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MARSH FORAMINIFERA FROM NANAIMO, BRITISH COLUMBIA (CANADA): IMPLICATIONS OF INFAUNAL HABITAT AND TAPHONOMIC BIASING

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ABSTRACT

Marsh foraminiferal faunas from nine cores in two transects in and around Nanaimo inlet were examined to assess the implications of infaunal habitat and taphonomic processes for biofacies formation. High marsh faunas live slightly deeper infaunally compared to those in the low marsh, reflecting harsher conditions in the high marsh. Most living *Jadammina macrescens* occur from 0–20 cm in the high marsh and from 0–11 cm in the low marsh; the main depth preference is from 2–8 cm. Most living *Trochammina inflata* occur between 0–25 cm in the high marsh and from 0–20 cm in the low marsh. *Haplophragmoides wilberti* is most abundant overall between 3–7 cm, being almost absent at the surface in all cores. *H. wilberti* is found primarily between 0–15 cm in the high marsh, and from 0–12 cm in the low marsh. Most living *Miliammina fusca* occur from 0–10 cm, with maximum abundance in the top 3 cm.

Five cluster analyses of the foraminiferal data using a sample base of 0–1, 0–3, 0–5, 0–7 and 0–10 cm, respectively, discriminated five biofacies in each case, which were then used to determine which near-surface aliquot is most analogous to deeper subsurface biofacies. Results show near-surface sediment sampling should be done through the 0–10 cm interval. This aliquot allows the main infaunal species characteristics to be observed, yet is thin enough that epifaunal species are also accurately represented.

These results indicate that at least in coastal British Columbia traditional sampling strategies that assess modern marsh foraminiferal occurrence based only on examination of the uppermost 0–1 cm will not give an accurate representation of actual marsh species distribution. Modern marsh foraminiferal distribution assessment based on the thicker surface interval that we propose will permit researchers to delineate both subtle and dramatic sea level changes more precisely. This precision is critical not only in studies designed to differentiate the magnitude of seismic events but also to recognize subtle relative sea level change events as well.

INTRODUCTION

Southwestern British Columbia is located in the most tectonically active area of Canada where there is concern that an earthquake much larger than any of the historical period may cause extensive damage to cities and the economic infrastructure of the region. Details of the periodicity and magnitude of prehistoric earthquakes in the area are not well known (written records date back less than 200 years), but the proximity of the Cascadia Subduction Zone (CSZ) dramatically increases potential for megathrust and other earthquakes (Clague and Bobrowski, 1990; Clague and Bobrowski, 1994; Nelson and others, 1996a, b). This high potential for damaging earthquakes has led to increased emphasis on seismic risk assessment studies.

New stratigraphic evidence and radiocarbon ages show that the zone of subsidence associated with earthquakes in the CSZ may extend north to central Vancouver Island, British Columbia. The amount of subsidence would be expected to decrease eastward, approaching zero several tens of kilometers east of the outer coast (Clague and Bobrowski, 1990; Mathewes and Clague, 1994). This evidence is in accord with geodetic and geophysical modeling that indicate the convergence of the oceanic Juan de Fuca and Explorer plates with the continental North American plate within the CSZ is locked and accumulating strain. This strain could be released in a potentially catastrophic (M8+) megathrust earthquake (Clague and Bobrowski, 1994; Blais and Patterson, in press; Fig. 1).

Marsh foraminifera have proven to be one of the most effective tools in recognizing paleo-seismic events (Guilbault and others, 1995). Distribution of foraminifera in tidal marshes is highly zoned and controlled by various physical parameters (e.g, salinity, pH, temperature and oxygen concentration; de Rijk, 1995) but the most important is still elevation. Very small changes in relative sea level (<10 cm) modify these parameters and can produce significant changes in the foraminiferal assemblages (Scott and Medioli, 1978; Patterson and others 1994; Patterson and others, 1995). Detailed knowledge of surficial marsh foraminiferal biozones can provide valuable insights about previous depositional environments and former sea levels which may, in turn, be associated with seismic events (see Patterson, 1990; Jonasson and Patterson, 1992; Guilbault and others, 1995). Sudden subsidence is the characteristic result of large seismic events on the west coast. In the marsh, this results in a low marsh fauna being juxtaposed upon a high marsh fauna. Tsunami deposits are occasionally associated with this boundary.

Many reconstructions of past sea-level changes utilize the modern distribution of marsh foraminifera as analogs of their fossil distribution (e.g., Goldstein and Harben, 1993). However, important parameters not widely studied to date, yet vital to such reconstructions, are the nature of the infaunal habitat of many foraminiferal taxa and their taphonomy.

The purpose of this baseline study in marshes adjacent to Nanaimo on Vancouver Island is to enhance the utility of marsh foraminifera as paleoseismic indicators. In particular, the main objectives are: 1) to determine preservational potential (taphonomic biasing) of marsh foraminiferal faunas in the subsurface; and 2) to determine the implication of marsh foraminiferal infaunal habitat on biofacies distribution.

Once the impact of taphonomic biasing and infaunal foraminiferal faunal habitat on biofacies formation is under-

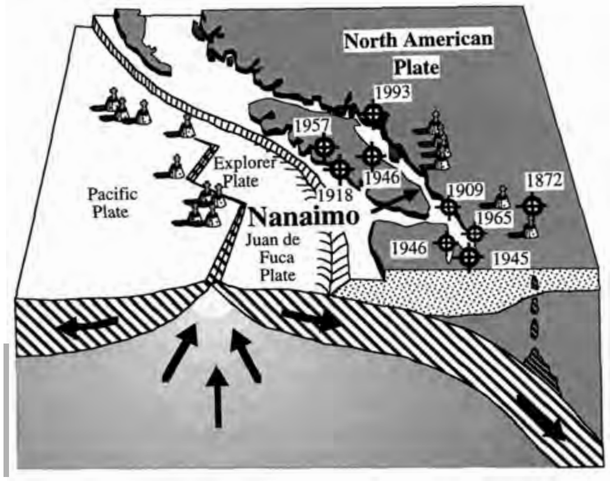

FIGURE 1. Tectonic setting of Nanamio, British Columbia. Epicenters and dates of large earthquakes are indicated.

stood, application of transfer functions (Guilbault and others, 1995) and Error Weighted Maximum Likelihood clustering methodologies (Fishbein and Patterson, 1993) will allow both subtle eustatic and dramatic seismically generated subsidence events to be fully documented.

PREVIOUS WORK

Few studies have addressed the impact of infaunal habitat and taphonomic effects on fossil foraminiferal distribution in general, and even fewer have specifically targeted marsh faunas. Although numerous researchers have identified infaunally dwelling foraminifera in the saltmarsh (e.g., Akers, 1971; Matera and Iee, 1972; Frankel, 1974, 1975; Steineck and Bergstein, 1979), the significance of these occurrences in the assessment of fossil biofacies was not realized until Goldstein (1988) and Goldstein and Harben (1993) reported on foraminifera living to depths of 30 cm below the marsh surface along the eastern coast of St. Catherine's Island, Georgia. Goldstein and others (1995a) hypothesized that these infaunal foraminiferal microhabitats, among the deepest reported in any marine environment, exist because oxygenated conditions occur relatively deeply due to the vegetated and highly bioturbated nature of salt marshes. In a taphonomic study in the same area, Goldstein and others (1995b) reported that total foraminiferal density decreases significantly within the top 10 cm of marsh sediment and with elevation. They also found that selective preservation of certain marsh taxa results in fossil faunas significantly different from their counterparts at the surface. These poorly preserving taxa include all calcareous species, which dissolve readily in the reducing marsh environment, and certain agglutinated species such as *Miliammina fusca* and *Ammotium* spp., which are particularly susceptible to bacterial degradation of cements. Thus, although absolute numbers decrease downcore, the relative abundance of some taxa actually increases. Hoge (1995) reported similar distributional and taphonomic phenomena in another study carried out in Texas coastal wetlands. In marsh environments of the Fraser River delta, southern British Columbia, near the present study area Jonasson and Patterson (1992) also found an overall decrease downcore in agglutinated and calcareous foraminiferal numbers implying poor preservation potential.

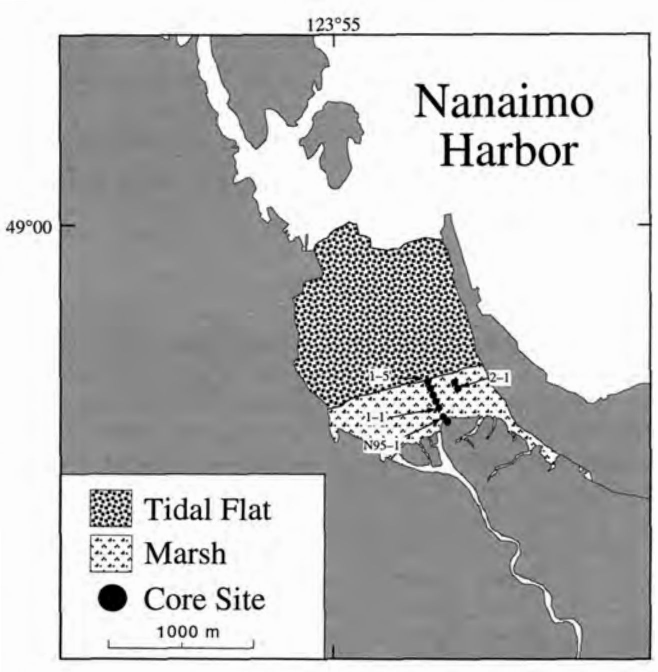

FIGURE 2. Location map of cores (1-1 to 1-5; 2-1, 2-2, N95-1 and N95-2) examined for this study.

Although their study area was far removed from the marsh, Loubere and Gary (1990) carried out innovative studies of taphonomic processes affecting deep water benthic foraminifera using methodologies directly applicable to wetland research. By analyzing both living and dead assemblages, they assessed the extent of taphonomic biasing for species living in both epifaunal and infaunal microhabitats. We have applied their methodology to the present research.

METHODS AND MATERIALS

One hundred eighty samples were taken from nine 31-cm cores along two transects in the marsh adjacent to Nanaimo inlet (Figs. 2 and 3; Appendix 1). Sampling for all sites except N95-1 and N95-2 was carried out using a push core. To test a new low-power portable vibracorer that we de-

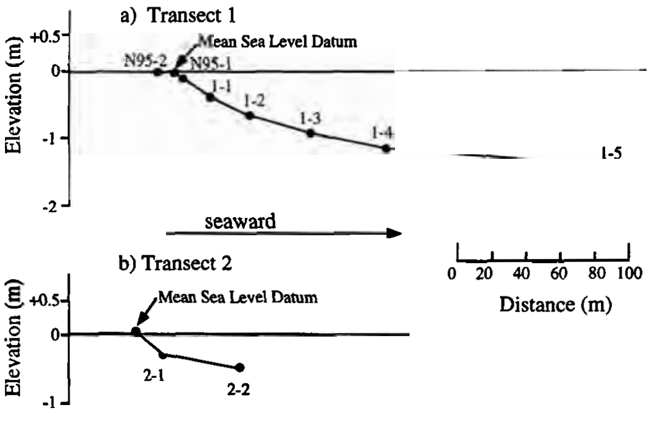

FIGURE 3. Cross-section of sampling sites indicating elevation of sample sites above or below mean sea level.

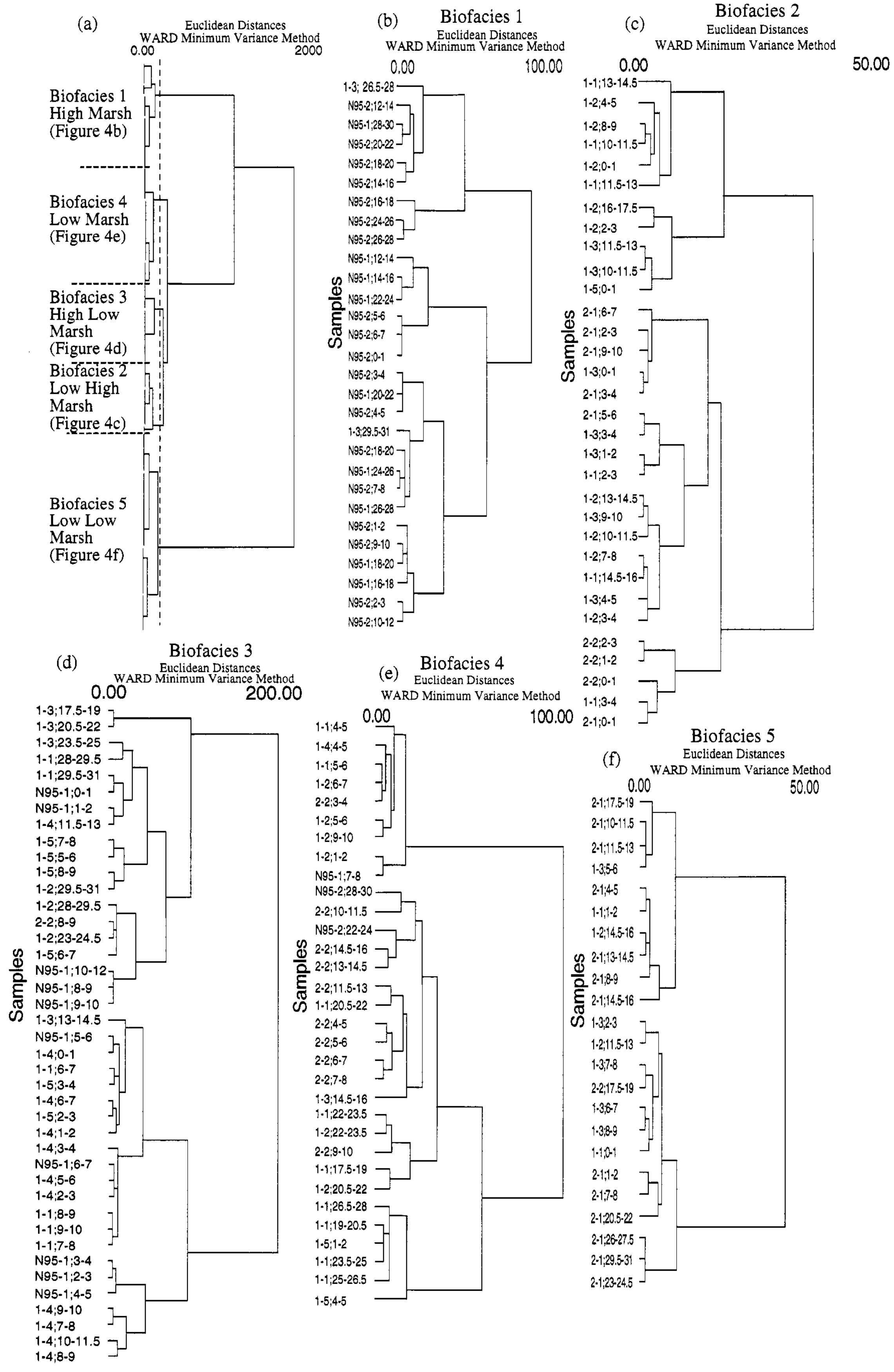

FIGURE 4. Q-mode dendrogram showing the results of the 0–1 cm Surface Interval Cluster Analysis, from Nanaimo, British Columbia. Distinct clusters of samples with correlation co-efficients greater than a selected level were considered biofacies. A summary of the results is presented in Fig. 4a with detailed sample distribution shown in the enlargements of each biofacies (Figs. 4b–4f).

signed to cut matted marsh vegetation with a minimum of disturbance, sites N95-1 and N95-2, collected during a second expedition to the site, were vibracored. Visual inspection of the stratigraphy in resultant cores revealed minimal sediment disturbance and indicate that low-powered vibracorers are viable sampling tools in heavily vegetated areas. Thus despite the different coring techniques, all cores are directly correlatable. Foraminiferal samples were taken at 1-cm intervals for the first 10 cm and then at 1.5- to 2-cm intervals through the remainder of each core. The cores generally consisted of an organic-rich silt or peat, overlying sand. Most samples were stored in sterilized plastic vials and treated in the field with formaldehyde in order to prevent microbial decay of living foraminiferal protoplasm. However, samples from cores N95-1 and N95-2 were stored in sterilized ziploc bags and treated in the field with isopropyl alcohol, as no formaldehyde or vials were available. The elevation of each core site was obtained using a surveying level. Absolute elevations were obtained by comparing these results to topographic maps of the tidal flats and marshes (Fig. 3; Canada, 1:50,000, 1994).

In the laboratory, approximately 10 cc of each sample were washed and sieved using a 0.063 mm mesh. To distinguish foraminifera living at the time of collection, samples were then fixed in a solution of Rose Bengal stain and buffered formalin and allowed to sit for several hours (Scott and Medioli, 1980a). After staining, the samples were washed in tap water and preserved in a 5% isopropyl alcohol solution. Samples were sieved using a 0.5 mm screen to remove large plant debris to facilitate counting. The sample residue was then split using a wet splitter until a fraction of countable size (≈500 specimens and usually $\frac{1}{6}$ of original sample) was obtained (Scott and Hermelin, 1993). Wet samples were then examined under a binocular microscope (generally at around 40×). Water immersion aids in sample identification of marsh species because organic matter found in marsh samples tends to stick to foraminiferal tests if samples are dried. Of the 180 samples, 157 contained statistically significant numbers of foraminifera (Appendix 1; see Patterson and Fishbein, 1989, for background on estimating statistical significance). Separate tallies of both total and live species were made (Appendix 1).

QUANTITATIVE ANALYTICAL PROCEDURES

The counts for each sample were converted into fractional abundances and standard errors were calculated as proposed by Patterson and Fishbein (1989) according to the following formula:

$$S_{Xi} = [X_i(1 - X_i)N]^{1/2}$$

Where S_{Xi} is the standard error: X_i is the estimated fractional abundance for each $i = 1, 2, 3, \ldots I$ species, where $I =$ the total number of species in the sample; i is each species; and N is the total number of specimens counted in a sample. When making N counts, the actual fractional abundance f_i lies between,

$$X_i - 1.96S_{Xi} > f_i < X_i + 1.96S_{Xi}$$

95% of the time. Therefore, the 95% confidence interval on the estimated fractional abundances is $X_i + 1.96S_{Xi}$.

Q-Mode cluster analysis was carried out on the total species counts in order to group samples that had similar foraminiferal species distributions. Samples that had similar species distributions were considered to be representative of a particular environment or biofacies. It was only necessary to carry out cluster analysis on the total counts because it is the absolute foraminiferal populations that define biofacies. Presence of infaunally living specimens influence the makeup of biofacies, as do other sources of taphonomic biasing such as preservation, but in the context of units recognizable in the fossil record they do not define biofacies in their own right.

Specimens of 13 foraminiferal and arcellacean species were observed in this study. However, only species that were deemed to be present in statistically significant numbers were used in the Q-Mode cluster analysis. The statistically significant species were those that had abundances equal to the standard error ±1% at the 95% confidence level in at least one sample. Those species included in the analyses are: *Trochammina inflata* (Montagu, 1808), *Miliammina fusca* (Brady, 1870), *Jadammina macrescens* (Brady, 1870), and *Haplophragmoides wilberti* Anderson, 1953. Although *Trochamminita salsa* (Cushman and Brönniman, 1948a) was found in statistically significant numbers, it was included with the possibly closely related *Jadammina macrescens* for the cluster analysis, as these species were tallied together at all sites except N95-1 and N95-2. The relatively low number of species abundant enough to be included in the statistical analysis is related to the nature of the marsh ecotone. Marginal environments such as these are typically dominated by only a few species. The number of species Q-Mode clustering of the reduced dataset was done on an Apple Macintosh cx computer using the SYSTAT v.5.2 statistical software package and Ward's minimum variance method (Wilkinson, 1992). The results of the cluster analysis were then reported as Euclidean distances and arranged in a hierarchical dendrogram (Figs. 4 and 5). The dendrogram was then used to define sample associations or biofacies (Figs. 4–6; Table 1). This methodology simulates a statistically based Error-Weighted Maximum Likelihood (EWML) clustering method fully described in Fishbein and Patterson (1993).

Five separate cluster analyses were carried out on the data, using 0–1 cm, 0–3 cm, 0–5 cm, 0–7 cm and 0–10 cm foraminiferal distribution data, to detect possible effects of foraminiferal infaunal habitat and taphonomically induced biasing on resultant biofacies.

Weighted faunal distribution graphs were generated for the percent infaunal living and absolute total population (live plus dead) data to correct for local variations in occurrence caused by selective dissolution and post-mortem transport (Fig. 7). The curve is fitted to each plot using the "locally weighted least squared error method" using the computer program KaleidaGraph (v.2.1; Abelbeck Software, 1990). The resultant best fit smooth curve passes through the center of the data. This is an extremely robust method and, unlike the "standard least squared method," is nearly insensitive to outliers. The smoothing procedure examines an arbitrarily selected fraction of the data populations (0.33 here) for each point on the curve: this determines the smoothness of the curve. We could have considered a large

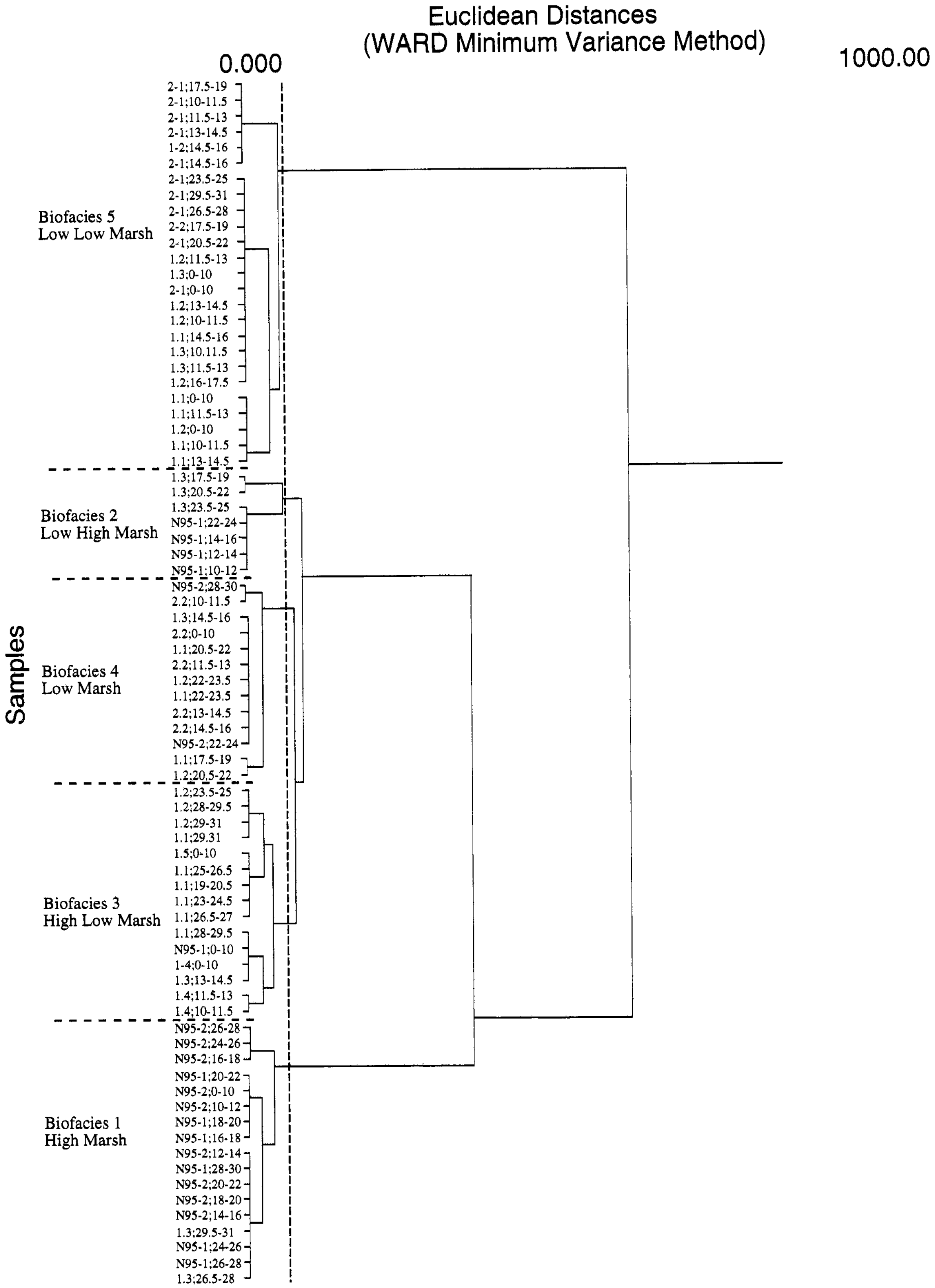

FIGURE 5. Q-mode dendrogram showing the 0–10 cm Surface Interval Cluster Analysis, from Nanaimo, British Columbia. Distinct clusters of samples with correlation coefficients greater than a selected level were considered biofacies.

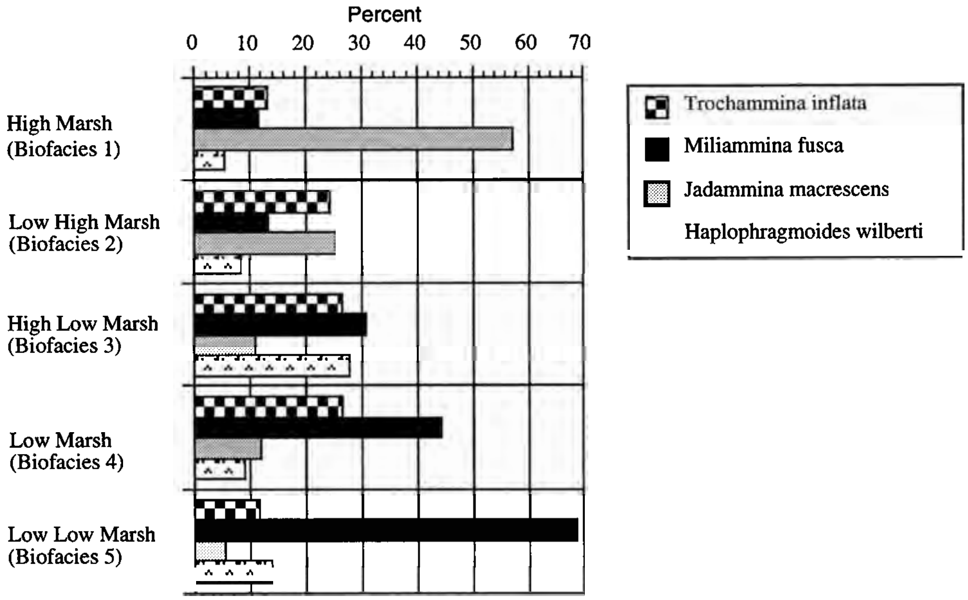

FIGURE 6. Relative mean abundance of four most abundant marsh species in recognized biofacies.

fraction (e.g., 0.66 or 1) but the resultant plots would have missed too much detail.

To avoid any possible confusion in the subsequent discussion about the meaning of "low" vs. "high" marsh faunas, some clarification is presented here. As has become the norm in papers examining the distribution of foraminifera in marshes, they are often informally described in terms of high and low faunas, in addition to presenting the distribution of various marsh biofacies in terms of absolute elevation above mean sea level (e.g., Scott and Medioli, 1980b; Patterson, 1990, etc.). The cut-off between high and low marshes has not so much to do with an absolute elevation, as this changes dramatically depending on the tidal regime, but usually depends on the dominance of important indicator species like *Jadammina macrescens* (high marsh), and *Miliammina fusca* (low marsh).

RESULTS AND DISCUSSION

PART 1: DOWNCORE FORAMINIFERAL DISTRIBUTION PATTERNS

To accurately assess infaunal habitat of the various foraminiferal species, and variations in their total population, distributional trends displayed by the four most abundant marsh species (*Jadammina macrescens, Miliammina fusca, Trochammina inflata,* and *Haplophragmoides wilberti*) will be discussed in detail (Figs. 7–9; Appendix 1).

Results of two different data manipulations are presented to assess the nature of foraminiferal infaunal habitat and the impact of taphonomic biasing (Figs. 7 and 9; Appendix 1). To determine the nature of infaunal habitat the proportion of live specimens at each sampling horizon is presented. To determine the impact that taphonomic processes (e.g., infaunal habitat, dissolution, bioturbation, etc.) have on biofacies formation the total number of specimens (live plus dead) at each horizon is also presented. In contrast to the approach used to assess infaunal habitat, absolute specimen counts are presented for this tally because this method permits us to recognize actual changes in standing diversity downcore. Presentation of the species abundance data as a fractional abundance would allow us to recognize neither the typical decrease in standing diversity, nor the increase in compound diversity that generally occurs downcore (Goldstein and others, 1995a, b).

Jadammina macrescens

Jadammina macrescens has a primarily infaunal habitat. The highest abundances and percentages of living *J. macrescens* are found in high marsh cores N95-1 and to a lesser extent N95-2 (up to 10.5%). Because *J. macrescens* is most abundant in the high marsh, distributional trends are most clearly identified here. To evaluate the depth where most individuals of each species resided, the depths above which

TABLE 1. Mean fractional abundances and associated standard error of four most abundant marsh species best characterizing each assemblage. For the purposes of this compilation *Trochamminita salsa* is lumped with the closely related *Jadammina macrescens,* as they were only separately tallied at two sampling stations, N95-1 and N-95-2.

Biofacies Assignment Species	1 High marsh (%)	2 Low high marsh (%)	3 High low marsh (%)	4 Low marsh (%)	5 Low low marsh (%)
Trochammina inflata	13.2 ± 5.41	24.1 ± 4.45	26.5 ± 14.62	26.5 ± 10.49	11.6 ± 8.20
Miliammina fusca	11.7 ± 9.31	13.3 ± 8.58	30.8 ± 15.90	44.2 ± 6.71	68.6 ± 14.90
Jadammina macrescens	57.4 ± 7.92	25 ± 13.64	11.0 ± 7.41	11.8 ± 6.16	5.4 ± 3.62
Haplophragmoides wilberti	5.5 ± 2.25	8.4 ± 4.58	27.7 ± 12.62	8.8 ± 5.61	13.7 ± 7.60

95% and 50% of the population of each species lived were calculated (Fig. 7). Although most live *J. macrescens* occur from 0–20 cm deep in the high marsh and from 0–11 cm in the low marsh, the main depth preference (based on percent live and absolute counts) is from 2–8 cm, as indicated by a slight "bulge" in the smoothed curve (Core 1-1 in Fig. 7) and by the average depth of infaunal habitat (see Cores 1-1, N95-1 and N95-2 in Fig. 7).

Under steady state conditions, unless taphonomic processes interfere, infaunal species will have abundances that increase down to preferred habitat depth, and then remain constant below that depth. Should taphonomic processes be at work, then a certain proportion of each species production will be destroyed and species abundance patterns will resemble the dashed lines in Fig. 8 (Loubere, 1989). By comparing the trend of *J. macrescens* with the trend in Fig. 8b, it can be concluded that there are taphonomic processes at work. Because both living populations and the total assemblage (live plus dead) of *J. macrescens* decrease downcore, there is evidence of some taphonomic biasing.

Trochamminita salsa (Cushman and Brönniman, 1948a) was grouped with *J. macrescens* in samples analyzed from sites in Transects 1 and 2 because it was unclear that these were two distinct species (Cores 1-1 through 1-5, 2-1, and 2-2; Fig. 7). However, separate counts were made in samples from cores N95-1 and N95-2 analyzed subsequent to a personal communication from J. P. Guilbault. Interestingly, *T. salsa* and *J. macrescens* show nearly identical infaunal living habitats and total population distribution at the two high marsh sites where they were differentiated (Fig. 9; Appendix 1). If similar results are observed in future analyses of other marsh sites, a systematic re-examination of these species may be in order. For consistency and because they behave similarly, these species have been lumped for the overall cluster analysis (Figs. 4 and 5).

Trochammina inflata

Trochammina inflata was relatively abundant in all low marsh cores. On average, *T. inflata* has a slightly deeper infaunal habitat than *J. macrescens,* being most abundant between 4 and 9 cm, and showing little variation from high to low marsh. However, based on the depth where 95% of the species lived, most living *T. inflata* occur between 0 and 25 cm in the high marsh and between 0 and 20 cm in the low marsh environment (see Cores 1-1 and 2-2; Fig. 7). The average depth of infaunal habitat of *T. inflata* was 10 cm. This observation is in agreement with Goldstein (1988), who found *T. inflata* living to depths of 30 cm. In all cores, the total population trends for *T. inflata* closely mirror declines in the total percent live trends downcore, illustrating strong taphonomic biasing of *T. inflata* fossil faunas.

Haplophragmoides wilberti

Most common in the low marsh (see Cores 1-3; 1-4 and 1-5; Fig. 7), *Haplophragmoides wilberti* also has an infaunal habitat. Although *H. wilberti* lives at slightly shallower depths in the low marsh compared to the high marsh, it is most abundant overall between 3 and 7 cm, being almost absent near the surface in all cores. The infaunal habitat for this species consistently averaged around 5 cm depth. *H. wilberti* is primarily found between 0 and 15 cm in a high marsh, and between 0 and 12 cm in a low marsh, as can be seen from the 95% line in Figure 7. In all cores, the total population mirrors declines in the percent live trend downcore, indicating the strong taphonomic effects on *H. wilberti* fossil populations.

Miliammina fusca

As has been observed elsewhere, *Miliammina fusca* is primarily epifaunal to very slightly infaunal (Frankel, 1975; Goldstein and others, 1995a, b). Populations of *M. fusca* in cores N95-1 and N95-2 are very low (with associated high standard errors) and thus they do not give an accurate representation of this species' distribution (Appendix 1). Most live specimens of *M. fusca* are found between 0 and 10 cm (95%), but they are most abundant in the top 3 cm (50%). In contrast to live populations, total population remains high in the subsurface. This indicates better resistance to taphonomic effects and slightly better preservation potential than for *J. macrescens, T. inflata* and *H. wilberti.* However, the total population declines dramatically at the base of the cores indicating that taphonomic biasing can impact this species. In some cores (e.g., cores N95-1, 1-1, 1-2, 1-3) this may be the result of higher marsh overlain by a lower marsh facies; however, this trend was also recognized in cores 2-1, 2-2, 1-4 and 1-5, where there was no change in the marsh.

General Distributional Trends

Analysis of total percent live vs. total assemblage reveals overall marsh foraminiferal taphonomic effects. In the high marsh, 95% of all living specimens occur slightly deeper infaunally (0–24 cm) as compared to the low marsh (0–12 cm; Fig. 7). This result holds true for individual species as well and may reflect less favorable surface conditions in the higher marsh. When expressed as a proportion of the total foraminiferal population, the average depth of living specimens across the entire marsh is 2–7 cm as a result of these infaunal living habitats. These results are in accord with those of Goldstein and others (1995a, b), who observed a similar bulge in samples from a Georgia salt marsh. In general, individual infaunal marsh foraminiferal species (*T. inflata, J. macrescens, T. salsa, H. wilberti*) have a slightly deeper infaunal habitat in a high marsh than in a low marsh. *M. fusca* remains epifaunal regardless of the environment.

These results also indicate that preservation potential decreases from high to low marsh settings. Overall, higher marsh cores (N956-2, N95-1, 2-1, 1-1) show very little change in total population downcore, whereas low marsh cores (1-2–1-5; 2-2) show a rapid decrease in species abundance downcore. This pattern is again the result of species in the higher marsh tending to live deeper infaunally than in the low marsh.

PART 2: COMPARISON OF SAMPLING INTERVALS

In studies of deep sea foraminifera, there has been some uncertainty regarding the thickness of the below-surface interval that provides the best analogue for fossil faunas. For example, Denne and Sen Gupta (1989) observed that the differences in population densities in cores from the same

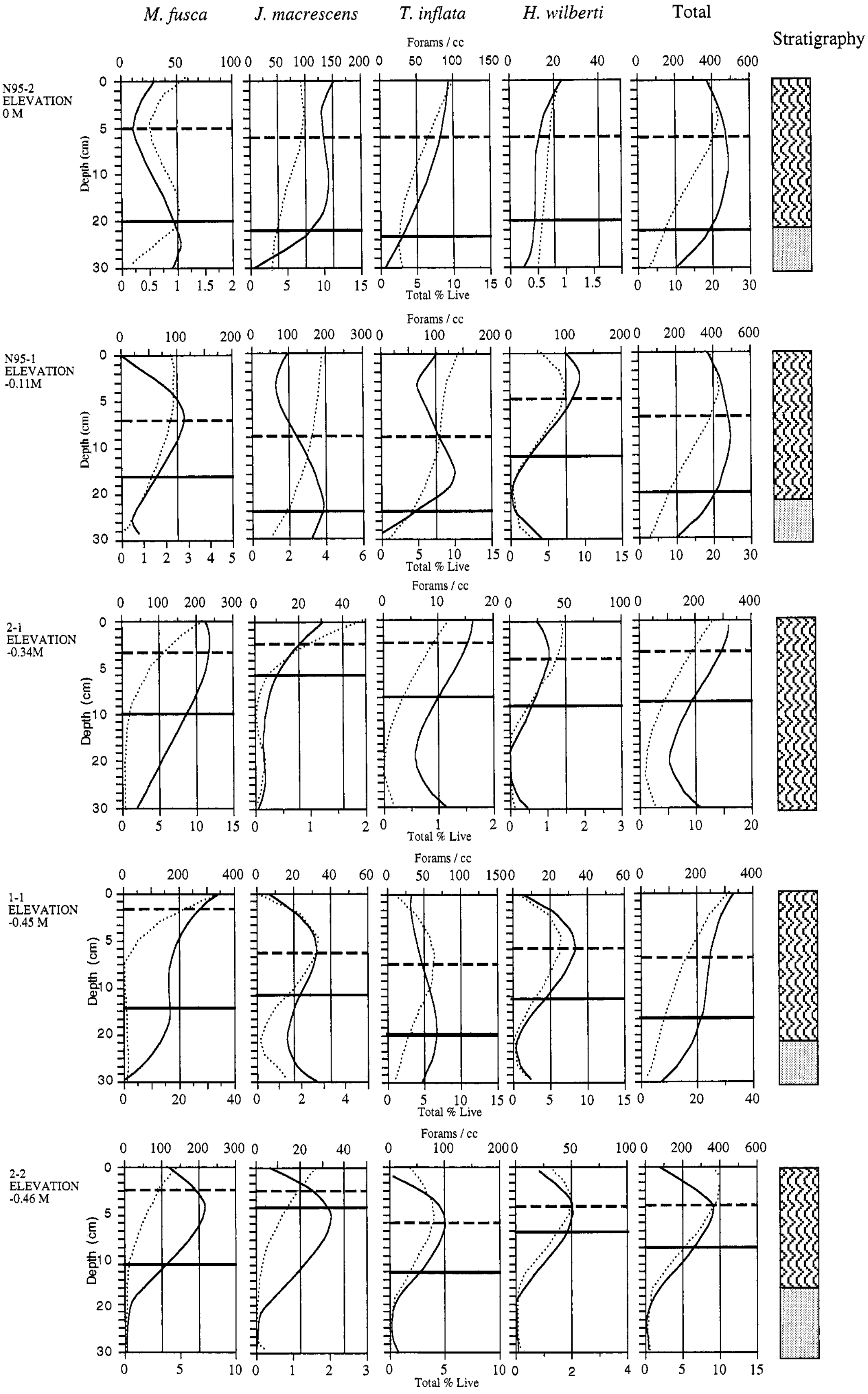

FIGURE 7. Weighted distributional graphs generated for each core showing species abundances in forams/cc and total percent live for individual species, as well as lines indicating interval above which 50% and 95% of fauna is live. Absolute foraminiferal distributional data is presented in Appendix 1. A stratigraphic summary is presented beside each core.

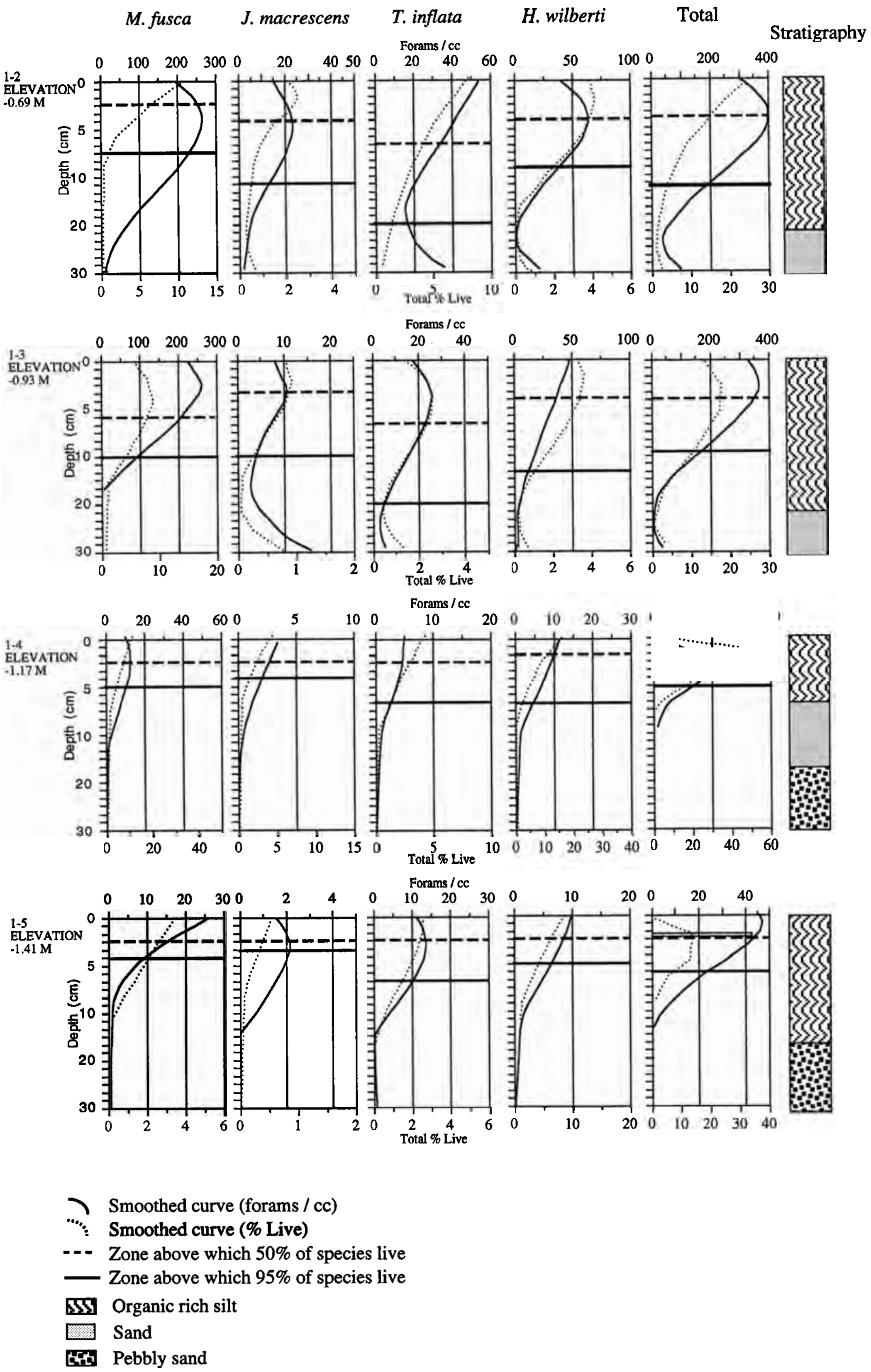

FIGURE 7. Continued.

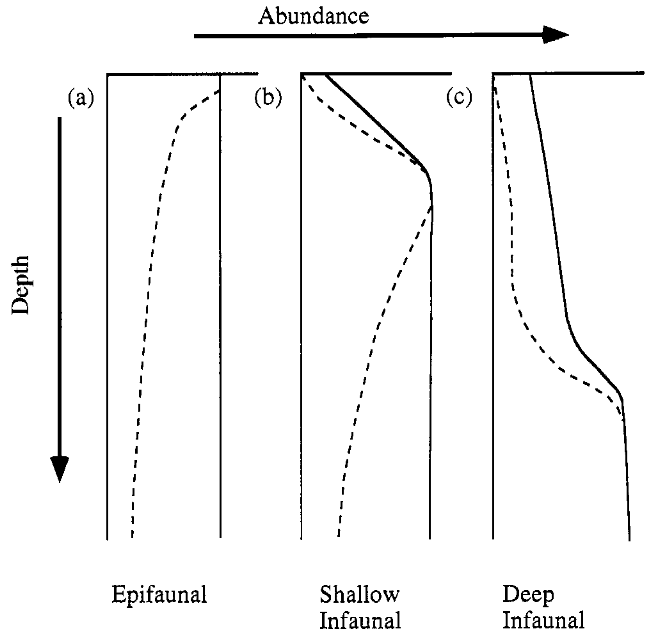

FIGURE 8. Theoretical downcore foraminiferal test preservation. Solid line represents theoretical downcore foraminiferal test preservation profile with no taphonomic biasing; dashed line represents theoretical downcore foraminiferal test preservation profile with taphonomic biasing profiles (after Loubere, 1989).

area could be attributed to surface sampling intervals, rather than variation in fossil faunas. They observed that some researchers sampled 0–1, 0–2 or 0–5 cm below the sediment-water interface, with each interval providing different results (Denne and Sen Gupta, 1989). They concluded that although the 0–1 cm interval may yield more accurate information about distribution of epifaunal specimens currently living in the area, information about infaunal species will be low. Thus, biofacies distributions determined for relatively thick (2, 5 or 10 cm deep) sediment layers are more useful analogues of fossil biofacies distribution for paleoecological applications (Denne and Sen Gupta, 1989).

From the infaunal distributional results reported in the previous section, it is obvious that a fossil foraminiferal biofacies assignment based on only the uppermost 0–1 cm will not provide a highly resolved identification of marsh characteristics. As the majority of species live several cm down in the subsurface, foraminiferal analysis of a thicker near-surface sediment layer provides a better analogue for neotectonic and paleoecological applications.

Five cluster analyses of the foraminiferal data using 0–1, 0–3, 0–5, 0–7, and 0–10 cm surface samples were carried out, and five biofacies were discriminated within each case. These analyses were carried out 1) to demonstrate if the 0–1 cm below-surface sample is sufficient to characterize fossil faunas, and if not, 2) to determine which near-surface interval is most analogous to these subsurface biofacies.

These analyses resulted in highly varied subsurface biofacies assignments (Fig. 10). As intuitively expected, a dendrogram based on a 0–1 cm surface interval resulted in many small and discontinuous marsh zones which could be mistakenly interpreted to indicate apparent cm-scale rapid oscillations in sea level. Little correlation between surface samples and core samples could be delineated, and it was unclear whether observed changes were actually characteristic of the core or artifacts of the analysis, the result of some infaunal marsh species not being considered, or was attributable to taphonomic biasing due to selective dissolution of some taxa.

Cluster analysis based on progressively thicker surface intervals decreased the impact of infaunal habitat and taphonomic biasing and provided more realistic results. More realistic results are defined here as the ability to correlate between cores (e.g., relative sea-level changes impact all isochronously deposited parts of the marsh and not just isolated core sites). This was the essence of our approach and all cluster analysis results were interpreted according to this manner.

The second dendrogram was generated by lumping samples from the 0–3 cm interval in each core together, thus partially taking the infaunal habitat of some foraminiferal species into consideration (Fig. 10). Biofacies resolution is clearer based on this interval, as many of the discontinuous zones have disappeared. Some biofacies could also be clearly traced between cores using this grouping.

The third dendrogram was based on grouping the top 5 cm in each core and included even more infaunal components (Fig. 10). Correlation between cores was further improved resulting in more realistic records of sea-level change. The fourth and fifth dendrograms produced were based on grouping the top 7 and 10 cm of each core, respectively (Figs. 5 and 10). Both of these groupings eliminated much of the noise in the data, and still provided a good indication of biofacies distribution in the marsh. Although results of both clusters are similar, we suggest that the 0–10 cm sampling interval more accurately reflects the infaunal characteristics of many species of marsh foraminifera, as 95% of live foraminifera are found in the upper 10–15 cm of the surface sediments. This interval is also thin enough that epifaunal species (e.g., *M. fusca*) are not under-represented in the analysis (Fig. 10, Table 1).

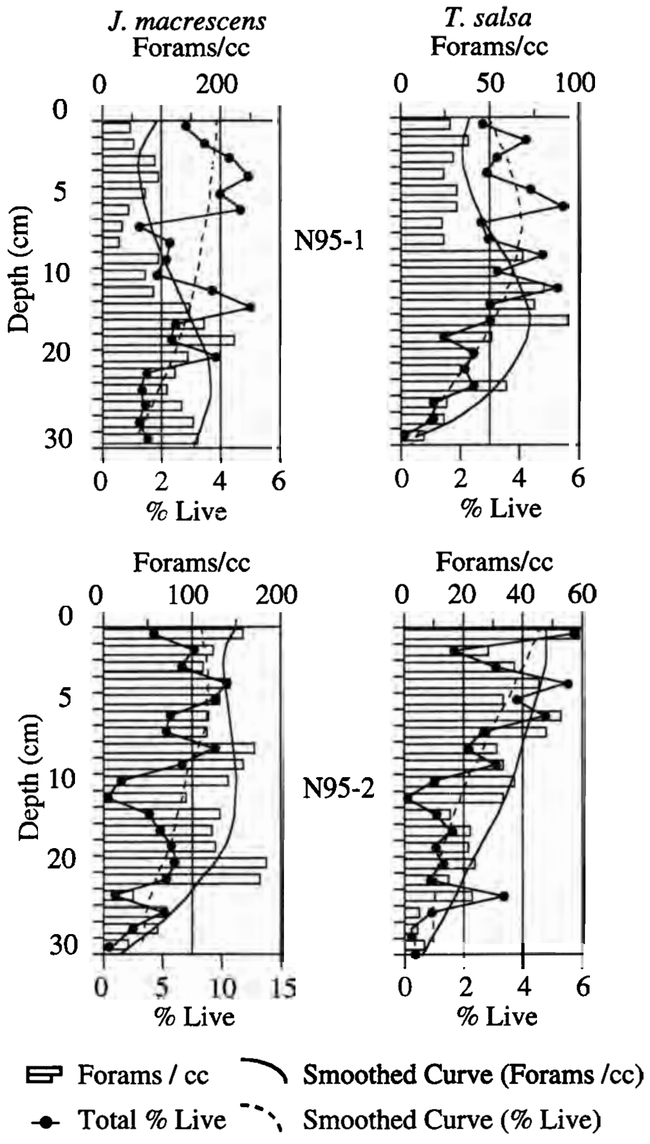

FIGURE 9. Absolute and weighted downcore distributional graphs showing relative abundance of *Jadammina macrescens* and *Trochamminita salsa* in forams/cc and total percent live for cores N95-1 and N95-2 from the high marsh.

SUMMARY AND CONCLUSIONS

Accurate assessment of paleo-sea-level change is critical if we are to increase our understanding of sea-level history across the entire Cascadia region, and particularly if researchers are to discriminate changes caused by earthquakes from those produced by nonseismic processes (e.g., Guilbault and others, 1995; Mathewes and Clague, 1994; Nelson and others, 1996a, b). The downcore distributional patterns of living marsh foraminifera and the preservation patterns displayed by total foraminiferal populations indicate that determination of past sea levels using foraminifera from the top cm of sediment as a modern analog may provide inaccurate results. Results obtained from analysis of both the living and total foraminiferal populations indicate that examination of foraminiferal faunas from a surface interval of 10 cm provides a much less biased modern analog of fossil faunas, greatly reducing the impact of taphonomic phenomena.

In addition, since there is considerable variation in faunal tiering and taphonomic grade across the marsh (higher marsh faunas tending to live deeper infaunally than low marsh faunas and taphonomic effects being more severe in the low marsh than high marsh) a greater number of elevation-associated assemblage zones can be recognized when a thicker surface interval is examined. Thus, although traditional methods may provide an approximation of relative sea-level changes, utilization of our proposed approach is important when it is desirable to document more subtle variations in sea level, and to accurately determine magnitude of coseismic subsidence.

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SYSTEMATICS

As foraminiferal systematics are not a central theme of this paper, we present only a limited systematic treatment here. Our concept of the various species agree closely with illustrations provided in the papers cited in synonymy.

FORAMINIFERA

Ammobaculites exiguus Cushman and Brönniman

Ammobaculites exiguus CUSHMAN and BRÖNNIMAN, 1948b, p. 38, pl. 7, figs. 7–8; PATTERSON, 1990, p. 239, pl. 1, fig. 2; JONASSON and PATTERSON, 1992, p. 297, pl. 1, fig. 1.

Ammotium salsum (Cushman and Brönniman)

Ammobaculites salsus CUSHMAN and BRÖNNIMAN, 1948a, p. 16, pl. 1, fig. 3.

Ammotium salsum (Cushman and Brönniman) PATTERSON, 1990, p. 239, pl. 1, fig. 3; JONASSON and PATTERSON, 1992, p. 297, pl. 1, fig. 2.

Haplophragmoides wilberti Anderson

Haplophragmoides wilberti ANDERSON, 1953, p. 21, pl. 4, fig. 7.

Haplophragmoides manilaensis Anderson PATTERSON, 1990, p. 239, pl. 2, figs. 3, 6; JONASSON and PATTERSON, 1992, p. 297, pl. 1, fig. 9.

Jadammina macrescens (Brady)

Trochammina inflata Montagu var. *macrescens* BRADY in BRADY and ROBERTSON, 1870, p. 290, pl. 11, fig. 5a–c.

Trochammina macrescens Brady SCOTT and MEDIOLI, 1980b, p. 44, pl. 3, figs. 1–8.

Jadammina polystoma BARTENSTEIN and BRAND, 1938, p. 381, figs. 1a–c, 2a–l, 3.

Jadammina macrescens (Brady) MURRAY, 1971, p. 41, pl. 13, figs. 1–5; PATTERSON, 1990, p. 239, pl. 2, figs. 7–9; JONASSON and PATTERSON, 1992, p. 297, pl. 1, fig. 4.

Miliammina fusca (Brady)

Quinqueloculina fusca BRADY in BRADY and ROBERTSON, 1870, p. 286, pl. 11, fig. 2.

Miliammina fusca (Brady) PATTERSON, 1990, p. 240, pl. 1, fig. 4; JONASSON and PATTERSON, 1992, p. 297, pl. 1, figs. 3, 4.

Reophax nana Rhumbler

Reophax nana RHUMBLER, 1911, p. 182, pl. 8, figs. 6–12; JONASSON and PATTERSON, 1992; p. 297, pl. 1, figs. 7, 8.

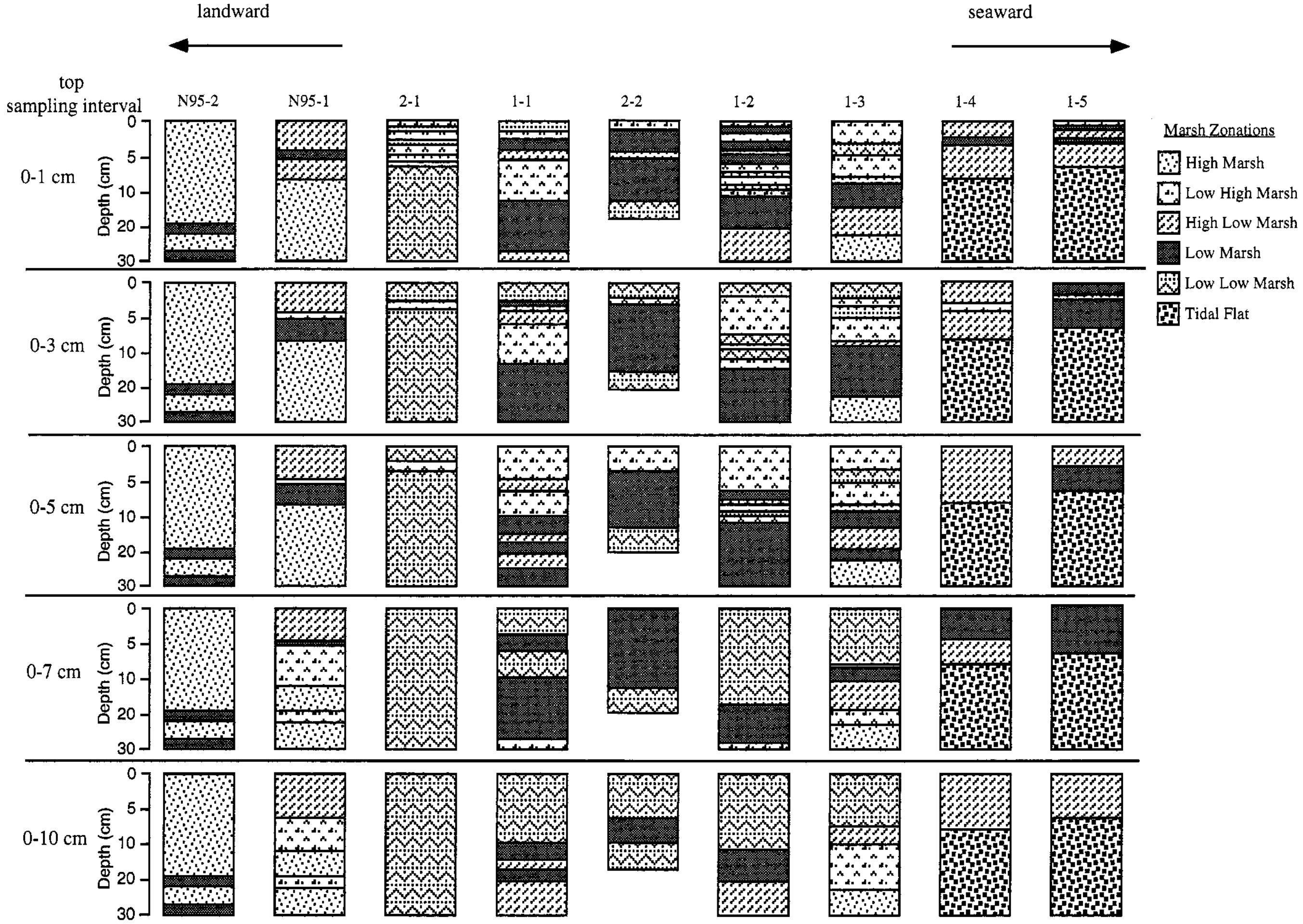

FIGURE 10. Biofacies zonations in each core based on cluster analysis of data from surface sampling intervals of 0–1 cm, 0–3 cm, 0–5 cm, 0–7 cm, and 0–10 cm.

Trochammina inflata

Nautilus inflatus MONTAGU, 1808, p. 81, pl. 18, fig. 3.
Trochammina inflata (Montagu) PATTERSON, 1990, p. 240, pl. 1, figs. 8–10; JONASSON and PATTERSON, 1992, p. 297, pl. 2, figs. 1–3.

Trochamminita salsa (Cushman and Brönniman)

Labrospira salsa CUSHMAN and BRÖNNIMAN, 1948a, p. 16, pl. 3, figs. 5, 6.

Trochamminita irregularis Cushman and Brönniman

Trochamminita irregularis CUSHMAN and BRÖNNIMAN, 1948a, p. 17, pl. 4, figs. 1–3.

ARCELLACEA (THECAMOEBIA)

Arcella vulgaris Ehrenberg

Arcella vulgaris EHRENBERG, 1830, p. 40, pl. 1, fig. 6.

Centropyxis aculeata (Ehrenberg)

Arcella aculeata EHRENBERG, 1832, p. 91.
Centropyxis aculeata (Ehrenberg) MEDIOLI and SCOTT, 1983, p. 39, pl. 7, figs. 10–19; PATTERSON, BARKER and BURBIDGE, 1996, p. 182, pl. 1, fig. 2.

Difflugia oblonga Ehrenberg

Difflugia oblonga EHRENBERG, 1832, p. 90; MEDIOLI and SCOTT, 1983, p. 25, pl. 2, figs. 1–7, 24–26.

Pontigulasia compressa (Carter)

Difflugia compressa CARTER, 1864, p. 22, pl. 1, figs. 5, 6.
Pontigulasia compressa (Carter) MEDIOLI and SCOTT, 1983, p. 35, pl. 6, figs. 5–14.

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APPENDIX 1. Microfaunal occurrences at sampling stations in marsh near Nanaimo British Columbia. Tallies for *Trochamminita salsa* are only included for stations N95-1, and N95-2, as this species was included with *Jadammina macrescens* at the other stations.

Sample Station	1-1	1-1	1-1	1-1	1-1	1-1	1-1	1-1	1-1	1-1	1-1	1-1	1-1	1-1	1-1	1-1	1-1	1-1
Sample Horizon (cm)	0-1	1-1	2-3;	3-4;	4-5;	5-6;	6-7;	7-8	8-9	9-10	10-11.5	11.5-13	13-14.5	14.5-16	17.5-19	19-20.5	20.5-22	22-23.5
Actual Count	523	626	515	493	558	459	509	514	574	470	551	548	512	495	557	487	552	467
Fraction Total Sample Examined	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167
Total Foraminifera /cc	314	376	289	298	328	276	260	312	340	282	335	325	309	305	321	167	334	272
Total Live (%)	37.9	33.7	7.7	8.0	24.3	20.4	18.4	24.8	19.4	17.0	13.1	11.3	7.4	4.3	13.5	5.4	6.8	4.0
Biofacies Assignment	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	3	4	4
Trochammina inflata (%)	10.29	3.98	4.97	5.84	18.46	14.57	24.19	17.69	15.32	14.89	14.13	14.94	7.18	10.04	37.94	32.92	25.49	36.56
Uncertainty +/-	3.36	1.98	2.50	2.66	4.20	4.16	5.20	4.23	3.83	4.15	3.73	3.87	2.88	3.37	5.31	7.13	4.67	5.72
Trochammina inflata (% live)	2.29	1.28	2.07	2.62	9.14	6.96	6.91	6.92	5.63	5.53	5.19	5.35	1.75	0.98	12.34	3.22	3.95	1.76
Uncertainty +/-	1.66	1.13	1.64	1.81	3.12	3.00	3.08	2.82	2.45	2.67	2.37	2.45	1.46	1.11	3.60	2.68	2.09	1.56
Miliammina fusca (%)	76.86	85.81	74.95	75.65	50.64	54.78	32.26	35.19	39.08	38.30	64.76	59.96	65.24	70.47	52.52	40.59	41.47	40.75
Uncertainty +/-	4.67	3.53	4.99	4.87	5.41	5.87	5.68	5.30	5.18	5.67	5.11	5.33	5.31	5.12	5.46	7.45	5.28	5.84
Miliammina fusca (% live)	31.93	28.71	2.90	1.21	5.67	3.04	4.61	3.85	2.46	1.70	4.11	1.48	2.14	1.38	0.93	0.99	0.54	1.32
Uncertainty +/-	5.16	4.57	1.93	1.24	2.50	2.03	2.55	2.13	1.65	1.51	2.13	1.31	1.61	1.31	1.05	1.50	0.78	1.36
Jadammina macrescens (%)	4.97	3.51	3.52	10.06	7.13	6.96	12.67	14.23	14.96	14.26	5.55	4.98	4.85	3.54	8.22	3.71	13.11	9.25
Uncertainty +/-	2.40	1.86	2.12	3.41	2.78	3.00	4.04	3.88	3.79	4.08	2.45	2.36	2.40	2.07	3.00	2.87	3.62	3.44
Jadammina macrescens (% live)	1.15	0.96	0.21	1.61	2.19	3.04	1.15	3.85	4.40	2.98	2.15	1.48	1.36	0.59	0.19	0.00	0.54	0.44
Uncertainty +/-	1.18	0.98	0.52	1.43	1.58	2.03	1.30	2.13	2.18	1.98	1.55	1.31	1.29	0.86	0.47	0.00	0.78	0.79
Haplophragmoides wilberti (%)	7.84	6.54	16.36	7.85	23.77	23.70	30.88	32.88	29.75	32.55	15.56	20.11	22.72	15.94	1.31	22.28	19.93	13.44
Uncertainty +/-	2.97	2.50	4.26	3.05	4.61	5.02	5.61	5.21	4.86	5.47	3.88	4.36	4.67	4.11	1.24	6.32	4.28	4.05
Haplophragmoides wilberti (% live)	2.49	2.71	2.48	2.62	7.31	7.39	5.76	10.19	6.87	6.81	1.61	2.95	2.14	1.38	0.00	1.24	1.80	0.44
Uncertainty +/-	1.72	1.64	1.79	1.81	2.82	3.09	2.83	3.36	2.69	2.94	1.35	1.84	1.61	1.31	0.00	1.68	1.42	0.79
Reophax nana (%)	0.00	0.16	0.00	0.60	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00
Uncertainty +/-	0.00	0.40	0.00	0.88	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.00	0.00	0.00	0.00	1.07	0.00	0.00
Reophax nana (% live)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ammobaculites foliaeceous (%)	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trochamminita irrregularis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trochamminita salsa (%)																		
Uncertainty +/-																		
Trochamminita salsa (%)																		
Uncertainty +/-																		
Ammotium salsum (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Centropyxis aculeata (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Difflugia oblonga (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arcella vulgaris (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pontigulasia compressa (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sample Station	1-1	1-1	1-1	1-1	1-1	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-2
Sample Horizon (cm)	23.5-25	25-26.5	26.5-28	28-29.5	29.5-31	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11.5	11.5-13	13-14.5
Actual Count	461	466	424	452	526	504	547	564	485	511	551	532	513	602	508	498	503	485
Fraction Total Sample Examined	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.333
Total Foraminifera /cc	277	143	147	131	134	309	339	316	295	311	334	320	316	334	308	306	302	147
Total Live (%)	3.0	4.0	4.3	2.5	0.9	17.7	26.4	26.4	11.4	9.8	11.7	11.6	7.8	7.9	10.3	6.9	2.8	5.3
Biofacies Assignment	3	3	3	3	3	5	5	5	5	5	5	5	5	5	5	5	5	5
Trochammina inflata (%)	30.09	34.38	26.68	27.23	39.16	16.50	17.35	16.54	9.98	10.81	10.95	13.11	10.44	14.72	11.28	8.63	7.16	9.16
Uncertainty +/-	5.40	7.78	7.14	7.62	8.25	4.14	4.03	4.10	3.42	3.45	3.35	3.70	3.37	3.80	3.53	3.15	2.91	4.66
Trochammina inflata (% live)	1.08	2.31	1.63	0.00	0.22	6.80	9.38	8.17	3.67	2.90	5.39	5.06	2.85	6.64	5.45	3.73	2.19	3.05
Uncertainty +/-	1.22	2.46	2.04	0.00	0.79	2.81	3.10	3.02	2.15	1.86	2.42	2.40	1.83	2.67	2.53	2.12	1.65	2.78
Miliammina fusca (%)	38.74	34.59	43.38	25.86	22.35	63.11	55.40	66.73	69.04	66.02	57.63	55.62	70.78	63.73	57.00	71.76	80.52	73.52
Uncertainty +/-	5.73	7.79	8.00	7.50	7.04	5.38	5.29	5.20	5.28	5.27	5.30	5.44	5.01	5.15	5.53	5.04	4.47	7.13
Miliammina fusca (% live)	0.43	1.05	1.22	1.37	0.00	7.38	9.03	14.07	3.87	3.09	1.08	1.50	2.28	0.72	0.39	0.20	0.20	0.20
Uncertainty +/-	0.77	1.67	1.77	1.99	0.00	2.91	3.05	3.84	2.20	1.92	1.11	1.33	1.64	0.91	0.69	0.50	0.50	0.73
Jadammina macrescens (%)	5.41	7.55	5.30	28.83	17.70	6.21	9.91	5.32	3.46	6.56	6.10	6.55	3.23	3.59	8.75	3.73	2.39	3.87
Uncertainty +/-	2.66	4.33	3.62	7.75	6.45	2.69	3.18	2.48	2.09	2.75	2.57	2.71	1.95	1.99	3.15	2.12	1.72	3.11
Jadammina macrescens (% live)	0.22	0.21	0.81	0.69	0.66	0.97	3.01	1.52	1.02	1.93	0.72	1.12	0.19	0.18	1.75	0.59	0.00	0.81
Uncertainty +/-	0.55	0.75	1.45	1.41	1.37	1.09	1.82	1.35	1.15	1.53	0.91	1.15	0.48	0.45	1.46	0.86	0.00	1.45
Haplophragmoides wilberti (%)	25.76	23.48	24.64	18.08	20.80	13.98	17.17	10.84	17.52	16.41	23.88	24.34	15.37	17.41	22.96	14.71	9.94	13.44
Uncertainty +/-	5.15	6.95	6.96	6.59	6.86	3.87	4.01	3.43	4.34	4.12	4.57	4.70	3.98	4.07	4.69	3.97	3.38	5.51
Haplophragmoides wilberti (% live)	1.30	0.42	0.61	0.46	0.00	2.52	4.96	2.66	2.85	1.93	4.49	3.93	2.47	0.36	2.72	2.35	0.40	1.22
Uncertainty +/-	1.33	1.06	1.26	1.16	0.00	1.75	2.31	1.78	1.90	1.53	2.22	2.13	1.71	0.64	1.82	1.70	0.71	1.77
Reophax nana (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.90	0.00	0.19	0.00	0.00	0.20	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.00	0.00	1.01	0.00	0.48	0.00	0.00	0.50	0.00	0.00
Reophax nana (% live)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ammobaculites foliaeceous (%)	0.00	0.00	0.00	0.00	0.00	0.19	0.18	0.38	0.00	0.19	0.54	0.37	0.00	0.54	0.00	0.98	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.49	0.45	0.68	0.00	0.49	0.78	0.67	0.00	0.78	0.00	1.10	0.00	0.00
Trochamminita irrregularis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trochamminita salsa (%)																		
Uncertainty +/-																		
Trochamminita salsa (%)																		
Uncertainty +/-																		
Ammotium salsum (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Centropyxis aculeata (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Difflugia oblonga (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arcella vulgaris (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pontigulasia compressa (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sample Station	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3
Sample Horizon (cm)	14.5-16	16-17.5	20.5-22	22-23.5	23.5-25	28-29.5	29.5-31	0-1	1-2	2-3;	3-4;	4-5	5-6	6-7	7-8	8-9	9-10	10-11.5
Actual Count	532	500	538	567	586	548	604	467	521	563	509	444	502	528	463	475	540	531
Fraction Total Sample Examined	0.167	0.333	0.500	0.333	0.333	0.500	0.500	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.333	0.333
Total Foraminifera /cc	159	98	81	81	89	66	66	289	313	333	349	269	296	325	324	287	152	160
Total Live (%)	1.3	6.1	1.1	5.6	2.2	0.9	2.5	7.9	10.3	21.3	22.9	8.8	5.1	18.3	13.0	10.6	14.0	17.3
Biofacies Assignment	5	5	4	4	3	3	3	5	5	5	5	5	5	5	5	5	5	5
Trochammina inflata (%)	5.85	21.93	34.26	34.94	48.05	48.92	52.58	7.28	6.51	7.93	5.16	9.73	2.43	9.06	8.70	9.19	10.04	14.66
Uncertainty +/-	3.65	8.21	10.34	10.40	10.40	12.03	12.06	3.00	2.73	2.90	2.32	3.54	1.75	3.12	3.07	3.34	4.77	5.49
Trochammina inflata (% live)	0.75	4.30	0.93	3.72	1.69	0.36	1.07	0.62	2.68	3.06	2.41	2.65	1.01	3.33	2.78	2.09	1.97	3.01
Uncertainty +/-	1.35	4.03	2.09	4.13	2.68	1.44	2.48	0.91	1.79	1.85	1.61	1.92	1.14	1.95	1.79	1.65	2.21	2.65
Miliammina fusca (%)	86.04	66.80	56.30	43.49	35.19	31.47	18.12	76.09	74.33	80.36	70.91	69.25	91.08	79.11	80.74	78.71	72.83	71.80
Uncertainty +/-	5.39	9.34	10.80	10.82	9.94	11.17	9.30	4.92	4.84	4.27	4.77	5.52	3.25	4.42	4.29	4.73	7.06	6.98
Miliammina fusca (% live)	0.38	1.23	0.19	0.00	0.00	0.00	0.00	4.57	3.64	14.05	14.80	2.43	3.25	9.61	6.11	5.43	9.06	11.65
Uncertainty +/-	0.95	2.19	0.94	0.00	0.00	0.00	0.00	2.41	2.07	3.73	3.73	1.84	2.02	3.21	2.61	2.62	4.56	4.98
Jadammina macrescens (%)	2.08	2.66	3.89	9.29	9.98	5.58	14.03	3.53	2.87	0.72	4.13	4.87	1.42	3.33	1.67	3.76	3.15	0.75
Uncertainty +/-	2.22	3.19	4.21	6.33	6.24	5.52	8.39	2.13	1.85	0.91	2.09	2.57	1.35	1.95	1.40	2.20	2.77	1.34
Jadammina macrescens (% live)	0.00	0.61	0.00	1.49	0.51	0.00	1.07	1.46	0.77	0.36	0.69	0.44	0.41	1.11	0.56	1.25	0.79	0.00
Uncertainty +/-	0.00	1.55	0.00	2.64	1.48	0.00	2.48	1.38	0.97	0.64	0.87	0.79	0.72	1.14	0.81	1.29	1.40	0.00
Haplophragmoides wilberti (%)	6.04	8.61	5.56	12.27	6.77	14.03	15.28	12.27	16.09	10.99	18.93	15.27	5.07	7.58	7.59	7.72	13.98	12.03
Uncertainty +/-	3.70	5.57	4.99	7.16	5.23	8.36	8.69	3.79	4.07	3.36	4.11	4.30	2.50	2.88	2.88	3.09	5.51	5.05
Haplophragmoides wilberti (% live)	0.19	0.00	0.00	0.37	0.00	0.54	0.36	1.25	3.26	3.78	4.99	3.32	0.41	3.33	2.22	1.25	2.17	1.88
Uncertainty +/-	0.67	0.00	0.00	1.33	0.00	1.76	1.44	1.28	1.97	2.05	2.29	2.14	0.72	1.95	1.61	1.29	2.31	2.11
Reophax nana (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.17	0.00	0.00	0.92	1.30	0.63	0.00	0.75
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.05	0.00	0.00	0.43	0.00	0.00	1.04	1.23	0.91	0.00	1.34
Reophax nana (% live)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.92	1.30	0.63	0.00	0.75
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.04	1.23	0.91	0.00	1.34
Ammobaculites foliaeceous (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.69	0.88	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.00	0.87	1.12	0.00	0.00	0.00	0.00	0.00	0.00
Trochamminita irrregularis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trochamminita salsa (%)																		
Uncertainty +/-																		
Trochamminita salsa (%)																		
Uncertainty +/-																		
Ammotium salsum (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Centropyxis aculeata (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Difflugia oblonga (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arcella vulgaris (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pontigulasia compressa (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sample Station	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-4	1-4	1-4	1-4	1-4	1-4	1-4	1-4	1-4	1-4
Sample Horizon (cm)	11.5-13	13-14.5	14.5-16	17.5-19	20.5-22	23.5-25	26.5-28	29.5-31	0-1	1-2	2-3;	3-4	4-5	5-6	6-7	7-8	8-9	9-10
Actual Count	512	343	314	301	305	174	302	304	348	328	315	338	311	369	214	106	52	145
Fraction Total Sample Examined	0.333	0.500	0.500	4.000	0.833	1.000	0.333	1.000	0.500	0.333	0.333	0.333	0.167	0.333	1.000	1.000	1.000	1.000
Total Foraminifera /cc	161	67	62	44	37	168	271	302	65	84	89	86	164	79	30	35	24	26
Total Live (%)	6.7	0.9	2.9	6.0	5.2	5.2	0.0	3.0	4.6	45.4	55.3	12.8	7.1	7.9	8.8	4.7	5.7	0.0
Biofacies Assignment	3	3	3	2	2	2	1	1	3	3	3	3	3	3	3	3	3	3
Trochammina inflata (%)	15.99	22.74	24.20	24.25	26.23	32.76	11.40	27.30	17.26	19.80	15.60	13.10	13.50	19.00	25.20	27.30	48.00	30.30
Uncertainty +/-	5.65	10.02	10.70	12.71	14.23	7.10	3.78	5.02	9.20	8.51	7.54	7.15	5.23	8.66	15.48	14.72	19.82	17.66
Trochammina inflata (% live)	1.86	0.00	1.27	0.66	0.33	3.45	0.00	1.32	0.86	7.00	3.80	3.00	1.30	1.90	2.30	0.90	1.80	0.00
Uncertainty +/-	2.08	0.00	2.80	2.41	1.85	2.76	0.00	1.29	2.25	5.45	3.97	3.61	1.73	3.01	5.35	3.12	5.28	0.00
Miliammina fusca (%)	70.26	21.57	40.13	3.99	5.25	12.64	1.10	1.32	30.16	25.30	43.20	37.50	52.80	44.50	27.10	10.40	8.60	16.60
Uncertainty +/-	7.05	9.83	12.24	5.81	7.21	5.02	1.24	1.29	11.17	9.29	10.30	10.26	7.63	10.97	15.85	10.08	11.12	14.30
Miliammina fusca (% live)	3.35	0.00	0.64	0.00	0.00	0.57	0.00	0.00	0.86	2.40	36.20	5.30	2.30	2.20	2.30	0.00	0.00	0.00
Uncertainty +/-	2.77	0.00	1.99	0.00	0.00	1.14	0.00	0.00	2.25	3.27	9.99	4.75	2.29	3.24	5.35	0.00	0.00	0.00
Jadammina macrescens (%)	1.67	9.33	3.82	5.65	9.18	20.69	74.63	66.12	15.28	9.10	13.30	6.80	7.10	6.30	5.10	10.40	1.90	4.10
Uncertainty +/-	1.98	6.95	4.79	6.85	9.34	6.13	5.18	5.34	8.76	6.14	7.06	5.33	3.93	5.36	7.85	10.08	5.42	7.62
Jadammina macrescens (% live)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.32	0.58	1.20	12.40	1.50	0.00	0.30	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.29	1.85	2.33	6.85	2.58	0.00	1.21	0.00	0.00	0.00	0.00
Haplophragmoides wilberti (%)	11.52	30.03	16.56	15.95	9.18	12.64	11.40	4.61	35.10	45.20	24.50	41.20	24.70	29.60	41.10	51.90	40.40	49.00
Uncertainty +/-	4.93	10.96	9.28	10.86	9.34	5.02	3.78	2.37	11.62	10.63	8.94	10.43	6.59	10.08	17.55	16.51	19.47	19.22
Haplophragmoides wilberti (% live)	1.12	0.58	0.96	1.33	0.33	1.15	0.00	0.33	2.30	34.80	2.90	3.00	3.50	3.00	4.20	3.80	3.90	0.00
Uncertainty +/-	1.62	1.82	2.43	3.40	1.85	1.61	0.00	0.65	3.65	10.17	3.49	3.61	2.81	3.77	7.15	6.32	7.68	0.00
Reophax nana (%)	0.37	13.12	11.78	44.85	46.23	17.24	1.10	0.00	0.00	0.30	3.20	1.20	1.60	0.80	0.90	0.00	0.00	0.00
Uncertainty +/-	0.94	8.07	8.05	14.75	16.13	5.71	1.24	0.00	0.00	1.17	3.66	2.31	1.92	1.97	3.37	0.00	0.00	0.00
Reophax nana (% live)	0.37	0.29	0.00	3.99	4.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00
Uncertainty +/-	0.94	1.29	0.00	5.80	6.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.56	0.00	0.00	0.00	0.00
Ammobaculites foliaeceous (%)	0.00	1.17	1.59	1.99	2.62	0.57	0.00	0.00	2.00	0.00	0.30	0.30	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	2.57	3.13	4.15	5.17	1.14	0.00	0.00	3.41	0.00	1.14	1.16	0.00	0.00	0.00	0.00	0.00	0.00
Trochamminita irrregularis	0.00	0.29	0.32	1.66	0.33	1.15	0.37	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	1.29	1.41	3.79	1.85	1.61	0.72	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trochamminita salsa (%)																		
Uncertainty +/-																		
Trochamminita salsa (%)																		
Uncertainty +/-																		
Ammotium salsum (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Centropyxis aculeata (%)	0.00	0.29	0.00	0.00	0.33	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	1.29	0.00	0.00	1.85	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Difflugia oblonga (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.00	0.00	0.00
Arcella vulgaris (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pontigulasia compressa (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ample Station	1-4	1-4	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	2-1	2-1	2-1	2-1	2-1	2-1	2-1
Sample Horizon (cm)	10-11.5	11.5-13	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	0-1	1-2	2-3	3-4	4-5	5-6	6-7
Actual Count	46	51	31	191	309	250	315	105	108	119	109	526	450	485	499	468	612	460
Fraction Total Sample Examined	1.000	1.000	1.000	1.000	0.666	0.833	0.666	1.000	1.000	1.000	1.000	0.167	0.167	0.167	0.167	0.167	0.167	0.167
Total Foraminifera /cc	31	21	36	38	63	41	43	38	26	21	10	316	270	291	299	281	367	276
Total Live (%)	0.0	0.0	0.0	5.2	11.3	7.6	5.0	2.9	0.9	1.8	1.6	14.3	7.8	13.8	13.4	6.0	4.1	5.2
Biofacies Assignment	3	3	3	3	3	3	3	3	3	3	3	5	5	5	5	5	5	5
Trochammina inflata (%)	39.10	35.30	16.10	31.40	21.70	23.60	40.30	58.10	43.50	49.70	58.10	3.80	7.11	4.95	6.21	2.56	4.25	4.57
Uncertainty +/-	17.18	20.44	12.01	14.72	10.18	12.97	14.66	15.65	19.06	21.33	30.28	2.11	3.07	2.49	2.73	1.85	2.06	2.46
Trochammina inflata (% live)	0.00	0.00	0.00	3.10	5.20	2.00	2.50	1.90	0.90	1.80	1.60	0.63	0.89	1.03	1.20	0.21	0.33	1.30
Uncertainty +/-	0.00	0.00	0.00	5.50	5.48	4.27	4.67	4.33	3.63	5.67	7.70	0.87	1.12	1.16	1.23	0.54	0.58	1.34
Miliammina fusca (%)	4.40	17.70	74.20	37.70	28.50	33.60	28.50	14.30	33.30	18.50	12.90	74.90	78.44	76.91	75.75	86.11	70.75	79.13
Uncertainty +/-	7.22	16.32	14.29	15.37	11.15	14.42	13.49	11.10	18.12	16.57	20.57	4.78	4.91	4.84	4.85	4.05	4.65	4.79
Miliammina fusca (% live)	0.00	0.00	0.00	2.10	4.50	4.80	2.50	1.00	0.00	0.00	0.00	10.65	5.33	9.07	9.42	4.49	2.29	3.26
Uncertainty +/-	0.00	0.00	0.00	4.55	5.12	6.53	4.67	3.16	0.00	0.00	0.00	3.40	2.68	3.30	3.31	2.42	1.53	2.10
Jadammina macrescens (%)	10.90	9.80	0.00	4.20	6.80	5.20	2.20	3.80	12.00	5.00	12.90	13.31	6.67	3.92	4.41	2.56	5.88	3.70
Uncertainty +/-	10.97	12.72	0.00	6.36	6.22	6.78	4.38	6.06	12.49	9.30	20.57	3.75	2.98	2.23	2.33	1.85	2.41	2.23
Jadammina macrescens (% live)	0.00	0.00	0.00	0.00	1.60	0.80	0.00	0.00	0.00	0.00	0.00	1.90	1.11	1.24	0.60	0.00	0.33	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	3.10	2.72	0.00	0.00	0.00	0.00	0.00	1.51	1.25	1.27	0.88	0.00	0.58	0.00
Haplophragmoides wilberti (%)	43.50	37.30	9.70	24.60	41.10	36.80	28.30	23.90	11.10	27.70	16.10	5.89	7.11	14.02	12.22	8.12	17.81	12.39
Uncertainty +/-	17.45	20.68	9.67	13.66	12.15	14.73	13.46	13.52	12.07	19.10	22.56	2.60	3.07	3.99	3.71	3.19	3.91	3.89
Haplophragmoides wilberti (% live)	0.00	0.00	0.00	3.70	18.80	13.20	2.90	2.90	0.00	0.00	0.00	1.14	0.44	2.47	2.20	1.28	1.14	0.65
Uncertainty +/-	0.00	0.00	0.00	5.99	9.65	10.34	5.02	5.32	0.00	0.00	0.00	1.17	0.79	1.78	1.66	1.32	1.09	0.95
Reophax nana (%)	2.20	0.00	0.00	1.10	0.60	0.40	0.00	0.00	0.00	0.00	0.00	1.90	0.67	1.86	0.80	0.21	0.65	0.00
Uncertainty +/-	5.16	0.00	0.00	3.31	1.91	1.93	0.00	0.00	0.00	0.00	0.00	1.51	0.97	1.55	1.01	0.54	0.82	0.00
Reophax nana (% live)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ammobaculites foliaeceous (%)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.21**	**0.60**	**0.43**	**0.65**	**0.22**
Uncertainty +/-	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.52**	**0.88**	**0.76**	**0.82**	**0.55**
Trochamminita irrregularis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trochamminita salsa (%)																		
Uncertainty +/-																		
Trochamminita salsa (%)																		
Uncertainty +/-																		
Ammotium salsum (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Centropyxis aculeata (%)	0.00	0.00	0.00	0.50	0.30	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	2.24	1.35	1.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Difflugia oblonga (%)	0.00	0.00	0.00	0.50	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	2.24	1.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arcella vulgaris (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pontigulasia compressa (%)	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	1.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sample Station	2-1	2-1	2-1	2-1	2-1	2-1	2-1	2-1	2-1	2-1	2-1	2-1	2-2	2-2	2-2	2-2	2-2	2-2
Sample Horizon (cm)	7-8	8-9	9-10	10-11.5	11.5-13	13-14.5	14.5-16	17.5-19	20.5-22	23.5-25	26.5-28	29.5-31	0-1	1-2	2-3	3-4	4-5	5-6
Actual Count	404	501	401	527	440	340	498	487	370	361	420	407	434	430	394	610	596	466
Fraction Total Sample Examined	0.167	0.167	0.167	0.333	0.333	0.167	0.333	0.167	0.500	0.500	0.500	4.000	0.333	0.167	0.167	0.333	0.167	0.167
Total Foraminifera /cc	242	301	241	158	132	204	149	292	74	72	84	61	130	258	236	183	358	280
Total Live (%)	1.2	3.4	6.0	2.5	0.5	0.6	1.2	0.0	0.0	0.6	0.5	0.2	6.0	10.9	7.6	11.5	12.8	6.4
Biofacies Assignment	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Trochammina inflata (%)	5.9	4.2	6.0	2.5	2.3	5.3	1.6	2.7	12.4	11.6	10.5	11.8	6.0	9.1	10.9	13.9	22.8	24.5
Uncertainty +/-	2.98	2.27	3.00	2.42	2.54	3.07	2.02	1.85	7.52	7.39	6.55	8.09	4.08	3.50	3.97	5.02	4.35	5.04
Trochammina inflata (% live)	0.0	0.4	0.7	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	1.8	3.0	2.5	3.6	5.7	2.1
Uncertainty +/-	0.00	0.71	1.09	1.17	0.00	0.00	0.00	0.00	0.00	0.00	1.04	0.00	2.31	2.09	2.00	2.70	2.40	1.70
Miliammina fusca (%)	81.9	87.8	77.1	91.1	90.9	86.2	84.3	94.3	81.9	73.4	77.1	75.9	73.0	68.8	68.5	55.3	47.0	50.2
Uncertainty +/-	4.84	3.70	5.31	4.44	4.90	4.74	5.83	2.67	8.77	10.19	8.98	10.73	7.62	5.65	5.92	7.20	5.17	5.86
Miliammina fusca (% live)	0.5	1.8	3.5	1.5	0.5	0.6	1.2	0.0	0.0	0.3	0.0	0.0	2.3	5.6	2.5	3.6	2.0	1.3
Uncertainty +/-	0.88	1.50	2.32	1.91	1.15	1.05	1.75	0.00	0.00	1.21	0.00	0.00	2.58	2.80	2.00	2.70	1.46	1.32
Jadammina macrescens (%)	6.9	3.2	2.7	2.7	2.7	0.9	0.4	1.0	3.2	4.2	2.9	4.4	8.8	8.4	8.9	5.3	13.4	10.1
Uncertainty +/-	3.20	1.99	2.06	2.51	2.78	1.28	1.01	1.16	4.03	4.61	3.56	5.16	4.86	3.38	3.63	3.23	3.53	3.53
Jadammina macrescens (% live)	0.5	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.5	1.5	1.3	2.0	0.9
Uncertainty +/-	0.88	0.50	0.00	0.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.01	0.83	1.56	1.65	1.46	1.08
Haplophragmoides wilberti (%)	5.0	3.8	12.7	3.4	3.6	7.4	1.6	0.8	2.2	5.0	5.2	4.4	11.5	12.3	10.7	25.6	16.4	14.2
Uncertainty +/-	2.73	2.16	4.21	2.83	3.19	3.58	2.02	1.03	3.31	5.02	4.77	5.16	5.48	4.01	3.93	6.32	3.84	4.09
Haplophragmoides wilberti (% live)	0.2	1.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.9	1.0	3.0	3.0	2.1
Uncertainty +/-	0.63	1.12	1.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.16	1.65	1.28	2.45	1.77	1.70
Reophax nana (%)	0.3	0.8	1.3	0.2	0.2	0.0	0.2	1.2	0.3	5.8	4.5	3.2	0.0	0.9	0.8	0.2	1.0	0.9
Uncertainty +/-	0.63	1.01	1.40	0.68	0.82	0.00	0.72	1.26	1.18	5.40	4.44	4.41	0.00	1.17	1.11	0.58	1.04	1.08
Reophax nana (% live)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.21	1.04	1.24	0.00	0.00	0.00	0.00	0.00	0.00
Ammobaculites foliaeceous (%)	0.0	0.2	0.2	0.2	0.2	0.3	0.0	0.0	0.0	0.3	0.2	0.2	0.5	0.5	0.3	0.0	0.3	0.2
Uncertainty +/-	0.00	0.50	0.63	0.68	0.81	0.74	0.00	0.00	0.00	1.21	1.04	1.24	1.16	0.83	0.64	0.00	0.60	0.54
Trochamminita irrregularis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trochamminita salsa (%)																		
Uncertainty +/-																		
Trochamminita salsa (%)																		
Uncertainty +/-																		
Ammotium salsum (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Centropyxis aculeata (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Difflugia oblonga (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arcella vulgaris (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pontigulasia compressa (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sample Station	2-2	2-2	2-2	2-2	2-2	2-2	2-2	2-2	2-2	N95-1	N95-1	N95-1	N95-1	N95-1	N95-1	N95-1	N95-1	N95-1
Sample Horizon (cm)	6-7	7-8	8-9	9-10	10-11.5	11.5-13	13-14.5	14.5-16	17.5-19	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9
Actual Count	843	641	404	537	687	362	346	549	362	456	433	586	607	582	507	573	485	635
Fraction Total Sample Examined	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.333	6.000	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167
Total Foraminifera /cc	506	385	242	322	412	217	208	165	36	274	260	352	364	349	304	344	291	381
Total Live (%)	3.7	5.6	7.9	7.6	2.6	3.6	1.4	0.5	1.7	18.3	19.4	20.5	20.1	22.2	29.6	18.0	16.1	15.1
Biofacies Assignment	5	5	5	5	4	4	4	5	5	3	3	3	3	3	3	3	3	3
Trochammina inflata (%)	27.88	25.90	46.04	37.24	18.34	29.56	27.75	27.87	9.67	20.77	15.27	8.88	7.26	9.63	10.81	7.33	8.92	18.61
Uncertainty +/-	3.91	4.38	6.27	5.28	3.74	6.07	6.09	6.85	9.63	4.81	4.37	2.97	2.66	3.09	3.49	2.76	3.27	3.91
Trochammina inflata (% live)	1.78	0.94	6.68	6.52	2.18	2.76	1.45	0.55	1.10	6.07	4.76	3.76	3.39	4.90	5.98	3.23	3.46	5.30
Uncertainty +/-	1.15	0.96	3.14	2.70	1.41	2.18	1.62	1.13	3.41	2.83	2.59	1.99	1.86	2.26	2.66	1.87	2.10	2.25
Miliammina fusca (%)	47.92	51.48	37.13	46.55	36.24	41.71	50.58	46.63	80.39	15.35	17.09	16.38	15.82	14.78	26.23	42.06	55.67	29.92
Uncertainty +/-	4.35	4.99	6.08	5.45	4.64	6.56	6.80	7.62	12.93	4.27	4.58	3.87	3.75	3.72	4.94	5.22	5.71	4.60
Miliammina fusca (% live)	0.00	1.56	0.50	1.12	0.44	0.83	0.00	0.00	0.55	3.07	2.31	1.88	0.99	0.34	2.96	2.97	3.92	1.57
Uncertainty +/-	0.00	1.24	0.88	1.15	0.64	1.21	0.00	0.00	2.41	2.04	1.83	1.42	1.02	0.61	1.90	1.79	2.23	1.25
Jadammina macrescens (%)	7.83	5.62	6.19	8.75	9.61	15.47	13.87	17.12	2.76	17.32	20.79	25.43	26.03	20.62	14.40	9.60	9.69	25.20
Uncertainty +/-	2.34	2.30	3.03	3.09	2.85	4.81	4.70	5.75	5.34	4.48	4.93	4.55	4.51	4.24	3.95	3.11	3.40	4.36
Jadammina macrescens (% live)	0.24	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	2.85	3.46	4.44	4.94	3.95	4.73	1.22	2.27	2.20
Uncertainty +/-	0.42	0.00	0.63	0.00	0.00	0.00	0.00	0.00	0.00	1.97	2.22	2.15	2.23	2.04	2.39	1.16	1.71	1.47
Haplophragmoides wilberti (%)	16.01	16.54	10.64	7.45	6.55	13.26	7.23	7.29	5.80	26.32	33.26	40.96	44.15	45.53	38.26	33.68	16.91	7.56
Uncertainty +/-	3.20	3.71	3.88	2.87	2.39	4.51	3.52	3.97	7.61	5.22	5.73	5.14	5.10	5.22	5.46	5.00	4.31	2.65
Haplophragmoides wilberti (% live)	1.66	3.12	0.50	0.00	0.00	0.00	0.00	0.00	0.00	3.51	4.62	7.17	7.91	8.59	10.45	7.85	3.51	1.26
Uncertainty +/-	1.11	1.74	0.88	0.00	0.00	0.00	0.00	0.00	0.00	2.18	2.55	2.70	2.77	2.94	3.44	2.84	2.11	1.12
Reophax nana (%)	0.24	0.47	0.00	0.00	0.15	0.00	0.58	1.09	0.83	0.00	0.23	0.00	0.00	0.17	0.00	0.35	0.41	0.31
Uncertainty +/-	0.43	0.68	0.00	0.00	0.37	0.00	1.03	1.59	2.96	0.00	0.58	0.00	0.00	0.43	0.00	0.62	0.73	0.56
Reophax nana (% live)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ammobaculites foliaeceous (%)	0.12	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.16	0.17	0.00	0.17	0.00	0.31
Uncertainty +/-	0.30	0.00	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.00	0.42	0.43	0.00	0.44	0.00	0.56
Trochamminita irrregularis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trochamminita salsa (%)										10.12	14.75	8.36	6.74	9.11	10.29	6.81	8.40	18.09
Uncertainty +/-										3.57	4.31	2.89	2.57	3.02	3.41	2.66	3.19	3.86
Trochamminita salsa (%)										2.78	4.24	3.24	2.87	4.38	5.46	2.71	2.94	4.78
Uncertainty +/-										1.95	2.45	1.85	1.71	2.15	2.55	1.72	1.94	2.14
Ammotium salsum (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Centropyxis aculeata (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Difflugia oblonga (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arcella vulgaris (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pontigulasia compressa (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sample Station	N95-1	N95-1	N95-1	N95-1	N95-1	N95-1	N95-1	N95-1	N95-1	N95-1	N95-1	N95-2	N95-2	N95-2	N95-2	N95-2	N95-2	N95-2
Sample Horizon (cm)	9-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24	24-26	26-28	28-30	0-1	1-2	2-3	3-4	4-5	5-6	6-7
Actual Count	508	605	689	731	703	459	345	463	360	399	400	544	366	398	430	378	434	419
Fraction Total Sample Examined	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167
Total Foraminifera /cc	305	363	413	439	422	275	207	278	216	239	240	326	220	239	258	227	260	251
Total Live (%)	10.6	17.0	15.4	10.5	7.1	10.9	7.2	7.6	4.4	4.3	3.0	16.7	13.4	14.8	23.5	19.3	16.6	12.6
Biofacies Assignment	3	2	2	2	1	1	1	2	1	1	1	1	1	1	1	1	1	1
Trochammina inflata (%)	18.27	22.82	18.77	21.88	12.57	15.73	16.49	21.97	12.48	10.66	5.89	18.55	13.38	16.09	18.05	15.21	20.77	19.47
Uncertainty +/-	4.34	4.32	3.76	3.87	3.16	4.30	5.06	4.87	4.41	3.91	2.98	4.22	4.50	4.66	4.69	4.67	4.93	4.89
Trochammina inflata (% live)	3.80	5.80	3.53	3.54	1.97	2.98	2.72	2.96	1.65	1.64	0.64	6.14	2.17	3.53	5.96	4.23	5.21	3.12
Uncertainty +/-	2.15	2.40	1.78	1.73	1.33	2.01	2.22	1.99	1.70	1.61	1.00	2.60	1.93	2.34	2.89	2.62	2.70	2.15
Miliammina fusca (%)	35.04	28.10	21.19	10.94	15.36	13.07	4.64	10.58	8.06	6.77	14.50	4.78	9.29	13.57	2.33	2.91	6.22	5.97
Uncertainty +/-	5.36	4.62	3.94	2.92	3.44	3.98	2.87	3.62	3.63	3.18	4.45	2.31	3.84	4.34	1.84	2.19	2.93	2.93
Miliammina fusca (% live)	0.79	1.65	2.61	1.09	0.85	0.87	0.00	0.65	0.00	0.00	0.50	0.18	1.64	0.75	0.47	0.53	0.92	0.72
Uncertainty +/-	0.99	1.31	1.54	0.97	0.88	1.10	0.00	0.94	0.00	0.00	0.89	0.46	1.68	1.10	0.83	0.94	1.16	1.04
Jadammina macrescens (%)	24.02	23.47	35.56	39.12	52.92	52.29	58.55	38.66	61.67	63.91	67.00	48.35	56.28	47.24	55.12	58.47	45.62	46.78
Uncertainty +/-	4.80	4.36	4.61	4.57	4.76	5.90	6.71	5.73	6.48	6.08	5.95	5.42	6.56	6.33	6.07	6.41	6.05	6.17
Jadammina macrescens (% live)	1.77	3.80	5.08	2.46	2.28	3.92	1.45	1.30	1.39	1.25	1.50	4.23	7.65	6.53	10.47	9.26	5.53	5.25
Uncertainty +/-	1.48	1.97	2.12	1.45	1.42	2.29	1.63	1.33	1.56	1.41	1.54	2.18	3.52	3.13	3.74	3.77	2.78	2.76
Haplophragmoides wilberti (%)	4.53	2.98	6.24	6.43	7.11	3.05	4.35	6.26	5.83	7.77	4.75	8.46	4.92	5.53	6.74	7.67	5.53	8.11
Uncertainty +/-	2.33	1.75	2.33	2.30	2.45	2.03	2.78	2.85	3.12	3.39	2.69	3.02	2.86	2.90	3.06	3.46	2.78	3.37
Haplophragmoides wilberti (% live)	0.98	0.50	1.16	0.41	0.57	0.65	0.87	0.22	0.28	0.25	0.25	0.55	0.27	1.01	1.16	1.59	0.23	0.95
Uncertainty +/-	1.11	0.72	1.03	0.60	0.72	0.95	1.26	0.55	0.70	0.63	0.63	0.80	0.69	1.27	1.31	1.63	0.58	1.20
Reophax nana (%)	0.00	0.33	0.00	0.14	0.00	0.44	0.00	0.86	0.00	0.25	2.50	1.84	3.01	2.01	0.23	0.79	0.92	0.24
Uncertainty +/-	0.00	0.59	0.00	0.35	0.00	0.78	0.00	1.09	0.00	0.63	1.98	1.46	2.26	1.78	0.58	1.15	1.16	0.60
Reophax nana (% live)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ammobaculites foliaeceous (%)	0.39	0.00	0.00	0.14	0.00	0.22	0.00	0.22	0.00	0.50	0.00	0.00	0.27	0.00	0.00	0.26	0.69	0.48
Uncertainty +/-	0.70	0.00	0.00	0.35	0.00	0.55	0.00	0.55	0.00	0.89	0.00	0.00	0.69	0.00	0.00	0.67	1.01	0.85
Trochamminita irrregularis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trochamminita salsa (%)	17.75	22.30	18.25	21.36	12.05	15.21	15.97	21.45	11.96	10.14	5.37	18.03	12.86	15.57	17.53	14.69	20.25	18.95
Uncertainty +/-	4.29	4.28	3.72	3.84	3.11	4.24	4.99	4.83	4.33	3.82	2.85	4.17	4.43	4.60	4.64	4.61	4.88	4.84
Trochamminita salsa (%)	3.28	5.28	3.01	3.02	1.45	2.46	2.20	2.44	1.13	1.12	0.12	5.62	1.65	3.01	5.44	3.71	4.69	2.60
Uncertainty +/-	2.00	2.30	1.65	1.60	1.14	1.83	2.00	1.81	1.41	1.33	0.43	2.50	1.69	2.17	2.77	2.46	2.57	1.97
Ammotium salsum (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Centropyxis aculeata (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Difflugia oblonga (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arcella vulgaris (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pontigulasia compressa (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sample Station	N95-2	N95-2	N95-2	N95-2	N95-2	N95-2	N95-2	N95-2	N95-2	N95-2	N95-2	N95-2	N95-2
Sample Horizon (cm)	7-8	8-9	9-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24	24-26	26-28	28-30
Actual Count	449	428	417	324	313	333	407	502	458	253	439	427	416
Fraction Total Sample Examined	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.333	0.333	0.333
Total Foraminifera /cc	269	257	250	194	188	200	244	301	275	152	132	128	125
Total Live (%)	15.6	13.6	3.8	1.9	7.0	9.9	10.6	12.0	9.4	9.5	8.4	4.2	2.4
Biofacies Assignment	1	1	1	1	1	1	1	1	1	4	1	1	4
Trochammina inflata (%)	12.07	13.35	15.37	17.55	8.57	11.67	9.35	8.33	5.94	15.28	4.13	3.66	5.91
Uncertainty +/-	3.89	4.16	4.47	5.35	4.00	4.45	3.65	3.12	2.79	5.72	3.40	3.25	4.14
Trochammina inflata (% live)	2.60	3.53	1.46	0.57	1.54	2.06	1.49	1.75	1.35	3.82	1.40	0.73	0.86
Uncertainty +/-	1.90	2.26	1.49	1.06	1.76	1.97	1.52	1.48	1.37	3.05	2.01	1.47	1.62
Miliammina fusca (%)	6.90	6.31	10.55	14.20	10.54	13.81	26.54	17.73	15.07	41.50	32.80	38.88	37.50
Uncertainty +/-	3.03	2.97	3.81	4.91	4.39	4.78	5.54	4.31	4.23	7.84	8.02	8.44	8.49
Miliammina fusca (% live)	0.89	0.23	0.00	0.62	0.32	1.20	1.47	1.59	0.66	1.19	0.91	0.47	0.00
Uncertainty +/-	1.12	0.59	0.00	1.10	0.81	1.51	1.51	1.41	0.95	1.72	1.62	1.18	0.00
Jadammina macrescens (%)	63.25	61.68	56.12	47.84	69.97	61.26	51.60	61.16	64.41	21.74	54.21	48.24	21.88
Uncertainty +/-	5.76	5.95	6.15	7.02	6.56	6.76	6.27	5.50	5.66	6.56	8.51	8.65	7.25
Jadammina macrescens (% live)	9.35	6.54	1.44	0.31	3.83	4.80	5.90	6.18	5.24	0.79	5.01	2.34	0.96
Uncertainty +/-	3.48	3.02	1.48	0.78	2.75	2.97	2.95	2.72	2.63	1.41	3.73	2.62	1.71
Haplophragmoides wilberti (%)	5.35	4.44	2.40	3.40	2.56	2.10	3.69	4.78	9.17	6.32	3.87	6.09	5.29
Uncertainty +/-	2.69	2.52	1.90	2.55	2.26	1.99	2.36	2.41	3.41	3.87	3.29	4.14	3.93
Haplophragmoides wilberti (% live)	0.67	0.23	0.00	0.31	0.32	0.30	0.74	1.20	1.31	0.40	0.23	0.47	0.24
Uncertainty +/-	0.97	0.59	0.00	0.78	0.81	0.76	1.07	1.23	1.34	1.00	0.81	1.18	0.86
Reophax nana (%)	0.67	1.17	0.72	0.00	0.32	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.97	1.32	1.05	0.00	0.81	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00
Reophax nana (% live)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ammobaculites foliaeceous (%)	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trochamminita irrregularis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trochamminita salsa (%)	11.55	12.83	14.85	17.03	8.05	11.15	8.83	7.81	5.42	14.76	3.61	3.14	5.39
Uncertainty +/-	3.82	4.09	4.41	5.28	3.89	4.36	3.56	3.03	2.68	5.64	3.19	3.02	3.96
Trochamminita salsa (%)	2.08	3.01	0.94	0.05	1.02	1.54	0.97	1.23	0.83	3.30	0.88	0.21	0.34
Uncertainty +/-	1.70	2.09	1.20	0.31	1.44	1.71	1.23	1.25	1.07	2.84	1.59	0.79	1.02
Ammotium salsum (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Centropyxis aculeata (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Difflugia oblonga (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arcella vulgaris (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pontigulasia compressa (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncertainty +/-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00