may have sampled every second cycle of the NP-DO. Alternatively, it may be during the stronger NP-DO periods that an enhancement of the regional climate's storminess, precipitation and subsequent shelf upwelling is able to force shelf water incursions into the second restricted, innermost basin of the fjord. Increased storminess, precipitation and runoff may increase mixing and serve to lessen the density contrasts of the stratified waters – particularly in the upper surface layers, and allow more marine incursions to slide in over the sills. The stronger NP-DO forcing may lead to an enhancement of the preservation potential of the benthic foraminiferal record due to the marine incursions, and increased sediment deposition due to the precipitation and river flow. It is also at this decadal scale that the enhancement of economic fish stocks occur offshore British Columbia (Finney *et al.* 2000, 2002; Glavin 1999).

A similar mechanism is proposed for the rare ventilation of the predominantly anoxic deep basin waters of Saanich Inlet from ~ 7000 cal yBP to the Recent (Kumar and Patterson 2002). But the basin ventilations are becoming rarer as the influence of the freshwater from the Strait of Georgia increases and suppresses the shelf influence (Kumar and Patterson 2002). Therefore paleoclimate – ocean record of Saanich Inlet - has a slightly less direct connection with recording the ocean climate changes on the shelf, compared to Effingham Inlet. Kumar and Patterson (2002) also examined their foraminiferal samples as dry samples and sieved at 63 μm, therefore possibly losing some of the arenaceous and smaller size foraminifera that are important low oxygen environment indicators. (For example, of the 423 15 cm^3-samples over 223 m, only 58 samples were found to contain greater than 50 individuals.)

If more calcareous foraminiferal material was available, (*i.e.* a larger sample size) more ^{14}C dates would be very useful in calibrating the periodicity of these events, and possibly their predictability. Another problem is assigning the marine correction reservoir effect to the specimens; this could be simplified by selecting species from the 'blue water' foraminifers that would be expected to reflect more directly the local Pacific marine reservoir effect. If an indigenous estuarine calcareous foraminifer species was chosen, the effect of the estuarine waters and the relict or isolated marine waters of the fjord, would greatly complicate the determination of the ^{14}C reservoir effect.

Diatom Productivity

The diatom abundance and biogenic silica as measures of productivity is slightly elevated during Climate Interval II (M. Hay, pers. comm.) in the Inner Basin. Total diatom abundance for 99TulB-03 is dominated by *Skeletonema costatum*, with contributions from other spring bloom taxa (M. Hay, pers. comm.). The highest production occurs pre-4190 cal yBP with a decrease in production through to 3000 cal yBP. This is followed by lower production with some important increases around 2000 cal yBP and decreases around 1800 cal yBP.

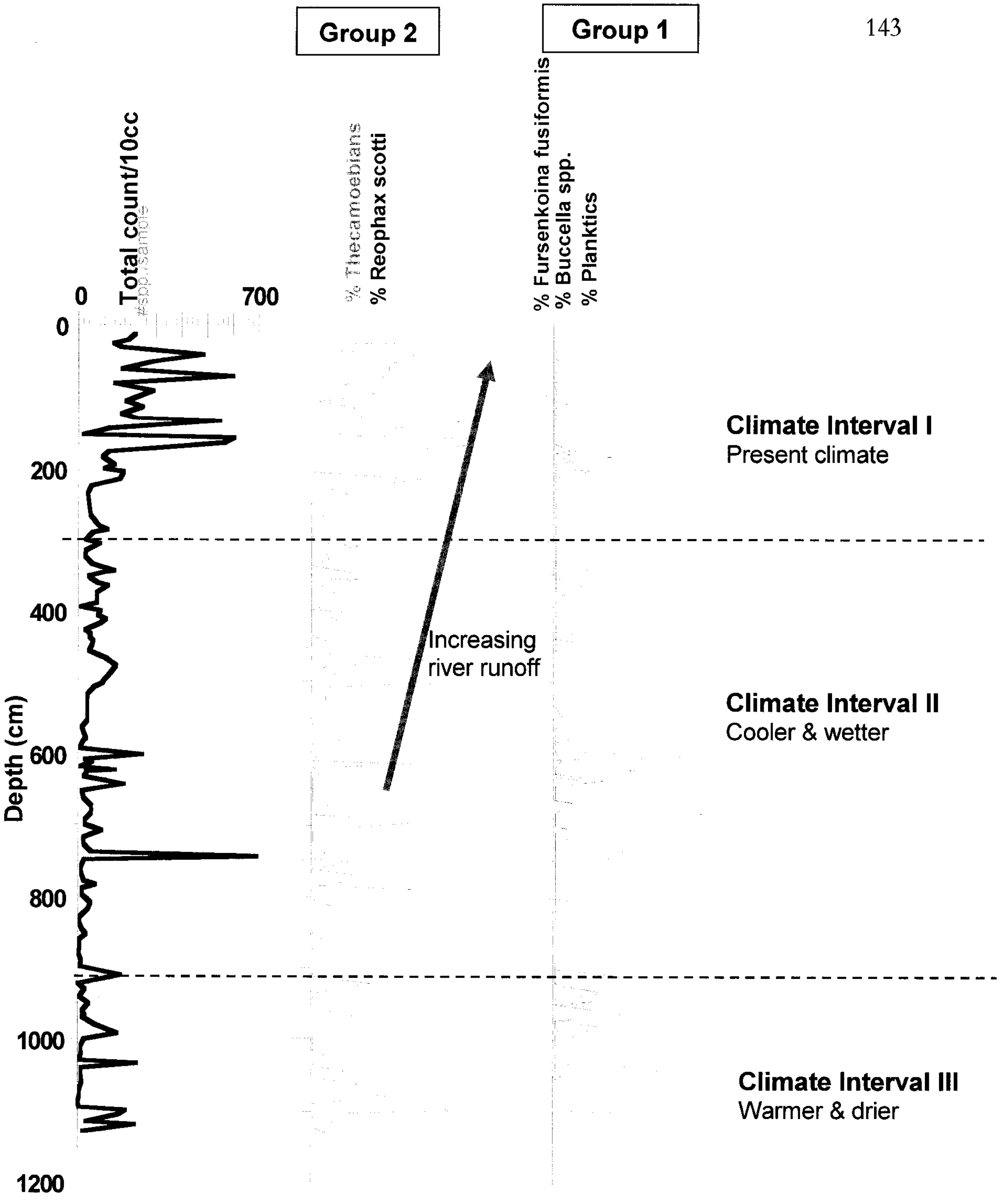


Figure 4.2. A summary figure of the representative foraminifera distributions for the main 2 assemblage groups and the approximate timing of the Climate Intervals for Inner Basin core 99TulB-03.

The Outer Basin.

Three cores were examined from the deepest areas of the Outer Basin. The Outer Basin is separated upstream from the Inner Basin by a sill at 65 m water depth, and from the head of the fjord by another sill at 45 m water depth. The waters are still highly stratified, due to their density differences that are predominantly caused by the salinity gradient. The Outer Basin waters are slightly more saline and the bottom waters are dysoxic to microxic (indicating a greater marine influence) compared to the brackish and anoxic to dysoxic bottom waters of the Inner Basin.

In addition, the sedimentation rates have been calculated by Dallimore (2001) at 5.5 mm/year for the Outer Basin are roughly twice that of the Inner Basin, and she states that the greater sediment loading is due to the increase in marine flux. In addition, according to Dallimore (2001), due to the higher sedimentation rate almost the entire lengths of the three Outer Basin cores are placed within Climate Interval I, with the possibility of sampling a small amount of the ending of Climate Interval II. So does the increasing marine influence (and decreasing riverine input) in the Outer Basin the influence the benthic foraminiferal fauna found there?

The three Outer Basin cores examined in this study are similar to each other with slightly varying habitat locations. 97TulA-01 and 97TulA-03 were both located within the deepest area of the Outer Basin (210 m), within 10's of meters from each other and have very similar foraminiferal abundance, species diversity and compositions. Patterson *et al.* (2000) characterizes the surficial foraminiferal assemblages in this area as the *Fursenkoina* assemblage (or #4, Figure 1.5) indicating dysoxia.

The third core, 99TulB-11, is located in slightly shallower waters, on the slope of the basin; this is just off the coast/shoreline of a small marsh, and Patterson *et al.* (2000) characterize the surficial foraminiferal species in this area as being *Miliammina* and *Fursenkoina-Bolivinella* (or #3 and #5, Figure 1.5). This shallow water association may be similar in living species to the deeper area since the *M. fusca* is reworked at this location.

The first Outer Basin core (99TulB-11) ranged between 1000 to 500 foraminiferal specimens counted per 10 cm^3, with a maximum of 3000 specimens per 10 cm^3 (Figure 4.3). Peaks in the abundance and species diversity were found predominately in the faintly laminated and some massive sediment units (Figure 4.8). The number of species found ranged from 35 to 5. Approximately 80 % of the samples counted contained a significant portion of the smaller sized 45 to 63 μm fraction. Notably from the bottom of the core until 250 cm, *Reophax scottii*, a deep estuarine Group 2A species, dominates the benthic foraminiferal faunas. *R. scottii* is also a small foraminifera. These are similar foraminiferal assemblage distributions to the Climate Interval I foraminiferal distributions in the Inner Basin core, and indicate an increase in productive estuarine conditions during the onset of Climate Interval I, until present. But in contrast, the percentage of the river-borne thecamobians (Group 2C) is greatly reduced thereby indicating a decreased influence of direct river input into the deep Outer Basin. This Outer Basin core also has more marsh and shallow water benthic foraminifera (Groups 2B, and 3) as it is located towards the edge of the basin.

This Outer Basin core has a significant percentage of shelf Group IA-C planktic and other species from the base of the core, until 300 cm during the middle of Climate Interval I. Also at this point, *F. fusiformis* dominates the benthic habitat and associated with many peaks of 'blue water' Group 1 foraminiferal associations, often located within the faintly laminated to massive muds. The massive mud units are interpreted by Dallimore (2001) to represent deposits from turbidity currents or debris flows, mostly generated by the marine incursions. The abundant peaks in Group 1 benthic foraminifera indicate frequent incursions of freshly oxygenated marine water into the Outer Basin, that in turn promotes primary production and subsequent high BOD that rapidly depletes the introduced dissolved oxygen of the bottom waters, and leads to dominance low oxygen tolerant Group 1D species such as *F. fusiformis*. As similarly noted in the Inner Basin, but with greater frequency in the more marine influenced Outer Basin. A calculated sedimentation rate of 5.5 mm/y and an average of 2-3 peaks per 50 cm gives an approximation of one marine incursion event every 45 to 90 years in the Outer Basin. The higher Outer Basin incursion frequency may be due to the thicker sediment column for Climate Interval I (therefore more samples were taken within Climate Interval I) compared to that of the Inner Basin although the Inner Basin has full coverage of Climate Intervals II and I. Unfortunately, a direct correlation of events within Climate Interval I between the Outer and Inner Basins is not simply done due to the lack of age constraints and stratigraphic information. (It is assumed that for a marine incursion event to have happened in the Inner Basin, it must have passed through the Outer Basin.)

The second Outer Basin core, 97TulA-01, located in the deepest part of the basin contained between 100 to 500 foraminiferal specimens counted per 10 cm^3, with a maximum of 1500 specimens per 10 cm^3 (Figure 4.4) The peaks in the abundance and species diversity were found in the massive, laminated and faintly laminated sediment units (Figure 4.8). The number of species found ranged from 35 to 10. Approximately 80 % of the samples counted contained a significant portion of the 45 to 63 µm size fraction. *Fursenkoina fusiformis* (Group 1D) and secondly *Reophax scottii* (Group 2A) dominate the benthic foraminiferal associations thereby indicating productive estuarine conditions dominate during Climate Interval I. The river-borne thecamoebian population (Group 2C) also decreased to 20 %, compared to the Inner Basin. The shelf Group 1A-C benthic foraminifera are also present in greater abundance in 97TulA-01 during the onset of Climate Interval I and until recent, thereby indicating an increase in marine influence within the Outer Basin. These are similar foraminiferal distributions to those within the Climate Interval I trends described for the previous Outer Basin core, and with a lesser marine emphasis - the Inner Basin core. Unfortunately, a direct correlation of events within the Outer Basin cores for Climate Interval I is not easily done due to the lack of age constraints and stratigraphic information.

The third Outer Basin core, 97TulA-03, also located in the deepest part basin has a much lower count ranging compared to the other Outer Basin cores ranging from 50 to 250 specimens and up to 1000 specimens per 10 cm^3 (Figure 4.5). The species diversity is also the lowest of the three Outer Basin cores, with 5 to 25 species per sample. Again, the peaks in the abundance and species diversity were associated with the faintly laminated sediment units (4.8). Also the 45 to 63 µm size fraction represents a significant portion of the counted specimens, and the small estuarine Group 2A benthic foraminifera *R. scottii* is common through the length of the core. *R. scottii* indicates productive estuarine basin waters. As with the other two Outer Basin cores, 97TulB-03 also has 20 % or less of the whole counts are the river-borne thecamoebians (Group 2C). The shelf Group 1A-C benthic foraminifera are also present in greater abundance in 97TulA-03 during the onset of Climate Interval I and until recent, thereby indicating an increase in marine influence within the Outer Basin. These are similar foraminiferal distributions to those within the Climate Interval I trends described for the previous two Outer Basin cores, and with a lesser marine emphasis - the Inner Basin core. Unfortunately, a direct correlation of events within the Outer Basin cores for Climate Interval I is not easily done due to the lack of age constraints and stratigraphic information.

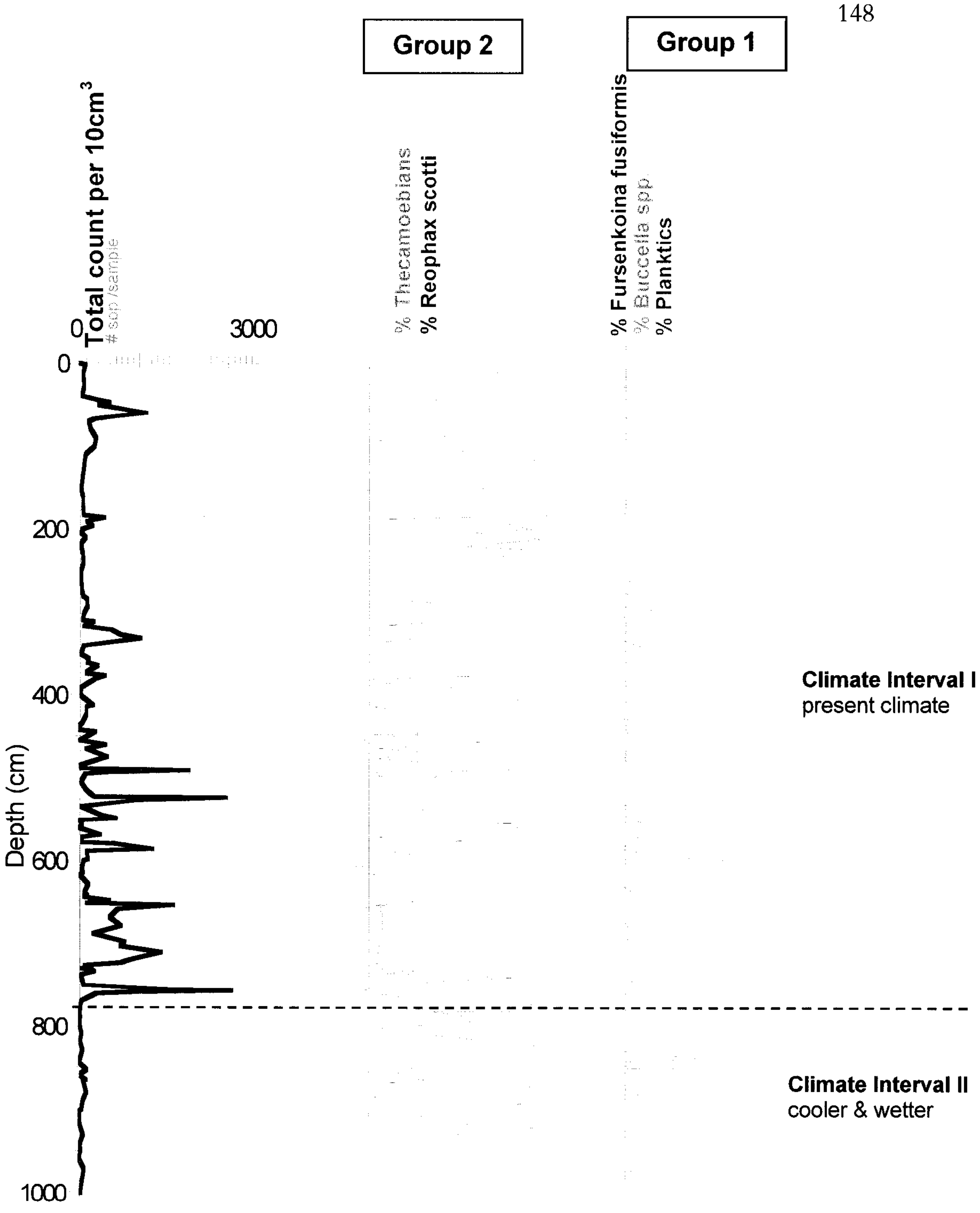


Figure 4.3. A summary figure of the representative foraminifera distributions for the 2 main assemblage groups and the approximate timing of the Climate Intervals for the Outer Basin core 99TulB-11.

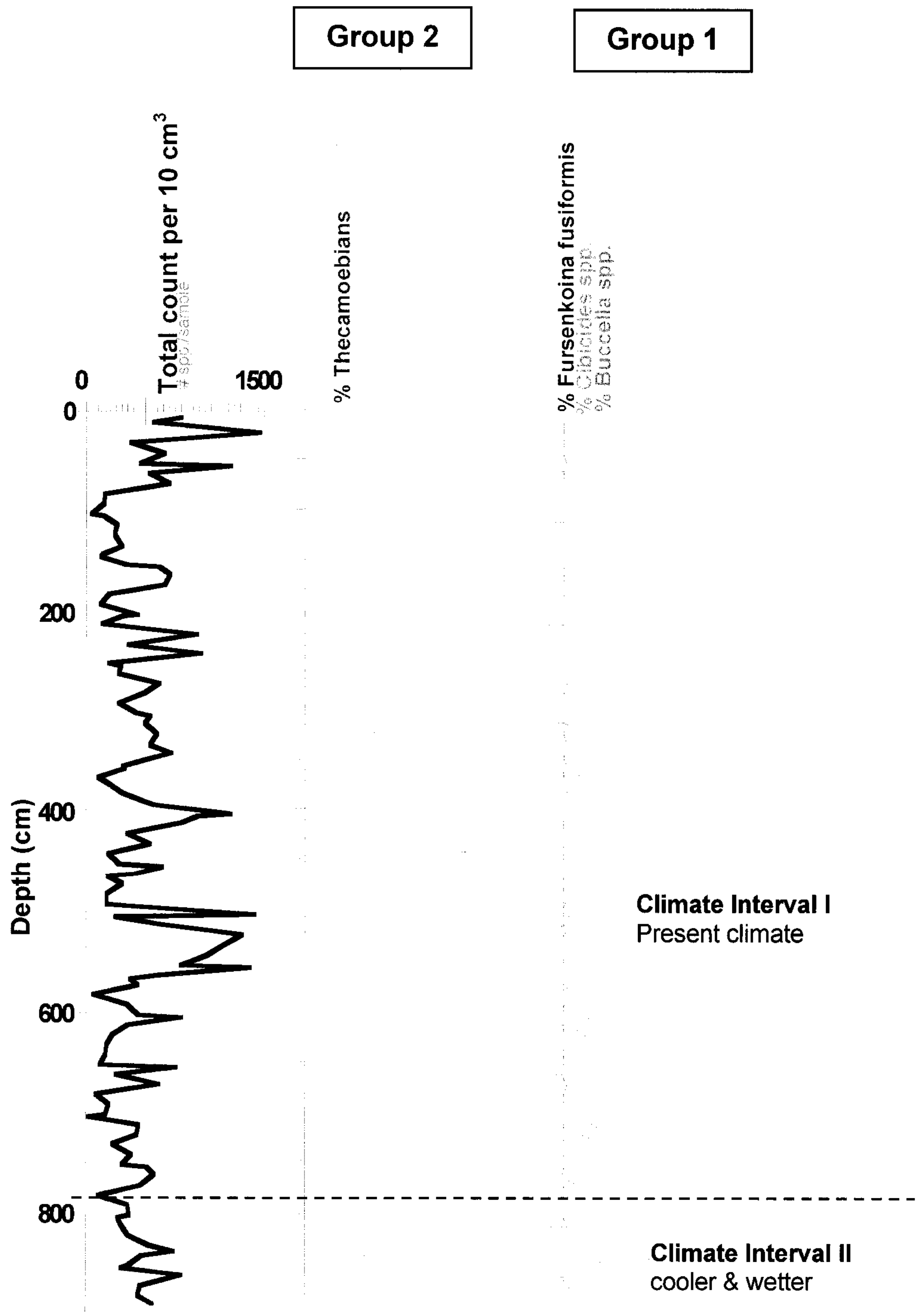


Figure 4.4. A summary figure of the representative foraminifera distributions for the 2 main assemblage groups and the approximate timing of the Climate Intervals for the Outer Basin core 97TulA-01.

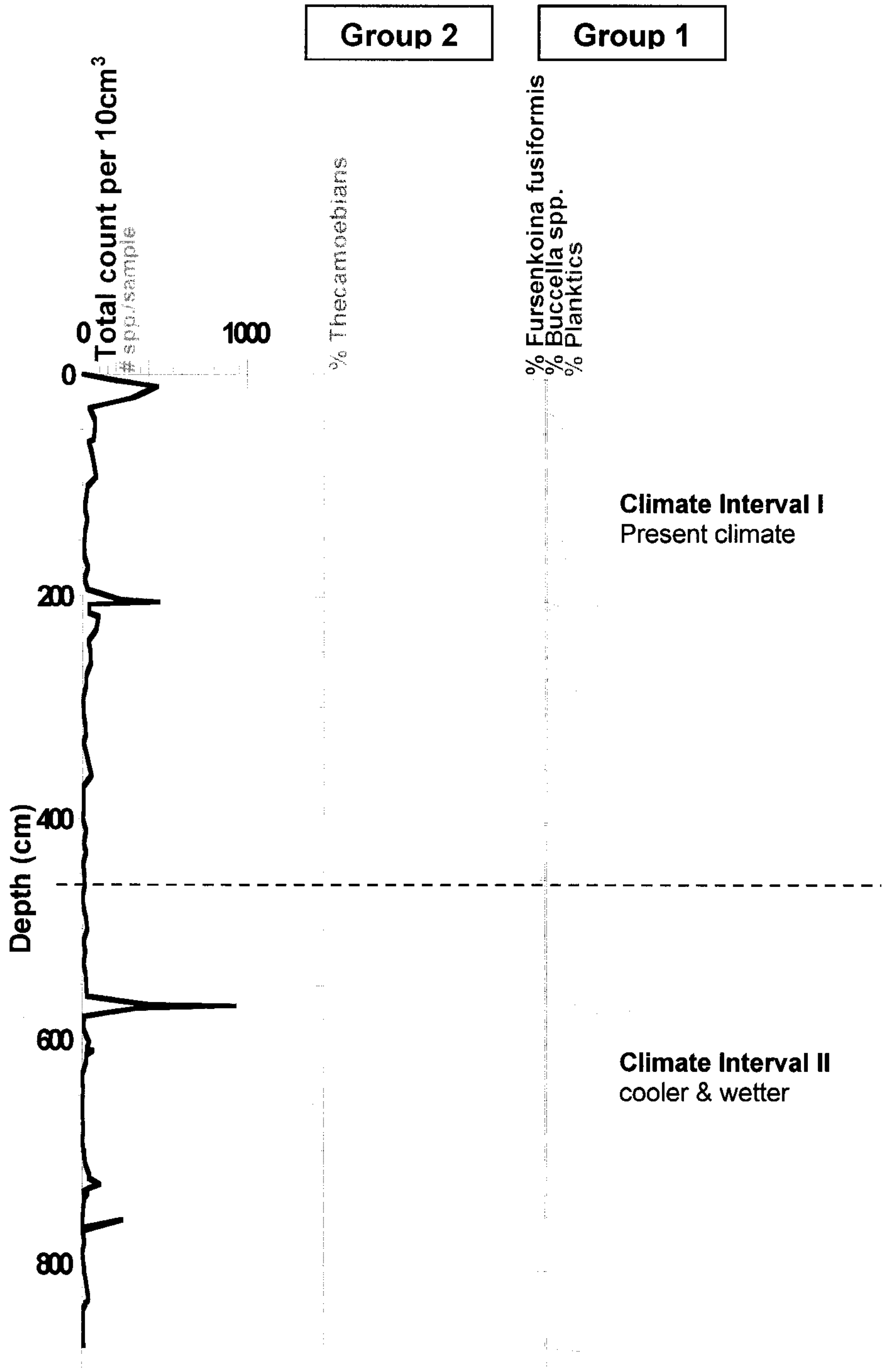


Figure 4.5. A summary figure of the representative foraminifera distributions for the 2 main assemblage groups and the approximate timing of the Climate Intervals for the Outer Basin core 97TulA-03.

Basin Summary

The resolution of the sedimentology is relatively coarse and only an estimate of the periodicity of marine incursions into the fjord as indicated by peaks in shelf and low-oxygen tolerant Group 1 foraminiferal abundance and diversity. A higher periodicity is calculated for the Outer Basin of one incursion event per ~ 45 to 90 years, versus one marine incursion per ~ 76 to 113 years in the Inner Basin during Climate Intervals I and II (Figures 4.6, 4.7, 4.8). Even with the difference in periodicity, the incursion events are probably synchronous as it would be difficult to imagine oceanic events occurring in the Inner Basin and not in the Outer Basin What is interesting is that the coarse periodicity determined in these cores for the marine incursions is close to the historic periodicity of the North Pacific Decadal Oscillation (NP-DO) of 30 to 50 years (Figures 1.1, 1.2).

There is a higher sedimentation rate in the Outer Basin, and it has microxic bottom waters that may be more corrosive to the calcareous foraminiferal tests. In a 10 cm^3 Outer Basin sample has more specimens present and may represent a collection of tests over 18 years, while a 10 cm^3 sample from the Inner Basin represents a sediment record of about 45 years. However the anoxic, alkaline bottom waters and lower sedimentation rate of the Inner Basin may have the better preservation potential. Hence preservation does not appear to be a problem in the Outer Basin despite the potentially less favorable conditions for preservation.

Climate Interval 1

2000 yBP until present;
~Present climate
~anoxic to dysoxic
~poorly to well laminated intervals
~infrequent oxic conditions

Climate Interval 2

4000 to 2000 yBP
~Cooler and wetter than present
~frequent massive ungraded and graded mud intervals, poorly to well defined laminations
~frequent oxic alternating with anoxic/dysoxic conditions

Climate Interval 3

4000 yBP +
~Warmer and drier than present
~well laminated, no short graded or ungraded massive mud intervals
~anoxic conditions.

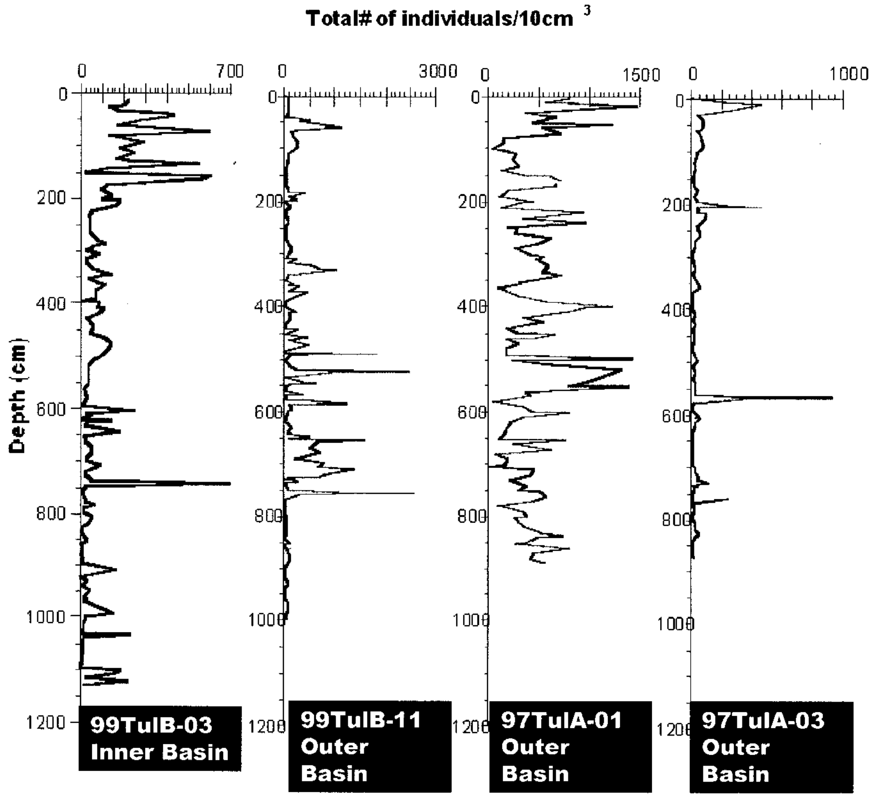
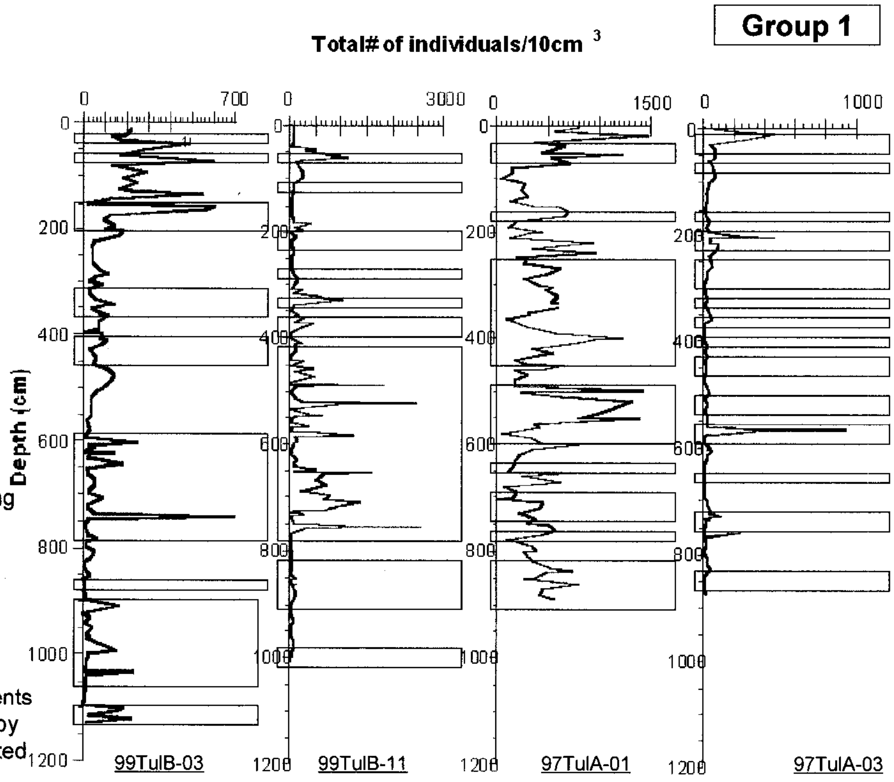


Figure 4.6. Summary diagram of the 4 Effingham Inlet cores – Inner to Outer Basins, of the Total number of individuals counted per 10 cm^3 versus depth, with ^{14}C dates and overlain by the Climate Intervals.



Climate Interval 1

~ 2000 yBP until present;

Stable climate conditions and brief infrequent flushing events

Climate Interval 2

~ 4000 to 2000 yBP,

Laminated sediments are interrupted frequently (~ 20 y or less) by massive and graded muds indicating that flushing events & debris flows are common.

Climate Interval 3

~ 4000 yBP +

Well laminated sediments only interrupted twice by 2 debris flows associated with seismic shaking; indicating a warm dry climate

Figure 4.7. Summary diagram of the 4 Effingham Inlet cores – Inner to Outer Basins, of the Total number of individuals counted per 10 cm^3 versus depth, with ^{14}C dates and overlain by the Climate Intervals, and time periods of the dominance of Group 1 foraminiferal assemblages.

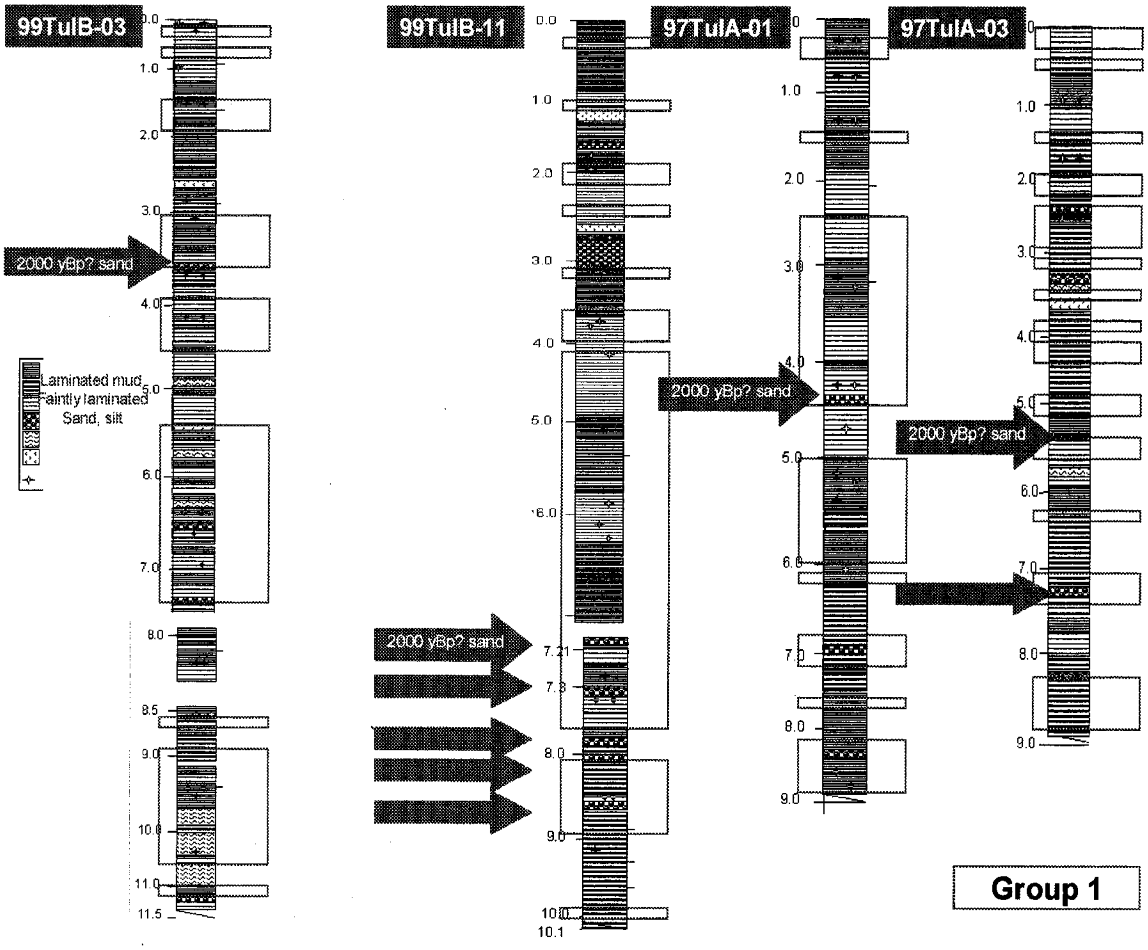


Figure 4.8. A summary diagram of the stratigraphic correlations, with arrows indicating the possible locations of the 2000 cal yBP tsunami sand and boxes highlighting the occurrences of the Group 1 foraminiferal associations.

Comparisons with other dysoxic-anoxic fjord and ocean basin foraminiferal associations.

Species diversity

Several studies have found that calcareous perforate species dominate the low oxygen tolerant foraminiferal assemblages, but agglutinated species can also occur in considerable abundance (Bernhard and Sen Gupta 1999). Very few milolaceans have been found in natural dysoxic, microxic or anoxic samples. *Nonionella stella, N. turgida, Nonionellina labradorica, Chilostomella oolina* commonly represent the Order Rotaliidae; other less common general species include *Rosalina, Valvulinera, Epistominella, Ammonia beccarri,* and *Elphidium excavatum. Bolivina, Fursenkoina, Uvigerina, Bulimina, Globobulimina, Buliminella, Cassidulina, Trifarina* and *Brizalina* represent the Order Buliminida. The Unilocular agglutinated genera include *Psammosphaera, Rhizammina* and *Saccamina.* The multilocular agglutinated genera include *Reophax, Spiroplectammina, Trochammina, Eggerella, Adercotryma, Bolivinopsis, Cribrostomoides, Textularia* and *Recurvoides.* Bernhard and Sen Gupta (1999) also state that it is crucial to realize that cogeneric species also occur in well-aerated environments; not all species of *Bolivina,* for example are indicative of oxygen depletion. Interestingly, none of the foraminiferal species to date in Low Oxygen Foraminiferal Assemblages (LOFA's) is known to live exclusively in anoxic environments, which suggests these species do not require low oxygen but can tolerate it.

In a study of the present day foraminiferal associations of Santa Barbara Basin (a dysoxic Southern California Borderland Basin, with laminated sediments located to the south of the current study site and is also bathed in the waters of the California Countercurrent), Bernhard *et al.* (1997) found the following species gradation corresponding to decreasing amounts of oxygen in the habitat – *Uvigerina juncea, Suggrundia eckisi, Loxostomum pseudoberychi, Bolivina argenta, Trochammina pacifica, Bolivina seminuda, Buliminella tenuata, Chilostomella ovoidea; Spiroplectammina earlandi* and finally *Nonionella stella.* When the bottom waters contained less than 2µmol of oxygen, they still found 236 *N. stella*/cm^3, and it represented 32 to 82 % of the stained assemblage (= living assemblage). These results enable estimations of paleo-oxygen concentrations for this basin, and similar basins in the area whose depositional records have been used extensively for Quaternary paleoceanographic and paleoclimatic reconstructions. Patterson *et al.* (2000)'s study of the recent benthic foraminifera from Effingham Inlet found a higher diversity in the generally dysoxic Outer Basin than the anoxic Inner Basin. This was also found to be true for this study during Climate Interval I (~ the last 2000 years). Common estuarine species included *Reophax scottii*, *R. arctica*, shallow water *Trochammina* spp. and the low oxygen tolerant *Fursenkoina fusiformis*. The diversity ranged between 5 – 35 species in the Outer Basin, and 10 – 35 in the Inner Basin. The peaks in diversity, more often than not, correspond with peaks in abundance, the appearance of the shelf foraminifera in the core, and faintly laminated to massive muddy sediments in the inlet. At these peaks, discrete appearances of *Buccella* spp., *Cibicides* spp., *Elphidium* spp. and often planktic species were found.

A planktic foraminifera core study of the anoxic Santa Barbara Basin, found a low diversity assemblage characterized by opportunistic species (Hendy and Kennett 2000). The low diversity assemblage is suggestive of a biotic community that is adapted to frequent environmental disruptions, *i.*e. the strong instability in the California Current System and perhaps local upwelling. They also suggest that from 25 000 to 60 000 cal yBP the presence of Dansgaard-Oescheger cycles, and other cycles (~ 70 years or the NP-DO), are recorded in the bimodality of these planktic foraminiferal assemblages. So this suggests the Pacific Decadal Oscillation has been influencing regional ocean-climate over the past 60 000 years, much longer than the 4200 cal yBP record in Effingham Inlet.

Foraminiferal abundance

High abundances of foraminifera for a period of time during deoxygenating of the waters may be due to the decrease in predation pressure because of the severe effect of oxygen depletion on metazoans. This is followed eventually by a 'crash' when the anoxia is sustained (Bernhard and Sen Gupta 1999). It has also been established that foraminifera colonize reoxygenated sediments that were previously anoxic for many decades and the dominant species of the low oxygen tolerant opportunitistic foraminiferal community were *Fursenkoina fusiformis* and *Spiroplectammina biformis* (Bernhard and Sen Gupta 1999). Similar peaks and crashes in the abundance and diversity of benthic foraminifera populations are found in the ~ 4200 cal yBP paleorecord of Effingham Inlet. (The mechanism driving the sustainability of population is the amount of dissolved oxygen found within the inlet, and the amount of oxygen introduced into the inlet is modulated by the regional ocean-climate that allows the marine incursions to occur.)

Some of these low oxygen tolerant foraminiferal associations have adapted or have several life strategies that enable them to exist in what is considered a 'harsh' environment for most foraminifera. *B. elegantissma* has been found to have a symbiotic relationship with an algal mat (*Beggioa*) to provide the needed energy mechanism for digestion and respiration. *Nonionella* sequesters or husbands chloroplasts from the diatoms it consumes, and *F. fusiformis* is able to facilitate a symbiotic relationship with sulfide-bacteria for food (Bernard and Bowser 1999).

Patterson *et al.* (2000), in their examination of the surface sediments of Effingham Inlet found that the anoxic Inner Basin yielded only one live stained *Fursenkoina fusiformis*, and proposed that the dead specimens were likely relict from an earlier oxic/suboxic period. In comparison, their study of the suboxic/dysoxic Outer Basin revealed numerous living specimens with *F. fusiformis* being the dominant species. And this is also in general agreement with the experimental results of Alve and Bernhard (1995) for the production of similar foraminiferal associations with similar life habitats.

In addition, Alve (pers. com.) in Patterson *et al.* (2000) found in her study of the Norwegian fjord, Lyngdalsfjord, that *F. fusiformis* is the predominant species in the deeper areas (about 100 to 250 m water depth and a salinity of 35 psu) where the oxygen concentration is generally less than 0.4 ml/L (18μM/kg), and is occasionally anoxic. The second most abundant species is *Bolivinellina pseudopunctata* in the deepest area and there are also some specimens of *Leptohalysis* (*Reophax scottii*). Patterson *et al.* (2000) concluded that there is a great similarity between the foraminiferal faunas found in Effingham Inlet, and Lyngadalsfjord. Both inlets have similar features, including a lack of human presence, hence no pollution and the dominant organic supply is generated naturally.

Furthermore, Patterson *et al.* (2000) found that there were two foraminiferal assemblages associated with the deep suboxic waters in the Outer Basin – the *Fursenkoina* and the *Fursenkoina-Bolivina* assemblages. They state that lab experiments show that at least *Fursenkoina fusiformis* can take advantage of suboxic/dysoxic conditions – and it seems likely that there is a causal link between suboxia and the occurrence of the *Fursenkoina* and the *Fursenkoina-Bolivinellina* assemblage. It appears that these assemblages grade into one another with lower oxygen levels at greater depths leading to a stronger dominance of *Fursenkoina fusiformis.*

And size does matter.

In addition, the size fraction of foraminifera is becoming increasingly important for the interpretation of the paleohabitats. In a recent study, Moodley *et al.* (1997) observed that conclusions regarding the survival of foraminifera in anoxia would be significantly different if one considered the > 63 μm fraction rather than the 38 μm fraction. Thus they suggest that the 38 – 45 μm fraction should be used as the lower size limit when assessing foraminiferal response to oxygen depletion. It has also been noted that calcareous species of Low Oxygen Foraminiferal Assemblages have thin shells, and therefore suggest that Low Oxygen Foraminiferal Assemblages should be sieved and picked wet – without prior drying to prevent excessive damage to the thin shelled forms (Bernhard and Sen Gupta 1999). This technique was used in the present study.

As previously mentioned, it has been suggested that small-sized foraminifera might survive episodes of oxygen depletion better than larger species because of a lesser oxygen requirement (Phleger and Soutar 1973; Moodley *et al.* 1997; Bernhard and Sen Gupta 1999). In the present study, it has been found the arenaceous foraminifera, such as *R. scottii*, and the 45 to 63 μm foraminifera are very important indicators of estuarine conditions and productivity. In a similar dysoxic fjord habitat, Hald and Korsun (1997) found that the modern foraminiferal assemblages of the Svalbard Fjord in Norway, were more comparable to the fossil assemblages when the arenaceous species were removed. They attributed the reduction in arenaceous tests to postmortem disintegration and therefore deleted all arenaceous taxa and recalculated the frequencies of the calcareous taxa. But the reduction in arenaceous taxa may have been caused by their sample preparation methodologies because they analyzed surface samples that were sieved at 1.0 mm to 0.1 mm and were examined dry. Scott *et al.* (2001) suggest drying samples has a tendency to obscure or destroy the smaller arenaceous foraminiferal associations thus loosing those small but important indicator species.

In Patterson *et al.*'s (2000) examination of the surficial samples from Effingham Inlet, whole sample count data were used in the construction of the foraminiferal faunal assemblages and the samples were counted wet with a lower limit of size was > 63 μm, whereas I have counted the >45 μm fraction.

Saanich Inlet

Kumar and Patterson's (2002) examination of approximately 223 m of sediment from the ODP cores from near by Saanich Inlet were also examined at > 63 μm and dry. With a sensitivity threshold of 50 foraminifera, only 50 of the 423 samples contained statistically sufficient counts. They state that in the last 40 – 50 m of core (~ 7000 cal yBP until present) that the deep basin waters of Saanich Inlet are anoxic with increasingly rare events of basin ventilation. The increasing influence of the freshwater input in the Strait of Georgia is apparently dampening the oceanic input (Kumar and Patterson 2002). In contrast, when examining the material from Effingham Inlet, basin ventilations are frequent over the last 2000 y BP in the Outer Basin, and ~ 4200 cal y BP in the Inner Basin. It is important to note that in my examination, the 45 – 63 μm benthic foraminifera were a substantial representation of 20 to 80 % in the Inner and Outer Basins.

Local Oceanography and Effingham Inlet

In the Northeast Pacific, salinity drives the density profiles (Thomson 1981). In Effingham Inlet the low salinity surface waters combined with weak tidal current energy results in a stable stratified water column that inhibits mixing, as revealed by the density profiles (Figures 1.9, 4.9). The bottom waters of Effingham Inlet are cold and uniformly saline waters, overlain by a layer of less saline but cold water, which itself is overlain by a warmer and progressively less saline mass, and finally the upper warmer fresh surface waters; and dissolved oxygen profiles show the characteristic decrease in oxygen with depth (Figures 1.9, 4.9; Dallimore 2001). Sampling captured an example of a marine incursion. In January 1999, high oxygen levels were found in the bottom waters and low oxygen levels at mid-depth in both basins, suggestive that deep water intrusions of low oxygen waters and flushing of the basin with oxygenated waters had already occurred. By May 1999, four months later, the bottom water stagnation had recurred, resulting in anoxic bottom conditions despite the high mid-depth oxygen levels that had penetrated part-way down the Outer Basin water column (Figure 1.10; Dallimore 2001). The cold ocean waters dissipated within the anoxic bottom waters of the inlet without appearing to raise the overall oxygen content of the waters above. The lack of over-turning of the water column, indicates that the marine incursions are entering the inlet along the bottom and not sinking to the bottom from above as would occur during an over-turning of the water column (Dallimore 2001).

By June 1999 the oxygen levels were generally lower throughout the water column, but anoxia in the deep and outer basins was gone. These moderate oxygen levels are evidence of additional flushing events occurring sometime between May and June 1999 (Dallimore 2001). Oxygen levels decreased in both basins from September through to October 1999 and again became fully anoxic by March 2000.

The stagnation of the bottom waters seems to recur after flushing by oxygenated upwelled waters within 4 - 6 months. The inlet is stratified with respect to density during flushing as a result of upwelling events, and the mechanism by which the ocean waters enter the inlet is by "sliding" along the bottom and overtopping the sills beneath the stable, stratified water column (Figure 4.9).

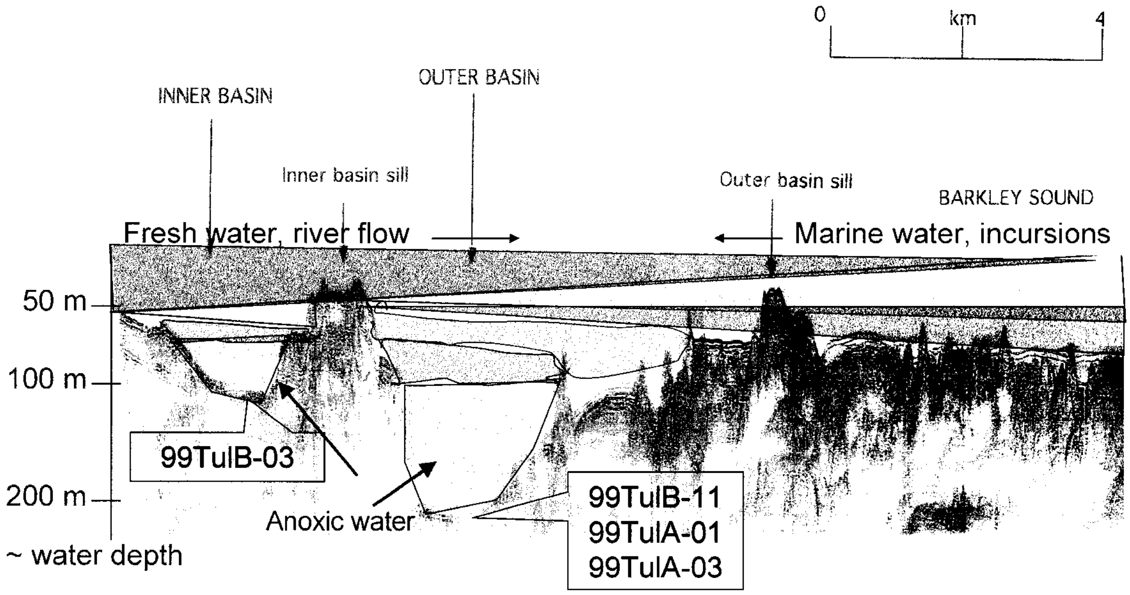


Figure 4.9. A summary diagram of the fjord, illustrating some of the estuarine characteristics of Effingham Inlet.

Marine Incursions, the benthic foraminifera and Effingham Inlet.

The marine incursions are originally deep, cold ocean waters and they have been replenished with oxygen at the surface along the coast during the upwelling process (Ware and Thomson 2000). These dense, yet oxygen rich waters, then enter the fjord at depth, beneath the highly stable stratified water masses of the Inner and Outer Basins (Patterson *et al.,* 2000). So the productivity is enhanced with the introduction of new organic material and oxygen, on a seasonally induced basis, but the blooms in productivity in this case are not due to overturning of the water masses (Dallimore 2001). The salinity driven density differences are too great, and therefore the oxygen is dissipated due to do upward migration and BOD (biological oxygen demand or uptake).

It is reasonable to assume that the mechanisms driving these recent marine incursions into Effingham Inlet are related to the paleoceanographic mechanisms, and are reflected in the foraminiferal couplets of the shelf 'blue water' associations and the low oxygen tolerant foraminifera of Groups 1A, B, C and D respectively. The background productivity and paleoclimate (precipitation) of the fjord is recorded by the presence of the Groups 2A-C and Group 3 benthic foraminifera.

In summary, even with the highly restrictive nature of the fjord, the impediment of the two raised sills and the highly density stratified water column, the major events of upwelling and introduction of freshly oxygenated marine waters into the Inlet are able to penetrate into the innermost reaches of the Inlet. The resolution of the geological sediment record, and preservation potential of the foraminiferal test material, is then a localized function of the sedimentation rate and sediment-water interface redox geochemistry. There is an introduction of material into the Inlet but not an output; except within the brackish surface waters, the exchange is not two-fold. However, the upwelling does seem to promote blooms of phytoplankton, which rains down to the seafloor, increases the BOD, and counteracts the increased oxygen brought in by the upwelling. It appears there is a cycle of oceanic influence that is rapidly suppressed by high BOD to be replaced by the low oxygen tolerant faunas of *R. scottii* and *F. fusiformis.*

Regional Oceanography, links to the Paleoceanography of Effingham Inlet and Fish abundance.

The NE Subarctic Pacific has one of the longest time series of any open ocean station. The Subarctic North Pacific is one of three major high nitrate, low chlorophyll (HNLC) regions of the world (Harrison *et al.* 1999). Two gyres, the Northeast and Northwest Subarctic gyres dominate this region and their position is influenced by the Jet Stream (Figure 4.10). The Northeast Subarctic gyre is also known as the Alaskan Gyre. The NE gyre has saturated NO_3 concentrations all year, and constantly low chlorophyll that is dominated by small cells. Primary productivity is also low and varies little seasonally. Iron limits the utilization of nitrate and hence the primary productivity of large cells (especially diatoms) except in winter when iron and light may be limiting.

As mentioned in the introduction, the Subarctic Current bifurcates in the eastern North Pacific near 48°N 130°W into the northward flowing Alaska Current and southward into the California Current of subtropical gyre (Figure 4.10; Harrison *et al.* 1999). The circulation of the gyre is influenced by various atmospheric factors. An intense low pressure system, the Aleutian Low, dominates in the winter leading to high precipitation, low evaporation and freshwater land runoff. Also, severe winter storms and the Aleutian Low result in upwelling in the Gulf of Alaska that maintains high nutrient concentrations in the surface waters (Gargett 1991).

Other related studies have shown that the atmospheric circulation over the North Pacific seems to vary on a multidecadal, 30 – 50 year time scale (the NP-DO, North Pacific Decadal Oscillation; Harrison *et al.,* 1999; Ware and Thomson 2000). The 30 – 50 year intensification cycle of strength and location of the Aleutian Low pressure system seem to lead to an increase in surface water temperatures, and an intensification of ENSO events (*i.*e. 1998). Also at this time scale, the total catches of fish such as Pacific salmon and California sardine increase with the increasing surface temperatures (Glavin 1999). The connection may be the capacity to draw cool, nutrient rich water up from the ocean depths or its effect on water temperature.

Finney *et al.* (2000, 2002) studied other proxies (sediment δ^{15}N, cladocerans and diatoms) as a measure of sockeye salmon productivity from coastal lakes in Alaska and produced 2200 cal yBP record. In their first paper (2000), a 300-year record produced noticeable multidecadal scale shifts in sockeye salmon abundances and they attribute it to both the climate and harvesting. Periods of increased harvesting occurred when there were greater abundances of salmon. In their 2002 paper, they produce a 2200 cal yBP record that extends beyond the historic catch data (or substantial human impact), and at this longer time scale they discovered multidecadal scale variations in Alaskan sockeye salmon abundances. In addition, it appears that the Alaskan salmon population abundances are slightly out of sync (and less abundant) compared with the more southerly population reconstructions of anchovy, sardines, herring, *etc.* from Saanich Inlet and Santa Barbara Basin. They suggest that the waters to the south that are predominately under the influence of the Californian Current. The southern bifurcation of the Subarctic Current (West Wind Drift) is more productive in the last 2000 years, versus the northern Alaskan Current. Fish bone patterns inferred from sediment cores in southern coastal British Columbia also indicate that fish productivity was higher from ~ 1000 AD to present (Tunnicliffe *et al.* 2001).

In the Inner Basin core of Effingham Inlet, during Climate Interval II (between 4000 to 2000 cal yBP), Dallimore (2002) found more intact fish skeletons on bedding plans indicating abundant productivity and large pebbles interpreted to be dropstones (indicating significant fresh water input and the freezing of these waters). M. Hay (pers. comm.) states that the diatom productivity also increases during this time period, until present.

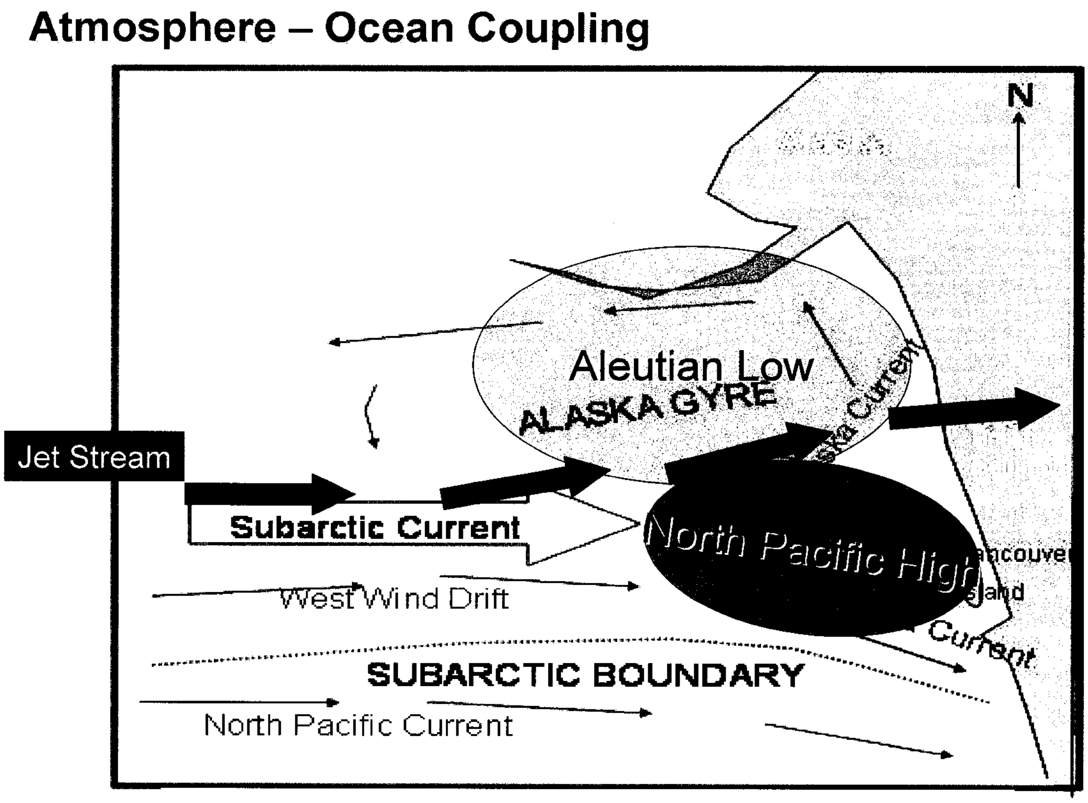


Figure 4.10. A diagram of the Regional Oceanography, adapted from Harrison *et al.* (1999).

The North Pacific Decadal Oscillation, El NiÑo Southern Oscillation, marine incursions into Effingham Inlet and benthic foraminifera.

An ocean regime shift was identified in 1976-77 by the southward displacement and intensification of the wintertime Aleutian Low (Trenberth and Hurrell 1994). The Aleutian Low pressure system intensified again in 1998. El NiÑo years produce a similar displacement and intensification of the Aleutian Low. In the winter of 1997/1998, the "El NiÑo of the Century" occurred, and then the "El NiÑo of the Century" occurred again in 2002/2003 (Kerr 2002).

During these intensified Aleutian Lows (and El NiÑo years), the northward transport via the Alaska Current dominates over southward transport via the California Current (Chelton and Davis 1982). The high eddy kinetic energies near the British Columbia-Alaskan coastline may be a reflection of instabilities in the coastal currents and this may give rise to the intrusion of offshore decaying eddies (upwellings that lead to marine incursions). This is more likely to occur in the spring circulation when the Alaskan Gyre circulation is weaker (Harrison *et al.* 1999). Thus marine incursions are more likely to occur during El NiÑo events, and the "El NiÑo's of the Century" appear to occur with the intensification of the Aleutian Low. The intensification of the Aleutian Low pressure system, or NP-DO, appears to occur on a multidecadal scale.

Given the sampling resolution available for the foraminiferal census, and the available amount of material suitable for ^{14}C dating to set the timing of events in the stratigraphic-sedimentological frameworks, it is reasonable to assume that decadal to centennial scale events may be resolved with the foraminifera record. The detection of ENSO events is possible within the Effingham Inlet cores and likely, but the lack of fine scale stratigraphic resolution impedes this determination. The detection of an overall increase in marine incursions is possible and likely within Effingham Inlet cores. The representation of Group 1 shelf and low oxygen tolerant benthic foraminifera is caused by the intensification of ENSO within the intensification of the Aleutian Low and the NP-DO.

Summary.

The Outer Basin foraminiferal faunas have a greater abundance per 10 cm^3 sample, greater diversity, less thecamoebians and contain a high fraction of the 45 μm to 63 μm sized foraminifera in comparison to the Inner Basin cores. Thin shelled calcareous foraminifera are abundant, and trace organic linings are not, suggesting that either extremely little carbonate dissolution has occurred or degradation of the entire shell test was complete. I would favor the former.

A 10 cm^3 sample in the Outer Basin represents roughly 18 years of deposition, while a 10cm^3 sample from the Inner Basin represents the accumulation of 45 years of sediment. The Outer Basin exhibits events at a frequency of one marine incursion approximately every 45 to 90 years, over the last ~ 2500 cal yBP during Climate Intervals II and I. The Inner Basin has a lower frequency of a marine incursions of approximately an event every 76 to 113 years, over the last 4000 cal yBP during Climate Intervals III to I. Peaks in foraminiferal abundance frequently occur within the massive sediment intervals that are thought to represent turbidity current and debris flow deposits generated during marine incursions. These estimations of basin ventilation (or marine incursion) frequencies are determined by the sampling intervals.

The Inner Basin core has a much longer sediment record chronologically than the Outer Basin, and it records 3 Climate Intervals, while the three Outer Basin cores only record Climate Interval I, and the end of Climate Interval II. The lack of dateable material has hindered the development of a stronger stratigraphic framework that may be necessary for better correlation of paleoceanographic events.

If resampling of the core material was possible, the frequency recorded may be increased. Regardless, given the overlap of timing between the Inner and Outer Basin timing, it is reasonable to assume the marine incursion events found in the Inner Basin were coincident with a basin ventilation event in the Outer Basin. Further it would appear that these paleo-records are relatively close in frequency to the historical frequency of 30 – 50 years of the NP-

DO, indicating little change in periodicity between pre-historic and historic times, *i.e.* over the last 4000 years.

Historical records of air and ocean temperature as well as atmospheric pressure fields, show significant interdecadal fluctuations in the North Pacific region. These climatic fluctuations appear to have had large impacts on marine ecosystems (Finney *et al.* 2000; 2002). Salmon catch records suggest a correlation between the intensification of the Aleutian Low, increased coastal sea surface temperatures in the eastern North Pacific, and increased production of Alaskan salmon during the 20th century (Figure 1.1; Glavin 1999, Finney *et al.* 2000, 2002). In their (2000) paper, Finney *et al.* found that the sockeye salmon population over the last 300 years fluctuated on a decadal scale, thus reflecting upon larger scale ocean-atmospheric dynamics and these climate fluctuations may also influence salmons' fortunes on shorter timescales. In 1997, 123 million salmon were caught off Alaska and two years later in 1999 almost twice that amount were caught (216 million; Whitefield 2002). In addition, fish bone patterns inferred from sediment cores in southern coastal British Columbia indicate that fish productivity was higher from ~ 1000 AD to present (Tunnicliffe *et al.* 2001; Finney *et al.* 2002).

Increased fish bone deposition and preservation has occurred in Effingham Inlet during Climate Intervals II and I (~4000 yBP until present). At these times, peaks in foraminiferal abundance and diversity, and a similar 30 – 50 year frequency of Group 1 appearances (foraminiferal assemblages associated with oxygen-rich, coastal waters) are also recorded in cores (Figures 4.5 to 4.7).

It would be reasonable to assume that the increased productivity through coastal upwelling events was triggered by the change in the intensity and position of the Aleutian Low, and this multidecadal frequency is also recorded in the benthic foraminiferal record preserved in Effingham Inlet. The benthic foraminiferal record of Effingham Inlet does act as a proxy for the regional North Pacific paleoceanography and paleoclimate, and is thereby an indicator of inferred paleoproductivity of fish stocks.

suggesting an increase in upwelling events. In addition, the dominance of the estuarine species has declined during Climate Interval II, and there is a stronger representation of the low oxygen tolerant foraminiferal assemblages, and exotic planktic species. This evidence further supports the theory that marine incursions and productivity may have increased during Climate Interval II.

Benthic foraminifera are abundant and diverse in the last 2000 cal yBP (Climate Interval I) particularly the deep water, organic-rich material favoring estuarine species, as recorded in the Inner Basin core. The river-borne thecamoebians and *M. fusca* in the Inner Basin occur in abundance in the last 2000 years. Their increased presence indicates a high amount of precipitation and more runoff into the deep basin because these species are either transported by the river or from shallow, brackish water areas. The cooling climate and increased precipitation levels recorded in Effingham Inlet are concurrent with the 1990 IPCC report that global cooling has occurred in the last 3,000 cal yBP (Houghton, *et al.*, 1990).

The foraminiferal assemblages show a shift from an appearance of shelf 'blue water' species to the estuarine, opportunistic low oxygen tolerant foraminiferal assemblages and finally the disappearance of even the anoxic dwelling foraminiferal assemblages. Based upon the appearance of these peaks in relative foraminifera assemblage abundances, the overall productivity of the marine waters bathing Effingham Inlet may have increased in the last 4000 years, and particularly between 4000 to 2000 yBP during Climatic Interval II as recorded by the diatom assemblage (M. Hay pers. comm.) and increased fish bone and scale depositions (Dallimore 2001). The three Outer Basin cores only briefly penetrated Climate Interval II, based upon the few ^{14}C ages.

The Outer Basin has a higher frequency of a basin ventilation event approximately every 45 to 90 years during Climate Interval I. The Inner Basin has a frequency of one basin ventilation approximately every 76 to 113 years. The periodicity of these marine incursions is similar to the ~ 30 – 50 intensification of the NP-DO, North Pacific Decadal Oscillation; that is linked to increases in productivity of economic fish stocks.

The benthic foraminifera of Effingham Inlet do act as a proxy for the regional North Pacific paleocean – climate, and its productivity.

Suggestions for Future Work.

1. Extending sampling to other dysoxic/anoxic fjords such as Smith Inlet (both nearby and farther along the North American Pacific coast) to construct a record of the regional paleoceanography and paleoclimate.
2. Further development of the paleorecord by comparing information gathered from several paleoproxies (such as diatoms, palynology, dinoflagellates, sediment biogeochemistry and fish remains) at more study sites, to compare how the different paleoproxies may vary locally but yet record the changes in the regional paleoceanography and paleoclimate.
3. A more frequent sampling interval downcore to provide a clearer resolution of events.
4. Better estimates of the periodicity of incursion events by using sedimentation rates generated specifically for each sediment unit.
5. The proper labeling and archiving of sediment cores collected for future reference to enable the resampling and re-examination of discovered intervals of particular interest.
6. Longer and deeper cores, in both basins.
7. Better aerial coverage of cores within the fjord, and outside the fjord mouth.
8. More age dating done, to strengthen the stratigraphy and therefore our understanding of the timing of paleoceanographic events.
9. Develop a marine correction that is applicable for this fjord, *i.e.* a contemporaneous pair.
10. Whole or half core X-ray or CAT scan analysis of the core material, prior to subsampling to examine the sediment microstructure and possibly locate more age datable material.
11. Larger sediment sample volumes, to increase the number of foraminiferal individuals found.
12. A standard method for sediment TOC analysis for all cores, in order to compare TOC values between cores (a combination of Rock Eval, geochemistry, and combustion analysis are showing very different values).
13. The use of remnant magnetism (paleomagnetism) is also a potentially powerful tool as correlation can be made between marine cores and terrestrial "Master Curves".

SYSTEMATIC TAXONOMY

This is a synopsis of essential information for the identification and ecological interpretation of benthic foraminifera and thecamoebians mentioned. The suprageneric classification of the foraminifera follows that of Loeblich and Tappan (1987); the suprageneric classification of Medioli and Scott (1983) and Medioli *et al.* (1987) was used for the Thecamoebians. Genera, and species within genera, are listed in alphabetical order. Each species includes the original reference and some generic changes for some species.

Benthic foraminifera

Adercotryma glomerata (Brady)

Lituola glomerata Brady, 1878, p. 433, pl. 20, figs. 1a-c.

Adercotryma glomerata (Brady). Barker, 1960, pl. 34, figs. 15-18; Williamson *et al.*, 1984, p. 224, pl. 1, fig. 1.

Remarks: Test agglutinated and irregularly coiled with elongated chambers. This species characterizes many types of estuarine as well as shelf environments; it is also one of the dominant forms in the deepest part of the ocean. This species appears to be common only in areas where there is no competition from calcareous species- i.e. below the Carbonate Compensation Depth [CCD] in the deep sea and in the cold, reduced salinity environments seen in polar regions; it also characterizes deep estuarine areas where salinity is relatively stable but slightly lowered, and where high organic matter concentrations lower the pH of the sediments, reducing or eliminating the presence of calcareous species.

Ammobaculites exiguus **Cushman** and Brönnimann

Ammobaculites exiguus Cushman and Brönnimann, 1948, p. 38, pl. 7, figs. 7, 8; Scott *et al.*, 1991, p. 384; Scott *et al.*, 1995, p. 292, Fig. 6.1.

Ammobaculites dilatatus Cushman and Brönnimann; Scott *et al.*, 1977, p. 1578, pl. 2, Fig. 6; Scott and Medioli, 1980a, p. 35, pl. 1, figs. 9, 10.

Remarks: Test agglutinated, initially planispirally coiled, later several chambers uniserial;

similar to *A. dilatatus* but much narrower in outline, when broken it can often be confused with *Ammotium salsum*. Its occurrence is similar to *A. dilatatus*.

Ammonia beccarii (Linné)

Nautilus beccarii Linné, 1758, p. 710.

Ammonia beccarii (Linné). Brünnich, 1772, p. 232; Scott and Medioli, 1980a, p. 35, pl. 5, figs. 8, 9.

Remarks: Test calcareous, trochospiral; morphologically highly variable which has led to the erection of a large number of specific and subspecific names. Schnitker (1974) demonstrated, through laboratory cultures, that many of the described forms are ecophenotypic variations of *Ammonia beccarii* and no attempt is made here to distinguish the various forms described in the literature. This species is very useful because it is one of the few species with some known ecological parameters.

Ammotium cassis (Parker)

Lituola cassis Parker in Dawson, 1870, p. 177, 180, Fig. 3

Haplophragmium cassis (Parker). Brady, 1884, p. 304, pl. 33.

Ammobaculites cassis (Parker). Cushman, 1920, p. 63, pl. 12, Fig. 5.

Ammotium cassis (Parker). Loeblich and Tappan, 1953, p. 33, pl. 2, figs. 12-16; Scott *et al.*, 1977, p. 1578, pl. 2, figs. 1,2; Miller *et al.,* 1982a, p. 2362, pl. 1, Fig. 8.

Remarks: Test agglutinated, initially planispirally coiled, later chambers tend to uncoil forming a wide uniserial pattern with slanting suture lines, aperture terminal and rounded. This estuarine species is indicative of increased levels of suspended particulate matter.

Bolivina acerosa Cushman var. *pacifica* Cushman and McCulloch

Bolivina acerosa Cushman var. *pacifica* Cushman and McCulloch, 1942, p. 185, pl. 21, fig. 2, 3

Bolivinellina pacifica (Cushman and McCulloch), Patterson *et al.*, 1998, p.14, pl. 13, figs. 1, 2.

Description: Test free, elongate, compressed, broadest near aperture and tapers to base; wall calcareous, hyaline, smooth, finely perforate; chambers 10 to 13 pairs, biserially arranged, slightly inflated and wider than high, gradually increase in size as added; sutures slightly curved and depressed, about 60° to longitudinal axis; aperture lipped and loop-shaped at base of final formed chamber, with internal tooth plate attached to one side.

Botuloides pauciloculus S.Y. Zheng

Botuloides pauciloculus S.Y. Zheng, 1979, p.141, 210; Loeblich and Tappan, 1987, P. 395, pl. 439, fig. 15-18; Patterson *et al.,* 1998, p.6, figs. 3,4.

Description: Test free, elongate, arcuate, circular in cross-section, made up of only 2 chambers, "sausage-like"; wall calcareous, hyaline, thin, surface smooth; proloculus elongate, about 2.5 times the diameter with a short basal process, followed by slightly shorter second chamber of similar form that partly overlaps distal end of proloculus; aperture small, round.

Brizalina subaenariensis (Cushman)

Bolivina subaenariensis Cushman, 1922a, p. 46, pl. 7, fig. 6.

Brizalina subaenariensis (Cushman); Williamson *et al.,* 1984, p. 224, pl. 1, fig. 8; Scott, 1987, p. 327, pl. 1, fig. 11; Patterson *et al.,* 1998, p. 14, pl. 13, figs. 8,9.

Remarks: Test calcareous, biserial, much compressed laterally, characterized by ribbing on the lower part of the test. This species appears to live in relatively warm water (>10°C) and is a good indicator of the break between cold-temperate and warm-temperate shelf waters.

Buccella depressa Andersen

Plate 1, Figure 1

Buccella depressa Andersen, 1952, p. 145, 146, fig. 7a-c, 8; Patterson *et al.,* 1998, p. 22, pl. 24, figs. 1-3.

Description: Test free, trochospiral, roughly biconvex, periphery rounded, lobatulate; wall calcareous, hyaline, smooth except concentrations of fine pustules in umbilicus and in narrow bands along sutures, coarsely perforate; two-and one-half whorls and all chambers visible on slightly convex spiral side; spiral side sutures slightly curved, oblique, and very slightly depressed; only highly inflated final 7 to 9 chambers of final whorl visible on umbilical side and gradually increase in size as added; umbilical side sutures slightly curved and radial; aperture interiomarginal with slit-like supplementary apertures found along posterior margins of chambers on umbilical side.

Buccella frigida (Cushman)

Plate 1, Figure 2

Pulvinulina frigida Cushman, 1922b, p. 144.

Eponides frigida (Cushman) var. *calida* Cushman and Cole, 1930, p. 98, pl. 13, fig. 13a-c; Phleger and Walton, 1950, p. 277, pl. 2, fig. 21.

Eponides frigidus (Cushman). Cushman, 1941, p. 37, pl. 9, fig. 16.

Buccella frigida (Cushman). Anderson, 1952, p. 144, figs. 4a-c, 5, 6a-c; Schafer and Cole, 1978, p. 27, pl. 8, figs. 1,2; Scott *et al.* 1980, p. 226, pl. 4, figs. 10,11; Miller *et al.* 1982a, p. 2364, pl. 2, figs. 9,10; Patterson *et al.* 1998, p.22, pl. 25, figs. 6-8.

Remarks: Test calcareous, trochospiral; granular material on the sutures of the umbilical area distinguishes this species from other similar ones. This species is characteristic of temperate to cold outer estuarine and inner shelf environments.

Buliminella elegantissma (d'Orbigny)

Plate 1, Figures 3-8

Bulimina elgantissma d'Orbigny, 1839a, p. 51, pl. 7, figs. 13, 14.

Buliminella elegantissma (d'Orbigny) HÖglund, 1947, p. 215, pl. 18, fig. 1; Feyling-Hanssen, *et al.,* 1971, p. 234, pl. fig. 15; Patterson *et al.,* 1998, p. 17, figs. 6,7.

Description: Test free, elongate, with a high and close spiral formed by numerous high narrow chambers in 3 to 4 whorls; wall calcareous, hyaline, smooth, finely perforate; aperture loop-shaped with internal tooth plate connecting aperture with foramen of previous chamber.

Cassidulina subglobosa cf. Brady

Plate 1, Figures 9-11

Cassidulina subglobosa cf. Brady. Barker, 1960, p. 112, Pl. 54, fig. 17.

Remarks: species identification based upon the apertural shape, but in general all calcareous specimens were greatly etched, burnished and poorly preserved.

Chilostomella oolina Schwager

Chilostomella oolina Schwager, 1878, p. 513, Pl. 1, fig. 16

Chilostomella oolina Schwager. Barker, 1960, p. 112, Pl. 555, fig. 12-14, 17, 18; Patterson *et al.,* 1998, p. 21, pl. 21, figs. 7,8.

Description: Test free, ovate, planispiral and involute; wall calcareous, hyaline, smooth; 2 strongly embracing chambers per whorl; aperture narrow interiomarginal slit in side of test.

Cibicides spp.

Cibicides fletcheri Galloway and Wissler

Cibicides fletcheri Galloway and Wissler, 1927, p. 64, pl. 10, fig. 8,9.

Lobatula fletcheri (Galloway and Wissler) Patterson *et al.,* 1998, p. 19, pl.19, figs. 4-6.

Description: Test free, plano-convex, trochospiral with spiral side flattened and umbilical side rounded and convex; wall calcareous, translucent, smooth, coarsely perforate on spiral side; 8 to 9 slightly inflated chambers visible on concave umbilical side; all chambers visible on spiral side with a well developed umbilical boss; sutures slightly curved and depressed; aperture low interiomarginal lipped, may extend along spiral suture on spiral side.

Cibicides lobatulus (Walker and Jacob)

Plate 1, Figures 12-13

Nautilus lobatulus Walker and Jacob in Kanmacher, 1798, p. 642, pl. 14, fig. 36.

Truncatulina lobatula (Walker and Jacob). d'Orbigny, 1839b, p. 134, pl. 2, figs. 22-24; Brady, 1884, p. 660, pl. 92, fig. 10, pl. 93, fig. 1; Cushman, 1918, p. 16, pl. 1, fig. 10, p. 60, pl. 17, figs. 1-3.

Cibicides lobatulus (Walker and Jacob). Cushman, 1927, p. 170, pl. 27, figs. 12, 13; Cushman, 1935, p. 52, pl. 52, figs. 4-6; Parker, 1952, p. 446, pl. 5, fig. 11; Schafer and Cole, 1978, p. 27, pl. 9, figs. 1,2; Scott *et al.,* 1980, p. 226, pl. 4, figs. 8, 9; Williamson *et al.,* 1984, p. 224, pl. 1, fig. 14.

Cibicides mckannai Galloway and Wissler, 1927, p. 65, pl. 10, fig. 5, 6.

Lobatula mckannai (Galloway and Wissler) Patterson *et al.,* 1998, p. 19, pl. 19, figs. 7-9.

Remarks: Test attached, calcareous, usually planoconvex, spiral side coarsely perforate and flat to irregular; aperture extending characteristically from convex side along the suture of the first few chambers of the flat side. Like most attached forms, this species, due to the shape of the surface of attachment, exhibits a high degree of variability that often has resulted in taxonomic chaos. This species lives in high energy nearshore environments, usually attached to rocks or plants.

Cribrostomoides crassimargo (Norman)

Haplophragmium crassimargo Norman, 1892, p. 17.

Cribrostomoides crassimargo (Norman) Barker, 1960, pl. 35, fig. 4; Schroeder, 1986, p.91.

Remarks: Wall mostly coarse grained.

Eggerella advena (Cushman)

Plate 4, Figures 1-2

Verneuilina advena Cushman, 1922b, p. 141.

Eggerella advena (Cushman). Cushman, 1937, p. 51, pl. 5, figs. 12-15; Phleger and Walton, 1950, p. 277, pl. 1, figs. 16-18; Scott *et al.,* 1977, p. 1579, pl. 2, fig. 7; Scott and Medioli, 1980, p. 40, pl. 2, fig. 7; Scott *et al.,* 1991, p. 385, pl. 2, figs. 1, 2; Patterson *et al.,* 1998, p. 5, pl. 27, figs. 1,2.

Remarks: Test finely agglutinated, later chambers triserial, roughly triangular in cross-section; aperture a small slightly protruding slit at the base of the last chamber. This species occurs worldwide in outer estuaries and appears to be more tolerant to pollution impacts than most species.

Elphidiella hannai (Cushman and Grant)

Elphidium hannai Cushman and Grant, 1927, p. 77, pl. 7, fig. 1.

Elphidiella nitida Cushman, 1941, p. 1941, p. 35, pl. 9, fig. 4.; Loeblich and Tappan, 1953, p. 107, 108, pl. 19, fig. 11, 12.; Bergen and O'Neil, 1979, pl. 1, fig. 3,4.

Elphidiella hannai (Cushman and Grant) Patterson *et al.,* 1998, p.22, pl. 26, figs. 3, 4.

Description: Test free, lenticular, planispiral and involute, bilaterally symmetrically, periphery rounded; wall calcareous, hyaline, smooth (except concentration of granular material near aperture); 13 to 15 chambers of the last whorl visible and increase gradually in size as added; sutures distinct, thickened but not raised, slightly curved, bordered by double row of fine sutural pores that extend to smooth umbilical region; aperture a row of pores at base of apertural face of final formed chamber.

Genus **ELPHIDIUM** de Montfort, 1808

Type species: *Nautilus macellus* var., B Fichtel and Moll, 1798, p.66; *Elphidium* de Montfort, 1808, p. 14.

Test lenticular, planispirally coiled, involute to partially evolute, biumbonate, occasionally with umbilical plug on both sides, seven to twenty chambers in the final whorl; the test sometimes displays deeply incised sutures. Surface, at times showing a complex ornamentation that varies between species and even within species; periphery carinate; wall calcareous, finely perforate surface with pores in the plugs and along the sutures; aperture a single or multiple pores. L. Eocene to Recent; cosmopolitan.

Remarks: some of the species included in *Elphidium* have been reported in the literature under *Cribrononion* or *Cribroelphidium*. The typical morphological variability within the genus *Elphidium* is so exceptional that the validity of the other two genera is debatable and, in any case, it is based on internal structures. Consequently, it was decided to group all species under the genus *Elphidium*.

Elphidium crispum (Linne)

Polystomella crispum (Linne) Brady

Elphidium crispum (Linne) Cushman and Grant, 1927, p. 73; Barker, 1960, p. 226, pl. 110, figs. 6,7.

Elphidium excavatum (Terquem)

Plate 1, Figures 15-16

Polystomella excavata Terquem, 1876, p. 429, pl. 2, fig. 2.

Elphidium excavatum (Terquem) *formae* Miller *et al*, 1982b, p. 116-155, 5 pls.

Cribroelphidium excavatum (Terquem) Patterson *et al.*, 1998, p. 22, pl. 25, figs. 4,5; pl. 26, figs. 1,2.

Remarks: This calcareous, planispiral species has been one of the most contentious in the history of foraminiferal study and the controversy is still active.

The species is listed here as "*E. excavatum formae*" because it includes several (maybe as many as 10) morphotypes or ecophenotypes that appear as "species" in the literature. Ecophenotypes, while they may have great ecological significance, have little taxonomic value and fall outside of the International Code of Zoological Nomenclature. Consequently, this species is subdivided here into "formae" which are considered to have ecological significance. Consequently, it is extremely useful to keep them separated because they can often provide the salinity and temperature information needed to study an estuary. For example: *E. excavatum forma clavata* occurs by itself in polar regions, *E. excavatum forma clavata* together with *Cassidulina reniforme* characterizes "warm" ice margins. *E. excavatum forma clavata*, alone, can also be found living on the Scotian Slope in 1000-2000m of water, which suggests its extreme versatility. To be able to make full use of this species "group" as a paleoecological proxy, it would be necessary to peruse the paper by Miller *et al.* (1982b). For most practical purposes, however, it will suffice to say that, as the water temperature increases, the number of formae increases, and the ornamentation and pore sizes become larger. This group, as a whole, is also tolerant of anthropogenic contamination but sometimes the specimens occur only as organic inner linings where the calcite has been dissolved due to the low pH.

Elphidium frigidum Cushman

Elphidium frigidum Cushman, 1933, p. 5, pl. 1, fig. 3; Schafer and Cole, 1978, p. 27, pl. 10, Fig. 2a,b.

Cribrononion frigidum (Cushman). Scott *et al.,* 1980, p. 228, pl. 2, fig. 8.

Remarks: This species, as the name implies, appears to prefer polar waters and is not tolerant to pollution.

Elphidium micrograntulosum (Galloway and Wissler)

Themeon micrograntulosum Galloway and Wissler, 1927 in Thalmann, 1951, *Elphiduim.*

Cribroelphidium micrograntulosum (Galloway and Wissler) Blais, 1995, p. 89, pl. 2-5, fig. 10.

Elphidium subarcticum Cushman

Elphidium hallandense Brotzen in Hessland, 1943, p. 268, fig. 109 (2a-c)

Elphidium subarcticum Cushman, 1944, p. 27, pl. 3, figs. 34-35.;Parker, 1952, p. 449, pl. 4, figs. 3-6.; Phleger and Walton, 1950, p. 277, pl.2, figs. 19, 20.; Gregory, 1970, p. 229, pl. 14, fig. 7.; Cole and Ferguson, 1975, p. 34, pl. 8, figs., 1, 2.; Schafer and Cole, 1978, p. 27, pl. 10, fig. 1.

Cribroelphidium subarcticum (Cushman), Scott, *et al.,* 1977, p. 171, pl. 6, fig. 7.

Cribroelphidium hallandense (Brotzen), Patterson *et al.,* 1998, p. 22, pl. 25, figs. 1-3.

Description: Test free, planispiral and involute, sides flat, periphery broadly rounded, slightly lobulate margin; wall calcareous, hyaline, smooth (except bands of granular material found in umbilicus along sutures and near aperture); 7 to 9 slightly inflated and gradually enlarging chambers in final whorl; sutures slightly depressed and curved; aperture a low interiomarginal equatorial arch often obscured by granular material covering apertural face.

Epistominella vitrea Parker

Epistominella vitrea Parker in Parker, Phleger, and Peirson, 1953, p. 9, pl. 4, fig. 34-36, 40-41; Patterson *et al.,* 1998, p. 19, pl. 20, figs. 3-5.

Description: Test free, trochospiral, biconvex, periphery rounded, and slightly lobulate; wall calcareous, hyaline, smooth, finely perforate; test spiral side with all 3 whorls and chambers visible and sutures straight, depressed and oblique; only final 6 chambers visible on umbilical side with sutures radial and depressed; aperture narrow lipped slit oriented slightly oblique to peripheral margin.

Euuvigerina juncea (Cushman and Todd)

Uvigerina juncea Cushman and Todd, 1941, p. 78, pl. 20, fig. 4-11.

Euuvigerina juncea (Cushman and Todd) Patterson *et al.,* 1998, p.17, pl. 17, figs. 1-4.

Description: Test free, elongate, rounded in section, with an approximately equal width for entire length; wall calcareous, translucent, finely perforate; inflated chambers triserially arranged; sutures depressed; numerous longitudinal costae extended along each chamber but do not cross sutures; aperture small and circular within a phialine lip atop a short neck; straight, narrow tooth plate extends from foramen to foramen.

Fissurina spp.

Plate 1, Figures 17-18

Remarks: A small selection of these calcareous, unilocular species is shown in the plates. Since, even as a group, these species often comprise less than 1% of the foraminiferal association, it is usually sufficient to just note the presence of the genus Consequently, it was decided to group all species under the genus *Lagena*... This genus usually occurs in deep water but, in small percentage and can also be found in deep estuarine and shelf environments. A list of species follows, that may have been observed but were not differentiated due to poor preservation.

Vermiculum marginatum Montagu, 1803, p. 524
Fissurina marginata (Montagu). Loeblich and Tappan, 1953, p. 77, pl., figs. 6-9; Gregory, 1970, p. 207, pl. 10, fig 1.; Schafer and Cole, 1978, p. 28, pl. 5, fig. 6.

Entosolenia marginata (Montagu) var. *lucida* Williamson, 1848, p. 17, pl. 2, fig. 17.
Fissurina lucida (Williamson) Patterson *et al.,* 1998, p.12, pl. 7, figs. 6, 7.

Fissurina subquadrata Parr, 1945, p. 203, Pl. 9, fig. 5a, b.; Patterson *et al.*, 1998, p. 12, pl 8, fig. 7-9.

Lagena vitreola Buchner, 1940, p. 477, pl. 13, fig. 256-258.
Fissurina vitreola (Buchner) Patterson *et al.* 1998, p. 12, pl. 9, figs. 1-5.

Fursenkoina fusiformis (Williamson)

Plate 1, Figures 19-20

Bulimina pupoides d'Orbigny *var. fusiformis* Williamson, 1858, p. 64, pl. 5, figs. 129,130
Fursenkoina fusiformis (Williamson). Gregory, 1970, p. 232; Scott *et al.* 1980, p. 228, pl. 3, figs. 9,10.
Virgulina schreibersiana (Czjzek). Feyling-Hanssen, Jorgensens, Knudsen and Andersen, 1971, p. 240, pl. 7, fig. 6-8 (not *Virgulina schriebersiana* Czjzek, 1848).
Stainforthia feylingi Knudsen and Seidenkrantz (1994), pl. 1, fig. 1 32; pl. 2, fig. 1-6, 8; Patterson *et al.,* 1998, p. 16, pl. 14, figs.5,6.; Alve (*in press*).

Remarks: Test calcareous, irregularly triserially-coiled and usually with a thin, transparent test. This species has been shown by several workers, most notably Alve (1990, 1991), to be the last species surviving in low oxygen, relatively high salinity lower estuary conditions - *i.e.,* it tolerates organic matter even better than some of the agglutinated species; this is puzzling considering that low oxygen often means low pH and dissolution of carbonate.

Globobulimina pupoides (d'Orbigny)

Plate 2, Figures 1-2

Bulimina pupoides d'Orbigny, 1846, p. 185, pl. 11, figs. 11, 12; Barker, 1960, p. 1.2, pl. 50, figs. 7-10.

Protoglobobulimina pupoides (d'Orbigny) Patterson *et al.,* 1998, p. 17, pl. 16, figs. 6,7.

Description: Test free, elongate, broadest near base, almost circular in cross-section; wall calcareous, hyaline, smooth, finely perforate; chambers inflated, much higher than wide and strongly overlapping, triserially arranged, in 2 or 3 whorls; sutures depressed; aperture elongate, extends up from base of final chamber; successive chambers connected by an internal tooth plate.

Glomospira gordialis (Jones and Parker)

Plate 2, Figure 3

Trochammina squamata var. *gordialis* Jones and Parker, 1860, p. 304.; Parker and Jones, 1865, pl. 15, fig. 32.

Ammodiscus gordialis (Jones and Parker). Brady, 1884, p. 333, pl. 38, figs. 7-9.

Gordiammina gordialis (Jones and Parker). Cushman, 1910, p. 99, pl. 36, figs. 7-9.

Glomospira gordialis (Jones and Parker). Cushman, 1918, p. 99, pl. 36, figs. 7-9.; Barker, 1960, p. 78, pl. 38, figs. 7-9.

Haplophragmoides Cushman

Plate 2, Figures 4-6

Nonionina canariensis d'Orbigny, 1839b, p. 128, pl. 2, figs. 33, 34;

Haplophragmoides Cushman (part.), 1910; HÖglund, 1947, p. 132.

Remarks: *Haplophragmoides* spp. were very similar in appearance to *Cribrostomoides* spp., but much finer-grain or smoother surface compared to the coarser grained wall structures of the latter.

Hemisphaerammina bradyi Loeblich and Tappan

Hemisphaerammina bradyi Loeblich and Tappan in Loeblich and Collaborators, 1957, p. 224, pl. 72, fig. 2.; Scott *et al.,* 1977, p. 1579, pl. 3, figs. 7,8.; Schafer and Cole, 1978, p. 28, pl. 1, fig. 5.;

Scott and Medioli, 1980a, p. 40, pl. 1, figs. 4,5.

Remarks: Test unilocular, agglutinated. This species appears to have a distribution similar to that of *A. cassis* but it is less wide spread, except when it can live in shallower water. It is often attached, sometimes forming groups of specimens clumped together.

Islandiella norcrossi (Cushman)

Cassidulina norcrossi Cushman, 1933, p. 7. pl. 2, fig. 7a-c.

Islandiella norcrossi (Cushman) Patterson *et al.* 1998, p. 15, pl. 14, figs. 1,2; pl. 31, figs. 4-6.

Description: Test free, biconvex, strongly compressed, subacute keel surrounds periphery; wall calcareous, translucent, smooth, finely polished; about 5 pairs of planispirally enrolled chambers, every chamber reaches the umbilical boss on both sides with the exception of the final chambers in a mature specimens leaving clear umbilical boss; sutures straight to slightly curved, flush; aperture elongate loop in plane of coiling, with projecting internal tooth.

Islandiella teretis (Tappan)

Cassidulina teretis Tappan, 1951, p. 7, pl. 1, figs. 30a-c.; Loeblich and Tappan, 1953, p. 121, pl. 24, fig. 3, 4.

Islandiella helenae (Feyling-Hanssen and Buzas, 1976 p. 155, Fig. 1-4); Patterson *et al.,* 1998, p.15, pl. 31, figs. 1-3.

Islandiella teretis (Tappan). Scott, 1987, p. 328, pl. 2, fig. 13.

Remarks: Test calcareous, irregularly coiled planispirally. This species is characteristic of cold (2-4°C), high salinity water.

Genus **LAGENA** Walker and Jacob (in Kanmacher 1798)

Plate 2, Figures 8-9

Remarks: A small selection of these calcareous, unilocular species is shown in the plates. Since, even as a group, these species often comprise less than 1% of the foraminiferal association, it is usually sufficient to just note the presence of the genus, some of the species included in *Lagena* have been reported in the literature under *Lagena, Protocerolagena, Hyalinonetrion,* or *Homolohedra.* Consequently, it was decided to group all species under the genus *Lagena*... This genus usually occurs in deep water but, in small percentage and can also be found in deep estuarine and shelf environments. A list of species follows, that may have been observed but were not differentiated due to poor preservation.

Hyalinonetrion sahulense Patterson and Richardson, 1988, p. 243, fig. 5, 6.

Lagena amphoriniformis McCulloch, 1977, p. 27, pl. 50, fig. 2.

Lagena apiopleura Loeblich and Tappan, 1953, p. 59, pl. 10, fig. 14-15

Lagena complurecosta Patterson, 1990, p. 681, 682, fig. 3.1-3.3

Lagena flatulenta Loeblich and Tappan, 1953, p. 60, Pl. 11, fig. 9, 10.

Lagena gracilis Williamson, 1848, p. 13, pl. 1, fig. 5

Lagena hisidula Cushman, 1913, p. 14, pl. 5, fig. 2, 3.

Lagena semilineata Wright, 1886, p. 320, pl. 26, fig., 7

Lagena sulcata var. spicata Cushman and McCulloch, 1950, p. 360, pl. 48, fig. 3-7.

Procerolagena simulampulla Patterson, 1991, p. 358, fig. 3, 4.

Pytine petaloskelis Patterson and Richardson, 1988, p. 257, fig. 37-39, 52; Patterson et al., 1998, p. 13, plate 12, figs. 1-3.

Miliammina fusca (Brady)

Plate 2, Figure 10 ; Plate 4, Figures 5-6

Quinqueloculina fusca Brady, 1870, p. 286, pl. 11, figs. 2, 3.

Miliammina fusca (Brady) Phleger and Walton, 1950, p. 280, pl. 1, figs. 19a,b; Phleger, 1954, p. 642, pl. 2, figs. 22, 23; Scott *et al.,* 1977, p. 1579, pl. 2, figs. 8,9; Schafer and Cole, 1978, p. 28, pl. 12, Fig. 2; Scott and Medioli, 1980a, p. 40, pl. 2, figs. 1-3. Scott *et al.,* 1991, p. 386, pl. 1, fig. 14.

Remarks: Test agglutinated, coiled in a "quinqueloculine" pattern.

This species occurs almost worldwide in low salinity low marsh and upper estuarine areas.

Nonionella digitata Norvang

Nonionella turgida (Williamson) *var. digitata* Norvang, 1945, p. 29, fig. 4.

Nonionella digitata Norvang Patterson *et al.* 1998, p. 20, pl. 21, figs. 1-3.

Description: Test free, compressed, general outline elongate elliptical, in low trochospiral coil, periphery rounded; wall calcareous, hyaline, smooth, finely perforate without pustules;

spiral side partially evolute around umbonal boss with all chambers visible (usually about 10), rapidly increasing in size, sutures strongly depressed and slightly curved; umbilical side involute with only 5 to 6 chambers of final whorl visible, flap -like extensions of final chambers subdivided in finger-like projections that cross umbilical regions, obscuring it; aperture small interiomarginal and nearly equatorial arch, extending onto umbilical side.

Nonionella stella Cushman and Moyer

Plate 2, Figure 12

Nonionella miocenica Cushman var. *stella* Cushman and Moyer, 1930, p. 56, pl. 7, fig. 17.

Nonionella stella Cushman and Moyer. Patterson *et al.* 1998, p.20, pl. 22, figs. 1-3.

Description: Test free, trochospiral, slightly compressed; wall calcareous, translucent, smooth, finely perforate; 7 to 10 inflated low chambers rapidly increase in size as added; large umbilical flap extends from last chamber and covers umbilical region; all chambers visible on spiral side; aperture low arch extending somewhat onto umbilical side, at base of large flat apertural face.

Nonionella cf. N. turgida (Williamson)

Rotalina turgida Williamson, 1858, p. 50, pl. 9, fig. 95-97.

Nonionella cf. N. turgida (Williamson). Patterson *et al.* 1998, p. 20, pl. 23, fig. 8.

Description: Test free, compressed, slightly elongated in low trochospiral coil, periphery rounded; wall calcareous, hyaline, smooth finely perforate; all chambers visible on spiral side, partially evolute around umbonal boss; only final 9 chambers visible on umbilical side, extension of final chambers extends into and partially obscures umbilicus; sutures depressed and slightly curved on both sides; aperture low, interiomarginal, and nearly equatorial arch, extends slightly onto umbilical side.

Nonionellina labradorica (Dawson)

Nonionina scapha var. *labradorica* Dawson, 1860, p. 191, fig. 4.

Nonionellina labradorica (Dawson). Williamson *et al.,* 1984, p. 224, pl. 1, fig.11; Patterson *et al.,* 1998, p. 20, pl. 23, figs. 1,2.

Remarks: Test calcareous, in early stages trochospiral, later stages almost planispiral with inflated basal lobes at the umbilical end of the chamber, with a flared last chamber; it differs from *Nonionella* in not having the umbilicus covered by the lobe of the last chamber. This species is an important indicator of warming conditions after the last glaciation in N. Atlantic shelf areas.

Genus **OOLINA** d'Orbigny

Plate 2, Figures 13-14

Remarks: As with Lagena, no species are discussed for this diverse, calcareous, unilocular genus because, even as a group, it usually comprises extremely low percentages. Its presence, however, may be indicative of more open marine conditions in outer estuarine areas.

Entosolenia lineata Willamson, 1848, p. 18, pl. 2, fig. 18.
Oolina borealis Loeblich and Tappan, 1954, p. 384.
Oolina melo d'Orbigny, 1839a, p. 20, pl. 5, fig. 9.
Oolina striaticollis d'Orbigny, 1839a, p. 21, pl. 5, fig. 14.

Planorbulina mediterranensis d'Orbigny

Planorbulina mediterranensis d'Orbigny, 1826, p. 280, no. 2., pl. 14, figs. 4-6; Bock, 1971, p. 60, pl. 22, figs. 11, 12; Wantland 1975, p. 392, pl. 11b.

Dyocibicides biserialis Cushman and Valentine, 1930, p. 31, pl. 10, fig. 1, 2.; Patterson *et al.,* 1998, p.20, pl. 20, figs. 1,2.

Description: Test attached, elongate, trochospiral, with attachment area on spiral side; wall calcareous, translucent, smooth, coarsely perforate; all chambers visible on flattened spiral side; only 7 to 8 slightly inflated chambers visible in final whorl of umbilical side, gradually increasing in size as added; later chambers uncoiled and irregularly biserial, increasing greatly in size as added; sutures depressed and curved; aperture terminal and lipped.

Remarks: *P. mediterranensis* has been included in the *Cibicides* spp. group due to their similar habitat and appearance.

Pseudononion basipinata (Cushman and Moyer)

Plate 2, Figure 15

Nonion pizarrensis Berry var. *basispinata* Cushman and Moyer, 1930, p. 54, pl. 7, fig. 18.

Nonionellina basispinata Lankford and Phleger, 1973.

Pseudononion basispinata (Cushman and Moyer) Patterson *et al.,* 1998, p. 21, pl. 23, fig. 3-5.

Description: Test free asymmetric planispiral and involute, compressed; wall calcareous, hyaline, smooth, finely perforate; 10 to 16 slightly depressed and curved with some hispid material found in open umbilicus and along lower parts of sutures on one side or with an umbilical knob on the other side; aperture narrow, interiomarginal with equatorial opening.

Quinqueloculina akneriana d'Orbigny

Quinqueloculina akerniana d'Orbigny, 1846, p. 290, pl. 18, fig. 16-21.

Description: Test free, large and robust in appearance, oblong, subtriangular in cross-section, edges rounded; wall calcareous, opaque, smooth, imperforate; chambers coiled, each one-half coiled in length and alternate regularly in 5 planes of coiling; 3 chambers visible on one side and 4 on opposite side; aperture large, semi-circular, no projecting neck, thick bifid tooth projects into the aperture from the margin adjacent to the preceding chamber.

Recurvoides cf. turbinatus (Brady)

Plate 2, Figure 16

Haplophragmium turbinatum Brady, 1881, p. 50.

Recurvoides turbinatus (Brady) Scott, 1987, p.328.

Reophax arctica Brady

Plate 4, Figures 3 - 4

Reophax arctica Brady, 1881, p. 405, pl. 21, fig. 2; Scott *et al.,* 1980, p. 321, pl. 2, fig. 1; Miller *et al.,* 1982a, p. 2362, pl. 1, fig. 6.

Remarks: Test agglutinated uniserial, elongated and flexible because of an inner organic lining; chambers increasing in size gradually; aperture simple on the top of the last chamber. This species is common in deep estuarine areas, but does not appear to be very resistant to anthropogenic contamination.

Reophax nana Rhumbler

Reophax nana Rhumbler, 1911, p. 182, pl. 8, figs. 6-12; Scott *et al.,* 1977, p. 1579, pl. 3, figs. 1,2;

Schafer and Cole, 1978, p. 29, pl. 2, fig. 4; Scott and Medioli, 1980a, p. 43, pl. 2, fig. 6.

Remarks: Test agglutinated, uniserial, elongated; characteristically, chambers increase in size more rapidly than in *R. arctica*; aperture simple on top of the last chamber. This species occurs over a wide area.

Reophax nodulosus Brady

Reophax nodulosa Brady, 1879, p. 52, pl. 4, figs. 7, 8.; Brady, 1884, p. 294, pl. 31, figs., 1-9.

Reophax nodulosus (Brady). Cushman, 1910, p., 87, 88, fig. 122.; Barker, 1960, p. 64, pl. 31, fig. 109.

Remarks: This species is generally large and robust. It shows a great deal in variation in chamber shape as shown in Brady's (1884) illustrations.

Reophax scottii Chaster

Reophax scottii Chaster, 1892, p. 57, pl. 1, fig. 1; HÖglund, 1947, p. 94, text-fig. 72; Miller *et al.,* 1982a, p. 2362, pl. 1., fig. 7.

Reophax catella Hoglund, 1947, p. 96, text-figs. 73, 74.

Leptohalysis catella (Hoglund) Blais, 1995, pl. 2-1, figs. 1,2.

Remarks: Test agglutinated, uniserial, elongated; usually very thin and with somewhat angular chambers; an inner organic lining makes the test particularly flexible. This species is a good indicator of high organic matter contamination.

Rosalina columbiensis (Cushman)

Discorbis columbiensis Cushman, 1925, p. 43, pl. 6, figs. 13a-c.

Rosalina columbiensis (Cushman). Lankford and Phleger, 1973, p. 127, 128, pl. 5, fig. 10-12; Patterson *et al.,* 1998, p. 18, pl. 19, figs. 1-3.

Description: Test free or attached, plano-convex, trochospiral; wall calcareous, hyaline, smooth, finely perforate; chambers irregular in shape and gradually increase in size as added, all visible on spiral side, and only 6 to 7 visible on final whorl around open umbilicus side; sutures depressed and slightly curved; aperture and interiomarginal arch at base of final chamber, near periphery on umbilical side extending into umbilicus; planktic-stage specimens have large subglobular float chamber completely covering umbilical side.

Saccammina difflugiformis (Brady)

Plate 2, Figure 11

Reophax difflugiformis Brady, 1879, p. 51, pl. 4, fig. 3a, b.

Proteonina atlantica Cushman 1944, pl. 2-3, fig. 4.

Saccamina cf. atlantica (Cushman) 1944.

Saccammina difflugiformis (Brady). Thomas *et al.* 1990, p. 234, pl. 2, figs. 10-12.

Remarks: Test agglutinated, unilocular, flask-shaped. This species is common in upper estuarine environments. *S. atlantica* is larger than *S. difflugiformis*, although difficult to tell them apart with out reference for size; therefore I have included them together here.

Spiroplectammina biformis (Parker and Jones)

Plate 2, Figure 17

Textularia agglutinans d'Orbigny var. *biformis* Parker and Jones, 1865, p. 370, pl. 15, figs. 23, 24.

Spiroplectammina biformis (Parker and Jones). Cushman, 1927, p. 23, pl. 5, fig. 1; Schafer and Cole, 1978, p. 19, pl. 3, fig. 2; Scott *et al.,* 1980, p. 231, pl. 2, fig. 2.

Remarks: Test agglutinated, elongated, early chambers coiled planispirally, later chambers arranged biserially. This species is common in deep estuarine areas, and has some tolerance to anthropogenic contamination.

Spirosigmoilina tenuis (Czjzek)

Quinqueloculina tenuis Czjzek, 1848, p. 149, pl. 13, figs. 31-34.

Spirosigmoilina tenuis (Czjzek) Patterson *et al.,* 1998, p. 6, pl. 2, figs. 1,2.

Description: Test free, elongate, compressed; wall calcareous, porcelaineous, translucent, smooth; chambers one test length long, early chambers sigmoid with later chambers 180° apart; aperture small and circular with short neck.

Textularia agglutinans d'Orbigny

Textularia agglutans d'Orbigny, 1839b, p. 144, pl. 1, figs. 17, 18, 32, 34.; Loeblich and Tappan, 1994, p. 27, pl. 33; figs. 8-12.; Javaux, 1999, p. 376, pl. fig. 14.

Textularia conica d'Orbigny

Plate 2, Figures 18-20; Plate 3, Figure 1

Textularia conica d'Orbigny 1839a, p. 143, pl.1, figs. 19, 20; Barker 1960, p. 88, pl. 43, figs. 13-14; Bock, 1971, p. 8, pl. 2, fig. 3; Javaux, 1999, p. 368, pl. 7, fig. 15.

Textularia earlandi Parker

Plate 3, Figure 2

Textularia earlandi Parker, 1952, p. 458 (footnote); Scott, 1987, p. 329.

Remarks: Test agglutinated, chambers biserially arranged, laterally compressed; aperture a simple arch at the base of the last chamber. This species is common in most coastal environments, but is usually not a dominant taxon.

Textularia torquata Parker

Plate 3, Figure 3

Textularia torquata Parker, 1952, p. 403, pl. 3, figs. 9-11; Scott, 1987, p. 329.

Tiphotrocha comprimata (Cushman and Brönnimann)

Trochammina comprimata Cushman and Brönnimann, 1948b, p. 41, pl. 8, figs. 1-3; Phleger, 1954, p. 646, pl. 3, figs. 20, 21.

Tiphotrocha comprimata (Cushman and Brönnimann). Saunders, 1957, p. 11, pl. 4, figs. 1-4; Scott *et al.,* 1977, p. 1579, pl. 4, figs. 3,4; Scott and Medioli, 1980a, p. 44, pl. 5, figs. 1-3; Scott *et al.,* 1990, pl. 1, figs. 10a,b; Scott *et al.,* 1991, p. 388, pl. 2, figs. 5, 6.

Remarks: Test agglutinated, trochospiral, ventral side somewhat concave. It is distinguished from *Trochammina* by a siphon-like extension to the aperture in the umbilical area. This species is common in middle and high marsh environments and in brackish areas, except for the Pacific basin.

Trifarina fluens (Todd)

Plate 3, Figure 4

Anglogerina fluens Todd, In Cushman and Todd, 1947, p. 67, pl. 16, figs. 6, 7. (nom. nud.) Patterson *et al.,* 1998, p. 18, pl. 16, figs. 4,5.

Trifarina fluens (Todd). Scott *et al.,* 1980, p. 231, pl. 4, figs. 12, 13; Scott, 1987, p. 329.

Trifarina angulosa (Williamson). Williamson *et al.,* 1984, pl. 1, fig. 15.

Description: Test free, elongate, trigonal in cross-section, angles subrounded and carinate; wall calcareous, hyaline, smooth except numerous discontinuous longitudinal costae cross suture lines and extend from base to aperture; chambers arranged in 4 to 5 whorls, initially triserial, become cuneate; sutures depressed and curved; aperture terminal, reniform, produced on a very short neck and bordered by pronounced lip; internal tooth plate extends from foramen to foramen, externally visible as narrow projection in aperture.

Remarks: Test calcareous, finely perforate, triserial, triangular in cross section, with longitudinal ridges; aperture terminal on a short neck. This species is common in some shelf environments, but is best known for its preference for continental slope environments.

Trochammina cf. T. charlottensis Cushman

Plate 3, Figures 11-12

Trochammina charlottensis Cushman, 1925, p. 39, pl. 6, fig. 4a, b; Blais, 1995, p. 92, pl. 2-3, fig. 6.; Patterson *et al.,* 1998, p. 4, pl. 26, figs. 5,6.

Description: Test free, compressed, very flat trochospiral, all chambers visible on spiral side, last 6 chambers visible on the umbilical side; wall coarsely agglutinated, opaque; sutures radiate and depressed although more so on umbilical side than spiral side; aperture a low interiomarginal arch opening into the open umbilicus.

Trochammina discorbis Earland

Plate 3, Figures 6-7

Trochammina discorbis Earland, 1934. ; Blais, 1995, p. 93, pl. 2-1, figs. 7, 8.

Trochammina inflata (Montagu)

Nautilus inflatus Montagu, 1808, p. 81, pl. 18, fig. 3.

Rotalina inflata Williamson, 1858, p. 50, pl. 4, figs. 93, 94.

Trochammina inflata (Montagu). Parker and Jones, 1859, p. 347. Phleger, 1954, p. 646, pl. 3, figs. 22, 23; Scott *et al.,* 1977, p. 1579, pl. 4, figs. 6,7; Scott and Medioli, 1980a, p. 44, pl. 3, figs. 12-14; pl. 4, figs. 1-3, Scott *et al.,* 1990, p. 733, pl. 1, figs. 3a,b; Scott *et al.,* 1991, p. 388, pl. 2, figs. 7, 8; Scott *et al.,* 1995, p. 294, figs. 6.10-17.

Remarks: Test agglutinated, trochospiral, chambers rather inflated, increasing in size gradually; aperture a low arch with a bordering lip. This is the type species of the genus *Trochammina.* This is perhaps the best known and most distinctive of all the endemic marsh species as well as being one of the earliest species ever described. It characterizes high marsh environments worldwide.

Trochammina lobata Cushman

Trochammina lobata Cushman, 1944, p. 18, pl. 2, fig. 10; Scott, 1987, p. 329.

Trochammina macrescens Brady

(forma *macrescens*)

Trochammina inflata (Montagu) var. *macrescens* Brady, 1870, p. 290, pl. 11, fig. 5. Scott, 1976b, p. 320, pl. 1, figs. 4-7; Scott *et al.,* 1977, pl. 4, figs. 6,7.

Jadammina polystoma Bartenstein and Brand, 1938, p. 381, figs. 1, 2.

Trochammina macrescens Brady. Parker, 1952, p. 460, pl. 3, fig. 3.; Phleger, 1954, p. 646, pl. 3, fig. 24; Scott and Medioli, 1980a, p. 44, pl. 3, figs. 1-12; Scott *et al.,* 1990, p. 733, pl. 1, figs. 1a,b,2a-c; Scott *et al.,* 1991, p. 388, pl. 2, figs. 10, 11; Scott *et al.,* 1995, p. 294, figs. 6.6-8.

Remarks: This species was first listed as a variety of *T. inflata* - from which it differs in being more compressed - but its distribution tends to be limited to somewhat lower salinity conditions. A high salinity ecophenotype, *T. polystoma*, often occurs with *T. inflata.* This high salinity form is sometimes called *Jadammina polystoma. T. macrescens* forms, when they occur by themselves in high numbers, generally indicate a very narrow zone near higher high water.

Trochammina nana (Brady)

Haplophragmoides nana Brady, 1881, p. 50

Haplophragmium nana Brady. Brady, 1884, p.311, pl. 35, figs. 6-8; Patterson *et al.,* 1998, p. 4, pl. 1, figs. 1-3.

Description: Test free, trochospiral, with spiral side almost flattened and umbilical side more convex, chambers somewhat inflated, particularly on umbilical side to result in lobulate test periphery; wall agglutinated, opaque, quite smooth; all chambers visible on spiral side, only final 6 to 7 visible on umbilical side; sutures radiate and depressed on both umbilical and spiral sides; aperture low interiomarginal arch extending into umbilicus.

Trochammina ochracea (Williamson)

Plate 3, Figure 8-10

Rotalina ochracea Williamson, 1858, p. 55, pl. 4, fig. 112, pl. 5, fig. 113.

Trochammina squamata Parker and Jones, 1865, p. 407, pl. 15, figs. 30, 31 a-c; Phleger and Walton, 1950, p. 281, pl. 2, figs. 12, 13; Parker, 1952, p. 408, pl. 4, figs. 11-16; Cole and Ferguson, 1975, p. 43, pl. 4, figs. 11, 12; Scott, *et al.,* 1977, p. 180, pl. 5, figs. 6, 7; Schafer and Cole, 1978, p. 29, pl. 5, fig. 1. Scott and Medioli, 1980a, p. 45, pl. 4, figs. 6, 7; Blais, 1995, p. 93, pl. 2-3, figs. 7,8.

Trochammina ochracea (Williamson). Cushman, 1920, p. 75, pl. 15, fig. 3; Scott and Medioli, 1980a, p. 45, pl. 4, figs. 4, 5.

Remarks: *T. ochracea* is distinguished from the previous two species of *Trochammina* by being very flat and concave ventrally. The distribution of this species is very hard to define because it shows up in some very strange places, such as high marsh areas in Tierra del Fuego and Alaska, as well as in upper estuarine areas in Nova Scotia and most oddly in the reefs of Bermuda (Javaux, 1999). This species is believed to be opportunistic.

Trochammina pacifica Cushman

Plate 3, Figures 13-14

Trochammina pacifica Cushman, 1925, pl. 2-2, figs. 7, 8.

Trochammina pacifica Cushman, 1939, pl. 2, figs. 6, 7. p. 103; Blais, 1995, p. 93, pl. 2-2, figs. 7,8.

Description: Test arenaceous, medium coarseness, fairly smooth finish, highly trochoid, pronounced umbilicus, chambers markedly inflated in the last whorl, even more *than T. inflata.* Aperture terminal in middle of last chamber. Aperture often covered by plug of detrital material in living specimens.

Trochammina rotaliformis Heron-Allen and Earland*

Plate 3, Figures 15-16

Trochammina rotaliformis Heron-Allen and Earland, 1911. p.309.

Trochammina rotaliformis (J. Wright MS, 1911) Heron-Allen and Earland, 1911; Heron-Allen and Earland, 1913, p. 52, pl. 3, figs. 11-13; Cushman, 1920, p.77, pl. 16, figs., 1,2; Blais, 1995, p. 93, pl. 2-3, figs. 1-3.

Remarks: *[In their *Report on some Recent Foraminifera found off the coast of Dublin and in the Irish Sea*, Balkwill and Wright (1885, *op. cit.*) illustrated four views, two umbilical and tow spiral (pl. 13, figs. 11a, b and 12 a, b) of agglutinating foraminifera which they refer to as '*Trochammina inflata* Montagu sp. var.'; no formal description was given. Twenty-six years later Heron-Allen and Earland (1911, *loc. cit.*) encountering in shore sands of Selsey Bill, Sussex, a single trochamminid which they regarded as identical with that reported by Balkwill and Wright, sent it to Joseph Wright in Ireland for a second opinion. Wright indeed agreed with their identification. In their paper, Heron-Allen and Earland cite it as "*Trochammina rotaliformis* J. Wright MS" and write "… as Mr. Wright will, we understand, describe and figure the variety shortly under the name *rotaliformis*, we refrain from further particulars of the variety which has not hitherto been accorded a distinctive name, although presenting well marked characteristics". Wright did not publish this description, but Heron-Allen and Earland by referring to Balkwill and Wright's figures, while citing Wright's manuscript name, they made the name available. Article 12 of the International Code of Zoological Nomenclature states " that names published before 1931…. must have been accompanied by a description, definition or indication [Art. 16]"; an indication being constituted under Article 16a (i) by "a bibliographic reference to a previously published description, definition or figure". An "indication" was therefore clearly given, furthermore, Heron-Allen and Earland are the authors of the name, not Wright, with 1911 being the date of availability (R.V. Melville, pers. comm.). This is contrary to subsequent references to the species as "Trochammina *rotaliformis* J. Wright MS" by Heron-Allen and Earland (1913, Roy. Irish Acad., Proc., Dublin, vol. 31 (1911-1915), sect. 3, p. 52, pl. 52, pl. 3, figs. 11-13), Cushman (1920, U.S. Nat. Mus., Bull., no. 104, pt. 2, p. 77, pl. 16, figs., 1,2) and in the Catalogue of Foraminifera (New York: American Museum of Natural History, Micropaleontology Press, 1942-, unpaginated).]

Valvulinera arctica Green

Valvulinera arctica Green, 1960; Blais, 1995, p. 93, pl. 2-5, fig. 4.

Valvulinera laeviginata Phleger, Parker and Pierson

Valvulinera laeviginata Phleger, Parker, and Pierson 1953, p. 28, pl. 13, figs. 11, 12; Scott, 1987, p. 329.

Thecamoebians

Genus **Centropyxis** Stein, 1859

(Miocene-Recent)

Type species: *Arcella aculeata* Ehrenberg, 1830.

Definition - Test from discoid (anterior angle of about 15°) to oval with flattened apertural side (anterior angle of about 60°) through a series of forms with increasingly higher anterior angle. The forms having a high anterior angle develop a backward-leaning appearance somewhat similar to that of the terrestrial gastropod *Helix*. This characteristic differentiates at first sight these forms from *Difflugia* with which they have often been confused. Peripheral spine may or may not be present; their presence and number may vary even within the same clone. Aperture variable in outline, from irregularly rounded to polyradiate, invaginated, usually in an anterior ventral position.

Approximate diameter: 100 - 400μm.

Habitat: Fresh or slightly brackish water.

Centropyxis aculeata (Ehrenberg), 1832 ab (Ehrenberg) 1830

Plate 1, Figure 14

Arcella aculeata Ehrenberg, 1832 (ab Ehrenberg, 1830, p. 60, nomen nudum), p. 91.

Centropyxis excentricus (Cushman and Brönnimann). Scott, 1976a, p. 320, pl. 1, figs. 1, 2; Scott *et al.,* 1977, p. 1578, pl. 1, figs. 1,2; Scott *et al.,*1980, p. 224, pl. 1, figs. 1-3.

Centropyxis aculeata (Ehrenberg). Stein, 1859, p. 43. Medioli and Scott, 1983, p. 39, pl. 7, figs. 10-19; Scott and Medioli, 1983, p. 819, Fig. 9I; Patterson *et al.,* 1985, p. 134, pl. 4, figs. 1-7; Scott *et al.,* 1991, p. 384, pl. 1, figs. 7-9.

Description - Test depressed; although quite variable it can be described as beret-shaped; in dorsal view, usually large and more or less circular; anterior sloping at 15° to 40°; posterior slope more pronounced; height: length ratio usually low (mostly 0.4 to 0.5). Aperture subcentral, usually slightly anterior, invaginated. Spines not always present; when present, mostly concentrated along the posterior margin. Test basically organic, mature specimens usually covered with somewhat loose, amorphous, siliceous particles, in most cases completely covering the membrane.

Approximate diameter: 100-300μm.

Habitat: Fresh or slightly brackish water.

Genus **Difflugia** Leclerc in Lamarck, 1816

(Eocene-Recent)

Type species: *Difflugia protaeiformis* Lamarck, 1816, p. 95 (with reference to material in a manuscript by LeClerc). Loeblich and Tappan, 1964, p. C35, fig. 13, no. 3. Haman, 1982, p. 367, pl. 4, figs. 1-3.

Definition - Test agglutinated; outline extremely variable, from subglobular, to flask-shaped to bullet-shaped, and often complicated by the irregular presence of blunt to acuminate spines. This genus includes a number of species that are by far the commonest fossilized thecamoebians in lacustrine deposits.

Approximate length: 30 - 450μm.

Habitat: Cosmopolitan in freshwater where it is probably the commonest genus.

Difflugia globulus (Ehrenberg) 1848

(?) *Difflugia proteiformis* Lamarck. Ehrenberg, 1848, p. 131 (part), pl. 9, figs. 1a, b.

Difflugia globulus (Ehrenberg). Cash and Hopkinson, 1909, p. 33, textfigs. 52-54, pl. 21, figs. 5-9.

Difflugia globulus (Ehrenberg), Medioli and Scott, 1983, pl. 5, figs. 1-15

Description - Test spheroidal to ellipsoidal (up to 20% longer than wide) with the oral pole truncated by a circular, occasionally slightly invaginated aperture that is usually large but can decrease in diameter to as little as 1/4. of maximum width. Overall shape resembling that of the sea urchin Echinus. At times the aperture is slightly protruding or slightly invaginated. Test composed of a chitinoid membrane covered by agglutinated quartz particles and/or diatom frustules.

The species differs from *D. corona* by the complete lack of apertural crenulation and spires, and from *D. urceolata* by the lack of a pronounced collar and by the relatively shorter main axis.

Approximate dimensions: insufficient information.

Habitat: Fresh water.

Difflugia oblonga Ehrenberg 1832

Difflugia oblonga Ehrenberg, 1832, p. 90.; Ehrenberg, 1838, p. 131, pl. 9, Fig. 2.; Medioli and Scott, 1983, p. 25, pl. 2, figs. 1-17, 24-26; Scott and Medioli, 1983, p. 818, fig. 9A-C; Patterson *et al.,* 1985, p. 134, pl. 1, figs 4-12.

Difflugia capreolata. Scott *et al.,* 1977, p. 1578, pl. 1, figs. 3,4; Scott *et al.,* 1980, p. 224, pl. 1, figs. 4-7.

Description - Test extremely variable in shape and size, pyriform to compressed and flask-shaped. In cross section rounded to slightly compressed. Fundus rounded to subacute or expanded into one to three blunt, rounded conical processes. Neck subcylindrical, more or less long, gradually narrowed toward the oral end. Aperture terminal, circular to slightly oval. Test made of sand particles sometimes mixed with a variable amount of diatom frustules that, if large, can partly or completely obscure the overall shape of the specimen.

Approximate dimensions: insufficient information.

Habitat: Fresh water.

Differs from *D. protaeiformis* by often being compressed and by lacking the acute spinal process that is so characteristic of that species. The ratio apertural diameter/maximum diameter varies between 0.5 and 0.2 while in *D. protaeiformis* it varies from 0.5 to 0.7. The test ranges from 60 to 580 μm in length, 40 to 240 μm in width, 16 to 120 μm in apertural diameter.

Difflugia protaeiformis Lamarck

Difflugia protaeiformis Lamarck, 1816, p. 95 (with reference to material in a manuscript by LeClerc).

Difflugia protaeiformis Lamarck, Medioli and Scott, 1983, p. 17, textFig.4, pl. 1, figs. 15-20

Description - Test shape extremely variable; amphora-like to elongate oval, cylindroconical, pyriform. Fundus more or less tapering, acute, either acuminate or prolonged into one or more blunt spine processes. The test blends into these processes with smooth curves. Neck long, short or absent. Aperture large, terminal, subcircular. Test composed of quartz grains of variable size and abundance, at times mixed with variable amounts of diatom frustules that, when abundant, completely obscure the shape of the test.

Approximate dimensions: length: from 84 to 520 μm, width: from 36 to 184 μm, diameter of aperture: from 24 to 100 μm.

Habitat: Fresh water.

Differs from *D. oblonga* in having smoother transition from test to spines and for its larger ratio of aperture diameter/maximum diameter which is about 0.7 to 0.5 for *D. proteiformis* and 0.5 to 0.2 for *D. oblonga.*

Genus **Lagenodifflugia** Medioli and Scott 1983

(Pleistocene-Recent)

Type specie: *Lagenodifflugia vas*, Medioli and Scott 1983

Description - Test agglutinated, with mineral xenosomes; flask-shaped, radially symmetrical and never laterally compressed; always consisting of two distinct chambers separated by a diaphragm the position of which is usually revealed from the outside by a marked constriction. Aperture simple at the upper end of the second chamber, a simple perforation in the diaphragm provides communication with the first chamber.

Approximate length: 90 - 300μm.

Habitat: Freshwater.

Nebela collaris (Ehrenberg)

Plate 2, Figure 11

Difflugia collaris Ehrenberg 1848, p. 218

Nebela collaris (Ehrenberg) Leidy 1879, pp. 145, 146, pl. 22, pl. 23, figs. 1-7, pl. 24, figs., 11,12; Scott *et al.,* 1991. p. 386, pl. 1, figs. 5,6.

Remarks: similar shape in appearance to *Difflugia*, but the test wall is composed of autogenic siliceous particles, and therefore tends to be more translucent.

Tintinnids

Tintinnopsis rioplatensis Souto

Tintinnopsis rioplatensis Souto, 1973, p. 251, figs. 5-8.

Difflugia bacillariarum Perty 1849. Medioli and Scott, 1983, p. 20, pl. 5, figs. 16-19, pl. 6, figs. 1-4.; Scott *et al.,* 2001, p. 144, pl. 3, fig. 19.

Remarks - *Tintinnopsis* is characterized by a cup-shaped lorica (test) made of xenosomes and more or less pointed at the bottom, aperture simple and large.

This tintinnid occurred with foraminifera in some samples, and being pelagic, proved to be an excellent indicator of high amounts of suspended matter. Medioli and Scott (1983) misidentified specimens of this species – from the Hudson Bay Lowland – as a thecamoebian. Later, after finding it in marine environments, they recognized its correct taxonomic position.

Plates

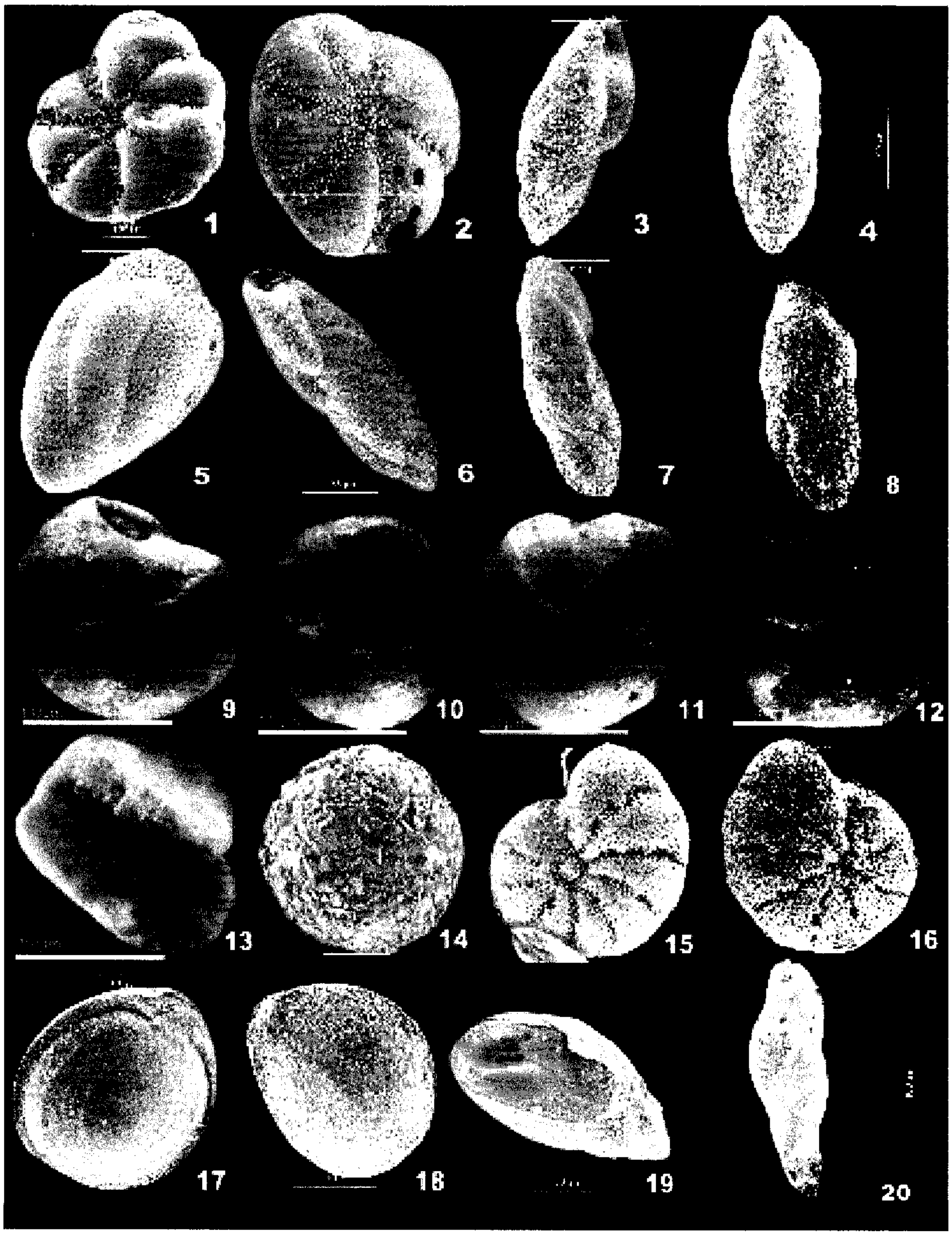
Images were captured by two methods - ESEM = Environmental Scanning Electron Microscope, and SLM = Scanning Light Microscope.

EXPLANATION OF PLATE 1

Figure #

1. *Buccella depressa, ventral view* - small dent/deformity (ESEM)
2. *Buccella frigida,* ventral view with bite marks (ESEM)
3. *Buliminella elegantissma,* apertural view (ESEM)
4. *Buliminella elegantissma,* lateral apertural view (ESEM)
5. *Buliminella elegantissma,* weird (ESEM)
6. *Buliminella elegantissma,* lateral apertural view - accentuated chambers (ESEM)
7. *Buliminella elegantissma,* dorsal view - accentuated chambers (ESEM)
8. *Buliminella elegantissma,* dorsal view - accentuated chambers (ESEM)
9. *Cassidulina subglobosa cf.,* lateral view (SLM)
10. *Cassidulina subglobosa,* apertural view (SLM)
11. *Cassidulina subglobosa,* lateral view (SLM)
12. *Cibicides lobatulus,* dorsal view (SLM)
13. *Cibicides lobatulus,* ventral view (SLM)
14. *Centropyxsis aculeata,* dorsal view (ESEM)
15. *Elphidium exclavatum clavatum,* dorsal view (ESEM)
16. *Elpidium exclavatum clavatum*, ventral view (ESEM)
17. *Fissurina subquadrata,* lateral view (ESEM)
18. *Fissurina vitreola,* lateral view (ESEM)
19. *Fursenkoina fusiformis,* apertural view (ESEM)
20. *Fursenkoina fusiformis*, lateral apertural view (ESEM)

Plate 1

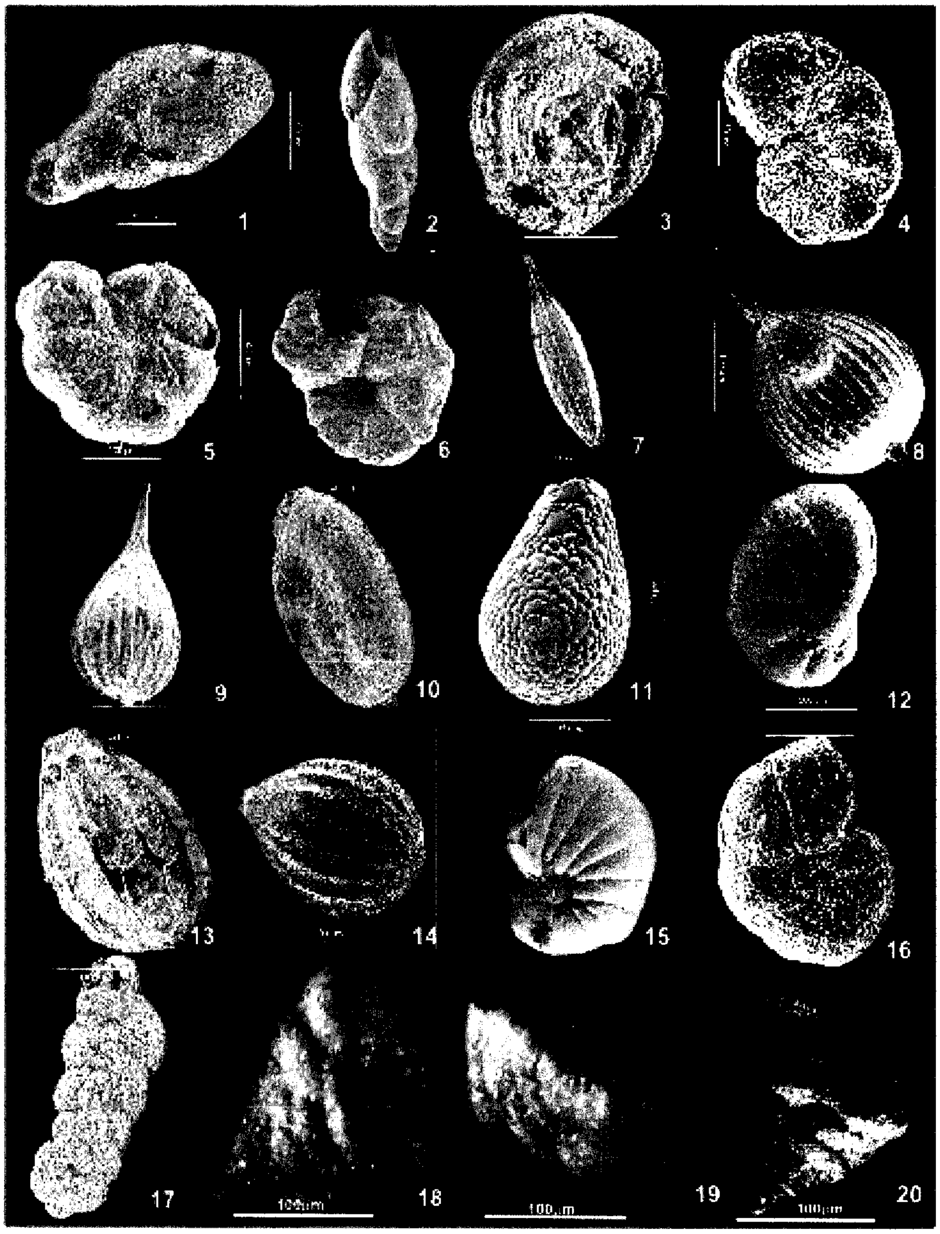


EXPLANATION OF PLATE 2

Figure #

1. *Globobulimina pupoides,* apertural view (ESEM)
2. *Globobulimina pupoides,* apertural view (ESEM)
3. *Glomospira gordialis,* ventral view? (ESEM)
4. *Haplophragmoides sp*?, ventral view (ESEM)
5. *Haplophragmoides canariensis*, dorsal view (ESEM)
6. *Haplophragmoides sp*?, ventral view (ESEM)
7. *Lagena complurecosta,* lateral view (ESEM)
8. *Lagena striata,* lateral view (ESEM)
9. *Lagena sp.,* lateral view (ESEM)
10. *Miliammina fusca,* lateral view (ESEM)
11. *Nebela collaris* (ESEM), lateral view (ESEM)
12. *Noninonella stella,* dorsal view (ESEM)
13. *Oolina melo,* lateral view (ESEM)
14. *Oolina borealis,* lateral view (ESEM)
15. *Pseudononion basispinata,* dorsal view (ESEM)
16. *Recurvoides turbinatus*, dorsal view (ESEM)
17. *Spiroplectimma biformis,* lateral view (ESEM)
18. *Textularia conica,* lateral view showing aperture (SLM)
19. *Textularia conica,* lateral view (SLM)
20. *Textularia conica*, end view (SLM)

Plate 2

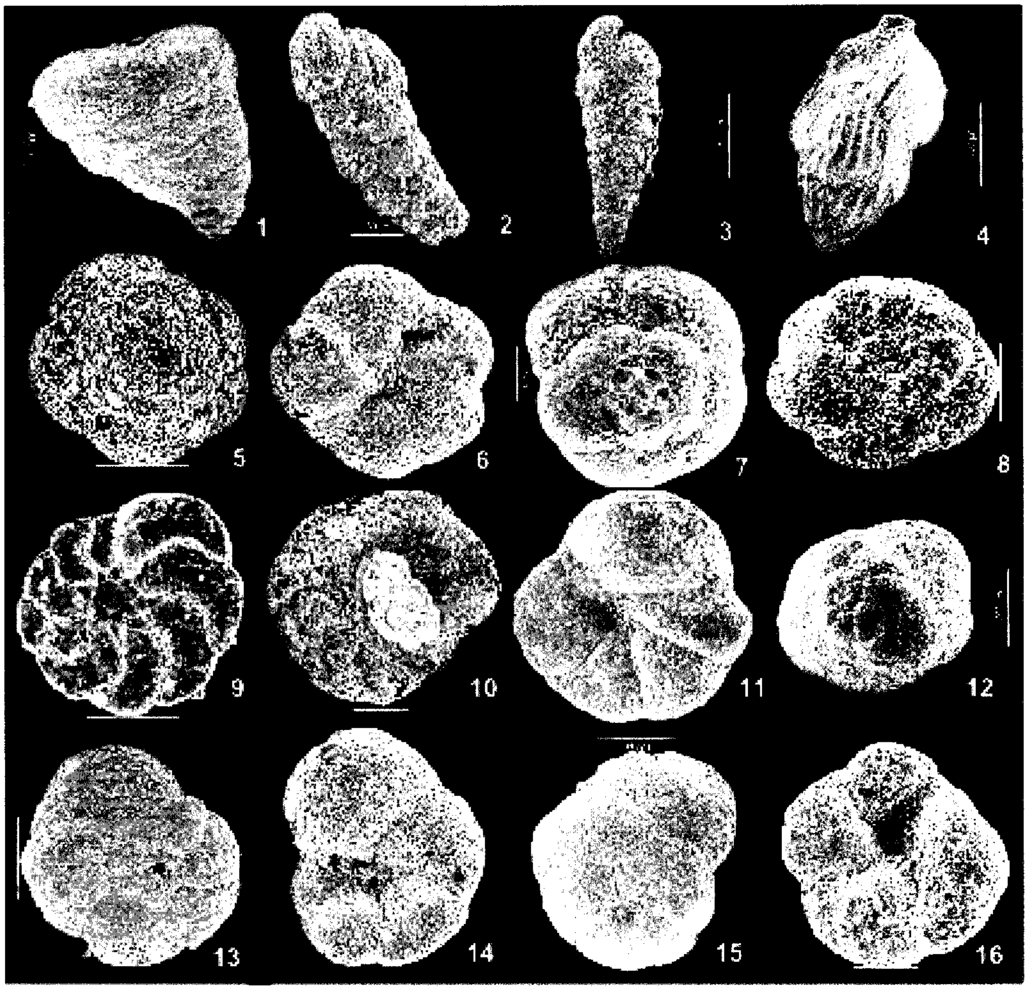


EXPLANATION OF PLATE 3

Figure #

1. *Textularia conica,* lateral view (ESEM)
2. *Textularia earlandi,* lateral view (ESEM)
3. *Textularia torquata,* lateral view (ESEM)
4. *Trifarina fluens*, lateral view (ESEM)
5. *Trochammina discorbis,* dorsal view (ESEM)
6. *Trochammina discorbis*, ventral view (ESEM)
7. *Trochammina discorbis,* dorsal view - a bit abraided (ESEM)
8. *Trochammina ochracea squamata,* dorsal view (ESEM)
9. *Trochammina ochracea squamata,* ventral view (ESEM)
10. *Trochammina ochracea squamata*, ventral views of 2 specimens (ESEM)
11. *Trochammina ochracea charlottensis,* ventral view (ESEM)
12. *Trochammina ochracea charlottensis,* dorsal view (ESEM)
13. *Trochammina pacifica*, dorsal view (ESEM)
14. *Trochammina pacifica*, ventral view (ESEM)
15. *Trochammina rotalliformis,* dorsal view (ESEM)
16. *Trochammina rotalliformis,* ventral view (ESEM)

Plate 3

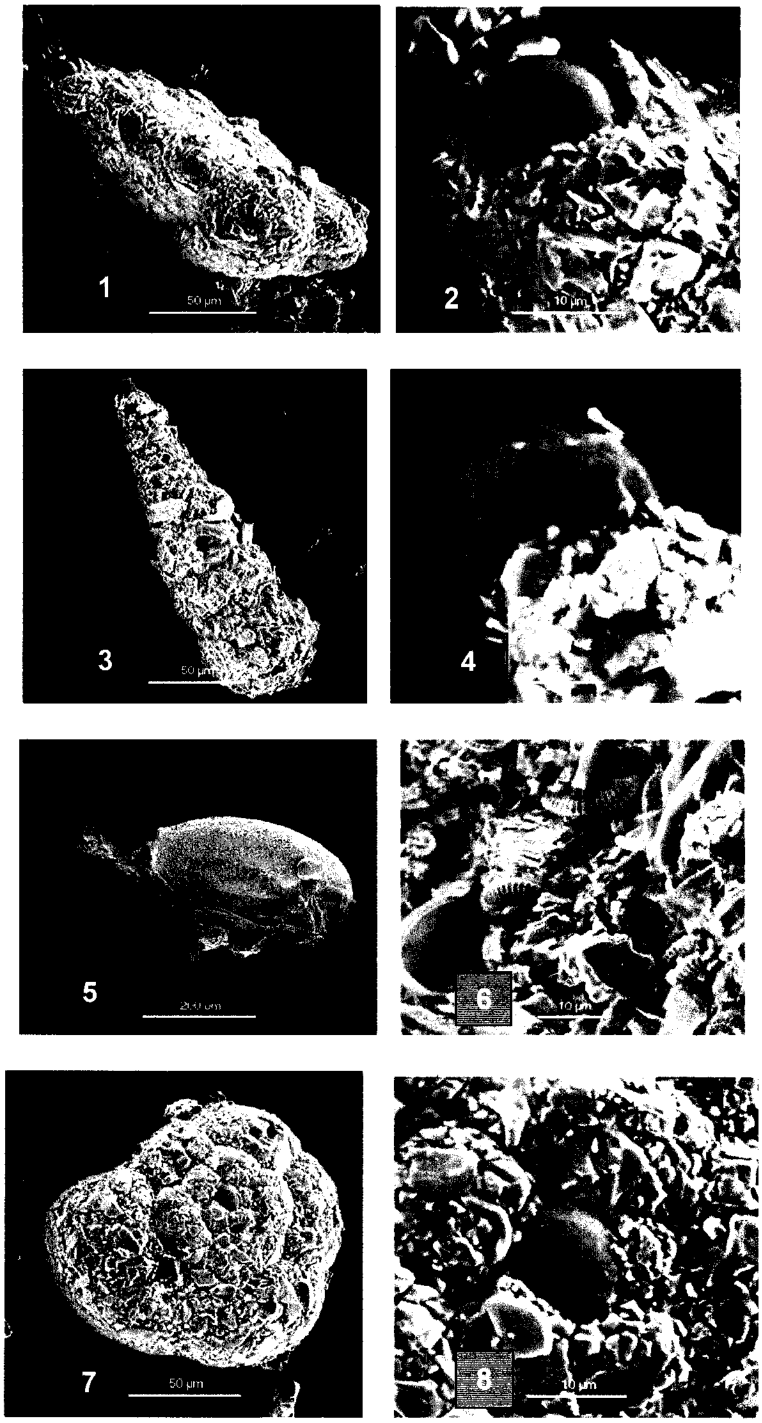


EXPLANATION OF PLATE 4

Figure #

1. *Eggerella advena,* lateral view (ESEM)
2. *Eggerella advena*, lateral view with close-up of the proloculus (ESEM)
3. *Reophax arctica,* lateral view (ESEM)
4. *Reophax arctica*, lateral view with close-up of the proloculus (ESEM)
5. *Miliammina fusca* on seaweed, lateral view (ESEM)
6. *Miliammina fusca*, close-up view of the material composing the shell (ESEM)
7. *Trochammina sp.,* dorsal view (ESEM)
8. *Trochammina sp.,* dorsal view with close-up of the proloculus (ESEM)

Plate 4



APPENDICES

Appendix 1 - Foraminiferal data

Inner basin

Tully 99b-03

corrected depth (cm)	14		22		28		32		42		52		62		72		82		92		106		114		124		129		134		144		152		157		164		176		184	
fraction (%total, %45 um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	10		10		10		10		10		10		10		10		5		7.5		10		10		10		10		10		7.5		5		10		10		10		10	
total count/10cc	220		193		136		169		484		282		169		598		139		290		184		248		167		221		549		123		19		604		564		118		94	
% #45 per 10 cc/total per 10 cc	5.45		18.7		19.1		3.56		1.65		3.55		13		4.01		8.63		0		13		3.23		2.4		14.5		0.91		15.2		8.89		6.62		2.13		10.2		6.38	
BENTHIC FORAMINFERA																																										
Adercotyma glomerata	0	0	0.53	0	0	0	0.79	0	0	0	0	0	0	0	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.26	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	4.73	0	0.83	0	0.95	0	2.37	0	0	0	0	0	0		0.73	0	0	0	0	0	0.63	0	0	0	0	0	0		0.33	0	0.35	0	1.69	0	0	0
Bolivina pacifica	0	0	0	0	0	0	0	0	0	0	0.95	0	0	0	1.34	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Buccella depressa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Buccella frigida	0	0	0	0	0	0	0	0	1.65	0	0	0	0	0	4.01	0	0	0	0.82		0	0	0	0	0	0	1.27	0	0	0	0	0	0		0	0	0	0	5.08	0	2.13	0
Buliminella elegantissma	0	0	0	0	0	0	0	0	9.09	0	0	0	0	0	1.34	0	2.16	0	0		0	0	0	0	0	0	4.43	0	4.37	0	0	0	0		0	0	8.87	0	6.78	0	0	0
calcareous fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	1.69	0	0	0
Cassindulina subglobosa cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0.73	0	0	0	0		0	0	0	0	1.69	0	0	0
Cibicides sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0.72	0	0		0	0	0	0	0	0	1.27	0	0.73	0	0	0	0		0	0	0	0	1.69	0	2.13	0
Cribrostomoides crassmargo	0.73	0	0	0	0.74	0	0.79	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0.72	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Elphidiella hannai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Elphidiella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1.28	0	0		0	0	0	0	0	0	0	0
Elphidium crispum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0.35	0	0	0	0	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1.46	0	0	0	0		0	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.72	0	0		0	0	0	0	0	0	0.63	0	0	0	0	0	0		0	0	1.42	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.67	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Epistominella vitrea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Fissurina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Fursenkoina fusiformis	0	0	0	0	0	0	0	0	4.96	0	0	0	0	0	15.7	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0.71	0	0	0	0	0
Glomerspira gordialis	2.18	0	2.07	0	2.21	1.47	0	0	1.65	0	1.65	0.71	0.59	0	0	0	1.44	0	0		0	0	0	0	0	0	0	0	0.73	0	0	0	0		0	0	0	0	0	0	0	0
Haplophragmoides sp.	0	0	1.04	0	14	0	14.2	0	0	0	3.78	0	1.18	0	0.67	0	2.88	0	1.64		2.17	0	1.61	0	3.99	0	0	0	2.91	0	1.28	0	0		1.66	0	0.71	0	3.39	0	0	0
Islandiella norcrossi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Lagena sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Milammina fusca	0	0	1.04	0	1.47	0	4.73	0	0.83	0	0	0	1.78	0	1	0	2.88	0	7.36		1.45	0	1.34	0.81	2.4	0	0	0	0.73	0	1.28	0	0		0	0	0	0	1.69	0	4.26	0
Nonionella turgida/digitata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Nonionella stella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Nonionella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Pseudononion basispinata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Oolina spp.	1.45	0	0	0	0.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Recuvoides turbinatus	0.73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	1.06	0	0	0	0	0
Reophax arctica	1.45	0	6.2	0	2.21	0	7.89	0	3.31	0	6.62	0	0	0	3.34	0	5.04	0	6.54		0.73	0	2.96	0.81	3.19	0	8.86	1.27	6.56	0	2.56	0	0		2.98	0	4.61	0	10.2	0	4.26	2.13
Reophax curtis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Reophax nana	4.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Reophax nodulosa	0	0	0	0	0	0	0	0	1.65	0	0	0	5.92	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Reophax scottii	47.8	2.7	38.3	3.11	15.4	7.35	7.35	11.1	53.3	1.24	34.3	2.13	33.1	1.18	31.1	2.01	13.7	1.44	27.8		2.17	0	18.8	1.61	3.99	0	37.3	2.53	64.7	0.55	17.9	3.85	5.26		71.5	4.3	67.4	4.61	27.1	0	21.3	0
Rosalina columbiensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Saccamina difflugiformis	2.55	1.8	7.25	7.25	5.88	5.88	0	0	0.41	0.41	0	0	0	0	0.67	0	0	0	0.82		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Spiroplectimma biformis	0	0	3.11	0	0.74	0	0	0	0	0	1.89	0	6.51	0	1.34	0	0	0	1.64		0	0	0	0	1.2	1.2	1.27	0	1.46	0	0	0	0		0.66	0.33	1.42	0.35	3.39	0	0	0
Textualaria agglutinans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Textularia earlandi	0	0	0	0	0	0	0	0	0.83	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	5.26		0.66	0	0	0	1.69	0	2.13	2.13
Textualaria torquata	0	0	0	0	0.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Tiphotrocha comprimata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	0	0	3.16	0	0	0	0	0	1.18	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Trochammina discorbis	1.45	0	0	0	9.56	0	12.6	0	0	0	8.51	0	0.59	0	0.67	0	6.47	0	1.64		0.73	0	0	0	1.6	0	1.27	0	0	0	3.21	1.92	0		1.66	0	3.19	0	1.69	0	2.13	0
Trochammina inflata	2.91	0	2.59	0	1.47	0	2.37	0	6.61	0	0.95	0	0.59	0	1.34	0	1.44	0	7.36		6.52	0	3.76	0	3.99	0	16.5	0	2.19	0	6.41	0	0		0.33	0	0.71	0	3.39	0	4.26	0
Trochammina lobata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0.73	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Trochammina macrens	0	0	1.55	0	0	0	0	0	0	0	0	0	0.59	0	0	0	1.44	0	0		0.73	0	0	0	0	0	0	0	0	0	0	0	0		0.33	0	0	0	0	0	0	0
Trochammina nana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0.33	0	0	0	0	0	0	0
Trochammina ochracea	8	0	6.73	0	6.6	0	4.73	1.18	0	0	6.62	0	7.69	1.18	3.68	0	8.63	0	14.7		9.4	0	4.9	0	10.6	0	5.06	0	2.91	0	7.69	0	10.5		3.97	0	2.48	0	1.69	0	10.6	0
Trochammina pacifica	6.55	0	1.55	0	0	0	1.58	0	0.83	0	1.89	0	0.59	0	0	0	0	0	3.27		2.9	0	3.4	0	0	0	1.27	0	0	0	0	0	0		0.33	0	0.35	0	0	0	0	0
Trochammina rotaliformis	0	0	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Trochammina sp.-lobate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Trochammina sp.-lesslob.	0	0	0	0	0	0	0	0	0.83	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0.35	0	0	0	0	0
Trochammina sp. (tiny)	0.73	0	4.15	4.15	0	0	0	0	0	0	4.49	0.71	2.37	1.18	2.34	0	2.88	0	0		0	0	1.61	0	2.4	0	1.27	0	4.37	0	5.13	0	0		0.33	0	0	0	3.39	3.39	0	0
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.82		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Valvulinera arctica.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0.35	0	0	0	0	0
organic linings	0	0	1.04	0	0.74	0	1.58	0	0.83	0	0	0	1.18	0	0.33	0	0.72	0	0.82		2.9	0	2.15	0	0.8	0	0.63	0	1.46	0	0	0	5.26		0.66	0	0	0	0	0	2.13	0
weird-ufo	0	0	0	0	0	0	3.95	0	0.83	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0.8	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0

corrected depth (cm)	14		22		26		32		42		52		62		72		82		92		106		114		124		129		134		144		152		157		164		176		184	
fraction (%total, % 45um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	10		10		10		10		10		10		10		10		5		7.5		10		10		10		10		10		7.5		5		10		10		10		10	
total count/10cc	220		193		136		169		484		282		169		598		139		290		184		248		167		221		549		123		19		604		564		118		94	
% #45 per 10 cc/total per 10 cc	5.45		18.7		19.1		3.56		1.65		3.55		13		4.01		8.63		0		13		3.23		2.4		14.5		0.91		15.2		8.89		6.62		2.13		10.2		6.38	
PLANKTONIC FORAMINIFERA																																										
planktonics	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.34	0	0	0	0		0	0	0	0	0	0	1.27	0	0	0	0	0	0		0	0	0	0	0	0	0	0
THECAMOEBIANS																																										
Centropyxis aculeata	6	0.91	9.8	4.1	11.8	4.41	7.89	0	1.65	0	7.57	0	7.69	0	15.7	0	21.6	0	41.7		26.8	4.34	30.7	0	37.5	0	12	2.53	0.91	0.18	21.8	0	36.8		5.3	0	2.13	0	6.78	0	14.9	0
Tintinnopsis rioplatensis	0	0	0	0	0	0	0	0	0	0	0	0	0.59	0	0	0	0.72	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Difflugia globulus	0	0	2.07	0	2.94	0	0	0	2.48	0	1.89	0	4.14	0	0	0	0	0	0		10.9	0	0	0	0	0	0	0	0	0	0	0	0		0	0	1.42	0	3.39	0	0	0
Difflugia oblongata	9.45	0	5.2	0	20.6	0	14.2	0	4.13	0	8.51	0	16.6	9.47	8.03	2.01	12.2	2.88	0		11.6	8.69	3.76	0	3.59	1.2	3.8	3.8	0.18	0.18	7.69	7.69	26.3		1.66	1.66	4.61	1.77	6.78	6.78	2.13	2.13
Lagenodifflugia sp.	5.09	0	4.66	0	0.74	0	0	0	3.31	0	4.73	0	7.1	0	5.02	0	17.3	0	16.4		20.3	0	19.4	0	12.8	0	6.33	0	3.64	0	23.1	0	5.26		6.95	0	2.13	0	6.78	0	27.7	0
Lagenodifflugia sp.2(ball)	0.73	0	0	0	0.74	0	3.95	0	0	0	5.67	0	3.55	0	0	0	2.88	0	0		0	0	3.76	0	10.4	0	3.16	0	0	0	1.28	0	0		0	0	0.35	0	0	0	0	0

corrected depth (cm)	194		200		204		214		224		234		266		280		286		290		300		305		315		324		335		344		346		351		255		361		365	
fraction (%total, %45 um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	10		10		10		10		10		10		5		5		10		10		10		10		10		10		7.5		10		10		10		10		10		5	
total count/10cc	141		101		175		162		51		36.7		46		78		113		55		28		85		28.8		26		54.1		140		96		39		49		75		116	
% #45 per 10 cc/total per 10 cc	1.42		0		1.14		7.41		0		27.3		8.7		5.13		7.08		18.2		28.6		0		0		7.69		14.8		1.43		6.25		5.13		12.2		0		0	
BENTHIC FORAMINFERA																																										
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0		0	0	0	0	0		0	0	0	0	0	0	5.31	0	1.82	0	0	0	0		0		0	0	2.17	0	1.43	0	8.33	0	10.3	0	4.08	0	0		0	
Bolivina pacifica	0	0	0		3.81	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Brizalina subaenariensis	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	2.08	0	0	0	0	0	0		0	
Buccella depressa	0	0	0		2.29	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	2.14	0	0	0	0	0	0	0	0		0	
Buccella frigida	5.67	0	0		6.1	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	7.86	0	0	0	0	0	0	0	10.7		0	
Buliminella elegantissma	0	0	0		3.81	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		5.52		0	0	0	0	2.14	0	0	0	0	0	0	0	1.33		0	
calcareous fragments	0.95	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	1.33		0	
Cassindulina subglobosa cf.	0	0	0		0.76	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	1.33		0	
Cibicides sp.	3.78	0	0		8.38	0	0	0	0		0	0	0	0	0	0	0	0	1.82	0	0	0	0		0		0	0	0	0	1.43	0	0	0	0	0	0	0	32		0	
Cribrostomoides crassmargo	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	1.18		0		0	0	0	0	0	0	2.08	0	0	0	2.04	0	0		0	
Eggerella advena	0	0	0		0	0	0.62	0	0		0	0	0	0	2.56	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Elphidiella hannai	0	0	0		1.52	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	2.67		0	
Elphidiella sp.	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Elphidium crispum	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Elphidium exclavatum	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Elphidium frigidium	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Elphidium subarcticum	0	0	0		0.76	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	1.43	0	0	0	0	0	0	0	5.33		0	
Elphidium spp. (tiny)	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	1.43	0	0	0	0	0	0	0	1.33		0	
Epistominella vitrea	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	1.33		0	
Fissurina spp.	0.95	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Fursenkoina fusiformis	9.46	0	0		39.6	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	5	0	0	0	0	0	0	0	0		0	
Glomerspira gordialis	0.95	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		3.45	
Haplophragmoides sp.	3.78	0	0		0	0	1.23	0	1.96		0	0	4.35	0	2.56	0	19.5	0	5.45	0	7.14	0	0		5.52		15.4	0	0	0	5.71	0	19.8	0	15.4	0	4.08	0	6.67		6.9	
Islandiella norcrossi	0.95	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		5.52		0	0	0	0	1.43	0	0	0	0	0	0	0	1.33		0	
Islandiella teretis	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Lagena sp.	0.95	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0.71	0	0	0	0	0	0	0	0		0	
Milammina fusca	2.84	0	3.96		0	0	3.09	0	1.96		0	0	0	0	5.13	0	5.31	0	12.7	0	10.7	0	12.9		0		23.1	0	6.52	0	0.71	0	2.08	0	10.3	0	4.08	0	4		10.3	
Nonionella turgida/digitata	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Nonionella stella	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	1.33		0	
Nonionella sp.	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Pseudononion basispinata	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Oolina spp.	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Recuvoides turbinatus	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Reophax arctica	0	0	1.98		0.76	0	6.79	0	0		3.6	0	0	0	0	0	5.31	0	1.82	0	0	0	9.41		0		3.85	0	2.17	0	2.14	0	8.33	0	7.69	0	8.16	0	0		3.45	
Reophax curtis	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	1.33		0	
Reophax nana	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Reophax nodulosa	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Reophax scottii	8.98	1.42	1.98		0	0	48.1	4.94	7.84		18	0	4.35	0	10.3	0	3.54	0	0	0	0	0	20		5.52		7.69	0	0	0	16.4	1.43	7.29	2.08	0	0	20.4	4.08	2.67		6.9	
Rosalina columbiensis	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Saccamina difflugiformis	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Spiroplectimma biformis	0.95	0	0		0.76	0	0	0	0		3.6	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	2.04	0	0		3.45	
Textualaria agglutinans	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	2.56	0	0	0	0		0	
Textularia conica	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	2.67		0	
Textularia earlandi	0	0	0		0	0	0	0	0		9.01	5.41	0	0	0	0	2.65	0	3.64	3.64	0	0	1.18		0		0	0	0	0	0	0	0	0	0	0	0	0	0		6.9	
Textualaria torquata	0	0	0.99		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Tiphotrocha comprimata	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Trifarina fluens	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	1.43	0	0	0	0	0	0	0	0		0	
Trochammina charlottensis	0	0	0		0	0	1.23	0	0		0	0	0	0	0	0	2.65	0	1.82	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	1.33		3.45	
Trochammina discorbis	4.73	0	2.97		1.52	0	2.47	0	7.84		0	0	0	0	7.69	0	7.08	0	0	0	0	0	1.18		11		15.4	0	4.35	0	2.14	0	9.38	0	0	0	6.12	0	0		0	
Trochammina inflata	2.84	0	11.9		0	0	1.23	0	0		0	0	4.35	0	0	0	5.31	0	7.27	0	0	0	1.18		0		15.4	0	8.7	0	2.14	0	8.33	0	2.56	0	2.04	0	2.67		6.9	
Trochammina lobata	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Trochammina macrens	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	10.7	0	0		0		3.85	0	0	0	1.43	0	1.04	0	0	0	2.04	0	0		3.45	
Trochammina nana	0.95	0	0.99		0	0	0.62	0	1.96		3.6	0	0	0	0	0	0.88	0	0	0	0	0	0		0		3.85	0	4.35	0	0	0	1.04	0	0	0	0	0	0		0	
Trochammina ochracea	8.51	0	2.97		2.29	0	6.17	0	9.8		7.21	0	13	0	17.9	5.13	8.85	0	1.82	0	10.7	0	5.88		22.1		15.4	7.69	2.17	0	7.86	0	8.33	0	12.8	0	10.2	4.08	1.33		3.45	
Trochammina pacifica	0.95	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	1.04	0	0	0	0	0	0		0	
Trochammina rotaliformis	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	5.71	0	3.13	0	0	0	0	0	0		0	
Trochammina sp.-lobate	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Trochammina sp.-lesslob.	0	0	0		0	0	0	0	1.96		0	0	0	0	30.8	0	0.88	0	0	0	0	0	0		5.52		0	0	4.35	0	0	0	0	0	0	0	2.04	0	1.33		0	
Trochammina sp. (tiny)	0	0	0		1.52	0	0	0	0		0	0	0	0	0	0	0	0	3.64	0	0	0	1.18		0		3.85	0	2.17	0	4.29	0	9.38	4.17	0	0	4.08	0	4		3.45	
Trochammina sp.	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Valvulinera arctica.	0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
organic linings	0.95	0	1.98		0.76	0	1.23	0	3.92		0	0	0	0	0	0	0.88	0	3.64	0	0	0	3.53		0		0	0	0	0	0.71	0	2.08	0	0	0	0	0	0		0	
weird-ufo	0	0	0		0	0	0	0	1.96		0	0	0	0	0	0	0.88	0	0	0	3.57	0	0		0		0	0	0	0	1.43	0	0	0	0	0	0	0	2.67		10.3	

corrected depth (cm)	194		200		204		214		224		234		266		280		286		290	
fraction (%total, % 45um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	10		10		10		10		10		10		5		5		10		10	
total count/10cc	141		101		175		162		51		36.7		46		78		113		55	
% #45 per 10 cc/total per 10 cc	1.42		0		1.14		7.41		0		27.3		8.7		5.13		7.08		18.2	
PLANKTONIC FORAMINIFERA																				
planktonics	1.89	0	0		6.86	0	0	0	0		0	0	0	0	0	0	0	0	0	0
THECAMOEBIANS																				
Centropyxsis aculeata	15.1	0	16.8		6.86	0	10.5	0	19.6		10.8	0	0	0	5.13	0	5.31	0	23.6	10.9
Tintinnopsis rioplatensis	0	0	0.99		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Difflugia globulus	10.4	0	22.8		0	0	1.23	0	7.84		7.21	0	17.4	0	5.13	0	0.88	0	0	0
Difflugia oblongata	0	0	27.7		1.9	1.14	8.02	2.47	0		21.6	21.6	13	8.7	5.13	0	24.8	7.08	25.5	3.64
Lagenodifflugia sp.	13.2	0	1.98		5.33	0	7.41	0	33.3		3.6	0	39.1	0	30.8	0	0	0	3.64	0
Lagenodifflugia sp.2(ball)	0	0	0		0.76	0	0	0	0		10.8	0	8.7	0	5.13	0	0	0	1.82	0

corrected depth (cm)	300		305		315		324		335		344		346		351		355		361		365	
fraction (%total, % 45um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	10		10		10		10		7.5		10		10		10		10		10		5	
total count/10cc	28		85		28.8		26		54.1		140		96		39		49		75		116	
% #45 per 10 cc/total per 10 cc	28.6		0		0		7.69		14.8		1.43		6.25		5.13		12.2		0		0	
PLANKTONIC FORAMINIFERA																						
planktonics	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
THECAMOEBIANS																						
Centropyxsis aculeata	32.1	7.14	16.5		11		0	0	19.6	0	4.29	0	0	0	10.3	5.13	8.16	0	1.33		17.2	
Tintinnopsis rioplatensis	14.3	14.3	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Difflugia globulus	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Difflugia oblongata	10.7	7.14	4.71		0		0	0	15.2	13	0	0	6.25	0	12.8	0	16.3	4.08	6.67		0	
Lagenodifflugia sp.	0	0	17.6		27.6		0	0	30.4	0	10.7	0	0	0	12.8	0	0	0	1.33		6.9	
Lagenodifflugia sp.2(ball)	0	0	3.53		0		0	0	0	0	0	0	0	0	0	0	0	0	0		3.45	

corrected depth (cm)	375		389		395		400		407		412		418		427		433		437		442		447		457		467		477		487		497		502		507		517		554	
fraction (%total, %45 um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	5		10		10		10		10		10		10		10		10		10		10		10		10		10		7.5		10		7.5		10		7.5		10		10	
total count/10cc	72		71		9		86		75		108		86		26		46		43		58		54		41		107		146		126		99.7		94		61.9		37		34	
% #45 per 10 cc/total per 10 cc	38.9		11.3		22.2		4.65		13.3		3.7		2.33		15.4		13		4.65		0		11.1		9.76		3.74		27.7		1.59		20.3		4.26		16.4		5.41		0	
BENTHIC FORAMINFERA																																										
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.17	0	0	0	1.72		1.85	0	0	0	0	0	4.84	0	2.38	0	0	0	3.19	0	0	0	0	0	0	
Bolivina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.17	0	0	0	0	0	0		0	0	2.44	0	0	0	0.81	0	0	0	0	0	0	0	0	0	0	0	0	
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.17	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0.79	0	0	0	1.06	0	0	0	0	0	0	
Buccella depressa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Buccella frigida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.52	0	0	0	5.17		3.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.94	
Buliminella elegantissma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.17	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
calcareous fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cassindulina subglobosa cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cibicides sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.33	0	4.35	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.7	0	0	
Cribrostomoides crassmargo	0	0	0	0	0	0	1.16	0	0	0	0.93	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0.81	0	0.79	0	0	0	1.06	0	0	0	0	0	0	
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	
Elphidiella hannai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Elphidiella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Elphidium crispum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Elphidium subarcticum	0	0	0	0	0	0	0	0	0	0	0.93	0	0	0	0	0	2.17	0	0	0	1.72		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Epistominella vitrea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Fissurina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Fursenkoina fusiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33.3	0	2.17	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.88	
Glomerspira gordialis	2.78	0	0	0	0	0	1.16	0	0	0	0	0	1.16	0	0	0	2.17	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Haplophragmoides sp.	0	0	0	0	0	0	11.6	0	2.67	0	6.48	0	8.14	0	0	0	2.17	0	6.98	0	5.17		0	0	2.44	0	3.74	0	10.5	0	25.4	0	1.22	0	9.57	2.13	8	4	10.8	0	0	
Islandiella norcrossi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Lagena sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.94	
Milammina fusca	8.33	0	8.45	0	0	0	8.14	0	17.3	0	9.26	0	20.9	0	8.33	0	10.9	0	9.3	0	15.5		3.7	0	9.76	0	0	0	2.42	0	7.14	0	0	0	4.26	0	4	0	5.41	0	8.82	
Nonionella turgida/digitata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Nonionella stella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Nonionella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pseudononion basispinata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Oolina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Recuvoides turbinatus	0	0	0	0	0	0	0	0	0	0	0.93	0	0	0	0	0	0	0	4.65	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Reophax arctica	0	0	2.82	0	11.1	0	5.81	0	2.67	0	13.9	0	17.4	0	0	0	0	0	2.33	0	8.62		7.41	0	0	0	10.3	0	11.3	3.23	3.97	0	7.32	0	5.32	0	4	0	0	0	0	
Reophax curtis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Reophax nana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Reophax nodulosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.33	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Reophax scottii	11.1	5.56	5.63	0	0	0	16.3	0	6.67	2.67	12	0	4.65	0	0	0	0	0	4.65	0	8.62		14.8	0	2.44	0	50.5	3.74	4.84	1.61	7.94	1.59	52.4	2.44	7.45	0	0	0	5.41	5.41	0	
Rosalina columbiensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0.79	0	0	0	0	0	0	0	0	0	0	
Saccamina difflugiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Spiroplectimma biformis	5.56	5.56	0	0	0	0	1.16	0	0	0	0.93	0	0	0	8.33	0	0	0	0	0	0		1.85	0	2.44	0	0	0	0.81	0	0.79	0	0	0	0	0	0	0	0	0	0	
Textualaria agglutinans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Textularia conica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Textularia earlandi	0	0	1.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.33	0	0		13	11.1	4.88	4.88	0.93	0	1.61	0	1.59	0	0	0	1.06	0	0	0	0	0	0	
Textualaria torquata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tiphotrocha comprimata	0	0	0	0	0	0	1.16	0	0	0	0	0	0	0	0	0	2.17	0	0	0	0		0	0	0	0	0	0	3.23	0	0.79	0	1.22	0	0	0	0	0	0	0	2.94	
Trifarina fluens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Trochammina charlottensis	0	0	2.82	0	0	0	2.33	0	0	0	0	0	1.16	0	0	0	0	0	2.33	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Trochammina discorbis	2.78	0	1.41	0	0	0	9.3	0	1.33	0	0.93	0	0	0	0	0	4.35	0	4.65	0	1.72		1.85	0	2.44	0	1.87	0	4.03	0	8.73	0	6.1	0	16	0	12	0	0	0	5.88	
Trochammina inflata	8.33	0	1.41	0	0	0	0	0	0	0	0	0	2.33	0	0	0	2.17	0	0	0	0		0	0	0	0	0	0	1.61	0	0	0	0	0	1.06	0	0	0	2.7	0	0	
Trochammina lobata	0	0	0	0	0	0	1.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Trochammina macrens	0	0	2.82	0	0	0	6.98	0	0	0	0.93	0	0	0	0	0	0	0	0	0	0		1.85	0	0	0	2.8	0	0.81	0	0	0	0	0	1.06	0	0	0	2.7	0	0	
Trochammina nana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.17	0	0	0	0		0	0	0	0	0	0	0	0	3.17	0	0	0	2.13	0	2	0	0	0	0	
Trochammina ochracea	2.78	0	5.63	0	0	0	3.49	0	9.33	0	11.1	0	6.98	0	0	0	10.9	0	4.65	0	5.17		11.1	0	9.76	0	9.35	0	8.87	0	6.35	0	3.66	0	11.7	0	22	0	0	0	11.8	
Trochammina pacifica	5.56	0	0	0	0	0	0	0	1.33	0	0	0	1.16	0	0	0	2.17	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Trochammina rotaliformis	2.78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.33	0	0		0	0	0	0	0	0	0.81	0	1.59	0	0	0	0	0	0	0	0	0	0	
Trochammina sp.-lobate	0	0	0	0	0	0	0	0	0	0	4.63	0	3.49	0	0	0	0	0	0	0	0		0	0	7.32	0	0.93	0	3.23	0	8.73	0	2.44	0	8.51	0	12	0	2.7	0	2.94	
Trochammina sp.-lesslob.	2.78	0	0	0	0	0	0	0	1.33	0	0	0	0	0	0	0	10.9	0	9.3	0	5.17		1.85	0	0	0	0.93	0	5.65	0	10.3	0	1.22	0	0	0	10	0	8.11	0	5.88	
Trochammina sp. (tiny)	0	0	7.04	5.63	33.3	0	1.16	0	4	0	0.93	0	2.33	0	0	0	0	0	2.33	0	5.17		3.7	0	14.6	0	4.67	0	8.87	1.61	3.17	0	3.66	0	10.6	0	6	0	2.7	0	11.8	
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Valvulinera arctica.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
organic linings	0	0	1.41	0	0	0	0	0	1.33	0	0.93	0	2.33	2.33	0	0	0	0	2.33	0	1.72		1.85	0	0	0	0	0	3.23	0	3.17	0	2.44	2.44	0	0	0	0	8.11	0	5.88	
weird-ufo	0	0	0	0	0	0	0	0	0	0	0.93	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

corrected depth (cm)	375		389		395		400		407		412		418	
fraction (%total, % 45um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	5		10		10		10		10		10		10	
total count/10cc	72		71		9		86		75		108		86	
% #45 per 10 cc/total per 10 cc	38.9		11.3		22.2		4.65		13.3		3.7		2.33	
PLANKTONIC FORAMINIFERA														
planktonics	0	0	0	0	0	0	0	0	1.33	0	0	0	0	0
THECAMOEBIANS														
Centropyxis aculeata	41.7	27.8	12.7	0	0	0	10.5	2.33	5.33	0	14.8	3.7	0	0
Tintinnopsis rioplatensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia globulus	0	0	0	0	0	0	0	0	2.67	0	4.63	0	5.81	0
Difflugia oblongata	2.78	0	26.8	5.63	22.2	22.2	3.49	2.33	5.33	5.33	11.1	0	1.16	0
Lagenodifflugia sp.	2.78	0	19.7	0	33.3	0	15.1	0	25.3	0	0	0	19.8	0
Lagenodifflugia sp.2(ball)	0	0	0	0	0	0	0	0	6.67	0	7.41	0	0	0

corrected depth (cm)	427		433		437		442		447		457		467	
fraction (%total, % 45um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	10		10		10		10		10		10		10	
total count/10cc	26		46		43		58		54		41		107	
% #45 per 10 cc/total per 10 cc	15.4		13		4.65		0		11.1		9.76		3.74	
PLANKTONIC FORAMINIFERA														
planktonics	0	0	0	0	0	0	0		0	0	0	0	0	0
THECAMOEBIANS														
Centropyxis aculeata	0	0	15.2	13	6.98	0	5.17		11.1	0	7.32	0	5.61	0
Tintinnopsis rioplatensis	0	0	0	0	0	0	0		0	0	0	0	0	0
Difflugia globulus	8.33	0	2.17	0	0	0	1.72		3.7	0	2.44	0	1.87	0
Difflugia oblongata	12.5	8.33	8.7	0	23.3	4.65	0		7.41	7.41	9.76	4.88	0	0
Lagenodifflugia sp.	8.33	0	4.35	0	9.3	0	29.3		20.4	0	22	0	7.48	0
Lagenodifflugia sp.2(ball)	0	0	0	0	0	0	0		0	0	0	0	0	0

corrected depth (cm)	477		487		497		502		507		517		554	
fraction (%total, % 45um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	7.5		10		7.5		10		7.5		10		10	
total count/10cc	146		126		99.7		94		61.9		37		34	
% #45 per 10 cc/total per 10 cc	27.7		1.59		20.3		4.26		16.4		5.41		0	
PLANKTONIC FORAMINIFERA														
planktonics	0	0	0	0	0	0	0	0	0	0	0	0	0	
THECAMOEBIANS														
Centropyxis aculeata	6.45	3.23	0.79	0	3.66	0	1.06	0	4	0	10.8	0	14.7	
Tintinnopsis rioplatensis	0	0	0	0	0	0	0	0	0	0	0	0	0	
Difflugia globulus	5.65	0	0	0	0	0	2.13	0	6	0	0	0	2.94	
Difflugia oblongata	3.23	3.23	0	0	4.88	4.88	2.13	2.13	4	4	0	0	0	
Lagenodifflugia sp.	5.65	0	3.17	0	9.76	0	16	0	4	0	27	0	14.7	
Lagenodifflugia sp.2(ball)	0	0	0	0	0	0	0	0	0	0	0	0	0	

corrected depth (cm)	563		573		579		583		593		602		608		612		619		623		625		628		633		643		653		663		673		683		692		700		708	
fraction (%total, %45 um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	10		10		10		10		5		10		10		10		10		10		10		10		10		10		10		10		10		10		5		10		10	
total count/10cc	15		24		30		18		8		247		25		53		9		143		28		32		22		177		14		21		50		51		26		26		90	
% #45 per 10 cc/total per 10 cc	0		0		0		0		0		0		8		7.55		22.2		0		0		0		18.2		0		0		0		20		0		3.42		7.69		2.22	
BENTHIC FORAMINFERA																																										
Adercotyma glomerata	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
agglutinated fragments	0		4.17		6.67		11.1		0		1.44	0	0	0	0	0	0	0	0		0		0		0	0	0		7.14		0		0	0	5.88		0	0	0	0	2.22	0
Bolivina pacifica	0		0		0		0		0		4.32	0	0	0	0	0	0	0	0		0		0		0	0	2.82		0		0		0	0	0		0	0	0	0	2.22	0
Brizalina subaenariensis	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Buccella depressa	0		0		0		0		0		4.32	0	0	0	0	0	0	0	0		0		0		0	0	0.56		0		0		0	0	1.96		0	0	0	0	3.33	0
Buccella frigida	0		0		3.33		0		0		23.8	0	0	0	0	0	0	0	18.2		0		0		0	0	16.9		0		0		12	4	31.4		0	0	0	0	14.4	0
Buliminella elegantissma	0		0		3.33		0		0		0.72	0	0	0	0	0	0	0	6.29		0		0		0	0	7.91		0		0		0	0	3.92		0	0	0	0	1.11	0
calcareous fragments	0		0		0		0		0		3.6	0	0	0	0	0	0	0	0		0		0		0	0	1.69		0		0		0	0	1.96		0	0	0	0	5.56	0
Cassindulina subglobosa cf.	0		0		0		0		0		0.72	0	0	0	0	0	0	0	0.7		3.57		0		0	0	1.69		0		0		0	0	1.96		0	0	0	0	1.11	0
Cibicides sp.	0		0		6.67		0		0		44.7	0	0	0	0	0	0	0	11.9		0		0		0	0	5.08		0		0		6	0	5.88		0	0	0	0	11.1	0
Cribrostomoides crassmargo	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		3.13		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Eggerella advena	0		0		0		0		0		0	0	0	0	0	0	0	0	0.7		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Elphidiella hannai	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Elphidiella sp.	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Elphidium crispum	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Elphidium exclavatum	0		0		0		0		0		5.05	0	0	0	0	0	0	0	3.5		0		0		0	0	0		0		0		0	0	0		0	0	0	0	2.22	0
Elphidium frigidium	0		0		0		0		0		3.6	0	0	0	0	0	0	0	2.1		0		0		0	0	1.13		0		0		0	0	3.92		0	0	0	0	0	0
Elphidium subarcticum	0		0		3.33		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	1.69		0		0		0	0	0		0	0	0	0	3.33	0
Elphidium spp. (tiny)	0		0		0		0		0		6.49	0	0	0	0	0	0	0	0		0		0		0	0	4.52		0		0		4	0	0		0	0	0	0	0	0
Epistominella vitrea	0		0		0		0		0		0.72	0	0	0	0	0	0	0	0		0		0		0	0	2.82		0		0		2	0	0		0	0	0	0	1.11	0
Fissurina spp.	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	3.39		0		0		0	0	0		0	0	0	0	0	0
Fursenkoina fusiformis	0		0		0		0		0		10.8	0	0	0	0	0	0	0	1.4		0		0		0	0	22.6		0		0		4	4	5.88		0	0	0	0	13.3	0
Glomerspira gordialis	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		4.55	0	0		0		0		0	0	0		0	0	0	0	0	0
Haplophragmoides sp.	6.67		0		6.67		0		0		3.6	0	4	0	3.77	3.77	11.1	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Islandiella norcrossi	0		0		0		0		0		0	0	0	0	0	0	0	0	5.59		0		0		0	0	0.56		0		0		2	0	1.96		0	0	0	0	3.33	0
Islandiella teretis	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0.56		0		0		0	0	0		0	0	0	0	0	0
Lagena sp.	0		0		0		0		0		0.72	0	0	0	0	0	0	0	2.1		0		0		0	0	1.13		0		0		2	0	0		0	0	0	0	1.11	0
Milammina fusca	0		4.17		0		0		12.5		0.72	0	8	0	0	0	11.1	0	18.2		7.14		12.5		9.09	0	1.69		7.14		9.52		6	0	1.96		0	0	7.69	0	2.22	0
Nonionella turgida/digitata	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Nonionella stella	0		0		0		0		0		7.21	0	0	0	0	0	0	0	0.7		0		0		0	0	13.6		0		0		0	0	0		0	0	0	0	0	0
Nonionella sp.	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Pseudononion basispinata	0		0		0		0		0		1.44	0	0	0	0	0	0	0	3.5		0		0		0	0	3.95		0		0		0	0	1.96		0	0	0	0	3.33	0
Oolina spp.	0		0		0		0		0		1.44	0	0	0	0	0	0	0	0.7		0		0		0	0	0.56		0		0		0	0	3.92		0	0	3.85	0	0	0
Recuvoides turbinatus	0		0		0		0		0		0.72	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Reophax arctica	6.67		4.17		3.33		0		0		1.44	0	4	0	1.89	0	11.1	0	0.7		3.57		0		9.09	0	0.56		0		0		4	0	0		0	0	0	0	0	0
Reophax curtis	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0.56		0		0		0	0	0		0	0	3.85	0	0	0
Reophax nana	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Reophax nodulosa	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Reophax scottii	0		0		13.3		0		0		1.44	0	0	0	43.4	3.77	0	0	4.2		3.57		3.13		0	0	0.56		0		0		10	8	1.96		53.8	30.8	15.4	7.69	0	0
Rosalina columbiensis	0		0		0		0		0		0.72	0	0	0	17	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Saccamina difflugiformis	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Spiroplectimma biformis	0		0		0		0		0		0	0	0	0	1.89	0	0	0	0		0		3.13		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Textualaria agglutinans	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Textularia conica	0		0		0		0		0		0.72	0	0	0	0	0	0	0	0		3.57		3.13		0	0	0		0		0		0	0	3.92		0	0	0	0	2.22	0
Textularia earlandi	0		0		0		0		0		2.88	0	0	0	0	0	0	0	0.7		0		0		0	0	0.56		0		0		0	0	0		0	0	0	0	2.22	2.22
Textualaria torquata	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Tiphotrocha comprimata	0		0		0		0		0		1.44	0	0	0	0	0	0	0	1.4		0		9.38		0	0	0		7.14		0		0	0	0		0	0	0	0	0	0
Trifarina fluens	0		0		0		0		0		0.72	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		2	0	0		0	0	0	0	1.11	0
Trochammina charlottensis	0		0		0		0		0		3.6	0	0	0	0	0	0	0	2.1		25		12.5		0	0	0		0		38.1		4	0	0		0	0	7.69	0	0	0
Trochammina discorbis	13.3		29.2		0		0		12.5		5.05	0	8	0	9.43	0	22.2	0	4.9		17.9		3.13		4.55	0	0.56		21.4		0		10	0	0		15.4	0	15.4	0	5.56	0
Trochammina inflata	0		0		0		11.1		0		0	0	0	0	1.89	0	0	0	0		0		0		0	0	0		7.14		4.76		2	0	0		0	0	0	0	4.44	0
Trochammina lobata	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Trochammina macrens	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		3.13		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Trochammina nana	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Trochammina ochracea	20		12.5		10		27.8		0		0	0	12	0	9.43	0	22.2	0	0.7		0		12.5		27.3	0	1.13		14.3		19		0	0	3.92		15.4	0	15.4	0	5.56	0
Trochammina pacifica	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Trochammina rotaliformis	0		0		3.33		0		0		2.16	0	0	0	0	0	0	0	0		0		0		0	0	0.56		0		0		0	0	0		0	0	0	0	0	0
Trochammina sp.-lobate	13.3		8.33		0		5.56		25		0	0	0	0	0	0	0	0	0.7		0		0		0	0	0.56		0		0		6	0	0		0	0	3.85	0	1.11	0
Trochammina sp.-lesslob.	0		0		6.67		0		0		2.88	0	0	0	5.66	0	0	0	3.5		28.6		6.25		0	0	0.56		0		0		4	0	0		7.69	0	11.5	0	1.11	0
Trochammina sp. (tiny)	13.3		4.17		3.33		0		0		3.6	0	28	0	0	0	0	0	2.1		7.14		15.6		0	0	1.69		7.14		4.76		0	0	5.88		7.69	0	3.85	0	0	0
Trochammina sp.	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Valvulinera arctica.	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
organic linings	0		0		0		0		0		0	0	0	0	0	0	0	0	1.4		0		0		9.09	9.09	0		0		0		6	4	3.92		0	0	0	0	0	0
weird-ufo	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0

corrected depth (cm)	563		573		579		583		593		602		608		612		619		623		625		628		633		643		653		663		673		683		693		700		708	
fraction (%total, % 45um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	10		10		10		10		5		10		10		10		10		10		10		10		10		10		10		10		10		10		5		10		10	
total count/10cc	15		24		30		18		8		247		25		53		9		143		28		32		22		177		14		21		50		51		117		26		90	
% #45 per 10 cc/total per 10 cc	0		0		0		0		0		0		8		7.55		22.2		0		0		0		18.2		0		0		0		20		0		3.42		7.69		2.22	
PLANKTONIC FORAMINIFERA																																										
planktonics	0		0		0		0		0		0.72	0	0	0	0	0	0	0	0		0		0		0	0	0.56		0		0		6	0	0		0	0	0	0	2.22	0
THECAMOEBIANS																																										
Centropyxsis aculeata	0		8.33		10		0		12.5		0.72	0	0	0	7.55	0	0	0	0		0		9.38		27.3	9.09	0		7.14		4.76		0	0	1.96		0	0	3.85	0	2.22	0
Tintinnopsis rioplatensis	0		0		0		0		0		0	0	4	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0
Difflugia globulus	6.67		4.17		6.67		16.7		0		0.72	0	16	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	7.69	0	0	0
Difflugia oblongata	0		4.17		0		5.56		0		0	0	8	8	0	0	22.2	22.2	0.7		0		3.13		4.55	0	0		0		0		0	0	0		0	0	0	0	0	0
Lagenodifflugia sp.	20		16.7		13.3		22.2		37.5		1.44	0	8	0	0	0	0	0	0		0		0		0	0	0.56		21.4		14.3		8	0	5.88		0	0	0	0	1.11	0
Lagenodifflugia sp.2(ball)	0		0		0		0		0		0	0	0	0	0	0	0	0	0		0		0		0	0	0		0		0		0	0	0		0	0	0	0	0	0

corrected depth (cm)	718		728		738		744		748		758		768		778		783		788		798		808		818		828		838		846		853		850		870		880		890	
fraction (%total, %45 um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	10		10		10		10		10		5		7.5		10		10		10		10		10		10		10		10		10		10		10		5		5		7.5	
total count/10cc	18		24		51		694		23		10		13.3		21		67		14		17		48		38		8		5		15		31		3		8		2		13.3	
% #45 per 10 cc/total per 10 cc	0		8.33		3.92		0.29		0		0		40		9.52		2.99		0		0		4.17		0		25		40		0		6.45		0		0		0		0	
BENTHIC FORAMINFERA																																										
Adercotyma glomerata	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0		4.19	0	0	0	0	0	0		0		0	0	0	0	4.48	0	7.14	0	0		0	0	5.26		0	0	0	0	0		3.23	0	0	0	0	0	0	0	0	0
Bolivina pacifica	0		0	0	0	0	4.03	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Brizalina subaenariensis	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Buccella depressa	0		0	0	3.92	0	3.17	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Buccella frigida	0		0	0	25.5	0	9.8	0	8.7		0		0	0	0	0	0	0	0	0	0		12.5	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Buliminella elegantissma	0		0	0	1.96	0	0.58	0	0		0		0	0	0	0	0	0	0	0	0		14.6	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
calcareous fragments	0		0	0	3.92	3.92	10.7	0.29	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Cassindulina subglobosa cf.	0		0	0	0	0	2.02	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Cibicides sp.	0		0	0	7.84	0	27.4	0	0		0		0	0	0	0	0	0	0	0	0		4.17	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Cribrostomoides crassmargo	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Eggerella advena	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Elphidiella hannai	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Elphidiella sp.	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Elphidium crispum	0		0	0	0	0	0.86	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Elphidium frigidium	0		0	0	1.96	0	2.59	0	0		0		0	0	0	0	0	0	0	0	0		2.08	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0		0	0	1.96	0	1.44	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0		0	0	1.96	0	7.2	0	4.35		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Epistominella vitrea	0		0	0	0	0	4.03	0	0		0		0	0	0	0	0	0	0	0	0		2.08	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Fissurina spp.	0		0	0	0	0	2.02	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Fursenkoina fusiformis	0		0	0	0	0	14.4	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Glomerspira gordialis	0		0	0	0	0	0	0	0		0		0	0	0	0	1.49	0	0	0	5.88		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Haplophragmoides sp.	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		3.23	0	0	0	0	0	0	0	0	0
Islandiella norcrossi	0		0	0	7.84	0	4.61	0	0		0		0	0	0	0	0	0	0	0	0		2.08	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0		0	0	0	0	2.31	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Lagena sp.	0		0	0	0	0	0.29	0	0		0		0	0	0	0	0	0	7.14	0	0		2.08	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Milammina fusca	22.2		4.17	0	1.96	0	0.58	0	0		40		0	0	9.52	0	17.9	0	21.4	0	17.6		8.33	0	23.7		0	0	0	0	13.3		25.8	0	0	0	25	0	0	0	20	0
Nonionella turgida/digitata	0		0	0	0	0	1.44	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Nonionella stella	0		0	0	0	0	5.76	0	0		0		0	0	0	0	0	0	0	0	0		2.08	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Nonionella sp.	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudononion basispinata	0		0	0	0	0	9.22	0	0		0		0	0	0	0	0	0	0	0	0		4.17	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Oolina spp.	0		0	0	1.96	0	2.31	0	0		0		0	0	0	0	0	0	0	0	0		2.08	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Recuvoides turbinatus	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Reophax arctica	5.56		4.17	0	5.88	0	0	0	0		0		40	20	4.76	0	0	0	0	0	0		2.08	0	0		0	0	60	40	6.67		0	0	0	0	0	0	0	0	0	0
Reophax curtis	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	2.63		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Reophax nana	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Reophax nodulosa	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Reophax scottii	0		4.17	0	5.88	0	0.58	0	17.4		0		20	20	14.3	9.52	2.99	0	42.9	0	0		8.33	4.17	0		0	0	0	0	0		6.45	6.45	0	0	0	0	0	0	0	0
Rosalina columbiensis	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Saccamina difflugiformis	0		0	0	0	0	0.29	0	0		0		10	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Spiroplectimma biformis	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	5.88		2.08	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Textularia agglutinans	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Textularia conica	0		0	0	0	0	0.86	0	4.35		0		0	0	0	0	1.49	0	0	0	0		0	0	0		0	0	0	0	0		3.23	0	0	0	0	0	0	0	0	0
Textularia earlandi	0		0	0	0	0	0	0	0		0		10	0	0	0	0	0	0	0	0		2.08	0	2.63		25	25	0	0	0		0	0	0	0	0	0	0	0	0	0
Textualaria torquata	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Tiphotrocha comprimata	5.56		20.8	0	3.92	0	0.58	0	0		0		0	0	0	0	4.48	0	0	0	11.8		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0		0	0	1.96	0	0.58	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina charlottensis	0		8.33	0	3.92	0	0.58	0	0		0		10	0	0	0	5.97	0	0	0	5.88		4.17	0	21.1		0	0	0	0	0		6.45	0	33	0	0	0	0	0	0	0
Trochammina discorbis	16.7		4.17	0	5.88	0	0.86	0	4.35		20		0	0	9.52	0	20.9	0	0	0	0		0	0	10.5		12.5	0	0	0	20		9.68	0	0	0	50	0	100	0	0	0
Trochammina inflata	16.7		4.17	0	3.92	0	0	0	0		0		0	0	0	0	2.99	0	0	0	0		4.17	0	15.8		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Trochammina lobata	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Trochammina macrens	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina nana	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		6.45	0	0	0	0	0	0	0	0	0
Trochammina ochracea	11.1		8.33	0	3.92	0	0.58	0	8.7		20		10	0	28.6	0	5.97	0	0	0	23.5		2.08	0	5.26		25	0	0	0	40		25.8	0	33	0	25	0	0	0	40	0
Trochammina pacifica	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Trochammina rotaliformis	0		0	0	0	0	0.58	0	0		0		0	0	0	0	5.97	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lobate	0		0	0	0	0	0.29	0	8.7		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		6.45	0	0	0	0	0	0	0	20	0
Trochammina sp.-lesslob.	16.7		0	0	0	0	0	0	8.7		20		0	0	9.52	0	16.4	0	0	0	0		2.08	0	5.26		0	0	0	0	6.67		0	0	0	0	0	0	0	0	0	0
Trochammina sp. (tiny)	0		0	0	0	0	0	0	8.7		0		0	0	0	0	7.46	2.99	7.14	0	0		0	0	7.89		12.5	0	20	0	0		0	0	33	0	0	0	0	0	20	0
Trochammina sp.	0		0	0	0	0	0	0	0		0		0	0	0	0	1.49	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
Valvulinera arctica.	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
organic linings	0		8.33	8.33	1.96	0	0	0	4.35		0		0	0	4.76	0	0	0	0	0	0		6.25	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
weird-ufo	0		0	0	0	0	1.44	0	0		0		0	0	4.76	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	718		728		738		744		748		758		768		778		783		788		798		808		818		828		838		846		853		860		870		880		890	
fraction (%total, % 45um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	10		10		10		10		10		5		7.5		10		10		10		10		10		10		10		10		10		10		10		5		5		7.5	
total count/10cc	18		24		51		696		23		10		13.3		21		67		14		17		48		38		8		5		15		31		3		8		2		13.3	
% #45 per 10 cc/total per 10 cc	0		8.33		3.92		0.29		0		0		40		9.52		2.99		0		0		4.17		0		25		40		0		6.45		0		0		0		0	
PLANKTONIC FORAMINIFERA																																										
planktonics	0		0	0	0	0	1.73	0	0		0		0	0	0	0	0	0	0	0	0		8.33	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
THECAMOEBIANS																																										
Centropyxsis aculeata	5.56		12.5	0	0	0	0	0	4.35		0		0	0	0	0	0	0	0	7.14	0	23.5		2.08	0	0		25	0	20	0	13.3		0	0	0	0	0	0	0	0	0
Tintinnopsis rioplatensis	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0
Difflugia globulus	0		8.33	0	1.96	0	0	0	8.7		0		0	0	0	4.76	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0
Difflugia oblongata	0		4.17	0	0	0	0.29	0	0		0		0	0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.	0		4.17	0	0	0	0	0	8.7		0		0	0	0	4.76	0	0	0	7.14	0	5.88		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.2(ball)	0		0	0	0	0	0	0	0		0		0	0	0	0	0	0	0	0	0	0		0	0	0		0	0	0	0	0		0	0	0	0	0	0	0	0	0

corrected depth (cm)	898		910		920		922		930		940		950		960		967		970		980		992		1000		1010		1020		1030		1034		1040		1050	
fraction (%total, %45 um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	5		10		10		5		10		10		10		10		10		10		10		10		10		10		10		10		10		10		10	
total count/10cc	8		165		24		0		26		6		41		17		26		16		64.9		152		23		12		13		5		226		13		10	
% #45 per 10 cc/total per 10 cc	0		1.21		8.33		0		0				0		23.5		7.69		0		3.08		0		8.696		0		30.77		0		0.885		46.15		40	
BENTHIC FORAMINFERA																																						
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	1.21	0	4.17	0			0	0	0	0	0	0	0	0	0	0	0	0	1.76	0	0.66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	0	0	4.85	0	0	0			0	0	0	0	0	0	0	0	3.85	0	0	0	1.76	0	4.61	0	0	0	16.67	0	0	0	0	0	4.225	0	0	0	0	0
Brizalina subaenariensis	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buccella depressa	0	0	3.03	0	0	0			7.69	0	0	0	0	0	0	0	0	0	0	0	0	0	1.32	0	0	0	0	0	0	0	0	0	2.817	0	0	0	0	0
Buccella frigida	0	0	11.5	0	0	0			3.85	0	0	0	7.32	0	0	0	0	0	0	0	10.1	3.08	3.95	0	0	0	0	0	0	0	0	0	15.96	0	23.08	0	0	0
Buliminella elegantissma	0	0	4.85	0	0	0			19.2	0	0	0	4.88	0	0	0	0	0	0	0	0	0	3.29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
calcareous fragments	0	0	4.85	0	0	0			3.85	0	0	0	2.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.981	0	0	0	0	0
Cassindulina subglobosa cf.	0	0	1.21	0	0	0			0	0	0	0	0	0	0	0	0	0	7.14	0	0	0	1.97	0	0	0	0	0	0	0	0	0	4.225	0	0	0	0	0
Cibicides sp.	0	0	12.7	0	0	0			0	0	0	0	12.2	0	0	0	0	0	0	0	8.79	0	9.21	0	0	0	8.333	0	0	0	0	0	21.6	0	7.692	0	0	0
Cribrostomoides crassmargo	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0			0	0	0	0	0	0	0	0	3.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella hannai	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella sp.	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium crispum	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.66	0	0	0	0	0	0	0	0	0	1.408	0	7.692	0	0	0
Elphidium frigidium	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.817	0	0	0	0	0
Elphidium subarcticum	0	0	3.64	0	0	0			3.85	0	0	0	0	0	0	0	0	0	0	0	0	0	1.97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0			0	0	0	0	4.88	0	0	0	0	0	0	0	3.52	0	5.92	0	4.348	0	0	0	0	0	0	0	1.878	0	0	0	0	0
Epistominella vitrea	0	0	3.64	0	0	0			0	0	0	0	2.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.408	0	0	0	0	0
Fissurina spp.	0	0	0	0	0	0			0	0	0	0	0	0	23.5	23.5	0	0	0	0	1.76	0	3.29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fursenkoina fusiformis	0	0	13.9	1.21	0	0			11.5	0	0	0	26.8	0	0	0	0	0	0	0	45.7	0	46.7	0	8.696	8.696	0	0	0	0	0	0	0.939	0	0	0	0	0
Glomerspira gordialis	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haplophragmoides sp.	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15.38	15.38	0	0	0	0	0	0	0	0
Islandiella norcrossi	0	0	0.61	0	0	0			3.85	0	0	0	7.32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0
Islandiella teretis	0	0	0.61	0	0	0			3.85	0	0	0	0	0	0	0	0	0	0	0	1.76	0	1.97	0	0	0	0	0	0	0	0	0	11.74	0	0	0	0	0
Lagena sp.	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.32	0	0	0	0	0	0	0	0	0	1.408	0	0	0	0	0
Milammina fusca	0	0	1.82	0	0	0			0	0	33.3	0	4.88	0	0	0	11.5	0	28.6	0	1.76	0	0	0	13.04	0	8.333	0	15.38	0	40	0	1.408	0	0	0	13.33	0
Nonionella turgida/digitata	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	1.76	0	0	0	0	0	0	0	0	0	0	0	0.939	0	0	0	0	0
Nonionella stella	0	0	1.82	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	1.76	0	1.97	0	0	0	0	0	0	0	0	0	3.756	0	0	0	0	0
Nonionella sp.	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.469	0	0	0	0	0
Pseudononion basispinata	0	0	7.27	0	0	0			0	0	0	0	4.88	0	0	0	0	0	0	0	1.76	0	2.63	0	0	0	0	0	0	0	0	0	3.286	0	0	0	0	0
Oolina spp.	0	0	0	0	0	0			7.69	0	0	0	0	0	0	0	0	0	0	0	66.4	64.6	0.66	0	0	0	0	0	0	0	0	0	1.878	0	0	0	0	0
Recuvoides turbinatus	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	25	0	1.21	0	25	0			0	0	16.7	0	0	0	35.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0
Reophax curtis	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax nana	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax nodulosa	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax scottii	0	0	0.61	0	25	0			0	0	0	0	0	0	11.8	0	19.2	7.69	7.14	0	3.52	0	0	0	0	0	0	0	7.692	0	0	0	0.939	0.939	15.38	15.38	0	0
Rosalina columbiensis	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Saccamina difflugiformis	0	0	0	0	8.33	8.33			0	0	0	0	0	0	0	0	3.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spiroplectimma biformis	0	0	1.82	0	0	0			0	0	0	0	0	0	5.88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textualaria agglutinans	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	1.21	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.939	0	0	0	0	0
Textularia earlandi	0	0	0	0	4.17	0			3.85	0	0	0	0	0	0	0	0	0	0	0	1.76	0	0.66	0	0	0	8.333	0	0	0	0	0	0.939	0	0	0	0	0
Textualaria torquata	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tiphotrocha comprimata	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0	0	1.21	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.347	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	4.17	0			0	0	0	0	0	0	0	0	7.69	0	7.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	50	0	3.64	0	0	0			0	0	0	0	0	0	11.8	0	15.4	0	0	0	1.76	0	0	0	0	0	0	0	7.692	0	0	0	0.939	0	0	0	0	0
Trochammina inflata	0	0	0.61	0	0	0			0	0	16.7	0	0	0	0	0	3.85	0	0	0	0	0	0	0	0	0	8.333	0	0	0	20	0	0	0	0	0	0	0
Trochammina lobata	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina macrens	0	0	0	0	0	0			0	0	0	0	7.32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina nana	0	0	1.21	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.469	0	0	0	0	0
Trochammina ochracea	0	0	6.06	0	16.7	0			3.85	0	33.3	0	9.76	0	5.88	0	7.69	0	7.14	0	1.76	0	1.97	0	26.09	0	8.333	0	30.77	15.38	0	0	0.939	0	7.692	0	53.33	0
Trochammina pacifica	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina rotaliformis	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lobate	0	0	0	0	0	0			0	0	0	0	0	0	5.88	0	0	0	7.14	0	0	0	0	0	17.39	0	8.333	0	7.692	0	0	0	0	0	0	0	0	0
Trochammina sp.-lesslob.	0	0	0.61	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30.43	0	25	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp. (tiny)	0	0	0	0	8.33	0			7.69	0	0	0	0	0	0	0	15.4	0	14.3	0	0	0	0	0	0	0	0	0	15.38	0	0	0	0.469	0	23.08	15.38	33.33	20
Trochammina sp.	0	0	1.82	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	1.76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Valvulinera arctica.	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
organic linings	0	0	1.21	0	0	0			3.85	0	0	0	0	0	0	0	7.69	0	14.3	0	0	0	1.32	0	0	0	0	0	0	0	0	0	1.408	0	0	0	0	0
weird-ufo	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	7.14	0	0	0	0.66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	898		910		920		922		930		940		950		960		967		970		980		992		1000		1010		1020		1030		1034		1040		1050	
fraction (%total, % 45um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	5		10		10		5		10		10		10		10		10		10		10		10		10		10		10		10		10		10		10	
total count/10cc	8		165		24		0		26		6		41		17		26		16		64.9.		152		23		12		13		5		226		13		10	
% #45 per 10 cc/total per 10 cc	0		1.21		8.33		0		0				0		23.5		7.69		0		3.08		0		8.696		0		30.77		0		0.885		46.15		40	
PLANKTONIC FORAMINIFERA																																						
planktonics	0	0	1.21	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	5.27	0	4.61	0	0	0	8.333	0	0	0	0	0	0.469	0	0	0	0	0
THECAMOEBIANS																																						
Centropyxsis aculeata	25	0	0	0	0	0			7.69	0	0	0	4.88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tintinnopsis rioplatensis	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia globulus	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia oblongata	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.	0	0	0	0	4.17	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.2(ball)	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	1060		1070		1080		1089		1096		1100		1106		1116		1120		1130	
fraction (%total, %45 um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	10		10		10		10		10		10		10		10		0.5		7.5	
total count/10cc	15		7		6		1		3		184		154		31		220		17.33	
% #45 per 10 cc/total per 10 cc	26.67		28.57		100		0		66.67		2.174		1.299		19.35		18.18		15.38	
BENTHIC FORAMINFERA																				
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	1.087	0	0.649	0	3.226	0	9.091	0	0	0
Bolivina pacifica	0	0	0	0	0	0	0	0	0	0	1.63	0	0	0	0	0	9.091	0	0	0
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buccella depressa	0	0	0	0	0	0	0	0	0	0	1.63	0	1.299	0	0	0	0	0	0	0
Buccella frigida	0	0	0	0	0	0	0	0	0	0	17.93	0	18.18	0	0	0	0	0	0	0
Buliminella elegantissma	0	0	0	0	0	0	0	0	0	0	0.543	0	4.545	0	0	0	0	0	0	0
calcareous fragments	0	0	0	0	0	0	0	0	0	0	10.33	0	4.545	0	0	0	0	0	0	0
Cassindulina subglobosa cf.	0	0	0	0	0	0	0	0	0	0	2.174	0	4.545	0	3.226	0	0	0	0	0
Cibicides spp.	0	0	0	0	0	0	0	0	0	0	19.02	0	27.92	0	0	0	0	0	0	0
Cribrostomoides crassmargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.692	0
Elphidiella hannai	0	0	0	0	0	0	0	0	0	0	1.087	0	0	0	0	0	0	0	0	0
Elphidiella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium crispum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	1.087	0	0.649	0	0	0	0	0	0	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	6.522	0	2.597	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	7.143	0	0	0	0	0	0	0
Epistominella vitrea	0	0	0	0	0	0	0	0	0	0	1.087	0	1.299	0	0	0	0	0	0	0
Fissurina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0.649	0	0	0	0	0	0	0
Fursenkoina fusiformis	0	0	0	0	0	0	0	0	0	0	0	0	1.299	0	0	0	0	0	0	0
Glomerspira gordialis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haplophragmoides spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella norcrossi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	6.667	0	0	0	0	0	0	0	0	0	7.065	0	2.597	0	0	0	0	0	0	0
Lagena spp.	0	0	0	0	0	0	0	0	0	0	0.543	0	1.948	0	0	0	0	0	0	0
Milammina fusca	20	0	0	0	0	0	0	0	0	0	1.63	0	1.299	0	9.677	0	9.091	0	7.692	0
Nonionella turgida/digitata	0	0	0	0	0	0	0	0	0	0	6.522	0	3.896	0	0	0	0	0	0	0
Nonionella stella	0	0	0	0	0	0	0	0	0	0	2.174	0	0	0	0	0	0	0	0	0
Nonionella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudononion basispinata	0	0	0	0	0	0	0	0	0	0	0	0	1.299	0	0	0	0	0	0	0
Oolina spp.	0	0	0	0	0	0	0	0	0	0	3.804	0	0.649	0	0	0	0	0	0	0
Recuvoides turbinatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	0	0	28.57	28.57	0	0	0	0	0	0	1.087	1.087	0	0	3.226	0	0	0	23.08	15.38
Reophax curtis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax nana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax nodulosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax scottii	20	13.33	14.29	0	33.33	33.33	0	0	66.67	66.67	0	0	0	0	12.9	12.9	0	0	7.692	0
Rosalina columbiensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Saccamina difflugiformis	0	0	0	0	0	0	0	0	0	0	0	0	0.649	0	0	0	0	0	0	0
Spiroplectimma biformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textualaria agglutinans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	2.717	0	5.195	0	3.226	0	0	0	0	0
Textularia earlandi	0	0	14.29	0	0	0	0	0	0	0	0	0	0.649	0	0	0	0	0	0	0
Textualaria torquata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tiphotrocha comprimata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	0	0	2.717	0	0.649	0	0	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	20	0	0	0	0	0	0	0	0	0	3.804	1.087	0.649	0	16.13	0	27.27	18.18	7.692	0
Trochammina inflata	0	0	0	0	0	0	0	0	0	0	0.543	0	0.649	0	0	0	0	0	0	0
Trochammina lobata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina macrens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina nana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.452	0	0	0	0	0
Trochammina ochracea	6.667	0	0	0	66.67	66.67	0	0	33.33	0	0	0	0.649	0	16.13	0	18.18	0	23.08	0
Trochammina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina rotaliformis	6.667	0	0	0	0	0	100	0	0	0	2.174	0	1.948	0	19.35	0	9.091	0	0	0
Trochammina sp.-lobate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.091	0	7.692	0
Trochammina sp.-lesslob.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp. tiny	13.33	13.33	28.57	0	0	0	0	0	0	0	0	0	1.299	1.299	6.452	6.452	9.091	0	7.692	0
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Valvulinera arctica.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
organic linings	6.667	0	14.29	0	0	0	0	0	0	0	0.543	0	0	0	0	0	0	0	0	0
weird-ufo	0	0	0	0	0	0	0	0	0	0	0	0	0.649	0	0	0	0	0	0	0

corrected depth (cm)	1060		1070		1080		1089		1096		1100		1106		1116		1120		1130	
fraction (%total, % 45um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	10		10		10		10		10		10		10		10		0.5		7.5	
total count/10cc	15		7		6		1		3		184		154		31		220		17.33	
% #45 per 10 cc/total per 10 cc	26.67		28.57		100		0		66.67		2.174		1.299		19.35		18.18		15.38	
PLANKTONIC FORAMINIFERA																				
planktonics	0	0	0	0	0	0	0	0	0	0	0.543	0	0	0	0	0	0	0	0	0
THECAMOEBIANS																				
Centropyxsis aculeata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tintinnopsis rioplatensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia globulus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia oblongata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.692	0
Lagenodifflugia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.2(ball)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

% Species abundances

Relative species abundance is presented as the % contribution of each selected species contained in a 10 cm^3 of sample (Figures 3.6 to 3.8).

Thecamoebians, protists and indicators of riverine freshwater input (Scott *et al.* 2001), are a constantly present with 10 to 80% from 0 cm to 760cm (~0 to 3800 yBP; Climate Intervals I and II), and then several lesser, discrete peaks in abundance at 840 to 900 cm (~3900 to 4000 yBP: Climate Interval II), and 1120cm (~4200+ yBP; Climate Interval III).

Due to generally low individual representation, *H. canariensis* and other species of the same genus have been grouped into *Haplophragmoides* spp. as an indicator of a high marsh input (Scott ??). *Haplophragmoides* spp. is found abundant in the upper 0 to 610 cm (~ 0 to 3000 yBP; Climate Intervals I and II), with relative abundances up of to 30 %. Two later discrete peaks occur at 840 cm (~ 3900 yBP: Climate Interval II) and 1020 cm (~4200 yBP; Climate Interval III).

Miliammina fusca is another marsh species (Patterson *et al.* 2000), and it is found continuously throughout the length of the core, ranging from 1 to 50% abundance. The greatest abundances, up to 10 to 50 %, are located from 750 cm to the end of the core (~ 3500+ yBP; Climate Intervals II to III). From 0 cm to 250 cm (~ 0 to 2000 yBP; Climate Interval I), the relative abundance is less than 10 %, and from 250 cm to 750 cm (~ 2000 to 3500 yBP; Climate Interval II) the abundance ranges from 30 to 50%.

Reophax scottii comprises up to 80% of the foraminiferal fauna at times, with generally greater relative abundance in the uppermost 220 cm (~0 to 2000 yBP; Climate Interval I). The average abundance in the upper 220 cm is 40% (~0 to 2000 yBP; Climate Interval I), with 20% from 220 to 500cm (~ 2000 to 2800 yBP: Climate Interval II), less than 10% between 500 to 650 cm (~2800 to 3100 yBP; Climate Interval II) with a brief peak of 60% at 620 cm, and three more peaks at 750 to 800cm (~3800 yBP: Climate Interval II), 950 to 1000cm (~4000 yBP; Climate Interval III), and 1010 to 1100 cm (~ 4100 yBP; Climate Interval III).

Trochammina spp. includes several species that have been combined into one species group under the genus - primarily, *T. ochracea, T. charlottensis,* T. *discorbis,* and *T. pacifica. Trochammina* spp. generally comprises no less than 20% of most samples. From 0 to 250 cm (~0 to 2000 yBP; Climate Interval I) the relative abundance is generally less than 20%; from 250 cm to 850 cm (~2000 to 3800 yBP; Climate Interval II) and 900cm until the end of the core (~4100 yBP; Climate Interval III) the relative abundances are generally 20 to 60 %. The highest peak in relative abundance of 100% occurred from 850 to 900cm (~3800-4000 yBP; Climate Interval II).

Buliminella elegantissma is present the length of the core in discrete intervals ranging from 5 to 25% abundance. Peaks in relative abundance of this species of 5 to 10% occur at 90 cm, 80 cm, 120 cm, 180 cm, 310 cm, 340 cm, 410 cm, 670 cm, 600 to 650cm, 670 cm (~0 to 3000 yBP; Climate Intervals I and II), and from 10 to 25% at 800 cm, 900 to1000 cm, and 1110 cm (~3700 + yBP; Climate Intervals II and III).

Reophax arctica is continuously present at 10% abundance from 0 to 750 cm (~0 to 3700 yBP; Climate Intervals I and II). Then from 750 cm onwards (~3700 yBP+; Climate Intervals II and III) it appears as several discrete peaks of relative abundance occur 750-760 cm (40%), 840 to 840cm (70%), 890 to 950cm (30%), 1020cm (25%), 1060cm (30%), 1110cm (25%).

Fursenkoina fusiformis has numerous discrete peaks in relative abundance of 10 to 50% throughout the length of the core at 40 cm, 60 cm, 190cm, 210cm, 340 cm, 420cm, 490cm, 600cm, 640cm, 670cm, 710cm, 740cm, 900-950cm and up to 60% at 980-1000 cm.

Buccella spp. is a grouping of 2 species, *B. frigida* and *B. depressa*, who have similar life strategies and appearance. Again, *Buccella* spp. is found as numerous discrete peaks in abundance throughout the length of the core. The relative abundance of *Buccella* spp. from 0 to 590 cm (~0 to 3000 yBP; Climate Intervals I and II) ranges from 0 to 10 %. The greatest abundance of 30 to 40% occurs from 590 to 750 cm (~3000 to 3700 yBP; Climate Interval II); and from 800 cm until the end of the core (~3800 yBP+: Climate Intervals II and III) the abundance has several peaks up to 25%.

Cibicides spp. is a species grouping of C. *lobatulus*, C. *fletcheri*, and *Planorbulina mediterranesis* - due to their similar life strategies, and morphological appearances. These species are found present in discrete intervals throughout the length of the core, ranging from 0 to 50% relative abundance. The locations of peak abundances are similar to those of *Buccella* spp. From 0 to 590 cm (~0 to 3000 yBP; Climate Intervals I and II), (with the exception of the peak of 34% at 360 cm) the relative abundance peaks range up to 10%. Then from 590 cm to 750 cm (~3000 to 3700 yBP; Climate Interval II) the abundances peak at 10 to 50%; and from 800 cm until the end of the core (~ 3800 yBP+; Climate Intervals II and III) the abundance has several peaks of 10 to 30%.

Elphidium spp. is a species grouping of *E. crispum*, *E. subarcticum*, *E. frigidium*, and *E. excavatum* - due to their generally low representation individually. These species are generally present as numerous discrete peaks throughout the length of the core, ranging from 0 to 15% abundance. The locations of peak abundances are similar to *Buccella* spp. and *Cibicides* spp. From 0 to 590 cm (~0 to 3000 yBP; Climate Intervals I and II), the relative abundance peaks range up to 10%. Then from 590 cm to 750 cm (~3000 to 3700 yBP; Climate Interval II) the abundances peak at 10 to 50%; and from 800 cm until the end of the core (~ 3800 yBP+; Climate Intervals II and III) the abundance has several peaks of 10 to 30%.

Islandiella spp. is a species grouping of *I. norcrossi* and *I. teretis*, due to morphological variability, and generally low individual representation. These species are present as numerous discrete peaks the length of the core. The locations of peak abundances are similar to *Buccella* spp., *Cibicides* spp. and *Elphidium* spp. From 0 to 590 cm (~0 to 3000 yBP; Climate Intervals I and II), the relative abundance peaks range up to 5%. Then from 590 cm to 750 cm (~3000 to 3700 yBP; Climate Interval II) the abundances peak at 5 to 10%; and from 800 cm until the end of the core (~ 3800 yBP+; Climate Intervals II and III) the abundance has several peaks of 5 % with an exceptionally high peak of 25% at 1040 cm.

Bolivina pacifica is present the length of the core as numerous discrete intervals with peaks of relative abundances up to 5%, with an exceptionally high peak at ~ 1000 to 1020 cm of 20 %.

The locations of abundance peaks are similar to *Buccella* spp., *Cibicides* spp., *Elphidium* spp., *Fissurina* spp., and *Islandiella* spp.

Nonionella spp. is a species grouping of *N. digitata, N. stella, N. turgida* and *Nonionella labradorica,* due to their morphologies, and generally low individual representations. These species are present the length of the core as numerous discrete peak abundance events ranging from 2 to almost 20 %. The locations of peak abundances are similar to *Buccella* spp., *Cibicides* spp., *Elphidium* spp., *Islandiella* spp. and others. From 0 to 590 cm (~0 to 3000 yBP; Climate Intervals I and II), the relative abundance peaks range up to 1%. Then from 590 cm to 750 cm (~3000 to 3700 yBP; Climate Interval II) the abundances peak at 5 to 20%; and from 800 cm until the end of the core (~ 3800 yBP+; Climate Intervals II and III) the abundance has several peaks of 5 to 10% relative abundance.

Planktics species include - *Globergerina spp.* and groups all planktic species due to their similar life histories, and generally low individual representations. These species are present the length of the core, at discrete peak abundance events ranging from 2 to almost 10 %. The locations of peak abundances are similar to *Buccella* spp., *Cibicides* spp., *Elphidium* spp., *Islandiella* spp. and others. From 0 to 600 cm (~0 to 3000 yBP; Climate Intervals I and II), the relative abundance peaks range up to 7%. Then from 600 cm to 750 cm (~3000 to 3700 yBP; Climate Interval II) the abundances peak at 1 to 7%; and from 910 cm until the end of the core (~ 4100 yBP+; Climate Interval III) the abundance has several peaks of 1 to 10% relative abundance.

Unilocular forms include *Fissurina* spp., *Lagena* spp., and *Oolina* species groups – that are further grouped together due to their low individual representation, but yet are still important indicators of the influx of shelf waters into the inlet. . These species are present the length of the core as numerous peak abundance events ranging from 1 to almost 70 %. The locations of peak abundances are similar to *Buccella* spp., *Cibicides* spp., *Elphidium* spp., *Islandiella* spp., planktics and others. From 0 to 590 cm (~0 to 3000 yBP; Climate Intervals I and II), the relative abundance peaks range up to 1%. Then from 590 cm to 750 cm (~3000 to 3700 yBP; Climate Interval II) the abundances peak at 5 % and from 925 cm until the end of the core (~ 4000 yBP+; Climate Interval III) the abundance has several peaks of 10 to 70% relative abundance.

Outer Basin

Tully 97A-01

corrected depth (cm)	892		882		872		862		854		852		842		838	
fraction (% total,% 45 um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	5.5		6		5		5		6		5		5.5		5	
total count/10cc	560		433		460		800		293		352		473		736	
% #45 per 10 cc/total per 10 cc	82		80		84.3		77		47.7		59.1		76.9		66.3	
BENTHIC FORAMINIFERA																
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammobaculites exigus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia beccarii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammotium cassis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buccella depressa	0	0	0	0	0	0	1	0	0	0	2.27	0	1.54	0	0	0
Buccella frigida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.26	0
Buliminella elegantissma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassidulina subglobosa cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cibicides spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10.9	0
Cribrostomoides crassmargo	0	0	0	0	0	0	0	0	6.82	0	0	0	1.54	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium frigidum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.09	0
Elphidium williamsoni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.09	0
Elphidium org.lining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euuvigerina juncea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fursenkoinia fusiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.61	5.43
Glomerspira gordialis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hemisphaerammina bradyi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena sp.	1.28	0	0	0	0	0	1	0	0	0	2.27	0	1.54	0	0	0
Milammina fusca	2.56	0	6.15	0	0	0	7	0	6.82	0	6.82	0	0	0	0	0
Nonionella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.09	0
Nonionella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oolina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (akneria)	0	0	0	0	0	0	0	0	0	0	2.27	0	0	0	0	0
Reophax arctica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax nana	3.85	3.85	1.54	1.54	1.74	0	4	4	2.27	0	2.27	2.27	1.54	0	3.26	3.26
Reophax nodulosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax scottii	83.3	74.4	80	73.8	78.3	78.3	76	68	68.2	43.2	65.9	52.3	80	83.6	57.6	57.6
Saccamina difflugiformis	1.28	1.28	0	0	3.48	0	1	1	4.55	0	0	0	3.08	1.82	0	0
Spiroplectimma biformis	0	0	0	0	0	0	2	1	0	0	2.27	2.27	0	0	0	0
Textualaria agglutinans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.09	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.52	0
Textularia earlandi	1.28	1.28	0	0	0.87	0.87	0	0	0	0	0	0	0	0	0	0
Textualaria torquata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1.09	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	1.28	0	0	0	0	0	0	0	0	0	0	0	0	0	4.35	0
Trochammina inflata	0	0	0	0	2.61	2.61	3	3	2.27	0	0	0	0	0	0	0
Trochammina lobata	0	0	1.54	0	0	0	0	0	0	0	0	0	1.54	0	0	0
Trochammina nana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.09	0
Trochammina ochracea	1.28	0	2.31	2.31	5.22	1.74	1	0	0	0	9.09	0	4.62	3.64	0	0
Trochammina pacifica	2.56	0	6.15	1.54	5.22	0	0	0	6.82	4.55	4.55	2.27	0	0	0	0
Trochammina sp.	0	0	0	0	0	0	0	0	2.27	0	2.27	0	1.54	1.82	0	0
Valvulinera laevigata cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PLANKTONIC FORAMINERA																
THECAMOEBIANS																
Centropyxsis aculeata	1.28	0	2.31	0.77	2.61	0.87	3	0	0	0	0	0	3.08	0	0	0
Lagenodifflugia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	832		822		812		804		802		792		782		772	
fraction (% total,% 45 um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	6		6		7		7		7		5		5.5		5	
total count/10cc	527		357		297		267		366		350		102		458	
% #45 per 10 cc/total per 10 cc	26.6		47.7		79.8		83.4		85.9		83.4		53.6		89.1	
BENTHIC FORAMINIFERA																
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammobaculites exigus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia beccarii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammotium cassis	0	0	0	0	0.48	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	5.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buccella depressa	1.27	0	0.77	0	0.96	0	0	0	0.39	0	0	0	0	0	0	0
Buccella frigida	13.9	0	2.31	0	0.48	0	0.53	0	0.39	0	0	0	0	0	0	0
Buliminella elegantissma	0	0	0	0	0	0	0	0	0	0	0.57	0	0	0	0	0
Cassidulina subglobosa cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chilostomella oolina	1.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cibicides spp.	19	0	0.77	0	0.48	0	0	0	0	0	0	0	0	0	0	0
Cribrostomoides crassmargo	1.27	0	0	0	0.48	0	1.07	0	0	0	1.14	0	0	0	0.44	0
Eggerella advena	0	0	0	0	0.48	0	0	0	0	0	0.57	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium frigidum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0	0	0	0	0	0	0	0	3.57	3.57	0	0
Elphidium williamsoni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp.	8.86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium org.lining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euuvigerina juncea	1.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fursenkoinia fusiformis	3.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glomerspira gordialis	0	0	0	0	0	0	0	0	0.39	0	0	0	0	0	0	0
Hemisphaerammina bradyi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena sp.	2.53	0	0.77	0	0.96	0	0	0	0.39	0	0	0	0	0	0	0
Milammina fusca	0	0	0.77	0	0	0	0	0	0	0	0.57	0	0	0	0	0
Nonionella sp.	1.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oolina spp.	0	0	0.77	0	0	0	0	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (akneria)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.87	0.87
Reophax nana	1.27	0	3.85	3.08	3.37	1.92	1.6	1.07	2.34	2.34	4.57	3.43	0	0	4.37	3.49
Reophax nodulosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax scottii	26.6	22.8	80	73.8	72.1	70.2	75.9	70.6	81.3	77.3	80.6	69.7	51.8	46.4	72.9	70.7
Saccamina difflugiformis	0	0	0	0	2.4	0.96	1.07	1.07	0.78	0.78	0	0	1.79	0	0.87	0
Spiroplectimma biformis	1.27	0	0.77	0	2.4	1.92	3.74	2.14	0.78	0	0	0	0	0	1.31	0.87
Textualaria agglutinans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	0	0	0	0	0.96	0.96	0	0	1.56	1.56	0	0	0	0	0.44	0
Textualaria torquata	0	0	0	0	0	0	0	0	0	0	0	0	3.57	3.57	0	0
Trifarina fluens	1.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	3.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina inflata	0	0	0.77	0	0	0	1.07	0	1.95	0	0.57	0	7.14	0	4.37	4.37
Trochammina lobata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina nana	0	0	0	0	0.48	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	1.27	1.27	2.31	0	10.6	1.92	10.7	5.35	7.03	3.91	9.71	9.14	17.9	0	8.3	4.37
Trochammina pacifica	3.8	2.53	2.31	0	2.4	0.96	4.28	3.21	0.78	0	0.57	0	10.7	0	5.24	3.49
Trochammina sp.	1.27	0	3.85	1.54	0	0	0	0	1.56	0	1.14	1.14	0	0	0	0
Valvulinera laevigata cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PLANKTONIC FORAMINERA																
THECAMOEBIANS																
Centropyxsis aculeata	0	0	0	0	0	0	0	0	0.39	0	0	0	0	0	0.87	0.87
Lagenodifflugia sp.	0	0	0	0	0.96	0.96	0	0	0	0	0	0	3.57	0	0	0

corrected depth (cm)	762		754		752		742		732	
fraction (% total,% 45 um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	5.5		5.5		5		6.5		5	
total count/10cc	576		513		300		385		220	
% #45 per 10 cc/total per 10 cc	78.2		86.5		78.7		91.2		90.9	
BENTHIC FORAMINIFERA										
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0
Ammobaculites exigus	0	0	0	0	0	0	0	0	0	0
Ammonia beccarii	0	0	0	0	0	0	0	0	0	0
Ammotium cassis	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	0.32	0	0	0	0	0	0	0	0	0
Buccella depressa	0.32	0	0.35	0	0	0	0	0	0	0
Buccella frigida	3.47	0.63	0.71	0	0.67	0	0	0	0	0
Buliminella elegantissma	0.32	0	0	0	0	0	0	0	0	0
Cassidulina subglobosa cf.	0	0	0	0	0	0	0	0	0	0
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0
Cibicides spp.	3.15	1.26	0.71	0	0.67	0	0.4	0	0	0
Cribrostomoides crassmargo	0.95	0	1.42	1.42	0.67	0	0.4	0	0.91	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0
Elphidium frigidum	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0.32	0	0	0	0	0	0.8	0	0	0
Elphidium williamsoni	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0
Elphidium spp.	0.32	0	0.35	0	0	0	0.4	0	0	0
Elphidium org.lining	0.95	0	0.35	0	2.67	0	0	0	0	0
Euuvigerina juncea	0	0	0	0	0	0	0	0	0	0
Fursenkoinia fusiformis	1.58	1.26	1.42	1.42	0	0	0	0	0	0
Glomerspira gordialis	0	0	0	0	0	0	0	0	0	0
Hemisphaerammina bradyi	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0
Lagena sp.	0.32	0	0.35	0	0	0	0	0	0	0
Milammina fusca	0.63	0.63	0	0	0.67	0	0.4	0	0	0
Nonionella sp.	0	0	0	0	0	0	0	0	0	0
Nonionella sp.	0	0	0	0	0	0	0	0	0	0
Oolina spp.	0.32	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (akneria)	0	0	0	0	0	0	0	0	0	0
Reophax arctica	0.32	0	0	0	1.33	1.33	0	0	1.82	1.82
Reophax nana	6.31	6.31	2.84	2.84	0.67	0	3.6	3.2	1.82	1.82
Reophax nodulosa	0	0	0	0	0	0	0	0	0	0
Reophax scottii	66.2	63.1	80.9	78	79.3	72	82	80	83.6	80
Saccamina difflugiformis	0	0	0.71	0	0	0	0.4	0	1.82	0
Spiroplectimma biformis	0.95	0	0.71	0	1.33	0	0.8	0.8	0	0
Textualaria agglutinans	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0.91	0
Textularia earlandi	0.32	0	1.77	1.42	0.67	0	0.8	0.8	0	0
Textualaria torquata	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0.32	0	0	0	0	0	0.4	0	0	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	0	0	0	0	0	0	0	0	0	0
Trochammina inflata	3.47	0.63	2.48	0	2	1.33	2.4	0.8	0	0
Trochammina lobata	0	0	0	0	0	0	0	0	0	0
Trochammina nana	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	4.73	1.89	4.26	1.42	8	4	3.2	2.4	7.27	5.45
Trochammina pacifica	1.89	0	0	0	0.67	0	0.8	0	0	0
Trochammina sp.	1.89	1.89	0.71	0	0	0	2.4	2.4	1.82	1.82
Valvulinera laevigata cf.	0	0	0	0	0	0	0	0	0	0
PLANKTONIC FORAMINERA										
THECAMOEBIANS										
Centropyxsis aculeata	0.63	0.63	0	0	0.67	0	0.8	0.8	0	0
Lagenodifflugia sp.	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	722		712		704		702		692		682		672		662		654		652		642		632		622		612		604		602		592		582		572		566		562	
fraction (% total,% 45 um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	4.5		5.5		6		6		5.5		5		5		5.5		6		5		7		5.5		5		5.5		5		5.5		5.5		5		6		4.5		5	
total count/10cc	427		445		16.7		167		191		80		616		253		760		120		166		178		226		355		802		444		347		58		433		367		622	
% #45 per 10 cc/total per 10 cc	76		71.8		60		74		81.9		70		92.2		92.1		95.6		60		93.1		77.6		88.5		83.1		41.9		85.2		80.6		69		90.8		87.3		84.9	
BENTHIC FORAMINIFERA																																										
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammobaculites exigus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1.23	0	1.05	0	0	0	0	0	0	0	0	0
Ammonia beccarii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammotium cassis	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.49	0	0.82	0	0	0	0	0	0	0	0.61	0	0	0
Buccella depressa	1.04	0	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.38	0	0	0	0	0
Buccella frigida	0.52	0	3.67	0	0	0	6	0	2.86	0	7.5	0	0	0	0.72	0	0	0	1.67	0	0	0	1.02	0	1.77	0	3.59	0	2.24	0	0	0	4.19	0	0	0	0.38	0	1.82	0	0	0
Buliminella elegantissma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassidulina subglobosa cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.61	0	0	0
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cibicides spp.	1.04	0	3.67	0	0	0	4	0	0.95	0	2.5	0	0	0	0.72	0	0	0	5	0	0	0	0	0	0	0	1.03	0	1	0	0.41	0	2.09	0	0	0	0.38	0	0.61	0	0.32	0
Cribrostomoides crassmargo	0.52	0	0	0	0	0	1	0	2.86	1.9	0	0	0	0	0.72	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0.41	0	0	0	0	0	0	0	0	0	0.32	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.45	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	4.49	0	0	0	0	0	0.95	0	0	0	0	0	0	0	0	0	1.67	0	0	0	0	0	0	0	2.05	0	0.75	0	0.41	0	0	0	0	0	0	0	0.61	0	0	0
Elphidium williamsoni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium org.lining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.32	0
Euuvigerina juncea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fursenkoinia fusiformis	0	0	2.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0.22	0	16.7	0	0	0	1.02	0	0	0	0.51	0	45.6	1	0	0	0.52	0	0	0	0	0	1.82	0	0	0
Glomerspira gordialis	0	0	0	0	0	0	0	0	1.9	1.9	0	0	0	0	0	0	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hemisphaerammina bradyi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena sp.	1.04	0	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0.38	0	0	0	0	0
Milammina fusca	0	0	0.41	0	10	0	3	0	0.95	0	2.5	0	0.32	0	0	0	0.44	0	1.67	0	3.45	3.45	5.1	0	0.88	0	0	0	0	0	0.41	0	0	0	3.45	0	0.77	0	1.82	0	0.64	0
Nonionella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oolina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.05	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (aknerla)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax nana	3.13	3.13	1.22	0.82	0	0	2	2	0	0	0	0	0	0	5.76	5.76	2.85	2.63	6.67	6.67	0	0	2.04	0	1.77	1.77	1.03	1.03	2.24	2	2.87	2.46	3.14	3.14	6.9	6.9	0.77	1.54	0	0	3.86	3.86
Reophax nodulosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax scottii	79.7	64.6	70.2	65.3	60	60	40	40	73.3	70.5	50	40	97.1	90.9	60.4	57.6	92.3	91.2	48.3	46.7	77.6	75.9	70.4	61.2	89.4	83.2	83.1	80	37.4	35.9	79.5	75.4	72.8	68.1	44.8	41.4	49.2	87.7	78.2	75.2	87.8	78.5
Saccamina difflugiformis	0	0	0	0	10	0	7	6	0	0	0	0	1.3	1.3	3.6	2.88	0.88	0	1.67	0	5.17	3.45	0	0	0	0	0	0	0	0	2.46	1.64	1.05	1.05	10.3	0	1.15	1.54	0	0	1.61	1.29
Spiroplectimma biformis	0	0	0.41	0	0	0	1	0	0.95	0	0	0	0.32	0	2.88	2.88	0.22	0	0	0	1.72	0	0	0	0.88	0	0	0	0	0	0.82	0.82	1.05	0	0	0	0.38	0	0	0	1.29	0
Textualaria agglutinans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.51	0	0	0	0	0	0.52	0	0	0	0	0	0	0	0	0
Textularia earlandi	0	0	0.82	0.82	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.41	0	1.05	1.05	6.9	6.9	0	0	0	0	1.29	1.29
Textualaria torquata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.38	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.82	0	0	0
Trochammina inflata	1.04	0	2.04	0	0	0	2	0	4.76	1.9	0	0	0.32	0	0	0	2.19	1.75	5	0	0	0	0	0	0.88	0	0.51	0	0.25	0	1.64	0	1.57	0	0	0	0	0	0	0	0	0
Trochammina lobata	0	0	0	0	0	0	0	0	0	0	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.32	0
Trochammina nana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	8.33	5.21	6.53	3.27	10	0	30	26	7.62	5.71	25	20	0.32	0	15.8	14.4	0.66	0	8.33	6.67	7.76	6.9	19.4	16.3	3.54	3.54	3.59	1.03	3.99	2	6.97	4.1	7.85	6.28	17.2	6.9	0	0	12.1	12.1	1.61	0
Trochammina pacifica	0.52	0	1.22	0.82	0	0	0	0	2.86	0	0	0	0.32	0	3.6	2.88	0	0	1.67	0	4.31	3.45	1.02	0	0	0	2.56	1.03	0.75	0	1.23	0.82	1.57	1.05	0	0	0.38	0	0	0	0.32	0
Trochammina sp.	0	0	0.82	0.82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0.52	0	0	0	0	0	0	0	0	0
Valvulinera laevigata cf.	0	0	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PLANKTONIC FORAMINERA																																										
THECAMOEBIANS																																										
Centropyxsis aculeata	3.13	3.13	0.82	0	0	0	0	0	0	0	0	0	0	0	5.76	5.76	0	0	1.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.9	6.9	0	0	0	0	0.32	0
Lagenodifflugia sp.	0	0	0	0	0	0	3	0	0	0	2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0.41	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	554		552		542		532		522		512		504		502		492		482		472		464		462		455		452		442		432		422		412		405		402		393	
fraction (% total,% 45 um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	5.5		6		6		6		5.5		7		6		5		5.5		6.5		7		4.5		5.5		5		5.5		4.5		7		7		6		5.5		5.5		6.5	
total count/10cc	1382		798		1023		1157		1318		630		248		1424		176		172		300		180		416		642		278		184		539		344		802		940		1220		572	
% #45 per 10 cc/total per 10 cc	91.6		94.4		95.1		95.7		91.6		93		74		89.2		56		93		96		73		85		66		69		34		90		72		70		44		89		84	
BENTHIC FORAMINIFERA																																												
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammobaculites exigus	0	0	0	0	0	0	0	0	0	0	0	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0.6	0.2	0	0	0	0	0
Ammonia beccarii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammotium cassis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	2	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0
Bolivina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0.6	0	0	0	0	0
Buccella depressa	0.26	0	0	0	0	0	0.14	0	0	0	0	0	0	0	0	0	1	0	0	0	0.5	0	4.9	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buccella frigida	0	0	0	0	0.16	0	0	0	0.28	0	0	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	5.3	0	3.9	0	0	0	0	0	1.2	0	1.7	0	1.4	0	0	0	0	0
Buliminella elegantissma	0	0	0	0	0	0	0	0	0.28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0.7	0	0	0	0	0	0	0	0.2	0.2	0.2	0.2	0	0	0	0
Cassidulina subglobosa cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.2	0.6	0	0	0	0.3	0.3
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cibicides spp.	0.53	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	7.4	0	0.9	0	0.3	0	0.7	0	0	0	0	0	1.2	0	1	0	2.9	0.6	0	0	0	0
Cribrostomoides crassmargo	0.26	0	0.21	0	2.93	2.61	0.43	0	0.69	0	0.5	0	1.3	0	0.14	0	0	0	0.9	0	0.5	0	6.2	0	3.9	0	4.7	0	3.9	0	0	0	0	0	0	0	0.2	0	0.4	0	0	0	0	0
Eggerella advena	0.13	0	0	0	0	0	0	0	0	0	0	0	2	0	0.14	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0.15	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	2.6	0	2.4	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium williamsoni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	0	0	0	0	0
Elphidium org.lining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0
Euuvigerina juncea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fursenkoinia fusiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glomerspira gordialis	0.53	0.53	0	0	0	0	0.58	0.6	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	0.4	10	2.9	39	4.4	0	0	0	0
Hemisphaerammina bradyi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0.4	0.2	0	0	0	0.3	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena sp.	0.26	0	0	0	0	0	0.14	0	0	0	0	0	0	0	0	0	1	0	0	0	0.5	0	4.9	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Milammina fusca	0.79	0	0.21	0	0.33	0	0.58	0	0.69	0	0.9	0	0	0	0.42	0	7.2	0	1.8	0	0.5	0	2.5	0	3.1	0	2.2	0	3.3	0	4.8	0	0.5	0	0.8	0.4	0	0	1.4	0	0.15	0	0.3	0.3
Nonionella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0
Oolina spp.	0	0	0	0	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (akneria)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	0	0	0	0	0	0	0	0	0.55	0.6	0	0	0.7	0.7	0	0	6.2	6.2	0	0	0	0	1.2	1.2	0	0	0.6	0.6	3.9	3.9	0	0	2.9	2.4	0	0	1.2	1	1	1	0	0	0	0
Reophax nana	1.18	1.05	1.25	0.84	1.95	1.95	3.03	2.9	1.79	1.7	0.9	0.9	0	0	1.26	4.5	1	0	0	0	1.4	1.4	0	0	0.4	0.4	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax nodulosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax scottii	91.3	87.4	94.8	91.9	90.9	88.6	91.5	90	92.1	88	94	91	85	72	94.2	344	52	37	90	88	93	93	69	69	82	81	65	60	57	54	52	46	90	85	85	69	74	63	39	34	94.6	87	93	13
Saccamina difflugiformis	0.92	0.53	1.04	0.84	0.33	0	0.14	0	0.28	0	0.9	0.9	2.7	0	0.42	0.6	8.2	5.2	2.7	1.8	1	1	1.2	1.2	1.3	1.3	3.7	2.8	3.3	3.3	12	2.4	2.1	0.5	5	1.7	0.8	0.2	3.9	1.4	1.19	0.3	1.9	0.8
Spiroplectimma biformis	0.39	0	0.63	0	0.65	0.65	0.43	0	0.14	0	0.7	0	2	0	0.56	0	0	0	0	0	0	0	0	0	0	0	1.2	0	2	1.3	0	0	0.8	0.3	0.4	0	1.7	0.4	0.2	0.2	0.45	0	0	0
Textualaria agglutinans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	0	0	0	0	0.81	0.65	0.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.2	0	0.3	0.3	0	0	0.4	0.2	0	0	0.15	0.1	0	0
Textualaria torquata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0.26	0	0	0	0	0	0	0	0.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.2	0	2	0	0	0	0	0	0.4	0	0.4	0	0	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	0.13	0	0.21	0	0	0	0	0	0	0	0	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0
Trochammina inflata	0	0	0.42	0	0.16	0	0.14	0	1.79	0	1.8	0.9	0	0	0	0	0	0	0	0	0.5	0	0	0	1.3	0	1.9	0	3.9	0	0	0	0	0	0	0	0.2	0	1.2	0.2	1.04	0.6	0.5	0.5
Trochammina lobata	0.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0.7	0	0	0	0	0	0	0	0.2	0	0.2	0	0.15	0	0	0
Trochammina nana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	1.97	1.58	1.04	0.84	0.65	0	2.59	2.3	1.24	1.1	0	0	1.3	0.7	1.26	3.9	8.2	4.1	4.5	3.6	1.4	1	0	0	3.1	1.3	5.3	1.2	5.9	3.9	9.6	7.2	0.8	0.5	1.7	0.4	2.3	0.2	1.2	0.4	1.49	0.7	2.2	1.1
Trochammina pacifica	0.26	0	0.21	0	0.81	0.65	0.14	0	0	0	0.2	0	1.3	0.7	0.56	0.6	4.1	0	0	0	0.5	0	0	0	1.7	0.9	4	0	3.9	1.3	0	0	1.1	0.8	1.7	0.4	2.5	0.6	2.3	0.2	0.3	0	1.1	0.5
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1.2	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.2	1.2	0	0	0	0
Valvulinera laevigata cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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Centropyxsis aculeata	0.53	0.53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.1	2.1	0	0	0	0	0	0	0	0	0.6	0.6	0.7	0.7	12	12	0.5	0	0.8	0	0	0	0	0	0	0	0.3	0.3
Lagenodifflugia sp.	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0.98	2.8	4.1	0	0	0	0	0	0	0	0	0	0.6	0.6	0	0	6	0	0.5	0.3	0	0	0	0	0.6	0	0.3	0	0	0

corrected depth (cm)	382		372		366		358		355		342		334		322		312		305		302		292		282		272		262		254		252		242		232		222		212		204	
fraction (% total,% 45 um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	6		5.5		7		5		6		6		10		6		6		5.5		5.5		5		6		5.5		5		6		5		5.5		6		6.5		6		5.5	
total count/10cc	303		187		103		324		310		717		538		597		492		542		422		272		492		616		272		295		192		967		355		935		133		311	
% #45 per 10 cc/total per 10 cc	12		72		57		86		54		76		63		73		83		77		67		76		76		72		64		61		29		80		67		86		38		64	
BENTHIC FORAMINIFERA																																												
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0.3	0	0	0	0
Ammobaculites exigus	0	0	0	0	0	0	0	0	0	0	0.2	0	0.2	0.2	0.3	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia beccarii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.2	0	0	0	0
Ammotium cassis	0	0	0	0	0	0	0	0	0.5	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	0	0	0	0	0	0	0	0	0.5	0	0.2	0	1.1	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buccella depressa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buccella frigida	3.3	0	1	0	0	0	0	0	2.7	1.1	0.7	0.2	0	0	0.6	0	0	0	1.3	0	0	0	2.2	0	0	0	0	0	0.7	0	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0
Buliminella elegantissma	0.5	0	1	0	0	0	0	0	1.6	0	0.2	0	0.4	0	0.3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassidulina subglobosa cf.	1.1	0	0	0	0	0	0	0	1.6	0	0	0	0.7	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cibicides spp.	0	0	2.9	0	2.8	0	0	0	3.2	0	0.9	0	0.7	0.6	1.1	0.3	0	0	0.7	0.3	1.3	0	0.7	0	0.3	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cribrostomoides crassmargo	0	0	1.9	0	0	0	0	0	0.5	0	0.2	0	0.2	0	0	0	1	0	0.3	0	6.5	0	0	0	0	0	0	0	0.7	0	0	0	0.6	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0.5	0	0.5	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	1.3	0	0	0	0	0	0	0	0	0	0.6	0	0	0	0.2	0	0	0	0	0	0	0	0.6	0
Elphidium subarcticum	1.6	0	0	0	0	0	0	0	0	0	0	0	0.2	0.2	0.8	0	0	0	0.3	0	0	0	0.7	0	0	0	0.3	0	1.5	0	1.1	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium williamsoni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0	0	0	0.9	0	0	0	0	0	0	0
Elphidium org.lining	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euuvigerina juncea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fursenkoinia fusiformis	74	0	1	0	6.9	0	0	0	22	3.2	1.2	0	34	17	4.5	0	0	0	0.3	0.3	0	0	0	0	0	0	4.4	0	6.6	0	2.3	0	0	0	0	0	0	0	0	0	0	0	0	0
Glomerspira gordialis	0	0	0	0	0	0	0	0	0.5	0.5	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0	0	0	1.3	0	0	0
Hemisphaerammina bradyi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena sp.	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5	0	0	0	0	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Milammina fusca	0	0	1	0	1.4	0	0	0	0	0	0.5	0	0	0	0	0	1	0	0.3	0	1.3	0	1.5	0	0	0	1.8	0	1.5	0	0.6	0	1.1	0	0	0	1.9	0.5	0.3	0	0	0	0	0
Nonionella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oolina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (akneria)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	1.1	0.5	1.9	1.9	1.4	1.4	0	0	1.1	1.1	0.2	0.2	1.1	1.1	1.1	1.1	1.4	1.4	1.3	1.3	2.2	1.7	0	0	0	0	0.3	0.3	2.2	0.7	0.6	0.6	0.6	0	2.4	1.9	2.8	1.4	0.5	0	1.3	0	0.6	0
Reophax nana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0.5	0	0	0	0
Reophax nodulosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax scottii	7.1	7.1	69	66	54	46	78	72	55	46	88	75	46	37	77	68	79	77	74	71	66	64	77	72	83	75	73	68	65	58	62	55	18	14	77	70	53	46	87	81	44	31	67	55
Saccamina diffiugiformis	2.7	0.5	8.7	1.9	8.3	4.2	3.8	1.1	1.6	1.1	0.2	0	0.7	0.7	1.4	0.6	1	0.3	2.7	0.3	2.2	0.4	3.7	0.7	2.4	0.7	2.7	1.5	2.9	0.7	4	2.3	7.9	0	1.7	0.6	4.7	2.3	2	0	7.5	1.3	2.3	0.6
Spiroplectimma biformis	0	0	0	0	0	0	0	0	0.5	0	0.9	0.2	3.7	2.8	0.8	0	2.7	0	3	0.7	3.4	0	0	0	0.7	0	0.6	0	1.5	0.7	0.6	0	1.1	0	1.1	0.2	0.9	0.9	0.8	0	0	0	0.6	0
Textualaria agglutinans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.1	1.1	0.5	0	0	0	0	0	0	0
Textualaria torquata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	0	0	0.9	0	1.5	0	0.8	0	0.3	0	0.7	0	0.9	0	0	0	0	0	0	0	0	0	1.1	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	0.5	0	0	0	0	0	0	0	0.5	0	0	0	0.4	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina inflata	1.1	0	1.9	0	5.6	0	0	0	1.6	0	0.2	0	0.6	0.4	0.3	0	0.3	0	1.3	0	1.7	0	0	0	0.7	0	1.2	0	1.5	0	2.3	0.6	2.3	0	0.6	0	0.5	0	0	0	1.3	0	0.6	0
Trochammina lobata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0.3	0	0.7	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0	0	0	0	0
Trochammina nana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	3.3	2.7	4.9	1.9	8.3	2.8	1.6	0.5	1.6	0.5	1.2	0.2	1.7	0.6	2.5	1.4	4.4	1.7	5	1.3	6	0.4	5.1	2.2	2	0.3	1.5	1.2	5.1	2.2	1.1	0.6	4.5	1.7	4.5	3	9.9	7	2.5	1.6	13	2.5	9.4	3.5
Trochammina pacifica	0.5	0	1.9	0	11	2.8	3.8	1.6	4.8	0.5	3.3	0	5.6	2	7	0.8	7.5	2.7	5.7	1.3	4.3	0.4	4.4	0.7	9.8	0.7	13	1.2	9.6	1.5	16	1.7	15	0.8	11	2.6	16	6.1	4.3	1.8	25	2.5	19	4.7
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Valvulinera laevigata cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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Centropyxsis aculeata	0	0	1.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0.4	0	0	0.3	0	0.9	0	0	0	0.6	0	1.1	0	1.1	0.8	4.7	1.9	1.3	0.3	2.5	0	0	0
Lagenodifflugia sp.	1.6	1.1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7	0	0	0	0.9	0	2.2	0	0.3	0	0.3	0	0	0	4	0	1.7	0	0.2	0	3.8	0.5	0	0	5	0	0	0

corrected depth (cm)	202		192		182		172		162		154		152		144		142		134		122		112		104		102		92		82		72		62		54		52		42		32	
fraction (% total,% 45 um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	5		7		6		7		6		7		8		8		7.5		5.5		4		4		4.5		4.5		5		5		5		5.5		3.5		2.5		5		4	
total count/10cc	436		121		197		664		710		614		344		126		139		304		240		263		147		47		152		160		700		533		1220		460		662		378	
% #45 per 10 cc/total per 10 cc	79		54		69.5		75		73		90		67		71		86		74		43		91		11		62		38		58		92		48		56.21		56		52		60	
BENTHIC FORAMINIFERA																																												
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammobaculites exigus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia beccarri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0	0	0	0
Ammotium cassis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	0	0	0	0	0	0	0	0	0	0	0.4	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.234	0	0	0	0.3	0	0	0
Buccella depressa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buccella frigida	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.234	0	0	0	0.3	0	0	0
Buliminella elegantissma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	0
Cassidulina subglobosa cf.	0	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cibicides spp.	0	0	0	0	0	0	0	0	0.7	0	0.8	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cribrostomoides crassmargo	0	0	1.2	0	0	0	0.6	0	0.7	0	0	0	0.7	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7	0
Eggerella advena	0	0	0	0	0	0	0.2	0	0.5	0.2	0	0	0	0	0	0	0	0	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium frigidium	0	0	0	0	1.69	0	1.3	0.4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium williamsoni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7	0
Elphidium spp.	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7	0
Elphidium org.lining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0
Euuvigerina juncea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fursenkoinia fusiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22.95	0	0	0	0.6	0	0	0
Glomerspira gordialis	1.4	0.5	1.2	0	0	0	0.4	0.4	0.2	0.2	0	0	0.4	0	0	0	0	0	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0.9	0	0.7	0
Hemisphaerammina bradyi	0	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Milammina fusca	0	0	1.2	0	5.93	0	1.1	0	0.5	0	0.8	0	0.4	0	1	0	1	0	0.6	0	1	0	1	0	4.5	0	4.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7	0
Oolina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (akneria)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	1.4	0.9	1.2	0	0.85	0.8	1.1	0.9	0.5	0.2	1.7	1.7	0.7	0.7	1	1	1.9	1	2.4	2.4	0	0	1	1	4.5	3	0	0	0	0	1.3	0	2	1.7	2	1.4	1.171	0.7	5.2	3.5	2.1	0	2.6	0.7
Reophax nana	0	0	0	0	0	0	0	0	1.2	1.2	4.6	4.2	1.8	1.5	3	2	0	0	0	0	0	0	0	0	1.5	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax nodulosa	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax scottii	69	61	65	52	68.6	64	71	65	73	65	73	68	65	59	44	42	83	82	72	66	78	39	81	81	70	0	57	48	59	38	64	51	88	87	70	43	53.86	48	61	47	61	47	74	58
Saccamina difflugiformis	7.3	6	2.4	0	4.24	3.4	3.7	1.1	2.6	1.2	3	1.3	5.1	2.2	11	7.9	1	1	1.2	0.6	4.2	0	3.8	1.9	7.6	6.1	4.8	4.8	14	0	5	2.5	3.1	1.1	3.1	0.7	2.108	0.5	2.6	2.6	0	0	0.7	0
Spiroplectimma biformis	1.4	1.4	0	0	1.69	0	1.7	0.2	0.9	0.2	1.7	0	1.1	0	3	2	1.9	0	0.6	0	2.1	0	1	0	0	0	0	0	1.3	0	5	0	0.9	0	0	0	0.234	0	3.5	0	0	0	0	0
Textualaria agglutinans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1.5	0	0	0	0	0	1.3	0	0.3	0	0	0	0	0	0	0	0.3	0.3	0	0
Textualaria torquata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0.3	1.3	0
Trochammina discorbis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina inflata	0.5	0	2.4	0	3.39	0	1.7	0.6	0	0	0	0	1.1	0.4	5.9	2	1.9	0	0	0	0	0	0	0	1.5	0	0	0	1.3	0	1.3	0	0.3	0	0.3	0	0.468	0.2	0.9	0	0	0	0	0
Trochammina lobata	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.234	0	0	0	0	0	0.7	0
Trochammina nana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	8.3	5.5	5.9	1.2	5.08	0.8	3.7	1.5	3.8	2.6	3	2.1	4.4	0.4	12	7.9	3.8	1	3.6	1.2	2.1	0	5.7	3.8	1.5	0	4.8	0	1.3	0	5	1.3	1.1	0.3	2	0	2.81	1.9	0	0	2.1	1.2	1.3	0
Trochammina pacifica	11	3.2	13	0	5.08	0	12	4.9	15	1.9	6.8	1.3	17	2.5	9.9	6.9	5.8	1	18	4.2	6.3	2.1	4.8	2.9	7.6	0	29	9.5	22	0	16	2.5	3.1	1.7	22	2.4	15.22	4.4	26	2.8	14	3.3	15	1.3
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Valvulinera laevigata cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PLANKTONIC FORAMINERA																																												
THECAMOEBIANS																																												
Centropyxsis aculeata	0	0	4.7	1.2	1.69	0.8	0.9	0	0.2	0	3	2.5	0.7	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.	0.5	0	2.4	0	1.69	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0.9	0.9	0.7	0.7	0.468	0.5	0	0	0	0	0.7	0

corrected depth (cm)	21.5		12		8.5	
fraction (% total,% 45 um)	%t	%45	%t	%45	%t	%45
volume (ml)	3.5		6		5	
total count/10cc	1463		565		800	
% #45 per 10 cc/total per 10 cc	77.54		81		82	
BENTHIC FORAMINIFERA						
Adercotyma glomerata	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0
Ammobaculites exigus	0	0	0	0	0	0
Ammonia beccarii	0	0	0	0	0	0
Ammotium cassis	0	0	0	0	0	0
Bolivina pacifica	0.195	0.2	0	0	0.5	0
Buccella depressa	0	0	0	0	0	0
Buccella frigida	0.195	0	0	0	0.5	0
Buliminella elegantissma	0	0	0	0	0	0
Cassidulina subglobosa cf.	0	0	0	0	0	0
Chilostomella oolina	0	0	0	0	0	0
Cibicides spp.	0.195	0	0	0	0	0
Cribrostomoides crassmargo	0	0	0	0	0	0
Eggerella advena	0	0	0.3	0	0.8	0
Elphidium exclavatum	0	0	0	0	0	0
Elphidium frigidium	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0	0
Elphidium williamsoni	0	0	0	0	0.3	0
Elphidium spp. (tiny)	0.195	0	0	0	0	0
Elphidium spp.	0	0	0	0	0	0
Elphidium org.lining	0	0	0	0	0	0
Euuvigerina juncea	0	0	0	0	0	0
Fursenkoinia fusiformis	0	0	0	0	0	0
Glomerspira gordialis	0.391	0	0.3	0	0.3	0
Hemisphaerammina bradyi	0	0	0	0	0	0
Islandiella teretis	0.195	0	0	0	0	0
Lagena sp.	0	0	0	0	0	0
Milammina fusca	0.195	0	0	0	0.8	0
Nonionella sp.	0	0	0	0	0	0
Nonionella sp.	0	0	0	0	0	0
Oolina spp.	0	0	0	0	0	0
Quinqueloculina sp. (akneria)	0	0	0	0	0.3	0
Reophax arctica	1.172	0.8	0.3	0	1	0.8
Reophax nana	0	0	0	0	1	1
Reophax nodulosa	0	0	0	0	0	0
Reophax scottii	83.4	73	84	79	62	56
Saccamina difflugiformis	0.781	0	0	0	0	0
Spiroplectimma biformis	0.781	0.2	0.6	0	1.5	0.3
Textualaria agglutinans	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0
Textularia earlandi	0.391	0.2	0.6	0	0	0
Textualaria torquata	0.195	0.2	0	0	0	0
Trifarina fluens	0.391	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	0	0
Trochammina discorbis	0	0	0	0	0	0
Trochammina inflata	1.563	0	1.8	0.6	2	0
Trochammina lobata	0	0	0	0	0	0
Trochammina nana	0	0	0	0	0	0
Trochammina ochracea	1.758	0.6	0.9	0.3	3.8	0.3
Trochammina pacifica	7.813	2.1	8.6	0.9	19	4.5
Trochammina sp.	0	0	0	0	0	0
Valvulinera laevigata cf.	0	0	0	0	0	0

PLANKTONIC FORAMINERA						
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Centropyxsis aculeata	0	0	0	0	0	0
Lagenodifflugia sp.	0.195	0	2.9	0.3	7.3	0

% Species abundances

Relative species abundance is presented as the % contribution of each selected species contained in a 10 cm^3 of sample (Figures 3.12 to 3.14).

Thecamoebians have a presence the length of the core ranging from 0 to 20%, but generally as numerous small peaks less than 5% of the relative abundance; with the exception of 5 peaks occurring at 0 to 10 cm, 180 to 230 cm, 440 cm (20 %), 480 cm and 580 cm.

Miliammina fusca is found present the length of the core mostly as numerous small peaks of less than 2 to 3% of the relative abundance, and has a greater presence at 100 cm, 170 cm, 440 cm, 460 cm, 480 cm, 620 to 630 cm, 700 cm (12%), 850 to 860 cm, and 880 to 890 cm.

Reophax scottii is present the length of the core, generally greater than 60% and dominates the relative abundance. Sharp declines in abundance occur at 249 cm, 375 cm, and 830 cm.

Trochammina spp. includes several species that have been combined into one species group under the genus - primarily, T. *discorbis, T. ochracea, T. pacifica* and others due to their morphological similarities. The relative abundance of *Trochammina* spp. ranges from 1 to 40% of the faunal assemblage, and is present the length of the core. The greatest relative abundance occur at 0 to 300 cm, and generally greater than 10%. It is less than 10% from 300 to 660 cm, and from 660 cm until the end of the core it is greater than 10%. Several peaks in abundance between 20 to 40% do occur at 20 to 60 cm, 80 to 100 cm, 150 cm, 200 cm, 380 cm, 700 cm, and 780 to 790 cm.

Reophax arctica is present in the upper 540 cm of the core, from 0.1 to 6%, and then appears as a small peak from 710 to 780 cm of 2 % relative abundance.

Spiroplectimma biformis has a presence throughout the length of the core ranging from 0.1 to 5%, and is generally present as numerous small peaks less than 2 to 3%, with the exception larger abundance occurring at 50 cm, 70 cm, 300 to 340 cm, 800 to 810 cm. It is particularly abundant from 0 to 350 cm.

Saccamina difflugiformis has a presence throughout the length of the core as numerous small peaks in relative abundance, generally less than 5% with the exception of larger abundances occurring at 70 to 130 cm, 150 cm, 190 to 210 cm, 250 cm, 360 to 370 cm, 440 cm, 480 cm, 580 cm, and 700 cm.

Fursenkoina fusiformis is found as several discrete peaks in relative abundance ranging from 4 to 80 % throughout the length of the core – 60 cm (25%), 250 to 260 cm (10%), 320 to 380 cm (40 to 80 %), 410 to 420 cm (50 %), 560 cm (6%), 600 cm (50%), 650 cm (20%), 710 cm (6%), 760 cm (6%), 830 cm (10%).

Bolivina pacifica is found as many small peaks in relative abundance generally less than 1 % throughout the length of the core – 0 to 50 cm, 160 cm, 260 cm, 320 to 350 cm, 410 cm, 560 cm, 760 cm with the exception of the larger peaks at 600 cm (3%) and 830 cm (5%).

Buccella spp. is a grouping of 2 species, *B. frigida* and *B. depressa*, who have similar morphologies. Again, *Buccella* spp. is found as many small peaks in abundance generally less than 5% throughout the length of the core - 0 to 10 cm, 40 cm, 140 to 160 cm, 250 to 260 cm, 280 to 310 cm, 350 cm, 370 cm, 410 to 430 cm, 440 to 460 cm, 470 cm, 560 cm, 570 to 620 cm, 660 to 710 cm, 760 cm, 810 to 850 cm, with the exception of a larger peak in relative abundance occurring at 830 cm (20%). The locations of peak abundances are similar to *Elphidium* spp. and *Cibicides* spp.

Cibicides spp. is a species grouping of C. *lobatulus*, C. *fletcheri*, and *Planorbulina mediterranensis* - due to their morphological similarities. These species are found in discrete peaks of relative abundance the length of the core generally up 5% - 110 cm, 160 cm, 260 to 300 cm, 310 to 350 cm, 360 cm, 400 to 430 cm, 460 cm, 500 cm, 550 to 610 cm, 650 cm, 660 to 730 cm, 760 cm, 810 cm with the exception of larger peaks in relative abundance occurring at 560 cm (10%) and 830 cm (25%). The locations of peak abundances are similar to *Buccella* spp. and *Elphidium* spp.

Elphidium spp. is a species grouping of *E. crispum*, *E. subarcticum*, *E. frigidium*, and others - due to their similar morphologies, and generally low individual representation These species are present almost the length of the core, generally less than 3% - 30 cm, 130 cm, 140 cm, 160 to 180 cm, 200 to 330 cm, 380 cm, 410 cm, 440 to 450 cm, 560 cm, 610 cm, 640 cm, 690 to 710 cm, 740 cm, 770 cm with the exception of a larger peak in relative abundance occurring at 830 cm (10 %). The locations of peak abundances are similar to *Buccella* spp. and *Cibicides* spp.

Unilocular forms include *Fissurina* spp. and *Oolina* species groups – that are further grouped together due to their low individual representation, but yet are still important indicators of the influx of shelf waters into the inlet. These species are present the length of the core as numerous as peak abundance events ranging from 0.5 to almost 5 %. The locations of peak abundances are similar to *Buccella* spp., *Cibicides* spp., *Elphidium* spp. and others. From 250 cm to 300 cm there are two peaks in relative abundance of ~ 1 and 2%, and from 375 to 610 cm, the abundance is continuous of 0.5 to 1.5% with a peak of 5% occurring at ~460 cm. These forms reappear again at ~700 cm, until the end of the core with relative abundances of 1.5 to 3%.

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corrected depth (cm)	6		11		21		31		41		51		59		61		71		93		101		121		131		141		154		165		175		185		195		203		206		208	
fraction (%total, % 45 um)	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45
volume (ml)	10		10		10		10		10		10		10		10		10		10		10		10		10		10		10		10		10		10		10		10		3.5		5	
total count/10cc	214		454		303		38		72		71		66		34		52		78		30		11		27		13		9		10		31		10		30		218		457		36	
% #45 per 10 cc/total per 10 cc	96.7		29		59		97.4		36		94.4		95.5		17.6		76.9		94		97		64		92.6		92.3		66.7		90		100		40		86.7		33.5		49		44	
BENTHIC FORAMINIFERA																																												
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.6	0
Ammonia beccarii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	0	0	3.1	0	2.3	0	0	0	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.4	2.5	0	0
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buccella depressa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0.6	0	0	0
Buccella frigida	0	0	0	0	0.3	0.3	0.5	0.5	5.6	2.8	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	1.9	1.3	0	0
Buliminella elegantissma	0	0	2	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0.6	0	0
calcareous fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassidulina subglobosa cf.	0	0	0	0	0	0	0	0	1.4	0	0	0	0	0	2.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.6	0
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0
Cibicides spp.	0	0	0.2	0	0.7	0	0	0	1.4	0	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0.9	0.9	0.6	0	5.6	0
Cribrostomoides crassimargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella hannai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	2.5	0	0
Elphidium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Epistominella vitrea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fissurina marginata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fursenkoina fusiformis	0	0	63	0	35	0	0.9	0.9	50	4.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.7	3.7	0	0	11	0	10	0	0	0	10	0	0	0	4.1	4.1	64	22	0	0
Globobulimina pupoides	0	0	0.4	0	0.3	0	0	0	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glomerspira gordialis	0	0	0	0	0	0	0	0	0	0	0	0	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haplophragmoides spp.	0	0	0	0	0	0	0	0	1.4	0	0	0	0	0	15	0	7.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	5.6	0
Islandiella norcrossi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena spp.	0	0	0.2	0	0	0	0	0	1.4	0	0	0	0	0	2.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.3	0	0.5	0.5	0	0	0	0
Milammina fusca	0.5	0	0.2	0	0	0	0	0	1.4	0	1.4	0	1.5	0	2.9	0	3.8	0	2.6	0	3.3	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	11	0
Nonionella turgida/digitata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella stella	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	2.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0
Pseudononion basispinata	0	0	0.2	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oolina melo	0	0	0	0	0	0	0	0	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (akneriana)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recuvoides turbinatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	1.4	1.4	0	0	0	0	0	0	0	0	1.4	1.4	0	0	2.9	2.9	1.9	1.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	10	0	0	0.9	0.9	2.5	2.5	5.6	5.6
Reophax scottii	96	95	28	28	56	55	14	14	29	29	92	92	92	91	15	15	75	75	92	92	90	90	64	64	89	81	92	92	56	56	90	90	94	94	30	30	80	80	26	26	18	18	39	39
Saccamina difflugiformis	0	0	0.7	0.7	0.7	0.7	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0.5	0	0	0	0
Spiroplectimma biformis	0.9	0	0	0	0	0	0	0	0	0	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.3	3.3	0	0	0	0	0	0
Spirosigmoilina tenuis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.6	0	0	0	0	0	0	0	0	0	11	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0.5	0	0	0	0	0	0	0	0	0	1.4	0	0	0	5.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	3.3	0	0	0	0	0	5.6	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.6	0
Trochammina discorbis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	1.9	0	1.3	0	0	0	9.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.6	0
Trochammina inflata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina macrens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0.5	0	0	0	0
Trochammina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina rotaliformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp. (tiny)	0	0	0.2	0.2	0	0	0.5	0.5	0	0	0	0	0	0	0	0	0	0	1.3	1.3	3.3	3.3	0	0	3.7	3.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lobate	0.5	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.7	0	0	0	0	0	0	0
Trochammina sp.-lesslob.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.9	0	0	0	0	0	0	0	9.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
organic linings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
weird-ufo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PLANKTONIC FORAMINIFERA																																												
planktonics	0	0	0	0	0	0	0	0	4.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.1	0	0	0
THECAMOEBIANS																																												
Centropyxsis aculeata	0	0	0	0	0	0	0	0	0	0	1.4	1.4	1.5	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia oblongata	0.5	0.5	0	0	0	0	0.5	0.5	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.5	6.5	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.3	3.3	0	0	3.7	3.7	0	0	0	0	0	0	0	0	0	0	3.3	3.3	0	0	0	0	0	0
Lagenodifflugia sp.2(ball)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	216		219		231		241		251		261		271		281		293		301		307		317		325		331		361		371		381		391		401		411		423		431	
fraction (%total, % 45 um)	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45
volume (ml)	10		5		10		10		10		10		10		10		10		10		10		10		10		10		10		10		10		10		10		10		10		10	
total count/10cc	39		94		82		34		47		151		24		22		4		5		6		15		18		6		53		6		5		5		3		22		9		21	
% #45 per 10 cc/total per 10 cc	59.0		80.9		96.3		97.1		51.1		86.8		88		41		100		40		83.3		46.7		36.0		66.7		17		16.7		60		40		100		63.6		33		71.4	
BENTHIC FORAMINIFERA																																												
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0
agglutinated fragments	2.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia beccarii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	0	0	0	0	0	0	0	0	0	0	1.3	1.3	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	5.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buccella depressa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buccella frigida	0	0	0	0	0	0	0	0	0	0	0.7	0	0	0	9.1	0	0	0	0	0	0	0	6.7	0	0	0	0	0	5.7	0	0	0	0	0	0	0	0	0	0	0	0	0	4.8	0
Buliminella elegantissma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
calcareous fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassidulina subglobosa cf.	26	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.5	0	0	0	0	0
Cibicides spp.	2.6	0	0	0	0	0	0	0	2.1	0	0.7	0	0	0	4.5	0	0	0	20	0	0	0	6.7	0	18	0	0	0	13	0	0	0	0	0	40	0	0	0	0	0	0	0	9.5	0
Cribrostomoides crassimargo	0	0	2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella hannai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.8	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Epistominella vitrea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fissurina marginata	0	0	0	0	0	0	0	0	2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fursenkoina fusiformis	0	0	15	15	0	0	0	0	43	0	94	83	0	0	41	0	0	0	0	0	0	0	0	0	0	0	0	0	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Globobulimina pupoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0
Glomerspira gordialis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haplophragmoides spp.	5.1	0	2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.7	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0
Islandiella norcrossi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Milammina fusca	5.1	0	0	0	1.2	0	2.9	0	0	0	0.7	0	8.3	0	0	0	0	0	20	0	17	0	20	0	0	0	0	0	0	0	33	0	40	0	20	0	0	0	14	0	33	0	0	0
Nonionella turgida/digitata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella stella	2.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudononion basispinata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oolina melo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (akneriana)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recuvoides turbinatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	0	0	0	0	0	0	2.9	2.9	0	0	0	0	0	0	0	0	0	0	20	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	67	67	0	0	0	0	0	0
Reophax scottii	56	56	66	66	95	94	94	94	49	49	2	2	92	88	41	41	100	100	20	20	83	83	47	47	33	33	67	67	17	17	17	17	40	40	40	40	67	67	64	59	22	22	76	71
Saccamina difflugiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0
Spiroplectimma biformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.5	0	0	0	0	0
Spirosigmoilina tenuis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.9	0	0	0	1.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	0	0	0	0	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.9	0	0	0	0	0	0	0	0	0	0	0	0	0	4.5	0	0	0	0	0
Trochammina discorbis	0	0	0	0	1.2	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	0	17	0	20	20	0	0	0	0	4.5	0	0	0	4.8	0
Trochammina inflata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina macrens	2.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina rotaliformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp. (tiny)	2.6	2.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lobate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lesslob.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
organic linings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
weird-ufo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PLANKTONIC FORAMINIFERA																																												
planktonics	0	0	0	0	0	0	0	0	2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THECAMOEBIANS																																												
Centropyxis aculeata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia oblongata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.	0	0	0	0	1.2	1.2	0	0	2.1	0.7	0.7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64	64	11	11	0	0
Lagenodifflugia sp.2(ball)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	441		451		461		470		472		481		491		501		511		521		532		541		561		568		569		572		579		583		591		602		609	
fraction (%total, % 45 um)	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45
volume (ml)	10		10		10		2.5		10		10		10		10		10		10		10		10		10		5		5		5		10		10		10		2.5		5	
total count/10cc	3		11		14		4		3		5		23		30		6		17		7		19		27		388		926		322		12		9		9		40		26	
% #45 per 10 cc/total per 10 cc	100		73		79		100		100		100		43		83.3		83.3		47.1		85.7		57.9		81.5		11.3		3.0		2.5		91.7		77.8		100		80		100	
BENTHIC FORAMINIFERA																																										
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia beccarii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	4.3	0	0	0	0	0	0	0	0	0	0	0	0	0	5.67	0	21	0	2.5	0	0	0	0	0	0	0	0	0	0	0
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buccella depressa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.52	0	0	0	1.2	0	0	0	0	0	0	0	0	0	0	0
Buccella frigida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.33	0	0	0	0	0	0	0	11	0	7.41	0	5.67	0	20	0	8.1	0	0	0	0	0	0	0	0	0	0	0
Buliminella elegantissma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.03	0	2.5	0	0.6	0	0	0	0	0	0	0	0	0	0	0
calcareous fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0.52	0	10	0	5.6	0	0	0	0	0	0	0	0	0	0	0
Cassidulina subglobosa cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.03	0	1.3	0	0.6	0	0	0	0	0	0	0	0	0	0	0
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1.9	0	0	0	0	0	0	0	0	0	0	0
Cibicides spp.	0	0	9.1	0	0	0	0	0	0	0	0	0	13	0	6.67	0	0	0	5.88	0	0	0	0	0	0	0	7.22	0	74	0	30	0	0	0	0	0	0	0	0	0	0	0
Cribrostomoides crassimargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella hannai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.2	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.52	0	7.5	0	1.2	0	0	0	0	0	0	0	0	0	0	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.3	0	0.8	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0	0	0	0	0	0	0	0	8.7	0	0	0	0	0	0	0	0	0	0	0	3.7	0	1.55	0	10	0	1.9	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.3	5.3	0	0	0	0	10	0.4	4.3	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.2	0	0	0	11.1	0	0	0	0	0	0	0
Epistominella vitrea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.55	0	1.3	0	3.1	0	0	0	0	0	0	0	0	0	0	0
Fissurina marginata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.06	0	10	0	1.9	0	0	0	0	0	0	0	0	0	0	0
Fursenkoina fusiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29.4	0	0	0	0	0	0	0	51	0.5	52	2.1	11	0	0	0	0	0	0	0	0	0	0	0
Globobulimina pupoides	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glomerspira gordialis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haplophragmoides spp.	0	0	9.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella norcrossi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.88	0	0	0	0	0	0	0	1.03	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	0	0	0	0	0	0	0	0	0	0	0	0	0
Milammina fusca	0	0	9.1	0	14	0	0	0	0	0	0	0	8.7	0	0	0	0	0	0	0	14.3	0	0	0	0	0	0.52	0	0	0	0	0	0	0	11.1	0	0	0	20	0	0	0
Nonionella turgida/digitata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.3	0	0	0	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella stella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.58	0	3.8	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudononion basispinata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.52	0	26	0	9.9	0	0	0	0	0	0	0	0	0	0	0
Oolina melo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.03	0	6.3	0	0.6	0	0	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (akneriana)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recuvoides turbinatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	33	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.692	7.7
Reophax scottii	67	67	55	55	79	79	100	100	100	100	100	100	43	43	80	80	66.7	67	52.9	47	85.7	86	53	53	85.2	81	10.3	9.8	3.8	3.8	2.5	2.5	91.7	92	77.8	78	77.8	78	80	80	92.31	92
Saccamina difflugiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spiroplectimma biformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spirosigmoilina tenuis	0	0	0	0	7.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.52	0	1.3	0	0.6	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.67	0	0	0	0	0	0	0	0	0	0	0	1.55	0	3.8	0	4.3	0	0	0	0	0	0	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16.7	17	0	0	0	0	5.3	0	0	0	1.03	0.5	2.5	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina inflata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina macrens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	0	0	9.1	9.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11.1	11	0	0	0	0
Trochammina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina rotaliformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.33	3.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.33	0	0	0	0	0	0	0	0	0
Trochammina sp.-lobate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lesslob.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
organic linings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
weird-ufo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8	0	0	0	0	0	0	0	0	0	0	0	0	0
PLANKTONIC FORAMINIFERA																																										
planktonics	0	0	0	0	0	0	0	0	0	0	0	0	4.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.8	0	4.3	0	0	0	0	0	0	0	0	0	0	0
THECAMOEBIANS																																										
Centropyxsis aculeata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.52	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia oblongata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.	0	0	9.1	9.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11.1	11	0	0	0	0
Lagenodifflugia sp.2(ball)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	610		614		621		631		641		651		661		671		681		691		699		700		711		721		724		730		733		736		738		741	
fraction (%total, % 45 um)	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45
volume (ml)	5		10		10		10		10		10		10		10		10		10		10		2.5		10		10		5		2.5		2.5		10		2.5		10	
total count/10cc	60		22		21		2		4		3		2		4		5		1		5		12		17		44		40		104		44		7		32		13	
% #45 per 10 cc/total per 10 cc	100		81.8		100		50		25		0		50		25		20		0		60		100		82.4		97.7		20		65.4		54.5		85.7		75		100	
BENTHIC FORAMINIFERA																																								
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.85	0	0	0	0	0	0	0	0	0
Ammonia beccarrii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buccella depressa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buccella frigida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	0	0	0	0	0	0	0	0	0	0	0
Buliminella elegantissma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
calcareous fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.69	0	0	0	0	0	0	0	0	0
Cassidulina subglobosa cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15.4	0	0	0	0	0	0	0	0	0
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cibicides spp.	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cribrostomoides crassimargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella hannai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp.	0	0	4.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Epistominella vitrea	0	0	4.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fissurina marginata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fursenkoina fusiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Globobulimina pupoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glomerspira gordialis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.85	3.85	0	0	0	0	0	0	0	0
Haplophragmoides spp.	0	0	4.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.69	0	9.09	0	0	0	0	0	0	0
Islandiella norcrossi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Milammina fusca	0	0	0	0	0	0	50	0	50	0	33.3	0	50	0	50	0	60	0	100	0	20	0	0	0	5.88	0	2.27	0	5	0	0	0	27.3	0	0	0	25	0	0	0
Nonionella turgida/digitata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella stella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudononion basispinata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oolina melo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (akneriana)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recuvoides turbinatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	0	0	0	0	4.76	4.76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.7	7.7
Reophax scottii	100	100	86.4	81.8	95.2	95.2	50	50	25	25	0	0	50	50	25	25	20	20	0	0	60	60	100	100	82.4	82.4	93.2	93.2	20	20	57.7	57.7	45.5	19.2	85.7	85.7	75	75	92	92
Saccamina difflugiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spiroplectimma biformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	5.88	0	2.27	2.27	0	0	0	0	0	0	0	0	0	0	0	0
Spirosigmoilina tenuis	0	0	0	0	0	0	0	0	0	0	66.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	2.27	2.27	15	0	3.85	3.85	9.09	3.85	0	0	0	0	0	0
Trochammina inflata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	9.09	0	0	0	0	0	0	0
Trochammina macrens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina rotaliformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lobate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lesslob.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
organic linings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	14.3	0	0	0	0	0
weird-ufo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PLANKTONIC FORAMINIFERA																																								
planktonics	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THECAMOEBIANS																																								
Centropyxsis aculeata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia oblongata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.2(ball)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	751		768		761		771		781		791		792		801		811		821		831		834		836		837		841		851		861		871		876	
fraction (%total, % 45 um)	% t	45%	% t	45%	% t	45%	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45	% t	%45
volume (ml)	10		10		2.5		10		10		10		2.5		10		10		10		10		10		2.5		5		10		10		10		10		10	
total count/10cc	7		2		236		4		14		1		4		9		17		26		38		35		16		22		7		5		9		9		10	
% #45 per 10 cc/total per 10 cc	100		50		96.6		75		92.9		100		100		100		94.1		96.2		94.7		80		50		63.6		100		80		66.7		88.9		40	
BENTHIC FORAMINIFERA																																						
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia beccarrii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buccella depressa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buccella frigida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
Buliminella elegantissma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
calcareous fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassidulina subglobosa cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cibicides spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cribrostomoides crassimargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella hannai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Epistominella vitrea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fissurina marginata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fursenkoina fusiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0
Globobulimina pupoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glomerspira gordialis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haplophragmoides spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.86	0	0	0	0	0	0	0	0	0	11.1	0	0	0	0	0
Islandiella norcrossi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
Milammina fusca	0	0	50	0	1.69	0	25	0	0	0	0	0	0	0	0	0	5.88	0	3.85	0	5.26	0	2.86	0	50	0	27.3	0	0	0	0	0	11.1	0	11.1	0	10	10
Nonionella turgida/digitata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella stella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11.1	0	0	0	0	0
Pseudononion basispinata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oolina melo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
Quinqueloculina sp. (akneriana)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recuvoides turbinatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	0	0	0	0	1.69	1.69	0	0	7.14	0	0	0	0	0	0	0	0	0	0	0	2.63	2.63	2.86	2.86	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax scottii	100	100	50	50	93.2	93.2	75	75	92.9	92.9	100	100	0	0	100	100	94.1	94.1	96.2	96.2	92.1	92.1	77.1	77.1	50	50	63.6	63.6	100	100	100	80	66.7	66.7	88.9	88.9	0	0
Saccamina difflugiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spiroplectimma biformis	0	0	0	0	1.69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30
Spirosigmoilina tenuis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	0	0	0	0	1.69	1.69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11.4	0	0	0	9.09	0	0	0	0	0	0	0	0	0	0	0
Trochammina inflata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina macrens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina rotaliformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lobate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lesslob.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
organic linings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
weird-ufo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PLANKTONIC FORAMINIFERA																																						
planktonics	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THECAMOEBIANS																																						
Centropyxsis aculeata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia oblongata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.	0	0	0	0	0	0	0	0	0	0	0	0	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.2(ball)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

% Species abundances

Relative species abundance is presented as the % contribution of each selected species contained in a 10 cm^3 of sample (Figures 3.18 to 3.20)

Thecamoebians have a sparse presence the length of the core from 0 to 640 cm (~0 to 1850 yBP; Climate Interval I) of up to 12% relative abundance.

Miliammina fusca is found present continuously the length of the core as numerous peaks generally from 10 to 20 %, with an exception peak of 100% composition at 790 to 810 cm (~2000 yBP; end of Climate Interval I, beginning of Climate Interval II).

Reophax scottii is present the length of the core and comprises up to 100% of the foraminiferal fauna at times. From 0 to 320 cm (~0 to 1700 yBP; Climate Interval I) the peaks in relative abundance range from 40 to 100%, then from 320 to 650 cm (~1700 to 1850 yBP; Climate Interval I) the range is mostly 20 to 40%, and from 650 cm to 775 cm (~ 1700 to 2000 yBP; end of Climate Interval II) is less than 10%. Then from 775 cm (~ 2000 yBP+; Climate Interval II) until the end of the core the relative abundance ranges from 40 to 100%.

Trochammina spp. includes several species that have been combined into one species group under the genus - primarily, *T. ochracea*, T. *discorbis* and *T. pacifica* due to their similar morphologies. *Trochammina* spp. are found present from 0 to ~ 990 cm (~0 to 2600 yBP; Climate Internals I and II) comprising 5 to 25% of the relative abundance with 3 extremely high peaks in relative abundance occurring at ~ 40 cm (46%), 175 cm (65%) and 860 cm (65%).

Fursenkoina fusiformis is present the length of the core except from ~100 to 180 cm and 200 to 250 cm (~ 0 to 1400 yBP; Climate Interval I). From 0 to 100 cm and 180 cm until the end of the core, the relative abundances range from 5 to 100 % of the composition.

Reophax arctica is present as several small, and discrete peaks in relative abundance the length of the core up to 5%, but in particular from 840 cm and deeper (~2500 yBP; Climate Interval II) the peaks in relative abundance range from 5 to 20%.

Bolivina pacifica is found the length of the core as numerous small peaks in relative abundance between 5 to 10 %. It is particularly continuously abundance from 400 to 775 cm (~1750 to 2000 yBP; Climate Interval I) and is followed by two extreme peaks of relative abundance at 870 cm (15%) and 20% at 980 cm (~2600 yBP+; Climate Interval II).

Buccella spp. is a grouping of 2 species, *B. frigida* and *B. depressa*, who have similar morphologies and is found the length of the core as a few peaks in relative abundance generally less than 5 % with an exceptionally large peak of 60% occurring at 870 cm (~2600 yBP; Climate Interval II).

Nonionella spp. is a species grouping of *N. digitata, N. stella, N. turgida* and *Nonionellina. labradorica*, due to their gradational morphologies, and generally low individual representations. These species are present the length of the core as discrete peak abundance events ranging from 2 to 16%. The locations of the relative peak abundances are similar to *Buccella* spp., *Cibicides* spp., *Elphidium* spp., *Islandiella* spp. and others. *Nonionella* spp. are sparsely present from 0 to 300 cm (~0 to 1700 yBP; Climate Interval I), and following are more continuously abundance until the end of the core. Two extreme peaks in relative abundance occur at 350 – 370 cm (10%) and 775 cm (16%) (~2000 yBP; at the end of Climate Interval I, beginning of II).

Islandiella spp. is a species grouping of *I. norcrossi*, and *I. teretis*, due to their similar morphologies, and generally low individual representation. These species are found present as several short peaks in relative abundance from ~ 180 cm until 860 cm. The locations of relative peak abundances are similar to *Buccella* spp., *Cibicides* spp. and *Elphidium* spp. From 180 cm until 860 cm, the relative abundances are ~ 5%, except for one extreme peak at 360 cm up to 16%.

Cibicides spp. is a species grouping of C. *lobatulus*, C. *fletcheri*, and*Planorbulina mediterranensis* - due to their morphological similarities. The locations of peak relative abundance events are similar to those of *Buccella* spp., *Islandiella* spp. and *Elphidium* spp. *Cibicides* spp. are sparsely present from 0 to 180 cm, and are then continuously present in amount of 3 – 5% from 200 cm until

850 cm. (~ 1700 to 2600 yBP; Climate Intervals I and II). There are three extreme peaks of relative abundance that occur at 180 cm (40%), 360 cm (25%) and 720 to 750 cm (25%).

Elphidium spp. is a species grouping of *E. crispum*, *E. subarcticum*, *E. frigidium*, and others - due to their similar morphologies, and generally low individual representation. The locations of peak relative abundance events are similar to those of *Buccella* spp., *Islandiella* spp. and *Cibicides* spp. *Elphidium* spp. are sparsely present from 0 to 180 cm, and are then continuously present in the amount of 3 – 5% from 180 cm until 800 cm. (~ 1700 to 2000 yBP; Climate Intervals I and II). There are three extreme peaks of relative abundance that occur at 180 cm (40%), 360 cm (25%) and 720 to 750 cm (25%).

Buliminella elegantissma is sparsely present the length of the core as discrete peaks in relative abundance up to 2 % abundance, with two extreme peaks in relative abundance occurring at 540 cm (5%) and 830 cm (12%). The locations of peak relative abundance events are similar to those of *Buccella* spp., *Islandiella* spp., *Elphidium* spp. and *Cibicides* spp.

Planktics species include - *Globergerina spp.* groups all planktic species due to their similar life histories, and generally low individual representations. These species are present at 90 cm at 2 % and then from 170 cm until the end of the core (~ 1700 to 2600 yBP; Climate Intervals I and II) at 5 to 15%. The locations of the relative peak abundances are similar to *Buccella* spp., *Cibicides* spp., *Elphidium* spp., *Islandiella* spp. and others. The interval of highest abundance (20 – 25%) is found at 610 cm, and 990 to 1000 cm.

Unilocular forms include *Fissurina* spp., *Lagena* spp., and *Oolina* species groups – that are further grouped together due to their low individual representation, but yet are still important indicators of the influx of shelf waters into the inlet. . These species are present the length of the core as numerous as peak abundance events ranging from 0.5 to almost 12 %. The locations of peak abundances are similar to *Buccella* spp., *Cibicides* spp., *Elphidium* spp., *Islandiella* spp., planktics and others. From 50 to 310 cm (~0 to 1800 yBP; Climate Interval I), the relative abundance peaks range up to 2% and are sparsely present. Then from 320 cm to 770 cm (~1700 to 2000 yBP; Climate Interval I) the relative abundances are continuous and range from 1% to 12 % and from 860 cm until the end of the core their presence is sparse again (~2000 yBP+; Climate Interval II).

Tully 99b-11

corrected depth (cm)	2		10		20		30		40		45		47		50		60		67		70		80		90		100		110		151		158		161		171		181		184	
fraction (% total, % 45um)	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45
volume (ml)	10		10		10		10		10		7.5		10		10		10		10		10		10		10		10		10		10		10		10		10		10		5	
total count/10cc	84		50		57		57		35		313		483		313		1113		235		140		180		262		247		86		12		31		48		47		61		58	
% #45 per 10 cc/total # per 10 cc	88.1		66		84.2		91.2		37.1		39.6		42.9		65.2		46.3		88.9		92.1		82.8		2.67		26.3		88.4		58.3		64.5		87.5		89.4		88.5		6.9	
BENTHIC FORAMINFERA																																										
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	1.7	0	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.09	0	0	0	0	0	0	0	2.67	0	8.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Botuloides pauciloculus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bucella depressa	0	0	0	0	0	0	0	0	2.86	0	0	0	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bucella frigida	0	0	0	0	0	0	0	0	0	0	0	0	0.83	0	0	0	0.9	0	0	0	0	0	0	0	0.38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buliminella elegantissma	0	0	0	0	0	0	0	0	0	0	0	0	0.41	0	0	0	0.18	0	0	0	0	0	0	0	0.38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
calcareous fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassindulina subglobosa cf.	0	0	0	0	0	0	0	0	2.86	0	0	0	0.41	0	0	0	0.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cibicides spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.54	0	0	0	0	0	0	0	0.38	0	0.81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cribrostomoides crassmargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella hannai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium crispum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0.41	0	0	0	0.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium microgranulosum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Epistominella vitrea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euuvigerina juncea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fissurina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fursenkoina fusiformis	0	0	0	0	0	0	0	0	11.4	0	0.43	0	26.5	0	0	0	39.9	0	0	0	0	0	0	0	87.8	0	49.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Globobulimina pupoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glomerspira gordialis	0	0	2	0	1.75	0	0	0	0	0	1.28	0	1.24	0	1.92	0	0	0	0.85	0	0	0	0.56	0	0	0	0	0	0	0	0	0	0	0	0	0	2.13	2.13	0	0	6.9	0
Haplophragmoides spp.	0	0	0	0	0	0	1.75	0	2.86	0	0	0	0.83	0	0.64	0	0	0	1.28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella norcrossi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.18	0	0	0	0	0	0	0	0	0	0.81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Milammina fusca	1.19	1.19	0	0	8.77	0	0	0	0	0	0.85	0	0.41	0	0	0	0	0	0.85	0	3.57	0	2.22	0	0	0	0	0	5.81	0	33.3	0	9.68	0	12.5	2.08	0	0	0	0	0	0
Nonionella turgida/digitata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella stella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.38	0	0.81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella frgs.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella sp.(tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudononion basispinata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oolina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (akneria)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recuvoides turbinatus	0	0	2	0	0	0	0	0	0	0	0	0	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	3.23	0	0	0	2.13	0	0	0	0	0
Reophax arctica	0	0	0	0	0	0	1.75	1.75	2.86	0	0	0	0.41	0	0.32	0	0.27	0.27	0	0	0	0	1.11	1.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.64	0	3.45	3.4
Reophax scottii	82.1	82.1	68	64	84.2	82.5	89.5	89.5	34.3	28.6	46.8	38.7	48.4	42.7	70.6	64.9	46.5	46	91.1	88.9	92.1	92.1	85.6	81.1	3.44	2.69	30	26.3	91.9	88.4	58.3	58.3	77.4	58.1	85.4	85.4	87.2	85.1	96.7	88.5	6.9	3.4
Rosalina columbiensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.23	3.23	0	0	0	0	0	0	0	0
Saccamina difflugiformis	0	0	0	0	0	0	0	0	2.86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0	2.08	0	2.13	0	0	0	0	0
Spiroplectimma biformis	0	0	0	0	0	0	0	0	0	0	0.85	0	0.83	0	2.88	0	0.36	0	0.43	0	0	0	0.56	0	0	0	0.4	0	0	0	0	0	6.45	3.23	0	0	0	0	0	0	0	0
Spirosigmoilina tenuis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	1.19	1.19	2	2	0	0	0	0	2.86	2.86	0.43	0	0.21	0.21	0.96	0.32	0.18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	1.75	0	1.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	0	0	14	0	1.75	0	1.75	0	8.57	0	0	0	0.41	0	1.28	0	0.18	0	1.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10.3	0
Trochammina inflata	0	0	0	0	0	0	0	0	0	0	0.43	0	0	0	0	0	0	0	1.28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20.7	0
Trochammina macrens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina nana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.96	0	0.18	0	0.85	0	0	0	0	0	0	0	0.4	0	1.16	0	0	0	0	0	0	0	0	0	0	0	20.7	0
Trochammina ochracea	1.19	1.19	0	0	0	0	0	0	5.71	2.86	0.43	0	1.24	0	0.96	0	0	0	0	0	0	0	0.56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.45	0
Trochammina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp. (tiny)	4.76	0	0	0	0	0	0	0	8.57	0	2.55	0.85	0	0	0	0	0	0	0	0	0.71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.45	0
Trochammina sp.-lobate	1.19	0	8	0	0	0	1.75	0	8.57	0	35.3	0	12.8	0	7.99	0	0.9	0	1.28	0	3.57	0	7.22	0	2.67	0	6.07	0	1.16	0	8.33	0	0	0	0	0	6.38	0	1.64	0	17.2	0
Trochammina sp.-lesslob.	0	0	0	0	0	0	0	0	2.86	0	9.36	0	2.48	0	11.2	0	0	0	0	0	0	0	1.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.9	0
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
organic linings	0	0	0	0	0	0	1.75	0	0	0	0.43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
weird-ufo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	2		10		20		30		40		45		47		50		60		67		70		80		90		100		110		151		158		161		171		181		184	
fraction (% total, % 45um)	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45
volume (ml)	10		10		10		10		10		7.5		10		10		10		10		10		10		10		10		10		10		10		10		10		10		5	
total count/10cc	84		50		57		57		35		313		483		313		1113		235		140		180		262		247		86		12		31		48		47		61		58	
% #45 per 10 cc/total # per 10 cc	88.1		66		84.2		91.2		37.1		39.6		42.9		65.2		46.3		88.9		92.1		82.8		2.67		26.3		88.4		58.3		64.5		87.5		89.4		88.5		6.9	
PLANKTONIC FORAMINFERA																																										
planktonics	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THECAMOEBIANS																																										
Centropyxsis aculeata	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia oblongata	2.38	2.38	0	0	1.75	1.75	0	0	2.86	2.86	0	0	0	0	0	0	0	0	0	0	0	0	0.56	0.56	0	0	0	0	0	0	0	0	0	0	0	0	2.13	2.13	0	0	0	0
Lagenodifflugia sp.	5.95	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	187		191		197		201		205		211		217		221		231		241		251		275		282		285		294		302		311		312		318		322		328	
fraction (% total, % 45um)	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45
volume (ml)	10		10		5		10		10		10		10		10		10		10		10		10		10		10		5		10		10		10		10		10		10	
total count/10cc	408		114		210		36		24		97		33		17		47		64		19		33		58		119		128		66.3		48		226		70		524		686	
% #45 per 10 cc/total # per 10 cc	8.3		70.2		93.3		55.6		79.2		94.8		54.5		88.2		78.7		89.1		94.7		63.6		60.3		22.7		138		86.4		47.9		25.2		90		99.2		21.9	
BENTHIC FORAMINFERA																																										
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0.88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.34	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	1	0	0	0	0	0	2.78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.03	0	3.45	0	0	0	0	0	0	0	0	0	0.37	0	0	0	0	0	2.04	0
Botuloides pauciloculus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bucella depressa	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bucella frigida	2.9	0	0	0	0	0	5.56	0	0	0	0	0	0	0	0	0	0	0	4.69	0	0	0	6.06	0	0	0	0	0	0	0	0	0	0	0	1.12	0.44	0	0	0	0	0.58	0
Buliminella elegantissma	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.43	0	0	0	0.15	0.15
calcareous fragments	7.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.03	0	0	0	5.04	0	2.34	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassindulina subglobosa cf.	3.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21.8	0	11.7	0	0	0	0	0	0	0	0	0	0	0	0.29	0
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cibicides spp.	36	0	0	0	0	0	0	0	0	0	0	0	3.03	0	0	0	0	0	0	0	0	0	3.03	0	5.17	0	11.8	0	5.47	0	0	0	0	0	0.75	0	1.43	0	0	0	0	0
Cribrostomoides crassmargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella hannai	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.03	0	0	0	0	0	0	0	1.52	0	0	0	0	0	0	0	0	0	0.29	0
Elphidiella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.68	0	1.56	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium crispum	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	5.9	0	0	0	0	0	2.78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.36	0	0	0	0	0	0	0	0.75	0	0	0	0	0	0	0
Elphidium frigidium	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium microgranulosum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.72	0	0	0	0	0	0	0	0.37	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.56	1.56	0	0	0	0	0	0	0	0	0	0	2.02	2.02	0	0	0.75	0.88	0	0	0	0	0	0
Elphidium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Epistominella vitrea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euuvigerina juncea	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fissurina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.37	0.44	0	0	0	0	0	0
Fursenkoina fusiformis	11	0	0	0	0	0	22.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.09	0	24.1	0	0	0	0	0	36.4	30.3	54.2	4.17	63.8	11.5	0	0	0	0	72.2	1.02
Globobulimina pupoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.02	2.02	0	0	1.12	1.33	0	0	0	0	0	0
Glomerspira gordialis	0.2	0.25	0.88	0	0	0	0	0	0	0	1.03	0	0	0	0	0	4.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haplophragmoides spp.	0	0	0.88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella norcrossi	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.36	0	1.56	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena spp.	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.15	0.15
Milammina fusca	0	0	3.51	0	6.67	0	2.78	0	12.5	0	0	0	42.4	0	11.8	0	12.8	0	0	0	0	0	6.06	0	1.72	0	5.04	0	0	0	1.52	0	0	0	1.49	0	4.29	0	0.57	0	0	0
Nonionella turgida/digitata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella stella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.87	0	0	0	0	0	0.29	0
Nonionella frgs.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella sp.(tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudononion basispinata	0.5	0	0	0	0	0	2.78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.08	0	0	0	0	0	0	0	0.29	0
Oolina spp.	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.37	0	0	0	0	0	0	0
Quinqueloculina sp. (akneria)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recuvoides turbinatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	0	0	0	0	2.86	2.86	0	0	0	0	1.03	1.03	0	0	0	0	0	0	0	0	0	0	0	0	1.72	1.72	1.68	1.68	0	0	8.08	8.08	0	0	0	0	0	0	0	0	0.15	0.15
Reophax scottii	8.1	7.6	72.8	70.2	88.6	88.6	55.6	55.6	79.2	79.2	92.8	91.8	51.5	51.5	82.4	82.4	72.3	72.3	92.2	87.5	94.7	94.7	48.5	48.5	51.7	51.7	20.2	20.2	66.4	66.4	44.4	44.4	39.6	39.6	8.58	10.2	91.4	90	99.2	99.2	20.7	20.1
Rosalina columbiensis	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Saccamina difflugiformis	0	0	0.88	0	0	0	5.56	0	0	0	0	0	0	0	0	0	4.26	0	0	0	0	0	0	0	1.72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spiroplectimma biformis	0.2	0.25	0.88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.68	0	0.78	0.78	0	0	0	0	0	0	0	0	0.19	0	0.29	0
Spirosigmoilina tenuis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.26	0	0	0	0	0	6.72	0	1.56	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina charlottensis	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.56	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	0	0	0.88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15.2	15.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina inflata	2.5	0	0	0	0	0	0	0	0	0	2.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina macrens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina nana	0.5	0	0.88	0	0	0	0	0	8.33	0	0	0	0	0	0	0	0	0	1.56	0	0	0	3.03	0	1.72	0	3.36	0	3.91	0	1.52	0	0	0	0	0	0	0	0	0	0.29	0
Trochammina ochracea	0	0	0	0	0.95	0.95	0	0	0	0	0	0	0	0	0	0	2.13	2.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.08	2.08	0.37	0.44	0	0	0	0	0.29	0
Trochammina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.26	4.26	0	0	0	0	0	0	0	0	1.68	0	0.78	0.78	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lobate	0	0	1.75	0	0	0	0	0	0	0	1.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.08	2.08	0	0	0	0	0	0	0.58	0
Trochammina sp.-lesslob.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
organic linings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
weird-ufo	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	187		191		197		201		205		211		217		221		231		241		251		275		282		285		294		302		311		312		318		322		328	
fraction (% total, % 45um)	t%	%45	t%	%45	-t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45
volume (ml)	10		10		5		10		10		10		10		10		10		10		10		10		10		10		5		10		10		10		10		10		10	
total count/10cc	408		114		210		36		24		97		33		17		47		64		19		33		58		119		128		86.3		48		228		70		524		686	
% #45 per 10 cc/total # per 10 cc	8.3		70.2		93.3		55.6		79.2		94.8		54.5		88.2		78.7		89.1		94.7		63.6		60.3		22.7		136		86.4		47.9		25.2		90		99.2		21.9	
PLANKTONIC FORAMINFERA																																										
planktonics	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.72	0	0	0	0	0	3.03	0	0	0	4.1	0	1.43	0	0	0	0	0
THECAMOEBIANS																																										
Centropyxsis aculeata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia oblongata	0	0	0	0	0.95	0.95	0	0	0	0	2.06	2.06	3.03	3.03	5.88	5.88	0	0	0	0	0	0	0	0	6.9	6.9	0.84	0.84	0	0	0	0	0	0	0.37	0.44	0	0	0	0	0	0
Lagenodifflugia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.29	0.29

corrected depth (cm)	332		342		352		357		361		362		365		373		375		377		382		392		402		413		415		425		435		437		443	
fraction (% total, % 45um)	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45
volume (ml)	10		10		10		10		10		10		10		10		10		10		10		10		10		10		10		10		10		5		5	
total count/10cc	1020		70		12		148		124		124		298		102		118		421		250		12		16		219		110		108		41		4		4	
% #45 per 10 cc/total # per 10 cc	8.82		91.4				31.8		3.23		3.23		5.37		42.2		55.1		25.2		7.48		75		87.5		42.9		21.8		47.2		75.6		50		100	
BENTHIC FORAMINFERA																																						
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	1.43	0	0	0	0	0	0	0	0	0	0.67	0	4.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	7.06	0	0	0	0	0	0	0	0	0	1.61	0	0.67	0	0	0	0	0	0.71	0.24	0.4	0	0	0	0	0	5.94	3.65	2.73	0	0	0	4.88	2.44	0	0	0	0
Botuloides pauciloculus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bucella depressa	0.2	0	0	0	0	0	0	0	1.61	0	0	0	1.34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bucella frigida	0.78	0.2	0	0	0	0	0.68	0	19.4	0	6.45	0	8.72	0	0.98	0	3.39	0	1.43	1.19	0.4	0	0	0	0	0	1.37	0	0	0	0.93	0	2.44	2.44	0	0	0	0
Bulimінella elegantissma	0	0	0	0	0	0	0.68	0.68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.91	0.91	0	0	0.93	0.93	0	0	0	0	0	0
calcareous fragments	0.39	0	0	0	0	0	0	0	6.45	0	4.84	0	6.04	0	4.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.44	0	0	0	0	0
Cassindulina subglobosa cf.	0	0	0	0	0	0	0	0	3.23	0	6.45	0	5.37	0	22.5	0	23.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0	0	0	0.67	0	0	0	1.69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cibicides spp.	1.96	0	0	0	0	0	2.03	0	22.8	0	14.5	0	22.8	0	12.7	0	11	0	1.43	0	0.8	0	8.33	0	0	0	1.83	0	0.91	0	0	0	2.44	0	0	0	0	0
Cribrostomoides crassmargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella hannai	0	0	0	0	0	0	0	0	0	0	3.23	0	2.01	0	0	0	0.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium crispum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	3.23	0	1.61	0	2.01	0	0	0	0	0	0.24	0	0	0	0	0	0	0	0	0	0	0	0	0	2.44	0	0	0	0	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	2.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.93	0	0	0	0	0	0	0
Elphidium microgranulosum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0.2	0	0	0	0	0	0.68	0	0	0	14.5	0	4.7	0	0.98	0	0	0	0	0	0	0	0	0	0	0	0.46	0	0.91	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0.91	0.91	0	0	0	0	0	0	0	0	0	0
Elphidium spp.	1.76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.71	0.71	0	0	0	0	0	0	0.46	0	0	0	0	0	0	0	0	0	0	0
Epistominella vitrea	0	0	0	0	0	0	0	0	0	0	0	0	0.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euuvigerina juncea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fissurina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.48	0.48	0.8	0	8.33	0	0	0	0.46	0	0	0	0.93	0	0	0	0	0	0	0
Fursenkoina fusiformis	74.2	0.69	0	0	0	0	64.9	10.8	4.84	0	3.23	0	4.7	0	0	0	0	0	91.2	21.6	88.4	0	8.33	8.33	0	0	75.8	31.1	74.5	6.36	67.6	26.9	65.9	58.5	0	0	0	0
Globobulimina pupoides	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.91	0.91	0	0	0.93	0.93	2.44	2.44	0	0	0	0
Glomerspira gordialis	0	0	1.43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haplophragmoides spp.	0	0	0	0	0	0	0	0	3.23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella norcrossi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0.2	0	0	0	0	0	0	0	6.45	0	16.1	0	8.05	0	3.92	0	1.69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena spp.	0.39	0	0	0	0	0	0.68	0.68	8.06	0	1.61	0	0.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.93	0	0	0	0	0	0	0
Milammina fusca	0	0	2.86	0	41.7	0	0	0	1.61	0	1.61	0	2.01	0	0.98	0	1.69	0	0.24	0	0	0	0	0	12.5	0	0.91	0	2.73	0	2.78	0	7.32	0	25	0	0	0
Nonionella turgida/digitata	0	0	0	0	0	0	0	0	0	0	6.45	0	0	0	0	0	0.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella stella	0.39	0	0	0	0	0	0.68	0	3.23	0	4.84	0	3.36	0	0.98	0	0	0	0.24	0	0.4	0	0	0	0	0	0.91	0.91	0	0	0	0	0	0	0	0	0	0
Nonionella frgs.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella sp.(tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudononion basispinata	0	0	0	0	0	0	6.76	0	0	0	0	0	1.34	0	0	0	0	0	0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oolina spp.	0.78	0	0	0	0	0	0	0	1.61	0	1.61	0	2.01	0	0.98	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (akneria)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recuvoides turbinatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	0	0	0	0	0	0	0	0	0	0	0	0	0.67	0.67	0	0	0	0	0.24	0.24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax scottii	7.84	7.84	91.4	90	50	50	20.3	19.6	3.23	3.23	3.23	3.23	4.7	4.7	41.2	41.2	54.2	54.2	0.71	0.71	7.33	6.93	66.7	66.7	81.3	81.3	0	0	15.5	15.5	18.5	18.5	9.76	9.76	25	25	25	25
Rosalina columbiensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Saccamina difflugiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spiroplectimma biformis	0.2	0	0	0	8.33	8.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spirosigmoilina tenuis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	3.23	0	3.36	0	0.98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.98	0.98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	25
Trifarina fluens	0.2	0	0	0	0	0	0	0	3.23	0	4.84	0	4.7	0	0.98	0	0.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina charlottensis	0.2	0	0	0	0	0	0	0	1.61	0	0	0	1.34	0	0	0	0.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	0	0	0	0	0	0	0	0	1.61	0	0	0	1.34	0	1.96	0	0	0	0	0	0	0	0	0	6.25	6.25	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina inflata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.96	0	0.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina macrens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina nana	0	0	0	0	0	0	0	0	1.61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	0.2	0	0	0	0	0	0	0	3.23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.91	0	0.93	0	0	0	0	0	0	0
Trochammina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.98	0	0	0	0	0	0.93	0.53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lobate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.33	0	0	0	0	0	0.91	0	0	0	0	0	0	0	0	0
Trochammina sp.-lesslob.	0	0	1.43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
organic linings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
weird-ufo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	332		342		352		357		361		362		365		373		375	
fraction (% total, % 45um)	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45
volume (ml)	10		10		10		10		10		10		10		10		10	
total count/10cc	1020		70		12		148		124		124		298		102		118	
% #45 per 10 cc/total # per 10 cc	8.82		91.4				31.8		3.23		3.23		5.37		42.2		55.1	
PLANKTONIC FORAMINFERA																		
planktonics	0.39	0	0	0	0	0	2.7	0	0	0	0	0	2.01	0	0	0	0	0
THECAMOEBIANS																		
Centropyxsis aculeata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia oblongata	0	0	1.43	1.43	0	0	0	0	0	0	0	0	0	0	0	0	0.85	0.85
Lagenodifflugia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	377		382		392		402		413		415		425		435		437		443	
fraction (% total, % 45um)	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45
volume (ml)	10		10		10		10		10		10		10		10		5		5	
total count/10cc	421		250		12		16		219		110		108		41		4		4	
% #45 per 10 cc/total # per 10 cc	25.2		7.48		75		87.5		42.9		21.8		47.2		75.6		50		100	
PLANKTONIC FORAMINFERA																				
planktonics	0.95	0	0	0	0	0	0	0	5.02	0	0.91	0	0	0	0	0	0	0	0	0
THECAMOEBIANS																				
Centropyxsis aculeata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia oblongata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.	0	0	0	0	0	0	0	0	1.83	1.83	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	445		455		461		465		475		485		489		491		493		495		505		515		523		524		528		535		545		549		551		552	
fraction (% total, % 45um)	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45
volume (ml)	10		10		10		10		10		10		10		10		10		10		10		10		5		10		10		10		10		10		2.5		10	
total count/10cc	252		5		431		108		460		9		18		1830		454		136		14		105		240		2463		910		22		349		608		104		5	
% #45 per 10 cc/total # per 10 cc	0.79		60		9.74		23.1		9.13		88.9		50		2.4		11.9		67		85.7		90.5		21.7		4.67		16		68.2		9.74		26.8		88.5		40	
BENTHIC FORAMINFERA																																								
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	3.17	0	0	0	3.02	0	0.93	0	4.57	0	0	0	0	0	1.26	0.11	2.86	0	0	0	0	0	0	0	0.98	0	1.66	0.04	3.08	0	4.55	4.55	1.72	0	0.49	0	0	0	0	0
Botuloides pauciloculus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bucella depressa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0	0
Bucella frigida	0.79	0	20	0	0	0	0.93	0	0.22	0	0	0	0	0	0.11	0.22	1.1	0.44	0.74	0	0	0	0	0	0.98	0	0.16	0	1.1	0	0	0	0.86	0.29	0.49	0	0	0	0	0
Buliminella elegantissma	0	0	0	0	0.23	0	0	0	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.08	0	0.11	0.11	4.55	4.55	0	0	0.16	0.16	0	0	0	0
calcareous fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassindulina subglobosa cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.22	0	0	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0.16	0	0	0	0	0
Chilostomella oolina	0	0	0	0	0.23	0	0	0	0.87	0	0	0	0	0	0.11	0	0.22	0	0	0	0	0	0	0	1.96	0.98	0	0	0	0	0	0	0.29	0	0	0	0	0	0	0
Cibicides spp.	0.79	0	0	0	0.7	0	0.93	0	3.04	0	0	0	5.56	0	0.87	0	4.41	0.44	0.74	0	0	0	0	0	1.96	0	0.16	0	2.86	0	0	0	0.57	0	0.49	0	8	0	0	0
Cribrostomoides crassmargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella hannai	0	0	0	0	0	0	0	0	0.43	0	0	0	0	0	0	0	0	0	0	0	7.14	0	0.95	0	0	0	0	0	0	0	0	0	0.29	0	0	0	0	0	0	0
Elphidiella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium crispum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium microgranulosum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0.79	0	0	0	0	0	2.78	0	0.65	0	0	0	0	0	0	0	0.66	0	0	0	0	0	0	0	0	0	0	0	0.22	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0.46	0.46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.94	0.98	0.08	0.08	0.11	0.11	0	0	0	0	0	0	0	0	0	0
Elphidium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Epistominella vitrea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.22	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euuvigerina juncea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fissurina spp.	0	0	0	0	0.23	0.23	0	0	0.87	0.22	0	0	5.56	0	0.11	0	0.22	0	0	0	0	0	0	0	1.96	0.98	0.2	0.04	0.22	0	0	0	0.57	0	0.16	0	0	0	0	0
Fursenkoina fusiformis	85.3	0	0	0	87.9	4.64	63.9	0	82	5.22	0	0	55.6	33.3	95.7	1.31	79.3	6.61	57.4	0.74	57.1	57.1	49.5	42.9	99	18.6	96.1	3.49	81	10	50	31.8	88.5	4.58	61.7	0	0	0	0	0
Globobulimina pupoides	0	0	0	0	0	0	0.93	0	0	0	0	0	0	0	0.33	0.22	0.44	0.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glomerspira gordialis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.74	0.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.16	0.16	0	0	0	0
Haplophragmoides spp.	0	0	0	0	0.23	0	0	0	0	0	0	0	0	0	0	0	0	0	0.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0.57	0	0	0	0	0	0	0
Islandiella norcrossi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.44	0	0	0	0	0	0.16	0	0	0	0	0
Lagena spp.	0.4	0	0	0	0	0	0	0	0	0	0	0	5.56	0	0	0	0.22	0	0.74	0	0	0	0	0	0	0	0.04	0.04	0.22	0	0	0	0	0	0	0	0	0	0	0
Milammina fusca	0	0	20	0	0.23	0	0.93	0	0	0	11.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.22	0	9.09	0	0	0	0.33	0	0	0	60	0
Nonionella turgida/digitata	0	0	0	0	0.23	0	0	0	0	0	0	0	0	0	0	0	0.66	0	0	0	0	0	0	0	0.98	0	0	0	0.44	0	0	0	0	0	0	0	0	0	0	0
Nonionella stella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.98	0	0.08	0	0.66	0	0	0	0.29	0	0.16	0	0	0	0	0
Nonionella frgs.	0.4	0	0	0	0	0	0	0	0.22	0	0	0	0	0	0	0	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.29	0	0	0	0	0	0	0
Nonionella sp.(tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudononion basispinata	1.59	0	0	0	0.23	0	0	0	1.96	0	0	0	0	0	0.33	0	1.1	0	0	0	0	0	0	0	0	0	0.08	0	0.88	0	0	0	0	0	0	0	0	0	0	0
Oolina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.08	0	0.22	0	0	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (akneria)	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recuvoides turbinatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax scottii	0.79	0.79	60	60	4.41	4.18	24.1	23.1	3.48	3.48	77.8	77.8	16.7	16.7	1.42	2.84	2.86	2.86	35.3	34.6	28.6	28.6	46.7	46.7	3.92	3.92	1.02	0.93	5.71	5.71	27.3	22.7	4.58	4.58	27	25.8	80	80	40	40
Rosalina columbiensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Saccamina difflugiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spiroplectimma biformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.49	0.16	0	0	0	0
Spirosigmoilina tenuis	0	0	0	0	0	0	0	0	0	0	0	0	5.56	0	0	0	0.44	0	0	0	0	0	0	0	0	0	0	0	0.22	0	0	0	0.29	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0.43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.22	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	0	0	0	0	0.23	0.23	0	0	0.22	0.22	0	0	0	0	0	0	0.22	0.22	0.74	0.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.16	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	0.22	0	0	0	0	0	0	0	0	0	1.47	0	0	0	0.95	0.95	0	0	0	0	0.22	0	0	0	0	0	0	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.11	0	0	0	1.47	1.47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.16	0	0	0	0	0
Trochammina inflata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina macrens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.44	0	0	0	0	0	0	0	0	0	0	0
Trochammina nana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	0	0	0	0	1.16	0	0	0	0	0	0	0	0	0	0.11	0	0.44	0.44	0	0	0	0	0	0	0	0	0.04	0.04	0	0	0	0	0	0	0.49	0.49	12	12	0	0
Trochammina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.55	4.55	0.29	0.29	0	0	0	0	0	0
Trochammina sp.-lobate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lesslob.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.16	0	0	0	0	0
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
organic linings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.11	0.11	0	0	0	0	0	0	0	0	0	0
weird-ufo	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	445		455		461		465		475		485		489		491		493		495		505		515		523		524		528		535		545		549		551		552	
fraction (% total, % 45um)	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45
volume (ml)	10		10		10		10		10		10		10		10		10		10		10		10		5		10		10		10		10		10		2.5		10	
total count/10cc	252		5		431		108		460		9		18		1630		454		138		14		105		240		2463		910		22		349		608		104		5	
% #45 per 10 cc/total # per 10 cc	0.79		60		9.74		23.1		9.13		88.9		50		2.4		11.9		67		85.7		90.5		21.7		4.67		16		68.2		9.74		26.8		88.5		40	
PLANKTONIC FORAMINFERA																																								
planktonics	0.79	0	0	0	0.46	0	4.63	0	0.43	0	0	0	5.56	0	0	0	1.32	0	0	0	7.14	0	1.9	0	0.98	0	0.08	0	1.32	0	4.55	0	1.15	0	0.16	0	4	0	0	0
THECAMOEBIANS																																								
Centropyxsis aculeata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia oblongata	0	0	0	0	0	0	0	0	0	0	11.1	11.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	555		561		569		572		578		580		586		589		599		600		609		615		617		619		629		639		643		645		649	
fraction (% total, % 45um)	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45
volume (ml)	10		10		10		2.5		10		10		5		10		10		5		10		10		2.5		10		10		10		10		2.5		10	
total count/10cc	39		5		337		32		28		370		1222		115		137		68		41		43		20		11		143		79		128		68		495	
% #45 per 10 cc/total # per 10 cc	82.1		60		10.1		75		28.6		21		13.3		25.2		33.6		82.4		73.2		11.6		20		63.6		14.7		39.2		26.8		23.5		1.01	
BENTHIC FORAMINFERA																																						
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	0	0	0	0	3.56	0	0	0	3.57	0	4.86	0	1.8	0.16	0	0	1.46	1.46	0	0	0	0	2.33	4.65	0	0	0	0	2.1	0	0	0	3.91	0	0	0	5.25	0
Botuloides pauciloculus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bucella depressa	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bucella frigida	0	0	0	0	0.3	0.3	0	0	3.57	0	1.08	1.08	0.98	0.33	0	0	2.19	0.73	0	0	4.88	4.88	2.33	0	0	0	18.2	36.4	1.4	2.8	0	0	5.47	0	0	0	0.81	0
Buliminella elegantissma	0	0	0	0	0.59	0.59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7	0	0	0	0	0	0	0	0.2	0.4
calcareous fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.44	0	0	0	0	0	0	0	0.7	0	0	0	0	0	0	0	0	0
Cassindulina subglobosa cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.78	0	0	0	0	0
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0	0.54	0	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0
Cibicides spp.	0	0	0	0	1.19	0	0	0	3.57	0	1.62	0	0	0	1.74	0	1.46	0.73	0	0	4.88	0	0	0	0	0	0	0	0.7	0	1.27	0	3.13	0	5.88	0	1.21	0
Cribrostomoides crassmargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella hannai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium crispum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.78	0	0	0	0.81	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium microgranulosum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.44	0	0	0	0	0	0	0	0.7	0	0	0	0	0	5.88	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0.3	0	0	0	0	0	0.54	0	0.33	0	0.87	0	0	0	0	0	2.44	0	2.33	0	0	0	0	0	2.1	2.8	1.27	2.53	2.34	0	0	0	1.62	0
Elphidium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.78	0	0	0	0	0
Epistominella vitrea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euuvigerina juncea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fissurina spp.	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	2.19	1.46	0	0	2.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0
Fursenkoina fusiformis	0	0	0	0	83.1	4.15	0	0	50	3.57	82.4	13.2	86.6	5.73	69.6	2.61	78.1	18.2	0	0	63.4	58.5	72.1	18.6	0	0	0	0	76.9	6.99	82.3	63.3	70.3	42.2	47.1	0	84	0
Globobulimina pupoides	0	0	0	0	0.3	0.3	0	0	0	0	0	0	0.49	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.27	2.53	0	0	0	0	0	0
Glomerspira gordialis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haplophragmoides spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella norcrossi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.78	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	3.57	0	0	0	0	0	0	0	0	0	0	0	0	0	2.33	0	0	0	0	0	0	0	0	0	1.56	0	0	0	0	0
Lagena spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.87	0.87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Milammina fusca	12.8	0	40	0	0.59	0	12.5	0	10.7	0	0	0	0	0	0.87	0	1.46	0	7.35	0	2.44	0	4.65	0	20	0	27.3	0	0	0	3.8	0	0	0	0	0	0	0
Nonionella turgida/digitata	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	1.46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.78	0	0	0	0.81	0
Nonionella stella	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.81	0
Nonionella frgs.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.78	0	0	0	0	0
Nonionella sp.(tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7	1.4	0	0	0	0	0	0	0	0
Pseudononion basispinata	0	0	0	0	0	0	0	0	0	0	0.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.4	0	0	0	2.34	0	0	0	0.4	0
Oolina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0
Quinqueloculina sp. (akneria)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0
Recuvoides turbinatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.74	1.74	0	0	2.94	1.47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0
Reophax scottii	82.1	82.1	40	40	4.15	4.15	50	50	25	25	6.49	6.49	6.22	6.22	20.9	20	10.2	10.2	35.3	35.3	9.76	9.76	0	0	20	40	36.4	72.7	6.29	12.6	2.53	5.06	4.69	9.38	23.5	47.1	0.61	1.21
Rosalina columbiensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Saccamina difflugiformis	2.56	0	0	0	0	0	0	0	0	0	0	0	0	0	0.87	0	0.73	0.73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spiroplectimma biformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.09	18.2	0	0	0	0	0	0	0	0	0	0
Spirosigmoilina tenuis	0	0	0	0	0	0	12.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	0	0	0	0	0.3	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11.8	0	0	0
Trochammina inflata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina macrens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina nana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	0	0	20	20	0	0	25	25	0	0	0.27	0.27	0.49	0.49	0	0	0	0	1.47	1.47	0	0	0	0	0	0	9.09	0	0.7	1.4	0	0	0.78	1.56	0	0	0.2	0.4
Trochammina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp. (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0.16	0.16	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lobate	2.56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lessiob.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.27	0	0	0	0	0	0	0
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
organic linings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
weird-ufo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	555		561		569		572		578		580		586		589		599		600		609		615		617		619		629		639		643		645		649	
fraction (% total, % 45um)	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45
volume (ml)	10		10		10		2.5		10		10		5		10		10		5		10		10		2.5		10		10		10		10		2.5		10	
total count/10cc	39		5		337		32		28		370		1222		115		137		68		41		43		20		11		143		79		128		68		495	
% #45 per 10 cc/total # per 10 cc	82.1		60		10.1		75		28.6		21		13.3		25.2		33.6		82.4		73.2		11.6		20		63.6		14.7		39.2		26.6		23.5		1.01	
PLANKTONIC FORAMINFERA																																						
planktonics	0	0	0	0	2.08	0.3	0	0	0	0	1.62	0	1.96	0	1.74	0	0	0	0	0	4.88	0	14	0	0	0	0	0	3.5	0	3.8	2.53	0	0	0	0	0.81	0
THECAMOEBIANS																																						
Centropyxsis aculeata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.78	0	0	0	0	0
Difflugia oblongata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.94	2.94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	652		654		659		669		679		689		699		704		711		719		721		724		727	
fraction (% total, % 45um)	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45
volume (ml)	5		10		10		10		10		10		10		10		10		10		10		10		10	
total count/10cc	114		1573		644		498		697		225		753		687		1368		924		798		694		80	
% #45 per 10 cc/total # per 10 cc	17.5		9.73		14.9		16.5		23.4		0		17.7		17.6		6.73		22.7		14.3		2.88		46.3	
BENTHIC FORAMINFERA																										
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0.25	0	0	0	0	0
Bolivina pacifica	0	0	1.02	0.38	3.57	0.16	1.2	0	5.31	1.29	7.11		5.98	0.66	6.4	0.58	3.65	0	3.46	0.43	6.52	0	5.48	0	0	0
Botuloides pauciloculus	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bucella depressa	0	0	0	0	0	0	0	0	0	0	0.89		0	0	0	0	0	0	0	0	0.5	0	0.58	0	0	0
Bucella frigida	0	0	0.51	0	0.78	0.16	1.41	1	1	0.72	0		1.73	0.13	0.73	0.73	1.32	0.15	1.41	0.11	1.38	0.88	4.03	0	2.5	1.25
Buliminella elegantissma	1.75	0	0.32	0.06	0.31	0.31	0	0	0	0	0.44		0.13	0.13	0	0	0	0	0.11	0.11	0	0	0.58	0	1.25	1.25
calcareous fragments	1.75	0	0	0	0.62	0	0	0	0	0	0		0.27	0	0	0	0.88	0	1.08	0	0.5	0	1.44	0	0	0
Cassindulina subglobosa cf.	0	0	0.32	0.19	0	0	0.4	0	0.29	0	0.44		0.8	0	0	0	0.15	0	0.43	0	0	0	0	0	0	0
Chilostomella oolina	0	0	0.06	0.06	0	0	0	0	0	0	0		0	0	0	0	0	0	0.22	0	0.25	0	3.46	0	0	0
Cibicides spp.	1.75	0	0.13	0.13	0.31	0	0.8	0	1.29	0.43	1.78		2.92	0.27	2.04	0	0.73	0	0.87	0.22	7.27	0	24.8	0	3.75	0
Cribrostomoides crassmargo	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella hannai	0	0	0	0	0	0	0	0	0	0	0.44		0	0	0	0	0.29	0	0	0	0.5	0	2.88	0	0	0
Elphidiella sp.	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium crispum	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0.31	0	0	0	0	0	0.44		0	0	0	0	0	0	0.22	0	0.75	0	0.86	0	0	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0.5	0	0	0	0	0
Elphidium microgranulosum	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	1.75	0	0.38	0	0	0	0	0	0	0	0.89		0	0	0.29	0	0	0	0	0	0	0	5.76	0	0	0
Elphidium spp. (tiny)	1.75	3.51	0.57	0.19	0.31	0.31	0.2	0.2	0.86	0	0.89		0.53	0.27	1.46	0.58	0.73	0.15	0.65	0.43	1.5	0.5	1.73	0.29	2.5	2.5
Elphidium spp.	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1.15	0	0	0
Epistominella vitrea	1.75	0	0.13	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1.25	0	1.44	0	0	0
Euuvigerina juncea	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fissurina spp.	0	0	0.19	0.06	0.31	0	0.4	0.4	0.29	0	0.89		0.13	0.13	0.29	0	0.73	0	0	0	0.25	0	0.29	0	1.25	0
Fursenkoina fusiformis	80.7	17.5	93.4	6.68	86	8.39	89.4	9.04	81.9	13.9	82.7		78.1	12.2	79.9	11.8	82.9	3.95	79.4	16.5	63.4	10.8	11.7	1.87	62.5	22.5
Globobulimina pupoides	0	0	0	0	0.47	0.47	0.2	0.2	0.72	0.72	2.22		0.4	0.4	0	0	0.15	0	0	0	0	0	0	0	3.75	3.75
Glomerspira gordialis	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haplophragmoides spp.	0	0	0	0	0	0	0	0	0.29	0	0		0	0	0	0	0.15	0	0	0	1	0	0	0	0	0
Islandiella norcrossi	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0.5	0	0.58	0	0	0
Islandiella teretis	0	0	0	0	0.31	0	0	0	0	0	0		0.8	0	0	0	0.15	0	0	0	1	0	0.58	0	0	0
Lagena spp.	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0.58	0	0.32	0.11	0	0	3.17	0	0	0
Milammina fusca	0	0	0	0	0.31	0	0	0	0.29	0	0		0	0	0	0	0	0	0	0	0	0	0	0	1.25	0
Nonionella turgida/digitata	0	0	0	0	0	0	0	0	0	0	0		0.27	0	0	0	0.29	0	1.3	0	3.01	0	2.59	0	0	0
Nonionella stella	0	0	0	0	0.31	0	0	0	0	0	0		0.53	0	0.58	0	0.44	0	0.65	0	1.25	0.25	0.58	0	0	0
Nonionella frgs.	0	0	0	0	0	0	0	0	0	0	0		0.13	0.13	0	0	0	0	0	0	0	0	0.58	0	0	0
Nonionella sp.(tiny)	0	0	0	0	0	0	0	0	0	0	0		0	0	0.29	0.29	0	0	0	0	0	0	0	0	1.25	1.25
Pseudononion basispinata	0	0	0.51	0	0	0	0	0	0.57	0	0		1.06	0	1.16	0	0.88	0	0.22	0	2.13	0.13	11.5	0	0	0
Oolina spp.	0	0	0	0	0.31	0	0.4	0	0	0	0		0	0	0	0	0.15	0	0.22	0	0.25	0	1.44	0	0	0
Quinqueloculina sp. (akneria)	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0.58	0	0	0
Recuvoides turbinatus	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	0	0	0.06	0.06	0.31	0.31	0	0	0.14	0.14	0		0	0	0.15	0.15	0.37	0.37	0.32	0.32	0	0	0	0	0	0
Reophax scottii	7.02	14	1.78	1.78	4.5	4.19	5.22	5.22	5.74	5.74	0.44		3.59	3.05	3.78	3.2	1.97	1.97	4.33	4.33	1.5	1.5	0.72	0.72	12.5	12.5
Rosalina columbiensis	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0.29	0	0	0
Saccamina difflugiformis	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0.15	0	0	0	0	0	0	0	0	0
Spiroplectimma biformis	0	0	0.13	0	0	0	0.2	0.2	0	0	0		0	0	0.29	0	0.07	0.07	0	0	0	0	0	0	0	0
Spirosigmoilina tenuis	0	0	0	0	0	0	0	0	0	0	0		0.53	0	0.29	0	0	0	0.65	0	0.25	0	0.58	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	0		0.53	0	0	0	0	0	0	0	0	0	0.29	0	0	0
Textularia earlandi	0	0	0	0	0	0	0	0	0.14	0.14	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0.25	0	1.73	0	1.25	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	0	0	0	0	0	0	0	0	0.29	0	0		0	0	0	0	0	0	0	0	0.13	0.13	0.29	0	1.25	0
Trochammina inflata	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina macrens	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina nana	0	0	0	0	0	0	0	0	0.29	0	0		0	0	0.58	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	0	0	0.13	0.13	0.47	0.47	0.2	0.2	0.72	0.43	0.44		0.27	0.27	0.44	0.15	0	0	0.43	0.22	0	0	0.58	0	1.25	1.25
Trochammina pacifica	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp. (tiny)	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lobate	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lesslob.	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
organic linings	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
weird-ufo	1.75	0	0.25	0	0	0	0	0	0.29	0	0		0.27	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	652		654		659		669		679		689		699		704		711		719		721		724		727	
fraction (% total, % 45um)	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45
volume (ml)	5		10		10		10		10		10		10		10		10		10		10		10		10	
total count/10cc	114		1573		644		498		697		225		753		687		1368		924		798		694		80	
% #45 per 10 cc/total # per 10 cc	17.5		9.73		14.9		16.5		23.4		0		17.7		17.6		6.73		22.7		14.3		2.88		46.3	
PLANKTONIC FORAMINFERA																										
planktonics	0	0	0.13	0	0	0	0	0	0	0	0		0.8	0	0.29	0	0.44	0	1.08	0	1.5	0	0.29	0	3.75	0
THECAMOEBIANS																										
Centropyxis aculeata	0	0	0	0	0.16	0.16	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia oblongata	0	0	0	0	0	0	0	0	0	0	0		0	0	0.15	0.15	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	729		730		732		734		738		739		740		750		756		757		758		760		769		773		779		786		789		799		809		819	
fraction (% total, % 45um)	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	5		2.5		5		5		5		5		5		10		5		5		5		10		10		2.5		10		10		10		10		10		10	
total count/10cc	190		36		194		244		38		18		24		65		1534		2558		968		283		28		16		9		5		11		2		32		10	
% #45 per 10 cc/total # per 10 cc	6.32		22.2		12.4		31.1		78.9		77.8		41.7		80		10.3		11.65		7.85		21.6		46.4		100		33.3		100		63.6		0		37.5		100	
BENTHIC FORAMINFERA																																								
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	0	0	8.33	0	1.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	0.53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.87	0	5.004	0.63	6.2	0	5.65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Botuloides pauciloculus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bucella depressa	0.53	0	0	0	0	0	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bucella frigida	1.58	0	0	0	6.19	0	1.64	0	0	0	0	0	0	0	3.08	1.54	0.78	0	1.251	0	0.83	0	3.53	0.71	7.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buliminella elegantissma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.078	0.08	0	0	0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	10
calcareous fragments	0	0	0	0	3.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassindulina subglobosa cf.	0	0	0	0	1.03	0	1.23	0	5.26	0	0	0	16.7	0	0	0	0	0	0.156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chilostomella oolina	1.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.41	0	1.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cibicides spp.	0.53	0	0	0	18	0	4.92	0	0	0	0	0	16.7	8.33	1.54	0	1.04	0	1.876	0	0.83	0	11	0.35	0	0	0	0	0	0	0	0	0	0	0	0	9.38	0	0	0
Cribrostomoides crassmargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella hannai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium crispum	0	0	0	0	0	0	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0.53	0	0	0	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium microgranulosum	0	0	0	0	2.06	0	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0.53	0	0	0	4.12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	1.05	0	0	0	0	0	0	0	0	0	0	0	0	0	1.54	1.54	0.52	0	1.095	0.31	0	0	0.35	0	0	0	0	0	0	0	0	0	9.09	0	0	0	0	0	0	0
Elphidium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Epistominella vitrea	0	0	0	0	2.06	0	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euuvigerina juncea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fissurina spp.	0	0	0	0	0	0	0.41	0	0	0	0	0	0	0	4.62	1.54	0.52	0	0.313	0	1.65	0	1.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fursenkoina fusiformis	38.9	0	0	0	4.12	0	21.3	0	0	0	0	0	0	0	58.5	16.9	83.1	1.69	84.68	6.96	77.1	0.62	51.6	1.77	42.9	3.57	0	0	0	0	40	40	9.09	9.09	0	0	56.3	6.25	0	0
Globobulimina pupoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.78	0	1.095	0.16	1.24	0	0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glomerspira gordialis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haplophragmoides spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.35	0	0	0	0	0	0	0	0	0	9.09	0	0	0	0	0	0	0
Islandiella norcrossi	0	0	0	0	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena spp.	1.05	0	0	0	0.52	0	0.41	0	0	0	0	0	0	0	3.08	3.08	0.13	0.13	0.156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Milammina fusca	0	0	66.7	0	0	0	1.23	0	0	0	0	0	16.7	0	6.15	0	0	0	0	0	0	0	1.41	0	3.57	0	0	0	66.7	0	0	0	18.2	0	100	0	0	0	0	0
Nonionella turgida/digitata	0	0	0	0	0.52	0	0	0	0	0	0	0	0	0	0	0	0.26	0	0	0	0	0	0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella stella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.83	0	3.89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella frgs.	0	0	0	0	0	0	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella (tiny)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudononion basispinata	0	0	0	0	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0.313	0	0	0	0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oolina spp.	0	0	0	0	0	0	0.41	0	0	0	0	0	0	0	0	0	0	0	0.156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (akneria)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recuvoides turbinatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	0.53	0.53	0	0	0	0	0.41	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax scottii	2.63	2.63	22.2	22.2	5.67	5.67	14.8	14.8	78.9	78.9	77.8	77.8	33.3	33.3	15.4	15.4	7.82	7.04	3.284	3.13	7.23	7.23	18.7	18.7	42.9	42.9	100	100	33.3	33.3	60	60	54.5	54.5	0	0	34.4	31.3	90	90
Rosalina columbiensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Saccamina diffugiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spiroplectimma biformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spirosigmoilina tenuis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.313	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0.52	0	0.82	0	0	0	11.1	0	8.33	0	0	0	0	0	0	0	0.41	0	0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.13	0.13	0.156	0	0	0	0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	5.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	0	0	11.1	0	0.52	0	0.41	0.41	5.26	0	11.1	0	0	0	0	0	0	0	0.469	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina inflata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina macrens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina nana	0.53	0	0	0	0	0	0.41	0	5.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	0	0	0	0	0.52	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0.391	0.39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp. tiny	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lobate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lesslob.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
organic linings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
weird-ufo	0	0	0	0	0	0	1.23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	729		730		732		734		738		739		740		750		756		757		758		760		769		773		779		786		789		799		809		819	
fraction (% total, % 45um)	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	t%	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	5		2.5		5		5		5		5		5		10		5		5		5		10		10		2.5		10		10		10		10		10		10	
total count/10cc	190		36		194		244		38		18		24		65		1534		2558		968		283		28		16		9		5		11		2		32		10	
% #45 per 10 cc/total # per 10 cc	6.32		22.2		12.4		31.1		78.9		77.8		41.7		80		10.3		11.65		7.85		21.6		46.4		100		33.3		100		63.6		0		37.5		100	
PLANKTONIC FORAMINFERA																																				
planktonics	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.62	0	0	0	0	0	0.41	0	2.12	0	3.57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THECAMOEBIANS																																				
Centropyxsis aculeata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia oblongata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	829		839		845		853		857		860		861		866		864		871		881		891		901		902		911		918		919		921		931		941	
fraction (% total, % 45um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	10		10		10		10		10		10		10		5		5		10		10		10		10		5		10		10		10		10		10		10	
total count/10cc	46		11		4		123		26		12		21		108		44		71		112		53		29		4.67		5		3		9		11		63		6	
% #45 per 10 cc/total # per 10 cc	97.8		54.5		25		15.4		23.1		25		57.1		11.1		22.7		97.2		0.89		86.8		27.6		85.7		40		66.7		88.9		90.9		17.5		100	
BENTHIC FORAMINFERA																																								
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	2.17	2.17	0	0	0	0	0	0	0	0	0	0	0	0	5.56	0	0	0	0	0	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.12	0	0	0
Botuloides pauciloculus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bucella depressa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bucella frigida	0	0	18.2	0	0	0	2.44	0	53.8	0	0	0	4.76	0	5.56	0	9.09	0	0	0	2.68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buliminella elegantissma	2.17	2.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
calcareous fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.7	0	4.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassindulina subglobosa cf.	0	0	0	0	0	0	0	0	0	0	0	0	14.3	0	0	0	22.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cibicides spp.	4.35	4.35	0	0	0	0	0.81	0	7.69	0	0	0	0	0	5.56	0	4.55	0	0	0	0.89	0	0	0	3.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cribrostomoides crassmargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella hannai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium crispum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium microgranulosum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	4.35	4.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.59	1.59	0	0
Elphidium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Epistominella vitrea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.12	0	0	0
Euuvigerina juncea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fissurina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fursenkoina fusiformis	56.5	56.5	36.4	9.09	0	0	53.7	0	0	0	0	0	28.6	28.6	22.2	0	0	0	0	0	68.8	0	0	0	51.7	0	0	0	0	0	0	0	0	0	0	0	77.8	1.59	0	0
Globobulimina pupoides	2.17	2.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glomerspira gordialis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haplophragmoides spp.	0	0	0	0	0	0	0	0	15.4	0	0	0	4.76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella norcrossi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	4.76	0	3.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.85	0	0	0	0	0	0	0	1.89	1.89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Milammina fusca	2.17	0	0	0	50	0	4.07	0	15.4	0	33.3	0	9.52	0	0	0	22.7	0	0	0	0	0	13.2	0	3.45	0	53.3	0	60	0	33.3	0	11.1	0	9.09	0	0	0	0	0
Nonionella turgida/digitata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella stella	0	0	0	0	0	0	4.88	0	0	0	0	0	4.76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella frgs.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella (tiny)	4.35	4.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.59	1.59	0	0
Pseudononion basispinata	0	0	0	0	0	0	0	0	7.69	0	0	0	0	0	3.7	0	0	0	0	0	0.89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oolina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (akneria)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recuvoides turbinatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	0	0	9.09	9.09	0	0	0	0	0	0	0	0	0	0	0	0	9.09	9.09	2.82	2.82	0	0	1.89	1.89	0	0	20	20	0	0	0	0	0	0	9.09	9.09	0	0	0	0
Reophax scottii	19.6	19.6	36.4	36.4	25	25	14.6	14.6	30.8	7.69	25	25	28.6	28.6	11.1	11.1	9.09	9.09	90.1	90.1	0.89	0.89	83	83	34.5	27.6	20	20	40	40	66.7	66.7	88.9	88.9	72.7	72.7	12.7	12.7	100	100
Rosalina columbiensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Saccamina difflugiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spiroplectimma biformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.41	1.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spirosigmoilina tenuis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0.81	0.81	7.69	0	16.7	0	0	0	0	0	4.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.09	9.09	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	7.69	0	0	0	0	0	9.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.55	0	1.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	0	0	0	0	0	0	0	0	53.8	3.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina inflata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina macrens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina nana	0	0	0	0	25	0	0	0	0	0	25	0	0	0	0	0	4.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	2.17	2.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.55	4.55	1.41	1.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp. tiny	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lobate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lesslob.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
organic linings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.41	1.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
weird-ufo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	829		839		845		853		857		860		861		866		864		871		881		891		901		902		911		918		919		921		931		941	
fraction (% total, % 45um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	10		10		10		10		10		10		10		5		5		10		10		10		10		5		10		10		10		10		10		10	
total count/10cc	46		11		4		123		26		12		21		108		44		71		112		53		29		4.67		5		3		9		11		63		6	
% #45 per 10 cc/total # per 10 cc	97.8		54.5		25		15.4		23.1		25		57.1		11.1		22.7		97.2		0.89		86.8		27.6		85.7		40		66.7		88.9		90.9		17.5		100	
PLANKTONIC FORAMINFERA																																								
planktonics	0	0	0	0	0	0	10.6	0	0	0	0	0	0	0	7.41	0	0	0	0	0	1.79	0	0	0	3.45	0	0	0	0	0	0	0	0	0	0	0	2.12	0	0	0
THECAMOEBIANS																																								
Centropyxsis aculeata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia oblongata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	950		951		961		971		976		981		991		1001	
fraction (% total, % 45um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	5		10		10		10		10		10		10		10	
total count/10cc	18		6		0		72		70		53		32		14	
% #45 per 10 cc/total # per 10 cc	100		50		0		15.3		57.1		7.55		96.9		28.6	
BENTHIC FORAMINFERA																
Adercotyma glomerata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
agglutinated fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivina pacifica	0	0	0	0	0	0	2.78	0	4.29	1.43	17	0	0	0	7.14	7.14
Botuloides pauciloculus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brizalina subaenariensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bucella depressa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bucella frigida	0	0	0	0	0	0	1.39	0	1.43	1.43	0	0	0	0	0	0
Buliminella elegantissma	0	0	0	0	0	0	0	0	2.86	2.86	0	0	0	0	0	0
calcareous fragments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassindulina subglobosa cf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chilostomella oolina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cibicides spp.	0	0	0	0	0	0	0	0	1.43	1.43	0	0	0	0	0	0
Cribrostomoides crassmargo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggerella advena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella hannai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidiella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium crispum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium exclavatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.14	0
Elphidium frigidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium microgranulosum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium subarcticum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elphidium spp. (tiny)	0	0	0	0	0	0	0	0	1.43	1.43	0	0	0	0	0	0
Elphidium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Epistominella vitrea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.14	0
Euuvigerina juncea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fissurina spp.	0	0	0	0	0	0	0	0	1.43	0	0	0	0	0	0	0
Fursenkoina fusiformis	0	0	0	0	0	0	84.7	13.9	77.1	44.3	69.8	0	0	0	35.7	14.3
Globobulimina pupoides	0	0	0	0	0	0	0	0	0	0	3.77	0	0	0	0	0
Glomerspira gordialis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haplophragmoides spp.	0	0	16.7	0	0	0	0	0	0	0	0	0	0	0	7.14	0
Islandiella norcrossi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Islandiella teretis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagena spp.	0	0	0	0	0	0	1.39	0	0	0	0	0	0	0	0	0
Milammina fusca	0	0	33.3	0	0	0	1.39	0	1.43	0	0	0	3.13	0	7.14	0
Nonionella turgida/digitata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella stella	0	0	0	0	0	0	1.39	0	0	0	0	0	0	0	0	0
Nonionella frgs.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonionella (tiny)	0	0	0	0	0	0	0	0	1.43	1.43	0	0	0	0	0	0
Pseudononion basispinata	0	0	0	0	0	0	4.17	0	2.86	0	0	0	0	0	0	0
Oolina spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quinqueloculina sp. (akneria)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recuvoides turbinatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reophax arctica	0	0	0	0	0	0	0	0	0	0	1.89	1.89	9.38	9.38	0	0
Reophax scottii	100	100	50	50	0	0	1.39	1.39	1.43	1.43	5.66	5.66	87.5	87.5	7.14	7.14
Rosalina columbiensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Saccamina difflugiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spiroplectimma biformis	0	0	0	0	0	0	0	0	1.43	1.43	0	0	0	0	0	0
Spirosigmoilina tenuis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia conica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textularia earlandi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifarina fluens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina charlottensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina discorbis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina inflata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina macrens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina nana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina ochracea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina pacifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp. tiny	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lobate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.-lesslob.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochammina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
organic linings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
weird-ufo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

corrected depth (cm)	950		951		961		971		976		981		991		1001	
fraction (% total, % 45um)	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45	%t	%45
volume (ml)	5		10		10		10		10		10		10		10	
total count/10cc	18		6		0		72		70		53		32		14	
% #45 per 10 cc/total # per 10 cc	100		50		0		15.3		57.1		7.55		96.9		28.6	
PLANKTONIC FORAMINFERA																
planktonics	0	0	0	0	0	0	0	0	0	0	1.89	0	0	0	21.4	0
THECAMOEBIANS																
Centropyxsis aculeata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Difflugia oblongata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lagenodifflugia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

% Species abundances

Relative species abundance is presented as the % contribution of each selected species contained in a 10 cm^3 of sample (Figures 3.24 to 3.26).

Thecamoebians are present throughout the length of the core as discrete peaks generally less than 20 % - 60 cm, 110cm, 140 cm, 180 cm, 190 cm, 240 cm, 250 cm (~0-2000 yBP; Climate Interval I), 450 cm, 510 cm, and 680 cm, with the exception of greater relative abundance peaks occurring at 410 cm (80%) and 890 cm (100%) (~2000 yBP+; Climate Interval II).

Miliammina fusca is found present continuously throughout the length of the core generally as numerous small peaks of less than 20% with the exception of a larger relative abundances occurring at 360 to 390 cm (40%) (~0 to 2000yBP; Climate Interval I), 420 cm (38%), 620 cm to 700 cm (60 to 100%), 770 cm (60%), and 840 cm (60%)(~2000yBP+; Climate Interval II).

Reophax scottii is present the length of the core with a relative abundance generally greater than 25%. Noticeable declines in relative abundance occur at 30 cm, 60 cm, 200 cm, 260 cm, 298 cm (~0 to 2000yBP; Climate Interval I), and 570 cm, 650 cm, 690 cm (~2000yBP+; Climate Interval II).

Fursenkoina fusiformis is found throughout the length of the core as numerous discrete peaks in relative abundance ranging from 18 to 100% – 20 cm (64%), 40cm (50%), 150 to 160 cm (10%), 180 cm (10 %), 200 cm (80%), 210 cm (20%), 250 to 260 cm (100%), 180 cm (60%), and 180 to 210 cm (40 %) (~0 to 2000yBP; Climate Interval II), and 520 cm (40%), 570 cm (50%), and 860 cm (25%) (~2000yBP+; Climate Interval II).

Trochammina spp. includes several species that have been combined into one species group under the genus - primarily, T. *discorbis, T. ochracea, T. pacifica* and others, due to their morphological similarities. *Trochammina* spp ranges from 0 to 22% of the faunal assemblage, and is present throughout the length of the core as numerous peaks in relative abundance of 5 to 22% that occur at 50 to 70 cm, 110 to 140 cm, 190 cm, 210 cm, 320 cm, 360 to 390 cm (~0 to 2000yBP; Climate Interval I), and 410 cm, 420 cm, 440 cm, 510 cm, 540 cm, 590 cm, 660 cm, 690 cm, 720 to 730cm, 760 cm, and 840 cm (~2000yBP+; Climate Interval II).

Bolivina pacifica and is found the length of the core in eight discrete peaks in relative abundance – 10 cm (4%), 40 cm (3%), 200 cm (5%), 260 cm (2%), 300 cm (23 %), 340 to 360 cm (6%) (~0 to 2000yBP; Climate Interval I), and 490 cm (5%), and 560 cm (25%) (~2000yBP+; Climate Interval II).

Buliminella elegantissma is present the length of the core, as four discrete peaks in relative abundance of less than 2% at 10 cm, 200 cm (~0 to 1000yBP; Climate Interval I), and greater than 4% at 560 cm and 730 cm (~2000yBP+; Climate Interval II).

Buccella spp. is a grouping of 2 species, *B. frigida* and *B. depressa*, who have similar morphologies. Again, *Buccella* spp. is found the length of the core generally as peaks in relative abundance of 10% or less at 40 cm, 60 cm (20%), 150 cm (12%), 180 cm (11%), 200 cm, 280 cm, 310 cm, 360 cm (~0 to 2000yBP; Climate Interval I) and 440 cm, 500 cm, 540 to 570 cm (15 to 20 %), 730 cm (40%) and 870 cm (11%) (~2000yBP+; Climate Interval II).

Cibicides spp. is a species grouping of C. *lobatulus*, C. *fletcheri*, and *Planorbulina mediterranensis* - due to their similar morphologies. These species range present as numerous peaks in relative abundance of 10 to 25% between 180 to 390 cm (~0 to 2000yBP; Climate Interval I) 410 to 530 cm, and 710 cm (~2000yBP+; Climate Interval II). Three greater peaks occur at 390 cm (45%), 570 cm (80%), and 640 cm (35%).

Elphidium spp. is a species grouping of *E. crispum*, *E. subarcticum*, *E. frigidium* and others - due to their morphological similarities, and generally low representation individually. These species are present the length of the core - 20 cm (1%), 200 cm (4%), 310 cm (15%), 330 to 360 cm (10%) (~0 to 2000yBP; Climate Interval I); 440 cm (5%), 480 cm (10%), 540 to 560 cm (5%), 570 cm (30%), 575 cm (30%), 610 cm (5%), 720 cm (11%), 830 cm (10 %), 860 cm (12%) (~2000yBP+;Climate Interval II). The locations of peak abundances are similar to *Buccella* spp. and *Cibicides* spp.

Nonionella spp. is a species grouping of *N. stella, N. digitata, N. turgida*, and *Nonionellina labradorica* due to their similar morphologies, and generally low individual representations. These species are present the length of the core, as 7 peaks in relative abundances - 60 cm (5%), 210 cm, (5%), 330 cm (20 %), 360 cm, (5%) (~0 to 2000yBP; Climate Interval I); 540 cm, (8%), 560 cm (35%) and 860 cm (12%) (~2000yBP+;Climate Interval II). The locations of peak abundances are similar to *Buccella* spp., *Cibicides* spp., *Elphidium* spp., *Islandiella* spp. and others.

Planktics species include - *Globergerina spp.* and groups all planktic species due to their similar morphologies and generally low individual representations. These species are present the length of the core as 5 peaks in relative abundance - 40 cm (4%), 200 cm (3.9%), 250 cm (3.6%), 390 cm (5%) (~0 to 2000yBP; Climate Interval I), and 580 cm (9%) (~2000yBP+; Climate Interval II). The locations of peak abundances are similar to *Buccella* spp., *Cibicides* spp., *Elphidium* spp., *Islandiella* spp. and others.

Unilocular forms include *Fissurina* spp., *Lagena* spp. and *Oolina* species groups – that are further grouped together due to their low individual representation, but yet are still important indicators of the influx of shelf waters into the inlet. These species are present from ~10 to 580 cm (~0 to 2400 yBP; Climate Intervals I and II) as 8 peak abundance events ranging from 1 to almost 20 %. The locations of peak abundances are similar to*Buccella* spp., *Cibicides* spp., *Elphidium* spp., planktics and others.

Appendix 2 – Radiocarbon age determinations

Geochron Laboratories report of analytical work

GEOCHRON LABORATORIES
a division of Krueger Enterprises, Inc.
711 Concord Avenue ✦ Cambridge, Massachusetts 02138-1002 ✦ USA
t (617) 876-3691 *f* (617) 661-0148 www.geochronlabs.com

RADIOCARBON AGE DETERMINATION		REPORT OF ANALYTICAL WORK	
Our Sample No.	**GX-30168-AMS**	Date Received:	04/18/2003
Your Reference:	PO # P9015868	Date Reported:	05/23/2003

Submitted by:

David B. Scott
Dept. of Earth Sciences
Room 3006, Life Sciences Center
Dalhousie University
Halifax, Nova Scotia B3H 4J1
CANADA

Sample Name: **97TulA-03section3 (54cm)**

AGE = **1530 ± 60 ^{14}C years BP (^{13}C corrected)**

Description: Sample of wood

Pretreatment: The wood sample was cleaned of dirt and other foreign material and split into small pieces. It was then treated with hot dilute HCl to remove any carbonates; with 0.1N dilute NaOH to remove humic acids and other organic contaminants; and a second time with dilute HCl. After washing and drying, the sample was combusted to recover carbon dioxide for the analysis.

Comments:

$\delta^{13}C_{PDB}$ = **-26.5 ‰**

Notes: This date is based upon the Libby half life (5570 years) for ^{14}C. The error is +/- 1 s as judged by the analytical data alone. Our modern standard is 95% of the activity of N.B.S. Oxalic Acid.

The age is referenced to the year A.D. 1950.

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RADIOCARBON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No.	**GX-30169-AMS**	Date Received:	04/18/2003
Your Reference:	PO # P9015868	Date Reported:	05/23/2003

Submitted by:
David B. Scott
Dept. of Earth Sciences
Room 3006, Life Sciences Center
Dalhousie University
Halifax, Nova Scotia B3H 4J1
CANADA

Sample Name: **97TulA-03section5 (147 cm)**

AGE = **2350 ± 60 ^{14}C years BP (^{13}C corrected)**

Description: Sample of wood

Pretreatment: The wood sample was cleaned of dirt and other foreign material and split into small pieces. It was then treated with hot dilute HCl to remove any carbonates; with 0.1N dilute NaOH to remove humic acids and other organic contaminants; and a second time with dilute HCl. After washing and drying, the sample was combusted to recover carbon dioxide for the analysis.

Comments:

$\delta^{13}C_{PDB}$ = **-24.3 ‰**

Notes: This date is based upon the Libby half life (5570 years) for ^{14}C. The error is +/- 1 s as judged by the analytical data alone. Our modern standard is 95% of the activity of N.B.S. Oxalic Acid.

The age is referenced to the year A.D. 1950.

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RADIOCARBON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No.	**GX-30167-AMS**	Date Received:	04/18/2003
Your Reference:	PO # P9015868	Date Reported:	05/23/2003

Submitted by:
David B. Scott
Dept. of Earth Sciences
Room 3006, Life Sciences Center
Dalhousie University
Halifax, Nova Scotia B3H 4J1
CANADA

Sample Name: **97TulA-03section1 (68cm)**

AGE = **500 ± 50 ^{14}C years BP (^{13}C corrected)**

Description: Sample of wood

Pretreatment: The wood sample was cleaned of dirt and other foreign material and split into small pieces. It was then treated with hot dilute HCl to remove any carbonates; with 0.1N dilute NaOH to remove humic acids and other organic contaminants; and a second time with dilute HCl. After washing and drying, the sample was combusted to recover carbon dioxide for the analysis.

Comments:

$\delta^{13}C_{PDB}$ = **-27.4 ‰**

Notes: This date is based upon the Libby half life (5570 years) for ^{14}C. The error is +/- 1 s as judged by the analytical data alone. Our modern standard is 95% of the activity of N.B.S. Oxalic Acid.

The age is referenced to the year A.D. 1950.

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