WHAT IMAGES RETURN

WHAT IMAGES RETURN:
A STUDY OF THE STRATIGRAPHY AND SEASONALITY OF A SMALL SHELL MIDDEN IN THE WEST ISLES OF NEW BRUNSWICK

by

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What seas what shores what grey rocks and what islands,
What water lapping the bow
And the scent of pine and the woodthrush singing through the fog
What images return...

(T.S. Eliot, _Marina_)

ABSTRACT

What Images Return:
A Study of the Stratigraphy and Seasonality
of a Small Shell Midden in the West Isles
of New Brunswick.

by David W. Black

This thesis addresses several aspects, both methodological and substantial, of the archaeology of coastal shell middens in the Passamaquoddy Bay and West Isles areas of southern New Brunswick. The inquiry takes the form of a detailed analysis of the stratigraphy and faunal assemblages of two shell midden sites, BgDr 48, a prehistoric site, and BgDr 49, an historic site, located on Partridge Island, one of the West Isles. Throughout the study aspects of these sites are compared to previously excavated sites in the area.

With respect to the analysis of shell midden sites, it is concluded that: 1) there is no evidence for serious stratigraphic disturbance or mixing in midden sites not affected by recent agricultural activity; 2) the use of extensive column sampling methods is useful and desirable in excavating such sites, as it results in the recovery of significant faunal and botanic remains missed by the traditional excavation methods employed in the area; 3) at least some shell middens can be analysed in terms of culturally

meaningful analytical units smaller than site size, defined on the basis of stratigraphic and faunal information.

With respect to aboriginal subsistence, this study suggests that the importance of soft-shelled clams relative to other invertebrate prey species may have been overemphasized in previous midden studies in the area; evidence is presented which indicates that shellfishing was carried on during both summer and winter seasons.

With respect to the settlement patterns of prehistoric peoples in the area, the study suggests that: 1) the preservation of Early Maritime Woodland components may be strongly selected against by rising sea levels, but that the measurement of foreshore slopes may be useful in predicting where such components may be preserved; 2) Early and Middle Maritime Woodland components are distinguishable on the basis of their respective faunal assemblages, and that discrete occupations within Middle Maritime Woodland components may be distinguishable on the basis of faunal variability; 3) these patterns in faunal variability are similar to patterns noted by archaeologists conducting research on the coasts of Maine; 4) the extant models of prehistoric coastal settlement for the area are probably simplistic, but more research is necessary before these can be replaced by more adequate and better substantiated models.

As regards the historic archaeology of the area, the study suggests that some of the shell midden sites recorded on this coast may have resulted from historic occupation, and that these may be distinguishable from prehistoric middens by virtue of the low species variability in historic shell deposits.

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A thesis project requires the co-operation of many persons, and this project was no exception; I am deeply indebted to all those who participated in the "Partridge Island 'Finest Kind' Fish Market and Archaeological Project". I must ask the indulgence of anyone I fail to mention below; the fault is memory and not intention.

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For an enjoyable field season I express my thanks to Miss Nellie Holmes, owner of Partridge Island, for permission to excavate; to the Deer Island Development Corporation for scenic accomodations in the field; to my fellow crew members, Jennifer Bishop, Linda Jefferson, Joan Peterson, Beth Armstrong, and Dimity Hammon-Demma, and to the others who visited and helped us more briefly, Albert Fergusson, Pat Allen, David Christianson, John Hamilton, Tim White, and Steve Davis, for good companionship; and to the people of Deer Island, in particular James Lord, Bob Kylie, James Chaffey, Beulah and Toots at the 45th Parallel Restaurant, and Sarah Calder at the Fairhaven Bakery, for their hospitality.

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CHAPTER 1:

INTRODUCTION TO THE STUDY.

> Favoured sites were consistently reoccupied and the resulting refuse deposits formed extensive mounds of shell and earth midden. The ability to discern separate components would be an archaeologist's nightmare.
> (Jackson and Popper 1980:57)

Archaeologists have laboured for decades to unravel the "nightmare" of shell midden deposition (see Yesner 1977: 13-47, for a recent discussion of these attempts). The present study reports a detailed analysis of the stratigraphy, faunal remains, and structural components of a shell midden in the West Isles of New Brunswick. The purposes of the study are threefold: first, to add to our knowledge of the settlement/seasonality/subsistence aspects of prehistoric shell middens in the West Isles/Passamaquoddy Bay area; second, to follow up on McCormick's (1980:146) suggestion that "in future midden analysis these important [shellfish] species will need to be examined" by presenting some of the data necessary to produce quantitative midden analyses in the Passamaquoddy Bay area, and to evaluate the utility of such studies; and third, to address the issues of shell midden accumulation, and intra-site distribution of structural components, to examine "the very small details of shell middens"(McCormick

1980:47), with reference to a particular site. In this introductory chapter these aims will be elaborated against the background of previous shell midden research conducted in the Passamaquoddy Bay area.

Previous excavations in the area have been reviewed in several places (Connolly 1977; Sanger 1971; Bonnichsen and Sanger 1977; McCormick 1980). Table 1 presents a summary of the research. The midden sites in question have yielded radiocarbon dates between about 2500 B.P., and about 500 B.P., and have been assigned to the Ceramic (Sanger 1971), Early and Middle Woodland (Bishop 1983), or Maritime Woodland (Keenlyside 1983), cultural historical periods.[1] In keeping with the intent of the present research, the previous archaeological research conducted in the Passamaquoddy Bay area will be discussed with respect to faunal remains, stratigraphy, seasonality, and intra-site variability.

In 1881 Baird published a brief comparative report of some shell mounds which he had tested in the Oak Bay, Back Bay, Lepreau, and Grand Manan areas of southern New Brunswick, on the American shore of Passamaquoddy Bay, on the Gulf of Maine coast, and on the Massachussetts coast. His report concentrated on shellfish remains in the sites, and, as a result, has received little attention since.

The Oak Bay mound was one of the largest Baird observed during his survey, and his report includes a vertical section

TABLE 1: History of Passamaquoddy Bay Archaeological Research.

DATE	RESEARCHER	INSTITUTION	SITES/AREAS	RESEARCH	REFERENCE
1864	S.F. Baird	Smithsonian	Oak Bay Back Bay	site survey and testing	(Baird 1881)
1883	G.F. Matthew	New Brunswick Natural History Society	BgDr 25[2]	excavation	(Matthew 1884) (Bishop n.d.)
1950	T. Stoddard	R.S. Peabody Foundation	BgDr 9	excavation	
1950	T. Stoddard	R.S. Peabody Foundation	Passamaquoddy Bay	site survey	(Stoddard 1950)
1960 → 1964	R. Pearson	National Museum of Canada	BgDs 1 BgDs 6 BgDs 10	survey and excavation	(Pearson 1970)
1963	C.S. Churcher	Royal Ontario Museum	BgDs 1 BgDs 6 BgDs 10	faunal analysis	(Churcher 1963)
1967 → 1970	D. Sanger	National Museum of Canada	BgDs 6 BgDs 10 BgDr 5 BgDr 11	excavations	(Sanger 1971)
1969	H.G. Savage	University of Toronto	BhDr 1	faunal analysis	(Savage 1969)

TABLE 1: continued.

1970	J. Burns	National Museum of Canada	BgDs 6 BgDs 10 BgDr 11	faunal analyses	(Burns 1971a, 1971b, 1971c)
1972 1973	S. Davis	Memorial University	BgDr 11	excavation thesis	(Davis 1974, 1978)
1973	L. Lavoie	University of Montreal	BgDs 6	thesis	(Lavoie 1974)
1974	F. Stewart	National Museum of Canada	BgDr 5	faunal analysis	(Stewart 1974)
1977	D. Sanger R. Bonnichsen	University of Maine	BgDs 10 BgDr 5	faunal analysis	(Bonnichsen and Sanger 1977)
1979	A. Fergusson	Historical Resources of N.B.	BgDs 10	excavation	(Stewart 1980)
1980	S. Davis A. Fergusson	Historical Resources of N.B.	West Isles	site survey	(Davis and Fergusson 1980)
[illegible]	J. McCormick	University of Maine	BgDs 5 BgDs 10 BgDr 5 BgDr 11	faunal analysis thesis	(McCormick 1980)

summarizing the stratigraphy of the site (1881:293). Baird was the first to note the ubiquity of the soft-shelled clam (Mya arenaria) in the Passamaquoddy Bay sites, and the absence of hard-shelled clams (Venus mercenaria). He also noted layers of "Echinus" shell (almost certainly the sea urchin Strongylocentrotus droebachiensis), and suggested that they "constituted a large portion of the food of the aborigines"(1881:292). Baird also noted a layer of fine gravel in his stratigraphic column, which he interpreted as an ancient beach deposit. This interpretation was probably mistaken, and Baird may have been the first excavator to encounter one of the gravel living floors which are characteristic of shell midden sites in the Maine/Maritimes area.

Matthew's (1884) description of the Bocabec site (BgDr 25) is a much more complete and satisfying archaeological statement. Matthew used careful excavation techniques, and analysed all aspects of the site. He recognised two cultural historical components, and gave detailed descriptions of the living floors ("huts") associated with the shell deposits (1884:11). Vertebrate and invertebrate faunal remains were identified (1884:24-25), and Matthew reported finding carbonized seeds (especially of the Beach Pea, Lathyrus maritimus Big.) in association with one living floor (1884:16). Matthew suggested a year-round seasonality for the site, but stressed the evidence for winter seasonality.

No further archaeological research was carried out in the Passamaquoddy Bay area until the 1950's, when Byers excavated at Holt's Point (BgDr 9), and Stoddard surveyed the shores of the Bay. A complete site report of BgDr 9 is in preparation at present (Hammon-Demma 1982:p.c.).

In the early 1960's Pearson tested and dated several sites in the St. Andrews area; this work has been briefly reported (Pearson 1970). No discussion of the stratigraphy of the sites is included in this report. Vertebrate faunal remains were partially analysed by Churcher (1963), who noted inter-site variability in faunal assemblages, and suggested that BgDs 1 may represent a winter occupation. Pearson presented a list of 10 invertebrate species recovered from the sites, but emphasized the dominance of soft-shelled clam remains over those of other shellfish. He also attempted to use the distribution of northern whelk (Buccinum undatum) shells to measure environmental changes, but was apparently unsuccessful (1970:185-186).

A more ambitious archaeological program was carried out by Sanger in the late 1960's and early 1970's. Major excavations were carried out at several sites, and the analyses have appeared in several sources in the years since. Sanger has stated that the sites were "excavated with general culture historical motives and no prior experience in east coast shell midden excavation"(1982:199); however, the faunal remains and seasonality interpretations of the Passamaquoddy Bay sites have received considerable attention.

Faunal assemblages from the sites have been analysed by several researchers (see Table 1 for details). Some controversy concerning the seasonality of the sites developed because Burns (1971b:16, 1978:38) interpreted the abundant shellfish remains as indicative of summer occupation (see also Davis 1978:17; Christianson 1979:96; Snow 1972:220; Ganong 1889:102), and ascribed a year-round seasonality to the sites, while Stewart (1974:37,49, 1982:5) has rejected this argument by emphasizing the prevalence of paralytic shellfish poisoning in the summer months in the southern Bay of Fundy area. Stewart considers the avian and mammalian remains to indicate fall/winter/early spring occupation of the sites (1974:41, 1982:4). Sanger has generally adopted this interpretation in developing a settlement/seasonality model for the Passamaquoddy Bay sites (1971:18; Bonnichsen and Sanger 1977:112).

Sanger's model supports the dichotomy first proposed by Bourque (1971, 1973) between the ethnohistoric and the prehistoric seasonal movements of New England's aboriginal peoples. Bourque suggested on the basis of excavations on the central coast of Maine that components between 1750 B.P. and 800 B.P. represent late winter/early spring occupations of the coast, while the historic accounts suggest that the Indians exploited the interior in winter, and the coast during the late spring and summer. Snow has recently (1980:301-304) reiterated this settlement/subsistence model for the northern New England/Maritimes region in a major treatise on New England archaeology, suggesting coastal occupations from November to March, and from April to June, with interior occupations from March to April, and July to October, for the period from 2000 B.P. to 800 B.P. For the Passamaquoddy Bay area specifically, Sanger has argued for coastal residence in all but the summer months (Sanger 1979:109; Snow 1980:302). In some respects it is unfortunate that this model has become entrenched in the literature at a time when Sanger himself seems to be re-evaluating the previous seasonality interpretations, in light of his most recent research on the central Maine coast.

In their most recent contributions, Sanger (1982:202) has presented evidence for coastal occupation during all seasons, and has argued against the adoption of neatly dichotomized seasonal-round models, while Stewart (1982:11-12) has stated that although the majority of Passamaqoddy Bay archaeological faunal indicators suggest winter occupations, there is some evidence for summer occupation of the coast prior to the ethnohistoric period. Stewart has argued for regional variability in seasonality using data from several Maritimes sites, and has cautioned against uncritical acceptance of ethnohistoric accounts. McCormick's thesis, summarizing the faunal data from Sanger's excavations, presents no data which contradict previous seasonality interpretations (1980:106-107).

The original faunal analyses of the Passamaquoddy Bay sites tended to treat the site assemblage as a single unit of analysis, even in cases where the site was known to be multi-component. This approach was justified by suggesting that faunal preservation from the earlier components, generally considered not to be associated with shellfish gathering, would be minimal (see, for example, Davis 1978: 29,36). Later analyses paid some attention to units of analysis smaller than site size. Housepits were usually designated for separate consideration, and some attempts were made to compare the vertebrate faunal contents of midden deposits within and between sites (Bonnichsen and Sanger 1977). McCormick's (1980:80-110) attempts to trace faunal variability using features and arbitrary levels as analytical units are interesting and instructive, but of limited value, since his conclusions are mainly methodological and theoretical. He has made no attempt to reinterpret the sites on the basis of his comparisons.

The attitude of the more recent researchers to invertebrate faunal remains is typified by Sanger's (1971: 16) statement that the "soft-shelled clam (*Mya arenaria*) is by far the dominant species, with only inconsequential amounts of mussel (*Mytilus edulis*), and other shellfish." This brisk dismissal of shellfish remains (see also Stewart 1974, and Davis 1978) is mysterious considering that Sanger has also commented on the Indians' "dependence on shellfish as a protein base"(1971:16), and that most researchers have commented on the predominance of invertebrate remains in contrast to vertebrate remains in the sites (Matthew 1884: 24; Stewart 1974:28; Lavoie 1971:200). In addition, Burns has presented some evidence for intra-site variability in shellfish species content at BgDs 6 (1971b).

Apparently, the nature of stratigraphy varies from site to site. BgDs 6 and BgDs 10 seem to have exhibited complex microstratigraphy (McCormick 1980:63,67), while BgDr 11 and BgDr 5 exhibited little stratigraphy beyond the housepit/midden distinction (McCormick 1980:60; Davis 1978: 10). The excavation strategy adopted at BgDs 6 was apparently geared to exploring site stratigraphy, but McCormick (1980: 98) was unable to discern any faunal variability based on the stratigraphy.

McCormick (1980:46,90,94 109) has repeatedly stressed the need for research into the mechanics of shell midden deposition, citing this as one of the main methodological problems encountered in his study. The "mechanics of dumping on the site itself are not well known and detailed analysis of the movements of objects in middens, and the consolidation of separate dumping episodes is urgently needed"(McCormick 1980:109). These issues are not new to shell midden research on the Northeast coast.

Will (1976) has presented a model of shell midden deposition loosely based on Schiffer's (1972) notions about cultural and natural transformations in the archaeological record. His model dichotomizes between primary and secondary refuse, and envisions midden formation as a series of episodes in which living floors are located in one part of the site and middens on another. Successive occupations result in sequences of middens and living floors. Shell, once it has reached a degree of accumulation, ensures that bone and shell added to the site will be preserved regardless of its origin. The importance of distinguishing between natural and cultural inputs in such sites has been recognised in the Passamaquoddy Bay case for at least 100 years since Matthew (1884:24) speculated that the sea urchin remains in BgDr 25 might have been introduced by birds.

Brennan (1977,1981) and Sanger (1981) have presented contrasting views on the nature of shell midden contexts. Brennan has proposed that "it may never be assumed that artifacts found in shell middens are in contemporary context" (1977:122), and that "natural dissolution of shell... cancelled out centuries, even millenia..."(1977:136). Brennan is apparently pessimistic about the occurrence of any primary refuse in shell middens, and this may be related to his belief that Indians did not live on the shell heaps they accumulated (1977:137).

Sanger has countered Brennan's arguments by presenting data from the Passamaquoddy Bay sites which indicates contemporaneity between artifacts, housepits, and shell deposits. However, he also notes that artifact movements in shell deposits is a relatively unexplored problem (1981:41). Both Brennan's and Sanger's studies have concentrated on radiocarbon dating shells as a means of evaluating the intactness of midden contexts, rather than by reconstructing depositional histories of the sites. To some extent, the differences in their points of view may reflect differences in the ages and structures of shell middens they have studied (compare the general site descriptions in Brennan 1981:44 and Sanger 1981:38-39).

In the present study, the question of the stratigraphic integrity of shell midden sites is addressed in the context of the distribution of faunal remains. This strategy was adopted because of the relative frequency with which faunal remains occur in the sites relative to the low yeild of artifacts characteristic of shell deposits.

Several trends in the analysis of Passamaquoddy Bay middens can be discerned from this brief review of the literature. First, the earlier reports presented a balance between the identification of vertebrate and invertebrate faunal remains, although neither category was analysed in great detail. Burns was the only researcher who attempted a quantitative analysis of shell remains; his work remains unfinished and has not been followed up on. Later faunal analyses have concentrated, almost to the point of exclusiveness, on vertebrate remains, especially mammals and birds; fish remains have received less attention. Second, most of the faunal analyses have treated the site assemblage as a single unit of analysis; the only significant exception has been the occasional analysis of individual living floors (housepits). With the exception of housepits, the internal stratigraphy of the sites has received little attention. Intra-site variability, where it has been considered at all, has been treated in terms of a dichotomy between housepits and shell deposits, or has been treated in terms of arbitrary excavation units. Finally, although there have been theoretical discussions of shell midden deposition and taphonomy, and the cultural and natural processes which operate on archaeological remains in a shell midden context, there have been few discussions of the effects of these on particular sites.

The present contribution represents a part of recent research undertaken by the Historical and Cultural Resources Administration of New Brunswick in the West Isles area at the mouth of Passamaquoddy Bay (Bishop 1983). A microstratigraphic approach is taken to the analysis of midden stratigraphy. Intra-site variability is considered in terms of faunal remains (vertebrate remains, marine shell, terrestrial gastropods), carbonized and uncarbonized plant remains, and other structural components.[3] Wherever possible these components are treated in quantitative terms. Stratigraphic distribution is considered in discussing the seasonality aspects of the faunal remains. Relative quantities, relative importance, and the seasonality aspects of marine shell species are considered. The fine details of midden deposits are described using a column sampling and natural/cultural stratigraphy approach; the results are compared to those obtained by the traditional arbitrary level excavation methodology. Intra-site distributions of structural components are used to address the issues of cultural and natural transformations of the archaeological record.

Topically, this thesis is a combination of seasonality studies, as advocated by Monks (1981), and stratigraphic studies, as advocated by Harris (1979). It is intended to contribute data useful both in future faunal studies of shell middens, and for comparison with experimental studies of shell midden taphonomy (for example, Muckle 1982).

The thread which ties the various aspects of the present study together is an attempt to establish criteria by which to interpret the "nightmare" of shell midden stratigraphy noted in the quote at the head of this chapter.

CHAPTER 2:

DESCRIPTION OF THE WEST ISLES AREA AND PARTRIDGE ISLAND.

The salt is on the briar rose,
The fog is in the fir trees.
(T.S. Eliot, The Dry Sauvages)

Introduction:

The sites, the faunal remains and stratigraphy of which provide the basic data for this study, are located on one of the small islands, Partridge Island, of the archipelago known as the West Isles, which separates Passamaquoddy Bay from the Bay of Fundy. The West Isles are located in Charlotte County, New Brunswick, and extend from Letete, N.B., to the American mainland at Lubec, Maine.

The two largest islands of the archipelago are Deer Island and Campobello Island. Partridge Island is located off the northeastern shore of Deer Island at the position shown on Figure 1. Two archaeological sites, BgDr 48, and BgDr 49, are located on the island (Davis and Fergusson 1980), at the positions shown in Figure 2.

BgDr 48, the Partridge Island Site (Bishop 1983), is by far the larger of the two sites, and much of the following description relates specifically to it.

The sites which are drawn upon for comparative purposes in this study, and which were referred to in the

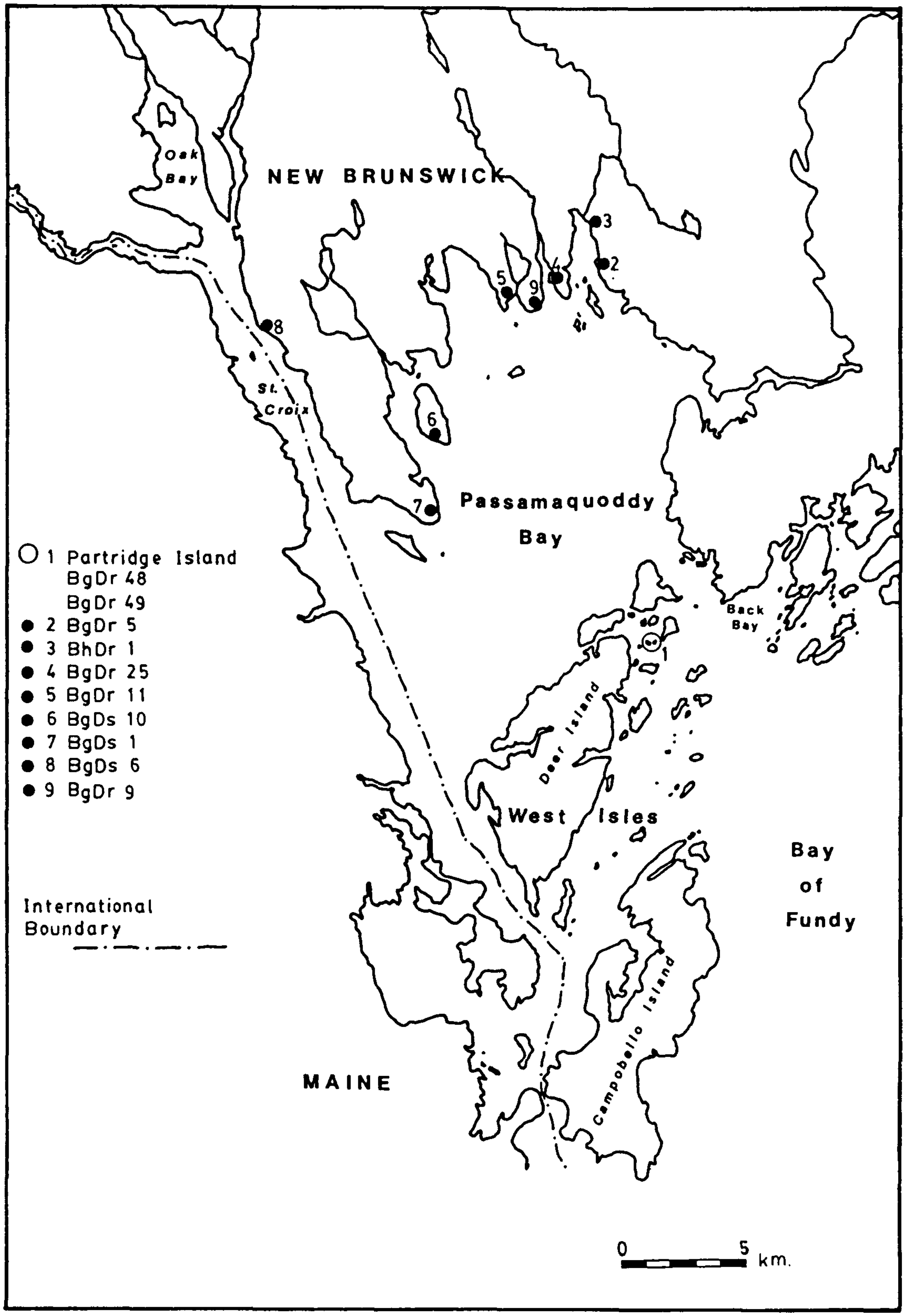


FIGURE 1: Sites and Areas Referred to in the Text.

previous chapter, are located along the northern shore of Passamaquoddy Bay proper, and on the St. Croix estuary. The locations of these sites and areas are shown in Figure 1.4

Geology:

The bedrocks of which the West Isles are formed are part of a geological formation known as the Mascarene Group; this formation consists of volcanics with a few sedimentary rocks intermixed. Extrusive volcanics include andesites, rhyolites, and basalts, while the sediments include conglomerates, shales, slates, and cherty argillites. These rocks are locally intruded by dykes and sills of igneous intrusive rocks such as gabbro and diabase (MacKay *et al.* 1978:11).

The bedrocks of Partridge Island appear to be mainly dark green, fine-grained, volcanics (Munsell color 5Y 5/2 -- olive green) with some crystalline inclusions. The other rock types of the Mascarene Group are represented as embedded rocks and pebbles on the intertidal zones. Several sizable rounded erratics of course crystalline granitic rock are present on Partridge Island in the vicinity of, and beneath, BgDr 48 (see Figure 4). These rocks are almost certainly glacial in origin, and were probably transported from the St. George batholith, located on the mainland to the north.

The only substantial soft rock deposits observed on

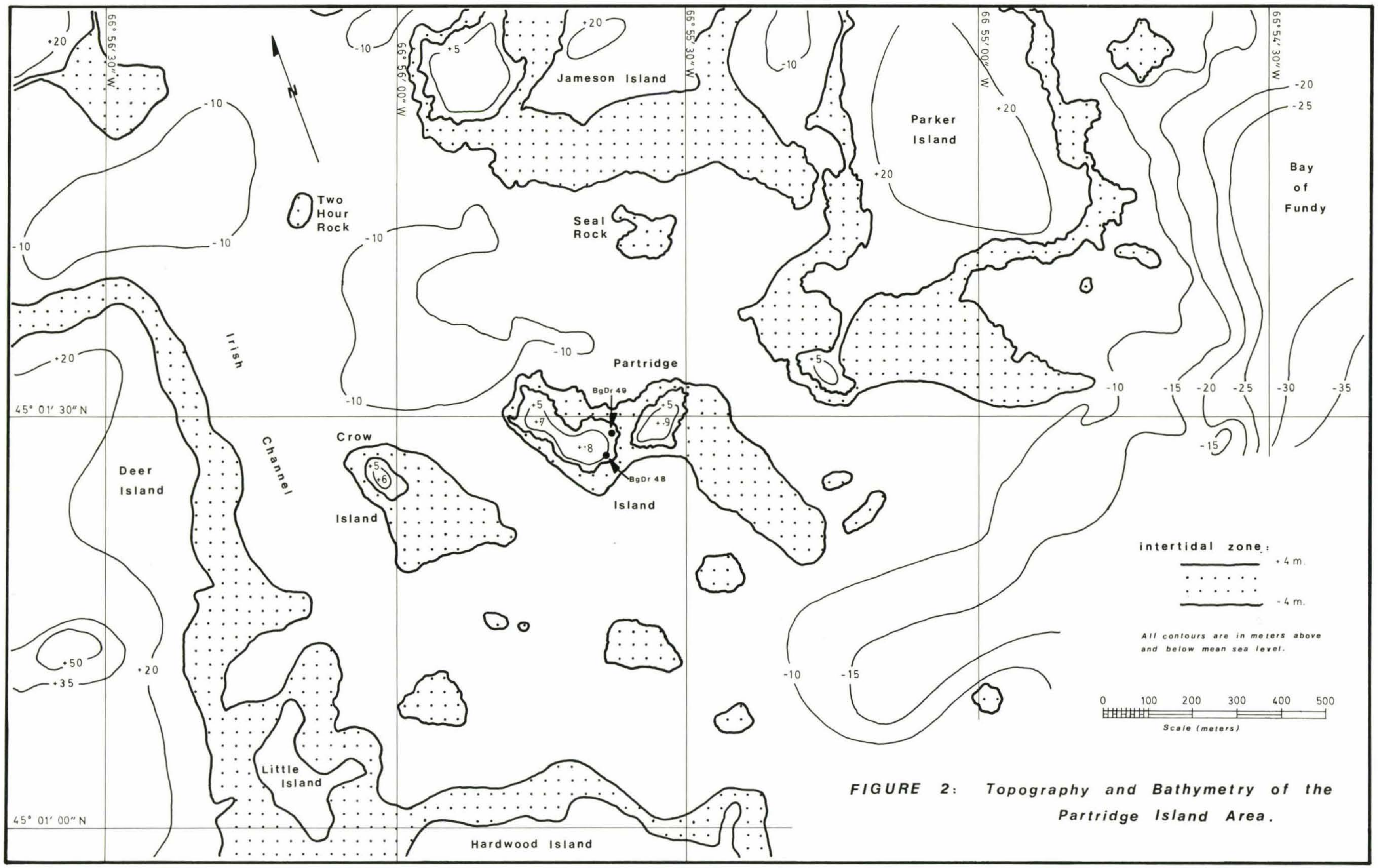


FIGURE 2: Topography and Bathymetry of the Partridge Island Area.

Partridge Island are those which underlie the two archaeological sites. Beneath BgDr 48 is a light brown silty gravel (Munsell color 10YR 5/6 -- yellow brown) mixed with frost spalls of the local bedrocks. The grains of this gravel are partially rounded but poorly sorted. No fossils were observed in the material; a glacial or glacio-marine origin seems probable.

In the vicinity of BgDr 49 a denser beige clayey subsoil (Munsell color 7.5YR 6/2 -- pinkish grey), relatively free of gravel, was observed. Again, no fossils were observed, and a glacial or glacio-marine origin is postulated.

On other parts of the island bedrocks were either bare, or covered by thin layers of organic soil. In low, wet areas between outcrops some deeper organic soils have accumulated.

Geomorphology and Bathymetry:

The West Isles are the tops of a series of low rounded hills which extend above the high water level of a rugged, drowned, coastline. There are more than 40 islands in the archipelago, and numerous intertidal ledges and rocks, all located very close to one another. Elevations on the smaller islands are generally less than 10 meters above mean sea level (a.s.l.), while elevations on the larger islands reach as much as 50 meters a.s.l.

Only Campobello Island and Deer Island are large enough to have significant freshwater drainages and catchments.

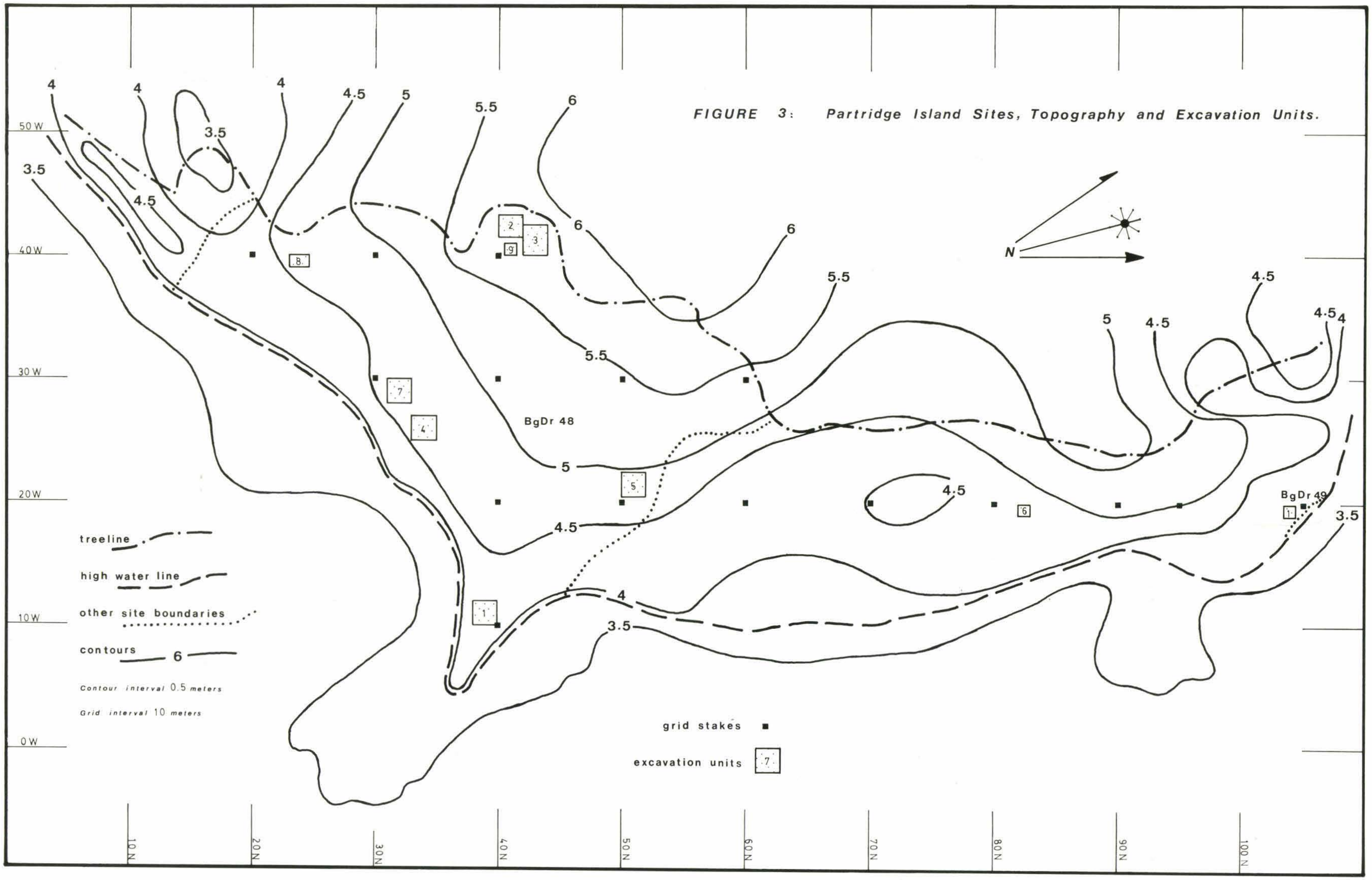


FIGURE 3: Partridge Island Sites, Topography and Excavation Units.

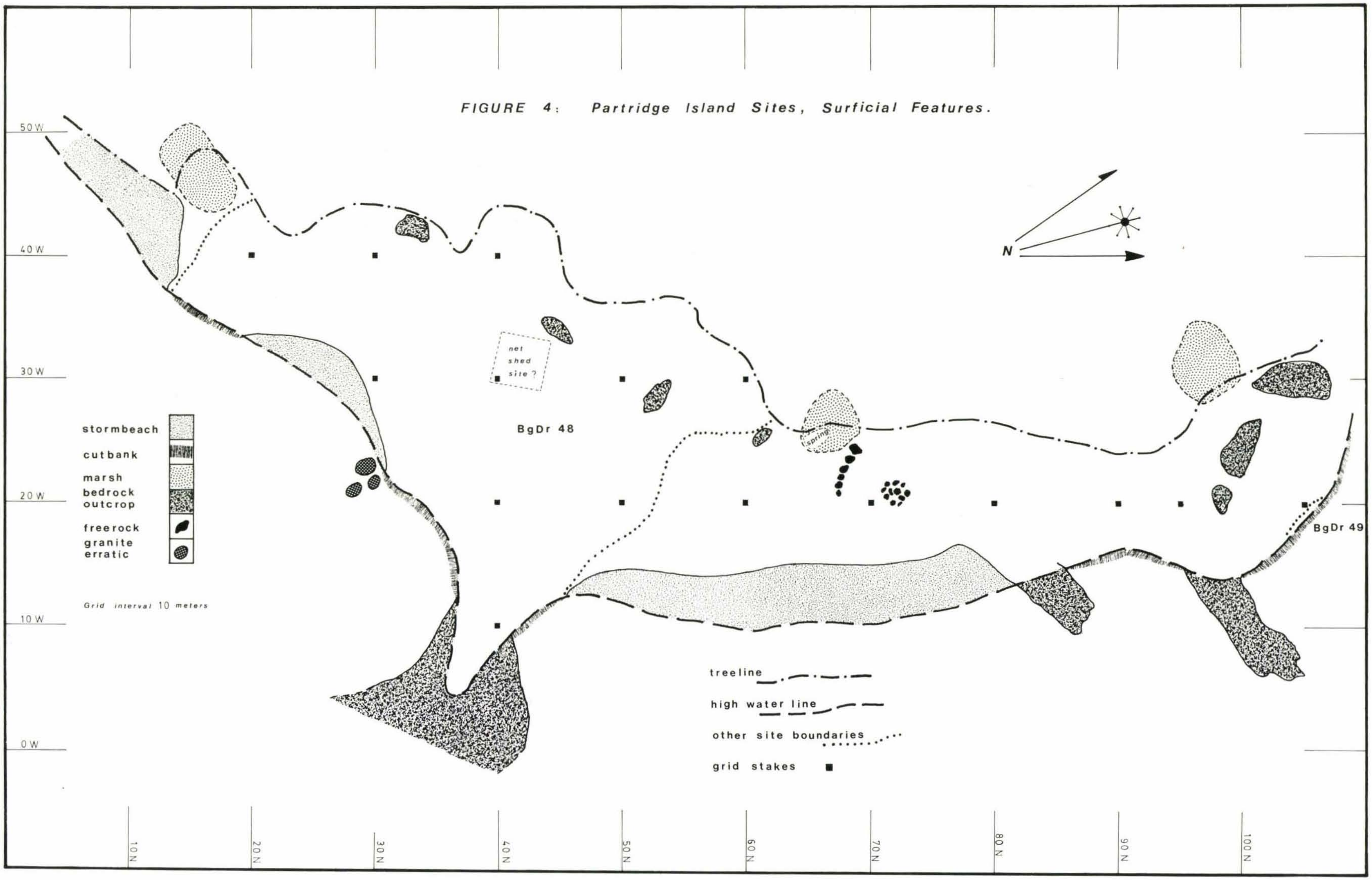


FIGURE 4: Partridge Island Sites, Surficial Features.

Two small, swampy lakes are located in the northern interior of Deer Island. Small swampy areas are common between bedrock outcrops on the smaller islands; three such areas adjacent to the Partridge Island archaeological sites (see Figure 4) may have served as fresh water sources for the aboriginal inhabitants of the island.

The West Isles bear considerable evidence of the effects of glaciation on the area, in the form of drumlinized hills, *roches mountonnèes*, striated bedrocks, and erratic boulders (MacKay *et al.* 1978:11). Glacial tills, outwash deposits, and glacio-marine deposits, are common on the adjacent mainland areas, and on southern Deer Island. Shorelines are generally steep and rocky, especially in the northern West Isles, in contrast to the northern shore of Passamaquoddy Bay where shoreline gradients tend to be shallower (Brinkhurst *et al.* 1975:Figure 2).

The subtidal geomorphology of the West Isles tends to be similar to the supratidal geomorphology (MacKay *et al* 1978: 11). Depths range from one meter to more than 90 meters, and changes in depth are often abrupt. The waters of the area are cold, clear, and highly saline (MacKay *et al.* 1978:183).

Partridge Island itself consists of a series of three hillocks of drumlinized bedrock oriented in a roughly east-west direction (Figure 2). Two of the drumlins are joined by a narrow, swampy area to form the largest, wooded portion of the island. The third, highest, unwooded hillock is joined to the others by a narrow gravel intertidal bar which is inundated by all but the lowest high tides.

The dimensions of Partridge Island are approximately 0.42 km. by 0.10 km., and the area above the high water line is about 0.42 km.^{2}. At low water the area of the island is more than doubled to about 0.10 km.^{2}. The intertidal zone at Partridge Island is composed mainly of outcropping bedrock, and course gravel shingle.

The highest elevation on the island is about 9 meters a.s.l., but the elevations of the two archaeological sites are between the high water line at about 4 meters a.s.l., and about 6 meters a.s.l. The topography of the site areas is shown in Figure 3. The sites are adjacent to the bar which connects the two parts of the island, BgDr 48 adjacent to the southern shore and extending to the tree line, BgDr 49 immediately above the high water line adjacent to the northern shore.

The important surficial features of the site areas are shown in Figure 4. A few small rock outcrops protrude through the shallower parts of BgDr 48; BgDr 49 is surrounded by higher outcrops. Where the sites are underlain by soft deposits, stormbeaches of loose gravel have been deposited against the sites, although these areas appear to be subject to erosion as they are undercut during high tides and storms.

Where the sites are underlain by outcrop, their shoreward edges are truncated by low cutbanks (circa 25 cm.).

The bare rectangular area near the center of BgDr 48 may be the location of a net shed previously situated on the island. At one side of the swampy area north of BgDr 48 is a depression which may have been excavated to provide a water source.

Partridge Island is located on a shelf of land which extends from the north end of Deer Island for about 1.5 km., and includes the adjacent Crow, Hardwood, Parker, and Jameson Islands. The waters over this shelf are generally less than 10 meters below mean sea level in depth.

The tides of the Bay of Fundy area are spectacular, although they are less extreme in the Passamaquoddy Bay area than in the Bay of Fundy proper. The average tidal range at Partridge Island is about 5.5 meters, but this range increases to about 7.8 meters during large tides (Canadian Hydrographic Service 1981). Tides are reported to reach their most extreme ranges during full moon periods in the spring and autumn (Tourism N.B. 1982). At these times of greatest tidal range, the waters also recede to their lowest annual levels. Tide tables for the area (for example, Canadian Hydrographic Service 1981) suggest that the lowest water level each year, and the exact time of extreme tidal ranges each year, are quite variable, and that in at least a few years the lowest tides occur in mid-winter and mid-summer.

Biogeography:

The biogeography of the Passamaquoddy Bay area has twice been summarized in the recent archaeological literature (in Davis 1978:9-12, and McCormick 1980:23-46). Accordingly, this information, although it will be drawn upon in the subsequent analysis, will be touched on only briefly here. The zoological and ethnohistoric literature pertaining to the seasonality and exploitation of particular animal species in the Maine/Maritimes area, has also been summarized several times in the recent archaeological literature (see especially Christianson 1979; Bourque 1971,1973; Stewart 1974; McCormick 1980:32-46). Again, this literature will be drawn upon below, but will not be restated in detail in this thesis. Instead, the local biostratigraphy of the Partridge Island sites will be described in some detail with the aim of using this description as a model to familiarize the reader with the local environment. This description will, in keeping with the intent of the present research, include the habitats of the marine invertebrates and fish which make up so large a part of the faunal remains in most Passamaquoddy Bay coastal sites; this latter information has not been previously summarized in the archaeological literature.

McCormick (1980:23) has provided a detailed synthesis of the present climate, climax vegetation, and available vertebrate species in the Passamaquoddy Bay area, including a summary of the paleoenvironmental data available for the time period from 2000 B.P. to 300 B.P. The present climate of the southern coast of New Brunswick is moderated by the ocean, especially in the winter (MacKay _et al_.1978:16). Temperatures are cool, and the air is moist in all seasons; fog is common, especially in the summer (McCormick 1980:30-31). Prevailing winds are from the northwest in winter, and from the southwest in summer; severe cyclonic storms tend to enter the area from the northwest. Storms and overcast weather are common in the late autumn and winter (MacKay _et al_.1978:12).

With respect to past climatic conditions, at and before 2000 B.P. the vegetation of the area seems to have been dominated by a mixed coniferous/hardwood forest, but between 2000 B.P. and 1000 B.P. a cooling trend in the climate caused a change in coastal vegetation to the present forest climax -- one dominated by spruce and fir (McCormick 1980:29-30).

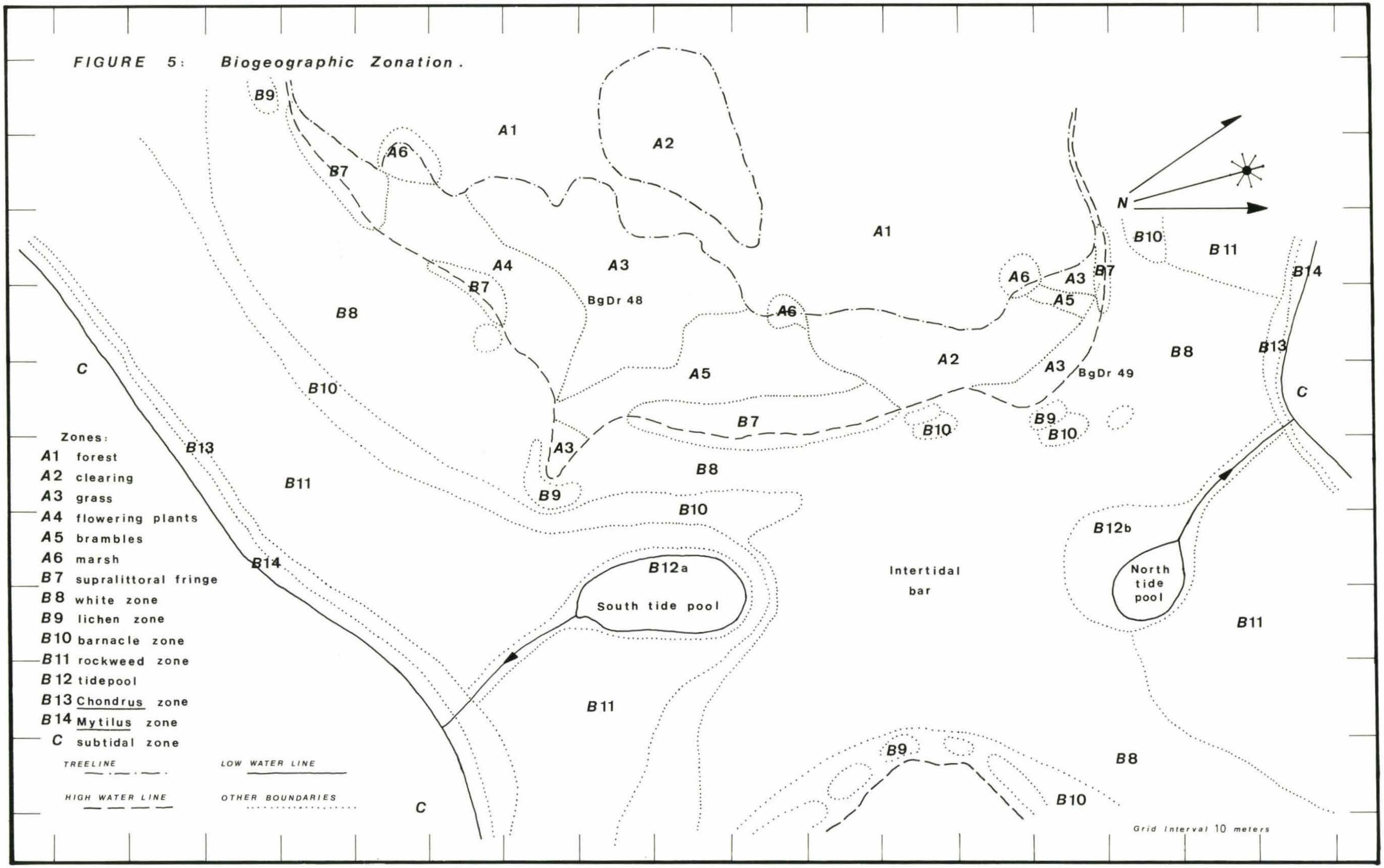
The biogeographic descriptions of McCormick and Davis are oriented toward the north shore of Passamaquoddy Bay; however, the terrestrial environments of the West Isles are generally similar to those of the north shore, and so their descriptions are probably largely applicable to the present study.

Common terrestrial mammals in the area include raccoon, fox, wolf, lynx, bobcat, beaver, porcupine, rabbit, deer, moose, and, in the past, caribou (Davis 1978:11). Sea mammals include several whale species, dolphin, harbour porpoise, and harbour seal (MacKay _et al._ 1978:151-152). There is good archaeological evidence for the presence of other seal species, grey, harp, and hooded seals, in the past (Stewart 1974). Avian fauna are diverse and abundant, including loons, grebes, cormorants, herons, geese, several species of ducks, gulls, terns, auks, osprey, and eagles (MacKay _et al._ 1978:151). Common fish species include alewife, smelt, herring, cod, pollack, haddock, tomcod, sea robin, sculpin, flounder, and halibut (MacKay _et al._ 1978:153-154).

In Figure 5 the site area and adjacent shorelines of Partridge Island are divided into a series of three major units, the Terrestrial Zone (A), the Intertidal Zone (B), and the Subtidal Zone (C). The first two of these are further subdivided into a series of subzones (see Figure 5). The Subtidal Zone also includes several distinct strata (see MacKay _et al._ 1978:181) but will be discussed as a single unit here.

The shoreline at Partridge Island combines the characteristics of muddy and rocky shorelines in the area, but is dominated by rocky substrates. Following are brief descriptions of each zone in Figure 5, listing plants and animals typical of, and/or observed in, each zone at Partridge Island. Much of the terminology used in this section, and the general framework for shoreline description, has been adopted from the Bay of Fundy Marine Resource Inventories.

FIGURE 5: Biogeographic Zonation.



A) The Terrestrial Zone.

A1) The Forest:

Much of Partridge Island is covered by a dense stand of black spruce (Picea mariana), white spruce (Picea glauca), and balsam fir (Abies balsamea), interrupted near the margins by clearings and less dense areas. The most conspicuous tree at the forest margin is the northern mountain-ash (Pyrus decora), although a few other deciduous saplings also occur. A lone fir tree stands at the shoreward edge of BgDr 48 in an area of peaty soil.

A2) The Clearings:

Two clearings occur in the site area, one immediately behind BgDr 48 and enclosed by the forest, the other between the two sites and adjacent to the intertidal bar. Both clearings occur in areas of shallow soil over bedrock, and this may partially explain the absence of trees. The clearings may be partially anthropogenic. Vegetation cover consists of tall and short grasses, mustard (Brassica), thistles (Cirsium, Sonchus), wild carrot (Daucus), goldenrod (Solidago), mosses and lichens.

A3) Grassy Area:

On the surface of BgDr 48 near the treeline, and over the entire surface of BgDr 49, are areas where the vegetation is dominated by short grasses and a few other low plants such as clover (Trifolium) and strawberries (Fragaria).

A4) The Flowering Plant Zone:

Most of the surface of BgDr 48 is covered by a bewildering array of herbaceous flowering plants. These include mustard (Brassica), false solomon's seal (Smilacina racemosa), bull thistle (Circium vulgare), common thistle (Circium ardense), sow thistles (Sonchus), blue-eyed grass (Sisyrynchium montanum), ox-eye daisy (Chrysanthemum leucanthemum), clover (Trifolium), fireweed (Epilobium angustifolium), bellflowers (Campanula), asters (Aster), devil's paintbrush (Hieracium aurentiacum), snapdragon (Linaria vulgaris), and bindweed (Convovolvus). The density of flowering plants increases toward the shoreward edge of the site, but their distribution is truncated at the extreme high water level.

A5) Brambles:

North and east of BgDr 48, in a shallow moist depression, is a patch of brambles consisting of raspberry (Rubus) and gooseberry (Ribes). Smaller patches of brambles occur in moist areas west of BgDr 48, and north of BgDr 49.

A6) Marshy Areas:

Two small swampy areas occur adjacent to BgDr 48, one between a stormbeach and the treeline, another between the brambles and the treeline. A third such area occurs in the trees northwest of BgDr 49. Water parsnip (Sium sauve), blue iris (Iris), tall buttercup (Ranunculus acris), and various reeds and grasses grow in these areas.

Partridge Island affords little opportunity for terrestrial animals, and only small mammals such as mice and voles were observed.

B) The Intertidal Zone.

B7) The Supralittoral Fringe:

This area includes the stormbeaches on the southern and eastern edges of BgDr 48, and the shingle immediately below the high water line. The stable crests of the beaches support a profuse growth of beach peas (Lathyrus japonicus), and occasional lamb's quarters (Chenopodium album). On the shingle are occasional growths of seaside plantain (Plantago junicoides), and seablite (Sueda maritima). The area is subject to inundation and wave action only during extreme tides and storms.

B8) The White Zone:
This is a narrow band of rocks and pebbles which is subject to extreme wave action and is generally devoid of life. At Partridge Island the crest of the intertidal bar is included in this zone because the shifting substrate does not allow permanent plant and animal life to exist on it.
B9) The Lichen Zone:
Lichens dominate the tops of the higher rocks and outcrops in the upper intertidal zone, where they are subject to spray at high water. Two types of lichens were observed in the area, a black variety, and a bright yellow-orange variety.
B10) The Barnacle Zone:
As the name implies, the dominant animal in this area is the common barnacle, Balanus balinoides, which covers all sizable rock surfaces. Patches of small rockweeds such as Fucus also occur. The small periwinkles Littorina obtustata and Littorina saxatilis are sometimes present.
B11) The Rockweed Zone:
On rocky substrates in the West Isles area this zone includes much of the intertidal area. Rockweeds such as Fucus vesiculosis and Ascophylum nodosum grow profusely, often covering the substrate. On and beneath the weeds is the preferred habitat of the small periwinkles L. obtustata and L. saxatilis; the large edible periwinkle L. littorea is present, and barnacles are common. The dogwhelk Nucella lapillus, and the rock blenny (Pholis), also inhabit this zone. Fucus and Ascophylum cease to occur abruptly about 1.5 meters above the mean low water line.
B12) The Tide Pools:
Two tide pools are present adjacent to the intertidal bar. Both are stratigraphically within the rockweed zone, but their characteristics are quite different.

B12a) The South Tide Pool:

This pond forms for several hours during most tidal cycles. It is characterized by a rocky substrate and the animal life in it consists mainly of large numbers of common periwinkles. The pool drains to the south side of the island along a tiny stream also inhabited by many periwinkles.

B12b) The North Tide Pool:

This pool forms on the north side of the bar and drains to the north side of the island. It is at a slightly higher elevation than the other pool, and drains almost completely during most tidal cycles. It is unique at Partridge Island at the present time, as it is the only intertidal area where appreciable amounts of mud are deposited. The substrate is a dense gravelly mud in which numbers of soft-shelled clams live. The clams are small and their productivity at present is low compared to the extensive mudflats in other areas of the West Isles and Passamaquoddy Bay. Marine worms are also present in the pool. Small amounts of algae are the main plant life.

B13) The *Chondrus* Zone:

The plant life in this narrow zone is dominated by Irish moss (*Chondrus crispus*), interspersed with other seaweeds such as dulse (*Ulva*). Common animals include periwinkles, the tortoiseshell limpet (*Acmaea testudinalis*), chitons (*Ischnochiton*), dogwhelks, the green sea urchin (*S. droebachiensis*), marine worms, blennies, and occasionally sea cucumbers and small sponges.

B14) The *Mytilus* Zone:

A broad band dominated by the common mussel (*Mytilus edulis*) occurs at the average low water line. These mussels occur as clumps or mats on embedded rocks and outcrops, and as dense mats on gravelly substrates. Other species present include sea urchins, chitons, limpets, blennies, marine worms, and the Arctic saxicave (Hiatella arctica). Starfish are common in the summer. Often, the northern whelk (Buccinum undatum) occurs at the low water line. The most conspicuous plants are dulse seaweeds (Ulva).

C) The Subtidal Zone:

The steep gradient of the Partrige Island intertidal zone gives way to a somewhat lower gradient below the low water line. Subtidal substrates are composed of rocky ledges, embedded rocks, and gravels. Algae below the low water line are predominantly Laminaria or Lithothamnion species. The most obvious and common subtidal animal at Partridge Island at present is the green sea urchin, which ofter covers the substrate as deep as can be seen. Barnacles (especially B. balanus), limpets, dogwhelks, northern whelks, and occasionally the ten-ridged whelk (Neptunea decemcostata) are present. The scallops (Placopecten magellanicus and Chalmys islandica) are sometimes present in shallow water but are more usually deep water species (Brinkhurst et al. 1975:48). The horse mussel (Modiolus modiolus) is abundant subtidally at Partrige Island (MacKay et al. 1978:92). The small bivalves Astarte undata, Astarte castanea, and Cyclocardia borealis are also present. Several species of crabs are common in the area, as are lobsters. Common fish include flounder (Pseudopleuronectes), sculpin (Myoxocephalus), cod (Gadus), pollack (Pollachius), haddock (Melanogrammus), tomcod (Microgaddus), smelt (Osmerus), mackerel (Scomber), and herring (Culpea) (MacKay et al. 1978:218). Several herring weirs are located adjacent to Partridge Island at the present time.

The northern West Isles area is presently rich in marine resources, and may be the richest part of the Passamaquoddy Bay area in terms of species diversity and overall productivity. This may be due to the conditions of tidal mixing and nutrient distribution caused by the narrow channels (MacKay et al. 1978:183, and Figure 8.11.1). From the point of view of marine resources, the most productive season is the late summer/early autumn (July, August, September). This coincides with the season of maximum plant productivity on the coast, when several species of berries are ripe, and beach peas are mature. On the other hand, terrestrial fauna are probably at their peak productivity in the late autumn/early winter.

Partridge Island is particularily productive of intertidal and immediately subtidal animals, because rocky substrates in the area are generally higher in productivity than either muddy or sandy substrates (MacKay et al. 1978:181). It is difficult to estimate the productivity of terrestrial environments in the West Isles except to suggest that they offer less in the way of total biomass and species diversity than do comparable environments on the mainland. The smaller islands are particularily restricted as to the numbers and sizes of animals they can support due to the fresh water restriction noted above. In terms of human exploitation, one might reasonably expect inhabitants of the West Isles to be more oriented toward marine exploitation than their mainland counterparts.

Dating and Cultural Historical Associations of the Partridge Island Sites:

Four radiocarbon dates have been processed from the BgDr 48 site: these are summarized in Figure 6, and will be discussed in detail with respect to their stratigraphic associations in a subsequent section. Briefly, however, the dates span the years between about 2400 B.P. and 1550 B.P. Bishop (1983:119-121) has stated, on the basis of an artifact analysis, that two cultural components are represented at the site. The first occupation of the site, dating prior to 2000 B.P., was by Early Maritime Woodland people, while the second component represents a Middle Maritime Woodland occupation of the site. The distribution of the radiocarbon dates supports the two component interpretation of the site, even when the dates are extended to a two standard deviation range. Bishop has suggested that there was a hiatus in occupation at the site between the two components.

BgDr 49 has not been dated by means of radiocarbon analysis. However, all of the artifacts recovered in the vicinity of the site are historic ceramics, glass, and nails, suggesting that BgDr 49 is an historic shell deposit.

Paleogeographic Reconstruction:

The effects of coastal erosion and inundation on the archaeological resources of the Maritimes have been discussed

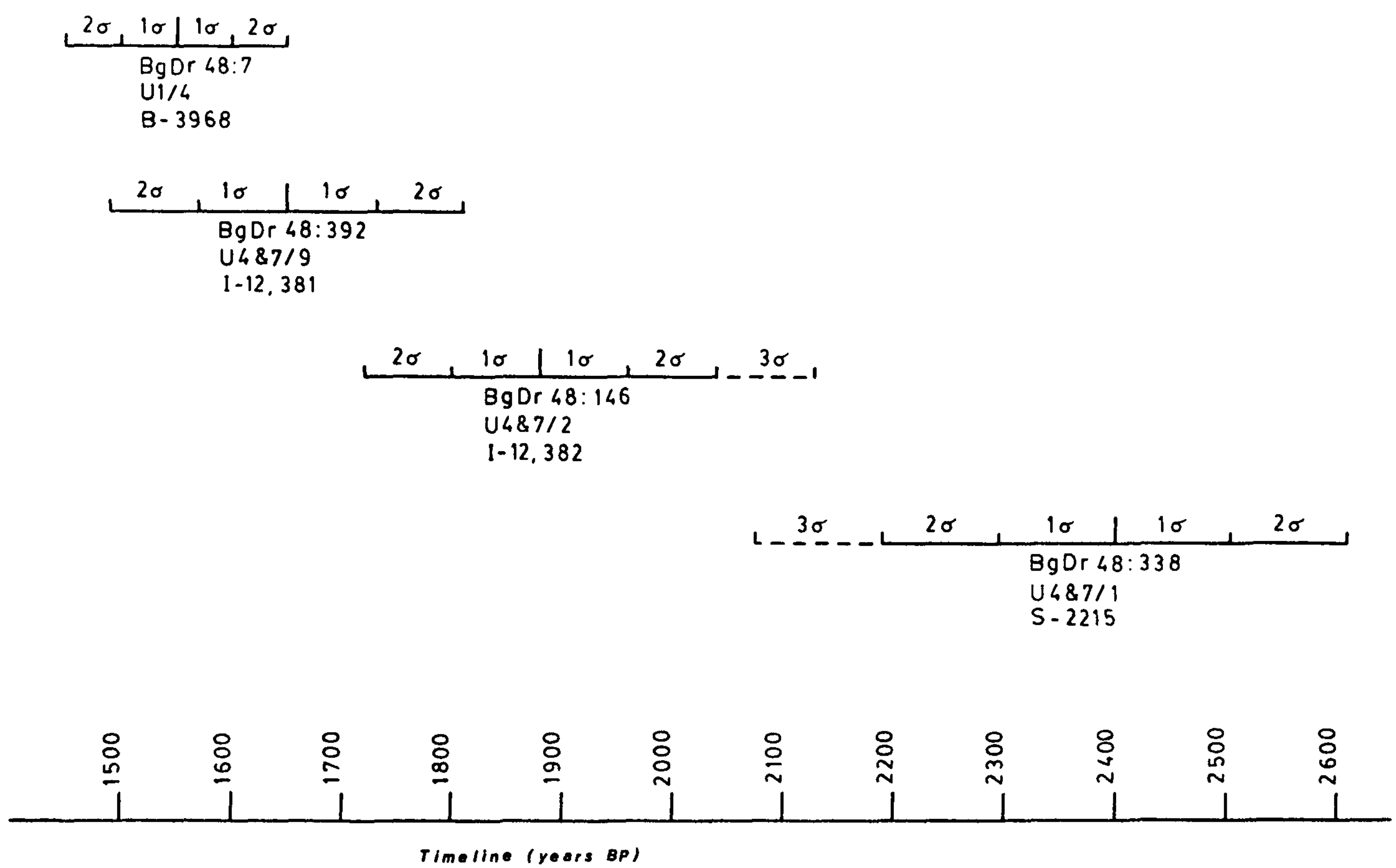


FIGURE 6: BgDr 48 Radiocarbon Dates.

by several authors (see especially Simonson 1979; Davis and Christianson 1979). It is difficult to determine with any precision the former extent of any site subject to erosion. However, some tentative inferences can be made concerning past conditions at Partridge Island.

The main tools used in this reconstruction are Grant's (1970) description of the processes of sea level change operating in the Bay of Fundy, and a knowledge of the topography and bathymetry of the Partridge Island area. Grant has suggested that the main forces are a rise in mean sea level relative to the land's edge of about 15 cm. per century, compounded by an increase in tidal amplitude, that is, the range of the tide above mean sea level, over the past 4000 years (1970:686, and Figure 15). The effect of these trends on mean sea level and the size of intertidal zones in the Partridge Island area are illustrated graphically in Figure 7. Mean water level has risen about 6 meters in the past 4000 years, while tidal range has more than doubled from 3.4 meters 4000 years ago, to about 8.0 meters at present. Because of the nature of change in tidal amplitude, the low water level has risen only 3.7 meters in 4000 years, while the high water level has risen about 8.3 meters. At 1550 B.P., the most recent BgDr 48 date, mean water level was 2.3 meters lower than present, and the tidal range about 8.0 meters. At 2400 B.P., the earliest BgDr 48 date, mean water level was 3.6 meters lower, and the tidal range about 8.0 m.

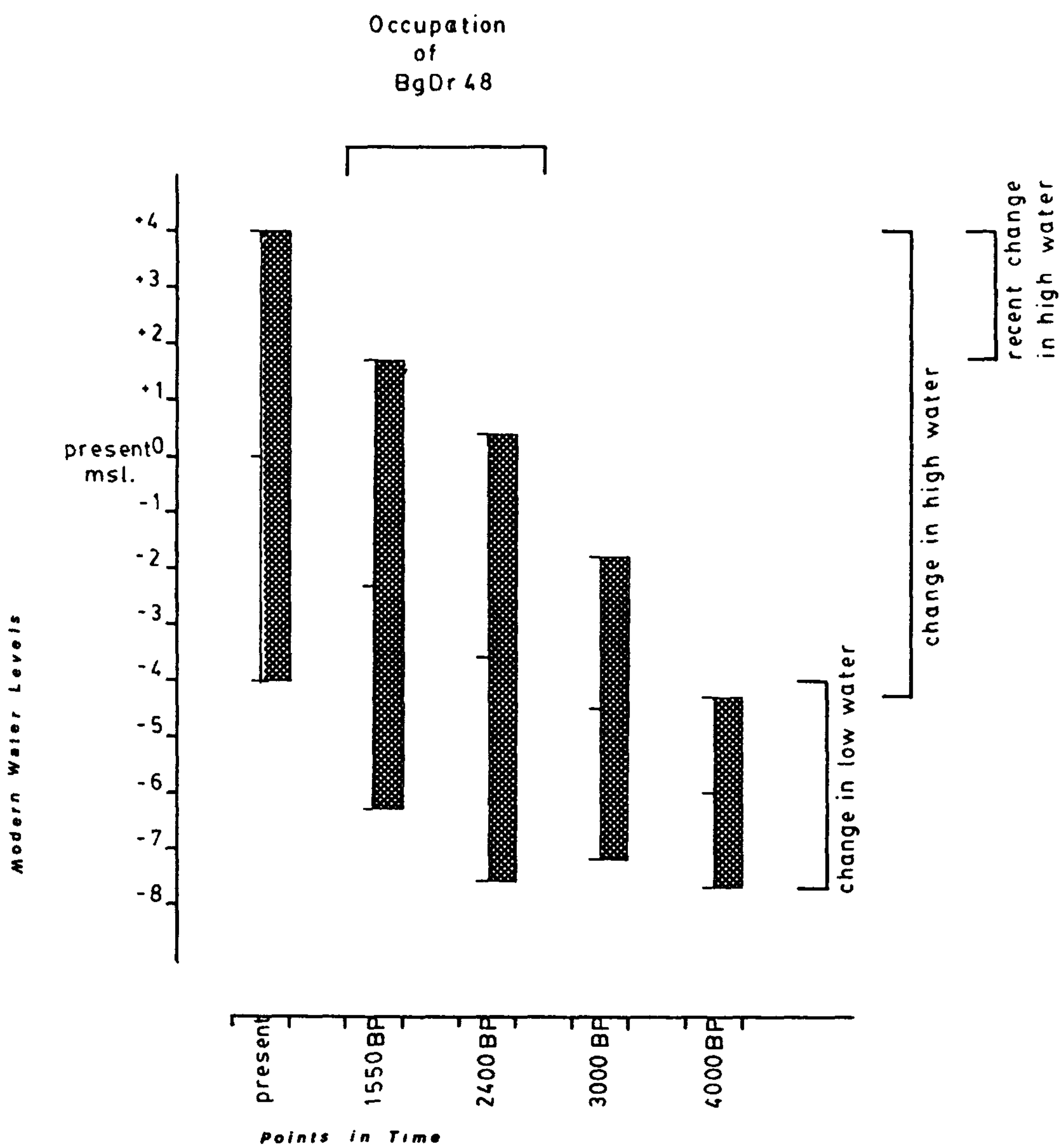


FIGURE 7: Changes in Mean Sea Level and Tidal Range.

It should be stressed that these figures are estimates only. Neither radiocarbon dating, nor Grant's geomorphological models are precise enough to allow firm conclusions to be drawn about specific events. The present geomorphology and bathymetry of the Partridge Island area are shown in Figure 2. For comparison, the same area is shown in Figure 8, but here estimated high and low water lines are shown for the dates 1550 B.P. and 2400 B.P. This reconstruction makes the untenable, but unavoidable, assumption that erosion associated with inundation has been minimal. In spite of the uncertainties, some interesting observations are possible.

First, at 2400 B.P., major tidal amplification had already taken place, and tidal range was near its present level. Second, the area of the intertidal zones around Partridge Island was almost certainly larger in the past, and has been progressively reduced in size since then. In earlier times proportionally larger parts of the intertidal zones may have been at lower gradients. Third, during most of the occupation of BgDr 48, it would probably have been possible to walk from Deer Island, across Crow and Partridge Islands, to Parker Island, at low tide. Since it is not possible to control for the effects of erosion, the possibility that dry land connections between some or all of these islands existed during part or all of the occupation must

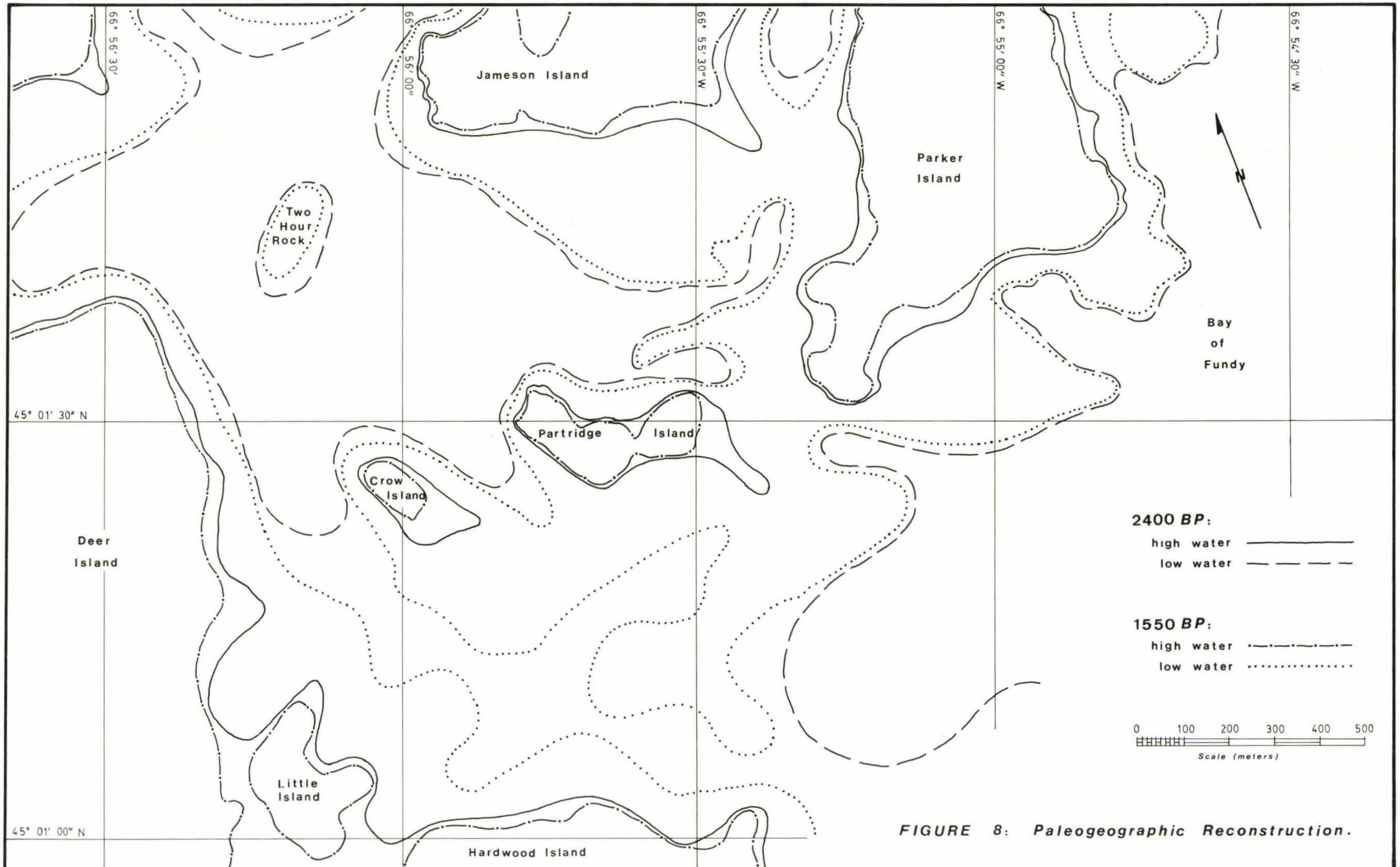


FIGURE 8: Paleogeographic Reconstruction.

be entertained. It is almost a certainty that the division of Partridge Island into two parts is a recent event. Fourth, the latest date from BgDr 48 roughly corresponds to the time when Irish Channel would have become permanently awash, separating Crow and Partridge Islands from Deer Island. It is tempting to conclude that the rapid reduction in island size and in the size of the local intertidal zones since that time, and the increasing isolation of Partridge Island, were factors in the subsequent abandonment of BgDr 48.

Finally, it is obvious that substantial parts of the cultural deposits at Partridge Island have been lost to erosion. In the report of their coastal survey, Davis and Fergusson (1980) suggested that much of BgDr 49 was eroded when the intertidal bar formed. This may also have been the case with BgDr 48 if the site formerly extended to the east. It is worth re-emphasizing the facts that Partridge Island is predominantly bedrock cored, and that the intertidal zones adjacent to the sites are at steep gradients; these factors have probably prevented more serious erosion from occurring. It is the absence of bedrock core which has allowed the extensive erosicn where the intertidal bar now exists.

CHAPTER 3:

SAMPLING, STRATIGRAPHY, AND PRESERVATION.

> One of the most ancient human habits must be the passion to dig in the earth for precious objects. Archaeological excavation may be said to be one of the more recent forms of that passion! (Harris 1979:15)

SAMPLING.

Excavation Methods:

Two distinct methodologies were used to sample the cultural deposits on Partridge Island; one of these involved excavating units in arbitrary levels, the other involved excavating sample columns according to the recorded natural and cultural layers. Both excavation units and columns were placed according to judgemental criteria and not according to any preordained sampling strategy. The locations and dimensions of these excavation units and columns are shown in Figures 3 and 9.

Excavation units of several sizes (1 $m.^2$, 4 $m.^2$, and 5 $m.^2$) were used to open up stratigraphy at the shoreward edges of the sites, at the treeline, and at several intermediate points, and at off-site locations. These units were excavated in 10 cm. arbitrary levels (except Unit 3,

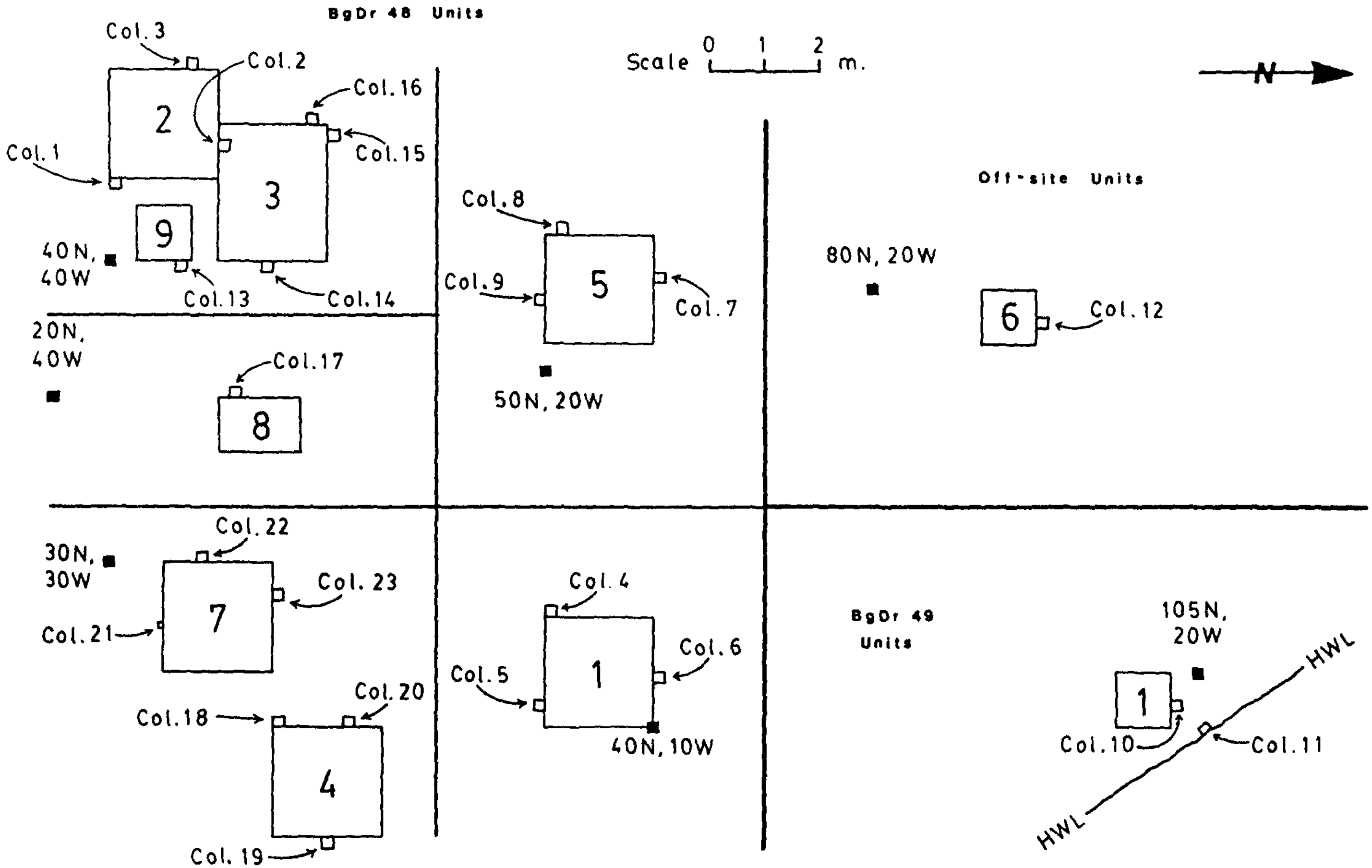


FIGURE 9: Column Sample Proveniences.

where 5cm. levels were used). All excavation was by trowel; excavated material was completly screened through 6mm. wire screen, and all bones, artifacts, and other objects of interest were saved for further analysis. Where it was possible to distinguish within arbitrary levels between material from shell deposits, and from gravel or humic deposits, this distinction was made in sorting the level material. In all, 8 such units were excavated in the BgDr 48 deposit, 1 adjacent to the BgDr 49 deposit, and 1 at a midpoint between the two sites.

After the completion of each of these excavations, each profile of each unit was drawn in order to record the natural and cultural stratigraphy of the sites. The second sampling procedure involved the excavation of a series of 20 $cm.^2$ columns into stratigraphy revealed by the excavation units. Each column consists of a series of column samples numbered sequentially as each was excavated from the top to the bottom of the profile. Column samples, in contrast to the excavation units, were excavated according to non-arbitrary layers in the stratigraphy. In most cases each column sample represents a single layer; where apparently unstratified deposits of greater than 10 cm. depth were encountered, these were subdivided into sequential arbitrary 5 cm. levels. In one case (Column 21) a finely stratified massive midden deposit was sampled using a 10 $cm.^2$ column and arbitrary 2 cm. levels. All material from each column was qualitatively described, dried and packaged, and returned to the lab for further analysis.

Columns were located at places where the stratigraphy was considered to be interesting, and to some extent, at locations where the maximum number of layers would be intersected. As a result of this sampling procedure, column samples varied widely in volume and weight, and the number of samples per column also varied. Each stratigraphic unit in the sites is represented by a different number of samples. Columns were carefully profiled so that the volume of each sample could be calculated, and this measure could be used as a common denominator for quantitative studies of the cultural contents of the columns.

In total, 23 columns were excavated, comprising 262 column samples. One column was excavated per each 2.75 meters of stratigraphy exposed. Of these, 20 columns were located in the BgDr 48 deposit, 2 in the off-site units, and one in the BgDr 49 deposit. Examples of columns and column samples are shown in the stratigraphic diagrams in Appendices B and D.

Additional soil samples were occasionally taken during the excavation; these were processed in a manner similar to the column samples.

The cultural deposit at BgDr 48 is approximately triangular in shape, and measures about 800 $m.^2$ in area. Assuming an average depth of deposit of about 40 cm. (based on the average depth of cultural material in the excavation units), the volume of the site is approximately 320 $m.^3$. The amount of cultural material excavated from BgDr 48, including both excavation units and columns, was 11.58 $m.^3$, or about 4% of the site. The column samples included 0.42 $m.^2$ of cultural material; thus about 4% of the excavated material was returned to the lab for examination.

The shell deposit at BgDr 49 proved, upon investigation, to be very small indeed. The 1 $m.^2$ excavation unit located adjacent to the site exposure and within 0.5 m. of the high water line failed to intersect the deposit. It seems unlikely that the site is larger than 1 $m.^2$ in area, and it averages only 2 cm. in depth. A 20 $cm.^2$ column was excavated into BgDr 49 on the erosional face of the site at the beach. The faunal remains from the site are from a single column sample of about 2000 $cm.^3$ size; this sample probably represents about 5% of the site.

It should be re-emphasized at this point that the sample sizes discussed here are measured in terms of site size at the time of excavation. The sites are being constantly eroded, and no attempt will be made to relate these sample sizes to the original sizes of the sites.

Analytical Methods:

The faunal remains recovered from the excavation units consisted mainly of bones and fragments of greater than 6 mm. in size. Some complete specimens of the rarer invertebrate species were also saved from these units. These remains were analysed using the arbitrary levels in which they were excavated as analytical units. The bones were sorted according to taxonomic class, and where possible, were identified to smaller taxonomic groups. Other aspects of the bone remains which were recorded included evidence of butchering, and of burning or charring, evidence of fragmentation and surface alteration, and evidence of the age and sex of the animals represented in the assemblage. The data resulting from this analysis is included in Appendix G.

In so far as was possible, these faunal remains were grouped and interpreted according to the cultural stratigraphic components outlined below. Unfortunately, the arbitrary excavation units tended to crosscut the cultural strata, and in some cases confused, rather than clarified, the faunal record.

The column samples were analysed with the intention of examining the details of midden accumulation, and of measuring the differences in faunal content between the cultural strata. In particular, the columns were intended to facilitate recovery of plant remains, of faunal bones smaller than 6 mm. in size, and of adequate samples of invertebrate remains.

In the lab, each of the column samples was described carefully and the presence or absence of humic soil, gravel, shell remains, bone remains, and plant remains was noted. Each sample was first screened through a 3 mm. mesh to separate it into two fractions, large particles and small particles. The large particle fraction was then examined macroscopically, sorted into shell, bone, plant and mineral, categories, and the specimens identified and described. Two 50 cc. subsamples were taken from the small particle fraction of each sample. One of these subsamples was examined macroscopically and miroscopically (using a 10X - 25X stereozoom microscope). The second subsample was floated and all carbonized and uncarbonized plant remains were removed, dried, and examined. If any remains of particular interest were discovered in either of these subsamples (for example, small fish bones, or carbonized seeds), then the remaining small particles of the sample were completely examined for similar remains.

Whenever possible, the plant, bone, and shell remains from column samples were identified to the smallest possible taxonomic classification. The results of these identifications are included in Appendix F. These remains were, of course, much more easily reconciled with the stratigraphic components.

Soil and mineral components of the sites were described according to two criteria, colour (measured using Munsell charts), and shape (measured using charts from Shackleton 1978:48, 50). Qualitative assessments were also made of charcoal and fire-cracked rock present in each sample.

In addition to this general examination of each column sample, several columns, and individual samples were selected for more detailed quantitative examinations, and for specific analytical tests. For example, columns 13, 17, 20, and 21, which intersected all of the major stratigraphic units, and represent remains from four different areas of BgDr 48, were selected for the quantitative analysis of invertebrate remains. All of the shell from each sample in the four columns was sorted by species, weighed, and the proportion of each species per sample by weight was recorded. The proportions of the most common species were then recalculated using meat:shell ratios in order to estimate their importance relative to one another. The amounts of charcoal, gravel, fire-cracked rock, and fine organic and mineral particles (less than 3 mm. diameter), were also quantified in these columns. Details of the methods used, and the results obtained, in these analyses are contained in Appendix D.

Thirty-eight of the column samples were selected for pH measurement of the various deposit types on and off the sites. The details and results of this analysis are given in Appendix C.

Finally, the cultural stratigraphy at Partridge Island was analysed in as much detail as possible using the principles developed by Harris (1979). Details of the stratigraphic analysis are contained in Appendix B; the balance of this chapter is devoted to a summary of the depositional history of the Partridge Island sites, and an evaluation of the stratigraphic integrity of the sites.

STRATIGRAPHY.

Off-site Soil Horizination (Figure B-1):

Soil horizonation at Partridge Island is relatively simple. The soils correspond to the brown podzols described by Strahler (1973:224-225). Horizons bleached by extreme elluviation were not observed. In general A horizons consist of partially decayed organics underlain by a layer of fine organic particles mixed with some mineral soil; these range in colour from very dark browns to black. B horizons consist of poorly or unsorted gravel and silt mixtures stained yellow-red and yellow-brown by illuviation and humic staining from the organic layers above. Transitions from A to B horizons tend to be abrupt. C horizons consist of bedrock.

There is little obvious difference between A and B horizons on the sites, and those off-site, except that the on-site horizons are mixed to some degree with cultural materials. Cultural layers are sandwiched between these natural soil horizons.

BgDr 49 Depositional History (Figure B-2):

The site consists of a single layer of shell deposited onto the subsoil (B horizon). This shell is mixed with a brown organic and mineral topsoil (A horizon) which may have been deposited with the shell, or which may represent soil formation prior to the deposition of the cultural material. The surface of this gravel has been partially stabilized by soil formation. Apparently, after the deposition of the beach, the shore edge was eroded resulting in the present exposure of the site.

BgDr 48 Stratigraphy:

The description of BgDr 48 stratigraphy falls into three parts. First, the criteria upon which stratigraphic definition depended are discussed, and the major matrix constituents described. Second, the depositional sequence of each excavation unit, or group of units, is described. Finally, these depositional histories are related to one another in order to produce an overall stratigraphic sequence for the site.

Matrix Constituents:

Three main constituents were considered in defining and describing the stratigraphy of the site: shell, gravel, and fine soil particles. The contrast between deposits which were mainly shell and those which were mainly gravel was the main stratigraphic distinction considered during excavation. Three types of shell deposits were recorded on profiles; these were 1) those in which whole or slightly fragmented shell predominated, 2) layers where finely fragmented shell predominated, and 3) small lenses consisting mainly of one shell species. The latter type proved impossible to isolate for analytical purposes. Shell layers were generally white or light mauve in color.

The gravel deposits consist of particles of local origin which superficially resemble the gravel deposited as storm beaches on Partridge Island at the present time. The color of the material is olive green (Munsell color 5YR 4/2), sometimes reddened (to 10YR 6/6) possibly by contact with fires, but more probably by illuviation staining. Closer inspection of the gravels indicates that the particles are generally more highly rounded (rounding index 0.6; sphericity index 0.85) than are the gravels formed now at the island (rounding index 0.1; sphericity index 0.55). This may indicate that a higher energy tidal regime operated at Partridge Island during the aboriginal occupation.

The occupants of the site apparently brought large amounts of this gravel onto the site at all stages of the occupation. The gravel was used as a base for living floors and hearths, and as fill for other features.

These cultural gravels are easily distinguished from the generally larger angular fragments of bedrock which often occur in the cultural layers. Most of these larger rocks were also probably brought on-site by the inhabitants, although some may derive from subsoil sources.

Fine mineral and organic soil content was also considered in defining stratigraphy. The colors of these materials range from black (Munsell color 2.5YR 2/0) to yellow-brown (10YR 5/6) to grey (7.5YR 7/2). Generally, darker materials occur near the surface of the site and contain more organic contents; lighter colored materials occur deeper in the site and contain more mineral particles. This probably indicates that the site contents are subject to natural soil horizonation.

However, almost all of the living floor and other gravel features in the site, especially those on which bones and artifacts occurred, exhibit layers of black greasy humic soil at their surfaces. This material may be predominantly cultural in origin.

Depositional History, Units 4 and 7 (Figures B-3, B-4, D-2, D-4, and Plate A-4):

The surface of the subsoil in these units, especially in Unit 7, is partially covered by granitic boulders and pieces of bedrock. These rocks were probably exposed by deflation or frost action, although some are firecracked and may have been culturally transported. On and around these rocks is a thin layer of black greasy soil which completely covers the subsoil. A few small lenses of cultural gravel are associated with this soil, stratigraphically above it. The soil layer contains cultural material and may represent a living floor deposit.

A compact layer of shell overlies part of this soil, and is in turn overlain by a more extensive series of thin gravel layers. This deposit probably represents the episodic construction and occupation of living floors, and associated shell dumping. The floors contain small amounts of shell and charcoal; at the surface of the layer is an intact hearth feature containing ash and charcoal.

Most of Units 4 and 7 were subsequently covered by a deep layer of shell remains. The shell is partly overlain by living floor and soil layers, but in places extends to the surface of the site. In Unit 4 the shell is stratigraphically below the floors, while in Unit 7 the two types of deposit are interdigitated and probably at least partly contemporaneous. Early in the deposition of the gravel layers two deep pits were dug through the shell layer into the subsoil. These were subsequently filled by deposits of soil and gravel.

Several small shallow pits, probably contemporaneous with the later living floors, were excavated into the surface of the shell midden. Later, shell from the midden, mixed with black soil, was spread over parts of the living floors and filled the small pits. This may have been the result of either cultural trampling or natural soil formation. Several centimeters of soil then formed over the area.

Depositional History, Unit 8 (Figures B-5, D-6):

There is no evidence of a pre-occupation soil formation on the surface of the subsoil in this area. The subsoil is overlain by a thick layer of cultural gravel mixed with black soil and cultural material, representing the construction and occupation of a living floor. Parts of this floor are covered by a thin layer of pure gravel in which no cultural material was evident. Shell from the layers above is only very slightly mixed into the surface of this floor.

Above the gravel layer the whole unit is covered by a thick shell deposit, the lower part consisting mainly of whole valves and large fragments, and the upper part mainly of finely fragmented shell. The whole shell layer is the purest shell midden deposit found at the site; the fragmented shell contains much larger amounts of gravel and soil particles.

Over the surface of the shell several centimeters of black humic soil have accumulated.

Depositional History, Unit 5 (Figures B-6, B-7):

Unit 5 is partly underlain by bedrock and partly by a yellow-brown subsoil; patches of black soil above the subsoil suggest a period of soil development prior to the cultural occupation. The cultural stratigraphy of Unit 5 is the most complex observed in the site, and the interpretation presented here is probably oversimplified.

Small patches of shell deposit, and perhaps a substantial shell midden, seem to have been the initial layer at this area. Later, either in this unit or adjacent to it, the midden was disturbed by a sizable excavation into the subsoil -- the result is a deposit of unstratified rocky subsoil mixed with marine shell, which extends almost to the surface of the unit in the southwest quadrant.

Next a complex series of small superimposed gravel layers were deposited over the northeastern quadrant of the unit. Contemporaneous, or perhaps subsequent to this, a few small shell lenses were dumped at other points in the unit. These events were followed by the construction and occupation of an extensive gravel living floor in a depression in the northwest quadrant of the unit. This depression subsequently became filled by an accumulation of peat soil; finally the entire unit was covered by several centimeters of soil.

Depositional History, Unit 1 (Figures B-8, B-9):

The cultural layers in this unit partly overlie bedrock, and partly a yellow-brown subsoil. There is no evidence of a pre-occupation soil development, and the surface of the subsoil has been disturbed and mixed slightly into the lower cultural layers.

Several small shell lenses occur on the surface of the subsoil and the bedrock. These are partly overlain by small gravel layers in which there is little evidence of cultural activity. However, the entire unit has been covered by a thin but extensive gravel and black soil layer which represents the construction and occupation of a living floor.

A considerable accumulation of peat soil overlies this floor, and is in turn covered by a mat of roots, conifer needles, and undecayed vegetation.

A small fir tree is growing adjacent to the unit.

Depositional History, Units 2, 3, and 9 (Figures B-10, B-11, and D-8):

This cluster of units is located at the treeline on the extreme landward edge of the site. The cultural layers are superimposed on bedrock and on a layer of yellow-red rocky subsoil. Sporadic thin patches of black soil, and concentrations of angular bedrock fragments, indicate an initial period of soil formation. This soil is devoid of obvious signs of cultural activity, but the rocks may derive from cultural and/or natural sources. The soil layer has been intruded and disturbed by later cultural activity.

At least two, and perhaps three or more, stages of living floor construction and occupation have taken place in this area of the site. First, a deep excavation was dug in the area between Units 2 and 3; the disturbed subsoil from this excavation was dumped at the west end of Unit 3 and in the area between Units 2 and 9. Subsequently, the excavation was filled with cultural gravel, but the resulting deposit contains little evidence of cultural activity.

The whole of Unit 9, the southern half of Unit 2, and the eastern half of Unit 3 were then covered by a thick accumulation of shell midden. This accumulation may have been partly contemporaneous with the occupation of the floor described above. The gravel and soil content of this midden is minimal.

Subsequent to the shell dumping another series of living floor constructions took place in the Unit 3 area, and the northern half of Unit 2. Circular depressions, partly superimposed on one another, were excavated into the edge of the shell midden and the adjacent subsoil. These depressions were filled with a series of gravel and black soil layers mixed with cultural material. At some point part of these living floors were bounded by a semicircular ring of stones in Unit 2. Possibly contemporaneous to these floors is evidence for the occupation of the surface of the shell deposit in Unit 9, in the form of a thin gravel and soil layer over part of the shell, and two small depressions in the shell, the latter possibly indicating post-holes.

A second episode of shell accumulation then took place over part of the previous midden, especially in Unit 9; this shell is capped by a thin layer of gravel and charcoal as was the previous midden. This midden is probably contemporaneous to the later living floors in Units 2 and 3.

The upper shell layer has been trampled over parts of the living floors subsequent to their occupation, either by cultural activity or by natural bioturbation, forming a thick layer of black soil and shell. Finally, several centimeters of black soil has formed over most of the area.

<u>The Generalized Stratigraphy of BgDr 48</u>:

The depositional history of BgDr 48 is complex and spans at least the past 2400 years. The relationships between strata in non-contiguous excavation units are impossible to ascertain with certainty except where strata are datable by some absolute means. However, it is possible to generalize about the site, integrating data from radiocarbon dates, unit depositional histories, and the culture history record, to suggest an overall depositional sequence for BgDr 48. Figure 10 is an attempt to integrate these data.

Bishop (1983:25, 38-50) has presented a description of the BgDr 48 stratigraphy in terms of features (hearths, pits, floors) assigning each feature to cultural component 1 or 2. These units of analysis did not prove to be practical in terms of a faunal analysis of the site. Here, the BgDr 48 stratigraphy will be discussed as a sequence of four main stratigraphic components, each of which is characterised by a distinct faunal assemblage.

In Figure 10 the horizontal bars represent the natural and cultural layers of the site, and the vertical bars the excavation units. The correspondence between stratigraphic components and cultural components is shown on the right side of the diagram, and the radiocarbon dates on the left. Layer A represents the post-depositional topsoil development on the site, layer B the subsoil beneath the site, and layer C the bedrock.

Stratigraphic component 1 (see Figures B-3, D-4, and Plate A-4) is a thin living floor composed mainly (50% or more) of fine black or brown mineral and organic soils mixed with charcoal, and having a greasy texture when wet and a sub-

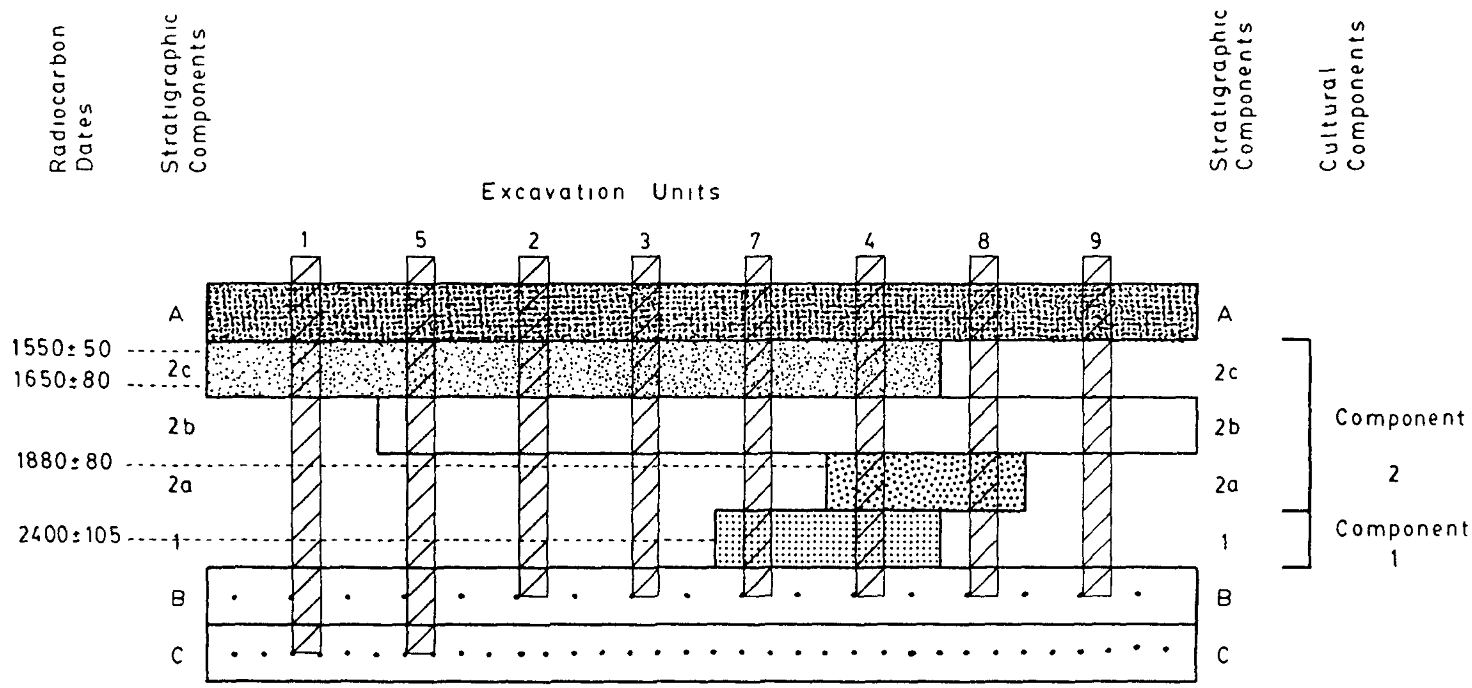


FIGURE 10: Composite Schematic Diagram of BgDr 48 Stratigraphy.

angular blocky texture when dry. This soil overlies the subsoil directly, has only a trace of shell content, and is associated with a few small lenses of cultural gravel. This component is intersected by Units 4 and 7 only. It equates to Bishop's cultural component 1 (1983:119) and features 8 and 14 (1983:38), and is dated by the 2400 ± 105 B.P. radiocarbon date.

This layer has been classed as a living floor. It may be completely anthropogenic, or it may represent a natural soil altered by cultural activity and burial.

Stratigraphic components 2a, 2b, and 2c, all equate to Bishop's (1983:121-122) cultural component 2.

Component 2a consists of at least one very densely packed shell deposit (Figure D-4, U4&7/2) containing only small amounts of gravel and soil, and a series of living floor deposits (Figures B-3 and D-4, U4&7/2) in Unit 4, and the living floor at the bottom of Unit 8 (Figures B-5 and D-8, U8/1). In both units component 2a is covered by dense shell deposits. The living floors in this component consist of fine rounded gravels (50-80%) in Unit 4, and course rounded gravels (93%) in Unit 8. Only small traces of shell are present, as are small amounts of ash and charcoal. Soil particles, generally black in color, make up 10-30% of the deposits.

Component 2a is dated at its upper limit by the 1880 ± 80 B.P. date in Unit 4; it has not been absolutely dated in Unit 8. This stratigraphic component was not assigned feature status or described by Bishop.

Component 2b consists of a layer, or series of layers of concentrated shell deposits which cover most of the site. In most areas this layer is comprised of 50-90% marine shell remains, and almost certainly represents a considerable period of shellfish exploitation. Fine mineral and organic particles are minimal in the deposits (usually less than 10%) but increase in amount toward the surface of the site.

This component has not been dated because of the absence of concentrations of charcoal in it. Minor lenses of gravel and black soil occur in the shell; these probably represent short-term occupations of midden surfaces. Several excavations associated stratigraphically with component 2c extend into and sometimes through 2b. Component 2b was intersected by all the excavation units except Unit 1; the small shell lenses in the latter unit may represent the same depositional episode.

Component 2c is the most complex part of the BgDr 48 sequence. It will not be treated in detail here because most of the features in it have been described in detail by Bishop (1983:38-50). This component consists of gravel deposits representing floors, pits, and hearths. It includes a feature in Units 2 and 3 which conforms to Sanger's (1971:17) descriptions of semi-subterranean house-pits; the living floors at the surface of Unit 4 may represent another such feature. These two features contain the densest concentrations of vertebrate faunal remains in the site.

In general component 2c consists of fine black soils mixed with gravel. Organic soil particles usually predominate (50-60%) near the surface, and contain some aggegations when dried. Gravels predominate in the lower layers of the component (60-70%), and these areas generally exhibit little evidence of cultural activity. Areas where charcoal and other cultural materials are present often have significant inclusions of shell debris (10-20%).

The stratigraphic relationship between components 2b and 2c is not completely clear from the stratigraphic analysis. There is some evidence that the two components were deposited simultaneously, especially in Units 3 and 7, but in most cases the 2b shell deposits are stratigraphically below the major 2c living floors. Where the shell overlies these features it appears to be the result of post-depositional disturbance of midden surfaces. This stratigraphic relationship will be considered further in the context of faunal assemblages.

Two radiocarbon dates pertain to component 2c. These are the 1650 ± 80 B.P. date from Unit 7, and the 1550 ± 50 B.P. date from the living floor in Unit 1. It is impossible to ascertain, given the present data, whether the latter is a reliable estimate of the final occupation of the site, or how the living floors in Units 2 and 3 relate to these dates.

This analysis of the stratigraphy of BgDr 48 does not differ materially from that of Bishop. The distinction between components 1 and 2 has been maintained, but component 2 has been subdivided into 3 superimposed stratigraphic units according to principles not used in Bishop's analysis. Where Bishop delineated features according to their shape and contents, and relegated shell to the background, this analysis has treated shell as a structural component equal to the others, and has treated shell layers as features.

At one point the two analyses do differ with regard to interpretation. Bishop (1983:55) has suggested that the earliest living floor and hearth features in Units 2 and 3 are associated with the component 1 occupation. Given the complex depositional history of these units, and the lack of faunal (see below) and artifactual (Bishop 1983) evidence for this association, all of the features in this area have been assigned to component 2c in the present analysis. The adjacent shell middens have been assigned to component 2b.

PRESERVATION AND STRATIGRAPHIC INTEGRITY.

The following section evaluates the effects of physical factors in disturbing the site stratigraphy and the preservation of cultural materials at Partridge Island. Three factors are considered: deposit acidity, biophysical turbation, and erosion.

Acidity (see Appendix C for details):

Podzolic soils, especially those in areas where precipitation is abundant and coniferous trees are common, tend to be acidic. The average pH of soil samples from Partridge Island was 6.94 for A horizons (range 6.30-7.30), and 6.07 for B horizons (range 5.80-6.40). The peat soils which cover parts of BgDr 48 tend to be more acidic, averaging pH 6.03 (range 5.20-7.10). None of these soils is extremely acidic, but it seems unlikely that unburned bone or shell in small quantities would be preserved for long periods of time in such conditions, and indeed no such remains were observed in soils off-site at Partridge Island except very occasionally on the surface.

The natural acidity of the Partridge Island soils is modified on the archaeological sites by the presence the substantial deposits of marine shell . The average on-site pH is about 8.0, with shell deposits and living floors exhibiting the highest alkalinities (average pH 8.16 and 8.06, respectively). The topsoil layers on the sites have remained rather acidic (average pH 6.03), but the subsoil deposits have been neutralized (average pH 7.82) probably by illuviation of calcium carbonates from the shells above.

The potential for bone preservation at the Partridge Island sites is thus very good. This has typically been the case in other Passamaquoddy Bay middens. However, some variability in acidity was noted at BgDr 48, and should be emphasized.

Acidity is greater at the peripheries of the site (Units 1 and 3). In the case of Unit 3 this seems to have little effect on preservation and considerable amounts of bone were recovered from the unit. In the case of Unit 1 soil acidity has been increased by the presence of the peat deposit, and the absence of substantial shell deposits. Only a few pieces of bone were recovered from Unit 1 and these, significantly, are mostly calcined fragments. It is possible that the faunal sample from Unit 1 has been prejudiced by excessive acidity. Elsewhere in the site bone preservation is excellent, although there is a slight tendency for the quality of preservation to decrease with depth.

Biophysical Turbation:

Biological activity on Partridge Island is minimal due to the small size of the island. Several species of insects and other soil fauna, and small burrowing mammals (mice and voles) were observed during the excavations. The activities of all of these creatures seem to be restricted to the topsoil layers above the sites. Ants probably play a role in mixing shell material into the topsoils. Rodent burrows were observed in the sites only in Units 2 and 3 where the shell content was minimal.

Since shell deposits inhibit the growth of coniferous trees, and the sites are presently unforested, it seems unlikely that tree falls have played a significant role in site disturbance.

The effect of frost heaving on such sites is difficult to assess, but there are no obvious signs of frost disruption below the topsoil layers.

Historic artifacts are restricted to the topsoil matrices in the BgDr 48 site which suggests minimal post-depositional disturbance of the aboriginal cultural deposits (Bishop 1983:23).

In brief, it seems reasonable to suggest that natural biophysical factors and post-depositional cultural activity have played a minimal role in disturbing the sites. However, cultural disturbances during the deposition of the sites, and the process of internal collapse of site materials may have significantly disturbed their cultural contents. These factors are assessed below in the context of the distribution of faunal remains.

Erosion and Preservation:

The role that increases in sea level in the Bay of Fundy area have played in the erosion of the Partridge Island sites has been referred to above (page 37). Here, erosion will be considered in the wider context of several Passamaquoddy Bay sites. In spite of shoreline erosion a cultural deposit of about 2400 years in age was dated at BgDr 48. Most of the sites excavated around Passamaquoddy Bay have been recognised to be multi-component sites, but only two have yielded radiocarbon dates comparable or nearly comparable in age to the oldest BgDr 48 date: these are BgDs 6 (1900 ± 100 B.P.) and BgDs 10 (2370 ± 80 B.P.). At the other multi-component sites component 1 artifacts were apparently without definite stratigraphic context (for example, Davis 1978:36). Even at BgDs 6 and BgDs 10 the older dates were not associated with a specific context, although the presence of charcoal concentrations indicates the presence of intact deposits dating to the measured antiquity. The following data are presented in support of a tentative explanation as to why earlier dates were obtained from these sites, but not from others. The explanation offered here implicates local geomorphology as a significant selective force in determining where and whether component 1 deposits will be preserved.

BgDs 6 and BgDs 10 can be compared favourably with BgDr 48 in several respects, and these three sites can be contrasted with other Passamaquoddy Bay sites. First, the three sites with early dates all exhibited complex stratigraphy in contrast to the later simply stratified sites (see page 10). Second, the oldest radiocarbon dates from BgDs 6 and BgDs 10 are from excavation units which were located in the deepest area of the shell middens close to the modern shoreline (McCormick 1980:64, 66), as is the case with the oldest BgDr 48 date. Parenthetically, the oldest dates for BgDs 6 and BgDs 10 came from Pearson's excavations rather than Sanger's (McCormick 1980:63,65); the former apparently located his excavations in the deepest parts of the sites, while the latter in accordance with his interest in house-pits, tended to concentrate his excavations toward the rear of the sites. Thirdly, the sites at which old dates were recorded all occur in areas with steep foreshore slopes, while the sites where only later dates were recorded all occur in areas where foreshore slopes are at a low angle.

Figure 11 correlates foreshore slopes to radiocarbon dates for seven sites from Passamaquoddy Bay. The three sites older than 1800 B.P. occur where foreshore slopes are greater than 5°, while the four sites with dates later than 1800 B.P. all occur where foreshore slopes are less than 5°. With the exception of BgDr 48, the foreshore slopes used here were measured from charts; it would be desirable to have slopes measured in the field for all the sites.

Figure 12 shows hypothetical examples of the effect of water level increase on a deposit at two different angles of slope. In the first case, at an angle of 10°, 28.2% of the deposit is placed in immediate threat of erosion, while in the second case, the same water level increase, against the same deposit size, at an angle of 3°, places 76.6% of the deposit in immediate danger of erosion. This two-dimensional model ignores such variables as horizontal extent of the site, and the effect of a bedrock substratum. Bedrock outcrops are the common reason for steep foreshore slopes, and further retard erosion by preventing undercutting of surface deposits. Thus,

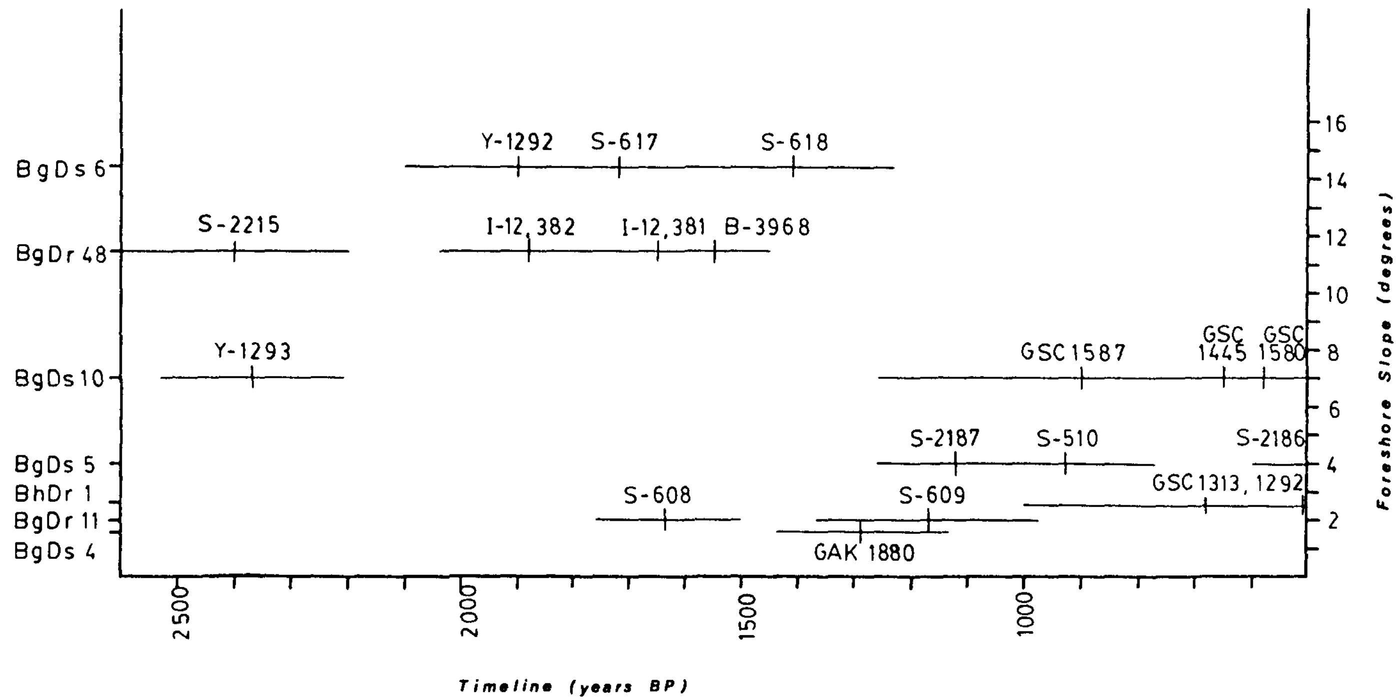


FIGURE 11: Relationship Between Foreshore Slopes and Radiocarbon Dates.

(sources: Wilmeth [illegible] :150; McCormick 19[illegible]: , 5; Sa[illegible]er [illegible]
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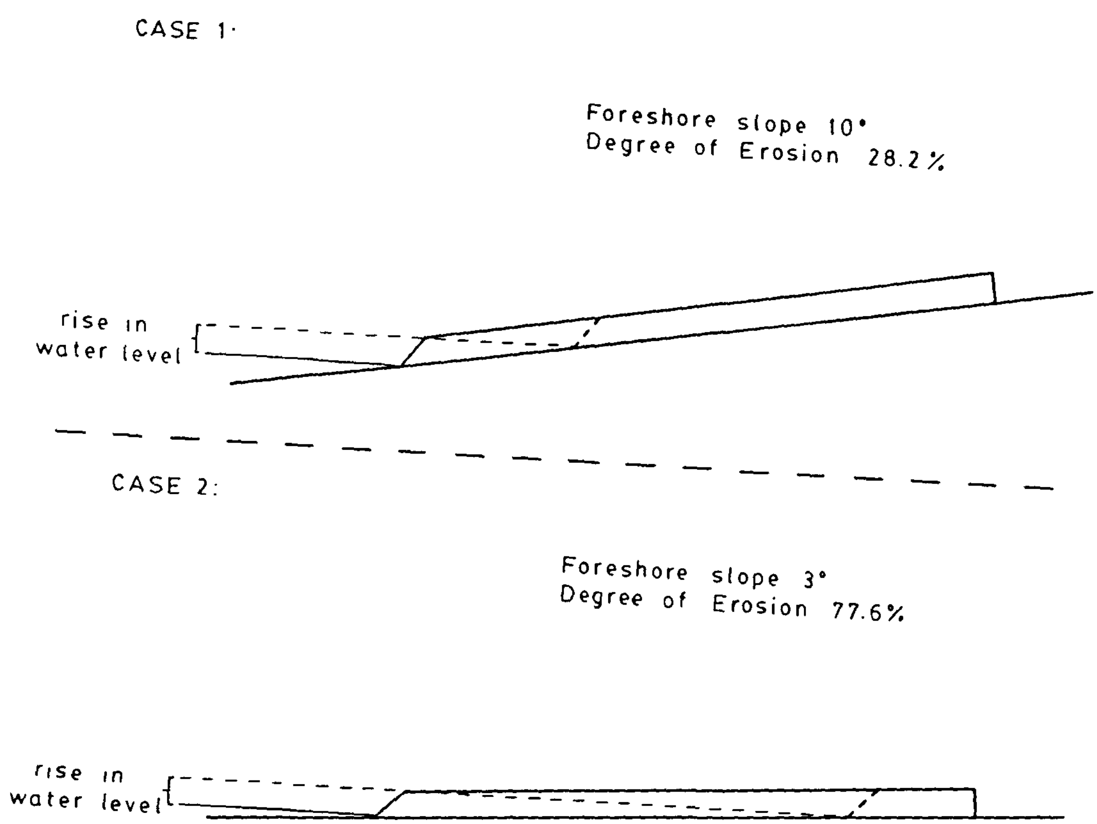

FIGURE 12: Hypothetical Effect of Foreshore Slope on Site Erosion.

if component 1 deposits are generally centered closer to the modern shoreline (because water levels were lower when they were deposited) than are component 2 and later deposits, component 1 deposits would be less likely to be preserved where foreshores are at a low angle of slope.

A sample of seven sites is hardly enough upon which to base firm conclusions; however, the correlation suggested here could be easily tested during future fieldwork. Also, it should be noted that preservation may not be the only factor involved in this correlation; Early Woodland people may have located their sites preferentially along steeper shores for cultural reasons. In spite of these uncertainties, two tentative suggestions can be made. First, it may be possible to use foreshore slope angles as a means of predicting sites where component 1 deposits are preserved; and second, the northern West Isles area, where foreshore slopes are commonly at higher angles than along the northern shore of Passamaquoddy Bay, may prove to be an important research area for archaeologists interested in Early Maritime Woodland exploitation of the southern coast of New Brunswick.

Finally, with regard to the extent of erosion, Yesner (1980:68) has estimated a loss to erosion of 30% of site areas for Casco Bay Woodland Period sites, where innundation is occurring at a rate of 0.07 cm./yr. Site area losses of 50% or more should be expected in the Passamaquoddy Bay area for sites of the same time period, since the innundation rate (0.30 cm./yr.) is so much higher.

CHAPTER 4:

BOTANICAL REMAINS.

> There is in certain places a store of strawberries and raspberries... in the woods small fruit, blue and red... There be a store of gooseberries like unto ours... And peas in great quantity along the seashores... (Lescarbot 1928:303)

The decision to sample for macrobotanical remains in the cultural deposits on Partridge Island was conditioned by two factors. First, one of the problems in evaluating the seasonality of Passamaquoddy Bay midden sites has been an inability to specify what type of faunal remains would indicate the summer occupation of a site on the coast (Snow 1980:302). It was thought that macrobotanical remains, if they were present in the sites, might provide a partial solution to this problem. Second, macrobotanical remains have been reported from one shell midden excavation (see page 5), and these indicated a summer occupation of the coast. This discovery was made 100 years ago, and has not been duplicated since, although this may be because the appropriate recovery techniques were not applied during the more recent excavations.

The botanic remains from BgDr 48 and BgDr 49 proved to be generally unexciting in terms of expanding our knowledge of aboriginal subsistence and seasonality; however, the distribution of these remains proved useful for the evaluation of post-depositional disturbance of the sites.

Macrobotanical remains were recovered from both the large and small particle fractions of the column samples, and by both flotation and dry sorting techniques. A relatively small amount of time and effort was expended in attempting to identify these remains, because, with few exceptions, they were uncarbonized, and unlikely to have been associated with aboriginal occupation. The distribution of these remains is discussed below in two categories, carbonized macrobotanics, and uncarbonized macrobotanics.

Uncarbonized Macrobotanics:

This category includes seeds, twigs, stems, and roots of woody and herbaceous plants, conifer needles, and the sclerotia of fungi. Several types of uncarbonized seeds were easily identifiable to genus -- these included cherry (Prunus pennsylvanica and/or Prunus virginiana), red elderberry (Sambacus pubens), raspberry (Rubus sp.), and gooseberry (Ribes sp.). Cherry and elderberry were not observed growing on Partridge Island at present, but may have in the recent past. These seeds may also be introduced from Deer Island and from the mainland in bird droppings. Raspberry and gooseberry seeds occurred in most excavations, but in the largest numbers near the present stands of these plants. Other uncarbonized seeds which were not further identified, probably derived from some of the flowering plants mentioned in Chapter 2. The distribution of uncarbonized macrobotanics (excluding fungal sclerotia) is shown in Table 2..

Fungal sclerotia are small black or brown spherical objects of various surface configurations and sizes (usually less than 2 mm. in diameter). These are produced by certain types of fungi as a means of propagation in times of adverse environmental circumstances, and can lie dormant in the earth for long periods of time. No attempt was made to further identify these. The distribution of sclerotia is different from that of other uncarbonized macrobotanics in the sites (see Table 3), and is discussed separately below. It seems probable that fungal sclerotia are preserved under conditions in which other uncarbonized botanics would not be preserved.

It can be seen from Table 2 that uncarbonized seeds tend to be restricted in distribution to the upper layers of the sites, and especially to the humic topsoil layers. They are generally found at depths greater than 15 cm. only in parts of the site where topsoils are deeper than 15 cm., where peat accumulations occur, and where the shell content of the sites is minimal. Thus, the distribution of uncarbonized seeds probably reflects the depth limit to which pedogenic factors are disturbing the surface of the sites at present. Their distribution suggests that humic and gravel deposits near the surface of the site have been disturbed more than shell deposits at the surface.

In contrast to the uncarbonized seeds, fungal sclerotia

TABLE 2: Maximum Depth to which Uncarbonized Macrobotanics were Detected (by Excavation Unit).

Site:	Unit:	Depth (cm.):	Layers Where Found:
BgDr 48	Unit 1	22	peat
	Unit 2	35	topsoil, peat, living floors
	Unit 3	40	topsoil, living floors
	Unit 4	15	peat, topsoil, living floors (45 cm. in U4&7/9)
	Unit 5	15	peat, topsoil
	Unit 7	15	topsoil, living floors
	Unit 8	15	topsoil
	Unit 9	25	topsoil, shell layers
BgDr 49	Col. 11	20	topsoil, stormbeach
Off-site	Unit 6	40	all deposits
	Unit 49/1	30	all deposits

are found at all levels of the sites, and in most, although not all, of the deposits. Although they occur in small numbers in shell and subsoil deposits, their densities are greatest in the humic deposits at the surface of the sites, and in certain humic deposits within the BgDr 48 site, particularly those overlying the subsoil in Units 2, 5, and 8. It is possible that their presence in these latter areas indicates periods of natural soil development prior to, and during, the deposition of the cultural stratigraphy.

In the off-site deposits, samples of both uncarbonized seeds and fungal sclerotia were found in all of the deposits, indicating that the natural soils adjacent to the sites are subject to pedogenic turbation through their depth.

Carbonized Macrobotanics:

No carbonized macrobotanic remains were associated with the BgDr 49 site. A few small pieces of carbonized wood were found in the topsoil levels of the off-site columns. The description below applies to BgDr 48 only.

Carbonized wood, or charcoal, the most common carbonized macrobotanic remain encountered, is ubiquitous in the BgDr 48 deposit, but some points should be made with regard to its distribution. Charcoal occurs as large and small discrete chunks in virtually all of the shell deposits, but never in large quantities. In contrast, living floor deposits usually contain large amounts of charcoal. In some cases (for example,

TABLE 3: Distribution of Fungal Sclerotia.

Site:	Unit:	Distribution:	Concentrations:
BgDr 48	Unit 1	all deposits	topsoil
	Unit 2	all deposits	topsoil, 1:7
	Unit 3	all deposits	topsoil
	Unit 4	topsoil and living floors at surface	topsoil
	Unit 5	all deposits	topsoil, 7:7, 7:8
	Unit 7	topsoil and living floors at surface	topsoil
	Unit 8	topsoil and living floors	topsoil, 17:9
	Unit 9	topsoil and shell layers at surface	topsoil
BgDr 49	Col. 11	all deposits	- - -
Off-site	Unit 6	all deposits	topsoil
	Unit 49/1	all deposits	topsoil

the floors U2,3,9/3,6,7) this charcoal was so finely fragmented that it was not collected for radiocarbon dating purposes. In other cases (for example, component 1 floors, U4&7/1) large chunks of charcoal were recovered and finely fragmented charcoal was a major structural component of the layers. In still other cases (for example, the component 2a floor, U8/1) very little charcoal was present.

In general fires seem to have been restricted mainly to living floors during the occupation of BgDr 48.

None of the carbonized wood has been identified to a taxonomic classification; however, the general impression is that it derives mainly from soft woods rather than hard woods.

Two other carbonized macrobotanics of some significance were recovered from one BgDr 48 column sample (see Figure D-4, sample 20:5, for the location). Both specimens have been tentatively identified as the carbonized berries of a dogwood (Cornus sp.) plant.[5] They are small black flattened ovals, about 8 mm. in diameter, having slightly grooved surfaces. Both are slightly broken and the seeds are visible as cavities in the carbonized fruit. These specimens are illustrated in Plate A-5.

The sample from which these carbonized berries were recovered consists of a black humic soil matrix containing fine gravel, charcoal, and fragmented shell. The deposit formed part of a complex living floor feature (component 2c) near the surface of Unit 4. This area contained the densest concentrations of faunal bone and artifacts found at the site, and it is one of the few areas in the site where appreciable amounts of burned shell were observed.

These carbonized berries are too large to be those of Cornus canadensis, the bunchberry, a small dogwood commonly observed in the area, whose berries are edible. They may belong to the species Cornus stolinifera, a larger dogwood whose range includes the Passamaquoddy Bay area, and whose berries are about the same size as the carbonized ones. Dogwood fruits mature in late summer and autumn. The berries of the larger dogwoods are eaten by wildlife, but are not generally considered edible by humans.

Perhaps the most significant aspect of the recovery of these remains is that it indicates the potential for botanic preservation in shell midden sites, and suggests that more extensive flotation or water screening of midden samples may reveal significant numbers of carbonized food plant remains.

CHAPTER 5:

INVERTEBRATE FAUNAL REMAINS.

> .... There is great beds of mussels wherewith we did fill our shallops... cockles, which never failed us; also chatagnes de mer, sea chestnuts [sea urchins, translator's note] , the most delicious fish that is possible to be; item, crabs and lobsters: those be the shellfishes. But one must take pleasure to fetch them, and are not all in one place.
>
> (Lescarbot 1928:285)

Introduction:

The invertebrate remains recovered from the Partridge Island sites are discussed below in two broad categories, marine shell remains and terrestrial gastropods. No shells of either category were recovered from off-site column samples. However, specimens of two marine shell species, the northern whelk, and the sea urchin were observed to be dropped onto the surfaces of the archaeological sites and the rest of Partridge Island by sea birds as they predated on these species. The effects of this process on the site faunal assemblages will be considered below.

All of the shell remains discussed are treated as food remains or intrusive specimens. Shell artifacts have been reported occasionally from northeast coastal sites (for example, Brett 1974), but there is no unequivocal evidence for the artifactual use of shell at Partridge Island. Two possible instances of the artifactual use of shell are mentioned below, but these are very speculative; the emphasis put on shell as a food remain seems justified.

BgDr 49 Invertebrate Remains:

Shell remains from BgDr 49 consist exclusively of those of the soft-shelled clam, *Mya arenaria*. Since no vertebrate remains were recovered from the site, these shells constitute the entire faunal assemblage. A tentative interpretation of BgDr 49 is that it represents an historic episode of shell-fish exploitation -- possibly it is a baiter's mound. The low species diversity, small number of artifacts, and small size of the site suggest a single episode of shell deposition. This interpretation is further substantiated by the site location, adjacent to the extant soft-shelled clam bed at Partridge Island.

Marine Invertebrate Species in BgDr 48:

Eighteen species of marine invertebrates were identified in the BgDr 48 faunal assemblage. These include 1 chiton, 9 pelecypods, 6 gastropods, 1 crustacean, and 1 echinoderm. Each of these species is discussed briefly below, emphasizing the nature of its occurrence in BgDr 48. Additional information pertaining to the ecology and description of each species is included in Appendix E. These species are illustrated in Figure E-2.

The northern red chiton, I. ruber, is a small animal of typical chiton form. Chiton valves occur rarely in BgDr 48, but were identified from several shell deposits. Chitons are edible, but the small size of the red chiton makes it an unlikely species for humans to exploit. It has not been reported from other sites.

The northern, or edible, whelk, B. undatum, is a large gastropod whose shell occurs with regularity, but in comparatively small numbers, in BgDr 48, in both shell midden and topsoil contexts. It is most common at the landward edge of the site near the treeline. This whelk has been reported from most other sites.

B. undatum remains have received some attention in previous excavations. Pearson noted distinct concentrations of these shells in BgDs 6, and differences in the sizes of the shells between that site and BgDs 10 (1970:185,187). Burns (1970b) noted that the whelks in BgDs 6 were more common near the treeline. At BgDr 48, large whelk shells tend to be found in topsoil layers, while the whelk shells in shell middens tend to be smaller, and often those of juveniles.

Since juvenile whelks tend to be most common at the average low water line, while adult whelks tend to be in deeper water (Berrill and Berrill 1981:275), it is possible to suggest that the large shells in the site derive from bird predation, and the smaller shells from human exploitation at the low water line. Sea birds apparently prey preferentially on adult whelks -- juvenile shells are rarely observed on the surface.

It is worth noting that if this interpretation of whelk distribution is accurate, concentrations of large whelk shells may be useful in identifying hiatuses in cultural deposition in New Brunswick middens.

The plate limpet, A. testudinalis, is a typical limpet of small size in comparison to many shellfish, but large in comparison to other east coast limpets. It occurs frequently at BgDr 48, but makes up a small proportion of the total shell remains. It has been reported from a few other sites.

The Atlantic dogwinkle, N. lapillus, occurs very commonly in almost all shell deposits at BgDr 48, either as scattered whole and broken shells, or as small concentrations of completely fragmented shells. It has been reported from several other sites.

N. lapillus is worthy of some further consideration here because of the possibility that this gastropod was not exploited as a food resource. Several authors (Ganong 1889: 14; Berrill and Berrill 1981:87) mention the use of this species by native people as a source for red or purple dye, but do not give any details of the practice, or cite any primary sources which describe the activity. In the quantitative analysis below, dogwhelks are treated as a food resource, but the possibility that it was not must be considered.

Two small periwinkle species, L. saxatilis and L. obtustata, occur very rarely at BgDr 48 in shell deposits. Their small size makes them unlikely prey species. The former has also been reported from BgDr 25.

A single specimen of the large gastropod species N. decemcostata, the ten-ridged whelk, was recovered from layer U4&7/5. The shell is complete, which is unusual in specimens, washed ashore, and indicates that the animal was probably brought on-site alive. It may result either from human or avian predation. The species has previously been reported from BgDs 6.

The small bivalve C. glandula, a bean mussel, occurs very rarely in a few shell deposits at BgDr 48. Its small size makes this an unlikely prey species, and its rarity an inconsequential one. The bean mussel has not been reported from other sites.

The horse mussel, M. modiolus, a large bivalve species, occurs abundantly at BgDr 48, in all shell middens. Horse mussel shells are usually highly fragmented, but complete umbos and occasional complete valves were observed. With few exceptions these remains represent large individuals. This species has been reported from most Passamaquoddy Bay sites, but has generally been considered to be present in inconsequential amounts.

The common, or edible, mussel, M. edulis, a smaller species than the horse mussel, occurs commonly at BgDr 48 in all shell deposits. The shells are usually fragmented, although intact umbos and occasional complete valves are present. All of the individuals observed are large, usually much larger than the common mussels growing in the area at present, and often in the size range of modern commercially grown mussels. This species has also been reported from most other sites, but again in inconsequential amounts.

Two small bivalves, C. borealis, the northern heart shell, and A. castanea, the smooth astarte, occur very rarely in BgDr 48 shell deposits. In several cases articulated left and right valves were observed, indicating that these shells were brought on-site alive but were probably not eaten. Their small size makes them inconsequential food resources at any rate. Neither has been reported from other sites in the area.

Two specimens of the deep-sea scallop, P. magellanicus, were recovered from BgDr 48. In one case two large fragments of a scallop valve were found in the house-pit living floors in Unit 3; these may be artifactual, although this interpretation is based on their provenience only. In the other case an almost complete valve was found in layer U8/4. The deep-sea scallop has been reported from several other sites, always as a rare occurrence.

Another small bivalve, the Arctic saxicave H. arctica, occurs occasionally in BgDr 48 shell deposits. Its small size makes it an unlikely prey species. It has not been reported from other sites.

The soft-shelled clam, M. arenaria, is the most common shellfish at BgDr 48, and occurs in all shell deposits either as complete valves or as large broken fragments. Clams of all sizes were noted, the largest being larger than any observed in the area at present. This species has been reported as the predominant invertebrate remain in all shell middens observed in the area.

One partial valve of the large surf clam, S. solidissima, was identified in layer U5/5. This species has been reported from several other sites.

Several fragments of barnacles were found in shell and gravel deposits at BgDr 48. These fragments probably belong to the species B. balanus. Barnacles are edible but their small size and the difficulty involved in exploiting them makes these crustaceans unlikely prey species. Barnacles have been reported from other sites.

The remains of the green sea urchin, S. droebachiensis, occur very frequently in BgDr 48 in almost every shell deposit. The sea urchin tests are completely disarticulated, but all of the component parts, spines, test plates, teeth, and Aristotle's lanterns are readily identifiable. These remains are scattered throughout the shell middens, and occasionally occur as small concentrations, probably representing several urchins deposited together. A wide range of sea urchin sizes was observed in the assemblage. Sea urchin shell has been reported from most other sites.

More marine shell species have been identified in the BgDr 48 faunal assemblage than at any other Passamaquoddy Bay site. This is probably a function of the emphasis placed on shell identification in this study, and the large amount of shell remains studied in detail. The previously reported assemblages which most resemble BgDr 48 are those from BgDs 6 and BgDs 10. This comparison must be viewed with caution since both of these assemblages were analysed by Burns (1970a, 1970b) who also placed considerable emphasis on invertebrate species identification. However, the difference in species diversity between the aforementioned sites and BgDr 11, which Burns (1978) also analysed, suggests real inter-site differences in shell assemblages. At present, it seems best to consider all inter-site comparisons of shell assemblages as tentative due both to the lack of quantitative data and the probable unevenness of species identification.

In spite of the species diversity in the BgDr 48 assemblage about 99% of the marine shell comes from only five of the aforementioned species, Mya arenaria, Modiolus modiolus, Mytilus edulis, Nucella lapillus, and Strongylocentrotus droebachiensis. These species will receive most of the attention in the quantitative analysis below. First, however, it is worth considering why and how the smaller, less common species came to be present in the assemblage.

The northern whelk has already been considered in this respect and both cultural and natural sources have been suggested. The ten-ridged whelk is best considered a fortuitous catch by either humans or birds. The plate limpet is common enough to suggest that it was subject to purposive human predation, although its contribution to subsistence must have been very small in comparison to the five most common species. Some of the other species may also represent infrequently exploited prey species; however, it seems more likely that they were brought on-site accidentally during the course of the exploitation of other marine resources. One source may have been mussel holdfasts which were collected at low water and then sorted on-site. Another possible source is fortuitous introduction on harvested seaweeds and in algal holdfasts.

The relative proportions of the five most common species were assessed using both shell weights per species in each sample analysed, and the relative proportions of the meat represented by the shell samples. The details of this analysis and the meat:shell ratios used are given in Appendix D. Table 4 summarizes these proportions to give a general picture of the frequency with which each of these species occurred at BgDr 48, and the importance of each species relative to the total contribution of marine invertebrates to the aboriginal diet.

Relative proportions from 60 samples were included in calculating these averages. The samples used exclude those from components A and B, into which shell is intrusive, and any samples from which less than 100 gm. of shell was recovered. The mean proportion is considered to be the most accurate indication of the general proportion of each species in the site. The range of proportions and the median proportion for each species is included in Table 4. Interpretations based on these statistics assume that the samples analysed are representative of the site assemblage. This cannot be demonstrated statistically because the sampling procedure used was judgemental and the overall sample size is small.

Considering proportions by shell weight, the analysis suggests that about 42.72% of the assemblage is soft-shelled clam, 33.72% horse mussel, 8.81% common mussel, 5.95% dogwhelk, and 8.97% sea urchin. Other species account for less than 1% by weight, and this category would mainly consist of northern whelks and limpets.

The conversion from shell weights to meat weights makes a considerable difference in the relative proportions of the five species. This measurement is considered to be a more accurate evaluation of the importance of each of the species to the diet of the aboriginal inhabitants of BgDr 48. Using this conversion soft-shelled clam accounts for 65.05% of the assemblage, horse mussel for 18.8%, common mussel for 3.83%, dogwhelk for 5.95%, and sea urchin for 6.59%. The meat yield from other species was considered to be negligible

TABLE 4: Proportions of Major Shellfish Species in BgDr 48.*

a) By Shell Weights.

Species:	Range:**	Median:	Mean:	Standard Deviation:	Variance:
M. arenaria	13-81	47.0	41.72	14.21	198.64
M. modiolus	11-57	34.0	33.72	13.04	167.17
M. edulis	01-22	11.5	8.81	4.79	22.60
N. lapillus	00-26	13.0	5.95	4.41	19.15
S. droebachiensis	00-24	12.0	8.97	6.62	43.13

(number of samples: 60)

b) By Equivalent Meat Weights.

Species:	Range:	Median:	Mean:	Standard Deviation:	Variance:
M. arenaria	30-92	61.0	65.05	12.75	159.74
M. modiolus	04-57	28.5	18.80	10.04	99.18
M. edulis	00-11	5.5	3.83	2.51	6.17
N. lapillus	00-21	10.5	5.95	4.20	17.34
S. droebachiensis	00-16	8.0	6.59	4.71	21.80

(number of samples: 60)

* relative proportions do not equal 100% exactly due to rounding to the nearest whole number in the raw data

** all numbers are percentages

in making this conversion.

It is worth making a special note of the extreme variability in the proportion that each species represents from one sample to another. While some of this variability is undoubtedly due to differences in sample size and to sampling bias, it probably also reflects real differences between the contents of midden deposits, and variations in the contents of particular middens.

Stratigraphy of Marine Shell Remains:

Two types of shell midden deposits were apparent in the BgDr 48 stratigraphy, whole shell deposits and crushed shell deposits. The former were less common and tended to be located lower in the stratigraphy of the site. The difference between the two types of midden do not seem to be related to the proportions of shellfish species present in them. Whole shell layers contain a high proportion of complete and almost complete valves of the larger bivalve species, and very small amounts of soil, gravel, bone, and artifacts; they also tend to exhibit little evidence of internal stratification. Crushed shell layers, in contrast, contain more soil, gravel, and other structural components, and characteristically exhibit some indication of internal micro-stratification; the shell contents are often finely fragmented and usually compact. It is possible that the whole shell layers represent rapid accumulations of shell resulting from periods of intensive shell gathering, while crushed shell layers represent longer periods of less intensive shell gathering during which considerable cultural activity took place on midden surfaces. (See Table D-1, and Figures D-6 and D-8, samples 13:8, 13:9, 17:7, and 17:8, for the clearest examples of whole shell layers.)

The distinct concentrations of particular species observed during the excavation suggest that the crushed shell layers were built up by the addition of relatively small increments of shell consisting of only one, or a few, species. The contents of middens appear to have been internally homogenized to some extent by the disintegration of mussel shells and sea urchin tests. The small particles of mussel and urchin have filled the spaces between the larger fragments of clam shell. Frequently, clam valves were observed to be packed full of small mussel and sea urchin fragments.

Details of the distribution of marine shell species are included in Appendix D. The five common species are present in virtually every sample except those representing components A and B, and samples from which less than 100 gm. of shell was recovered. One or several of the less common species is also present in almost every sample analysed. There seems to be little stratigraphic significance to the presence/absence of particular shell species. Indeed, Figure 13 indicates a fairly strong relationship between the size of shell samples and the number of species present in them (correlation coefficient = 0.73).

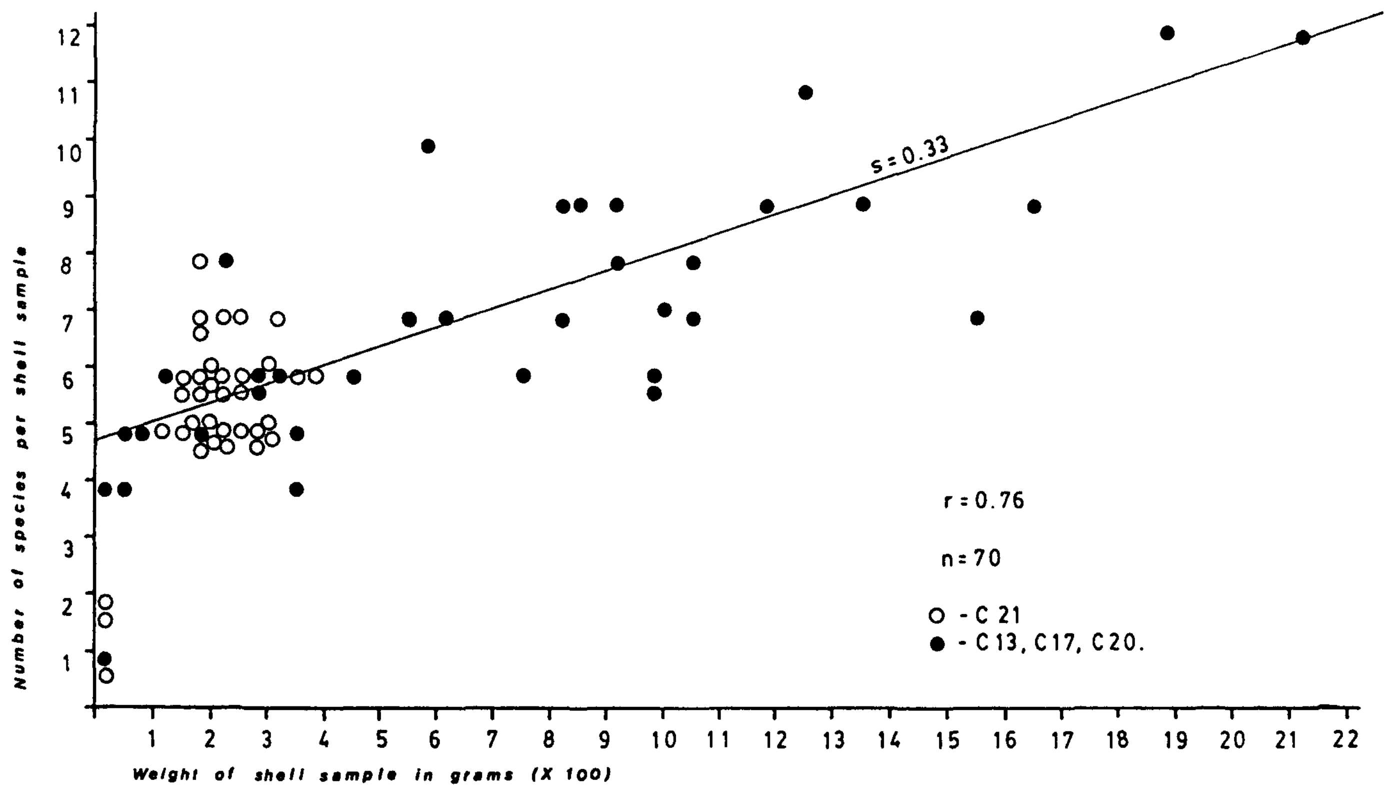

FIGURE 13: Relationship between Sample Size and Number of Species.

Shell remains recovered from component 1 samples are of two types. Small amounts of finely fragmented mussel and clam shell were found in living floor samples taken from below shell layers; these are considered to be intrusive. Where component 1 samples were not in contact with shell, they contained no obvious shell remains. Closer examination, however, revealed the presence of the periostrachum of marine shells in almost all component 1 samples.

One of the more interesting results of the present study is the finding that the periostrachum, the thin leathery outer covering of mollusks, may be preserved in deposits where the calcium carbonate portions of shells is not preserved. Fragments of periostrachum were observed in shell deposits, but they were also observed in concentrations in humic soil deposits on living floors at all levels and in soils at the edges of the site. Some pieces of preserved periostrachum are illustrated in Plate A-6.

Thus, it is possible that the calcium carbonate portion of the shells exploited during the component 1 occupation has disolved completely. At any rate, it is fairly safe to conclude that shellfishing did occur during this occupation -- this is the most reasonable explanation for the preservation of faunal bone from this component.

Component 2a living floors contained only very small amounts of shell; except on the upper surface of the floors this shell is probably not intrusive. The only unusual aspect of the species present in this component is the small amount of sea urchin shell recorded.

Component 2c living floors contain variable amounts of shell. Where they are in contact with shell layers, shell content of the floors is high and suggests intrusion and mixing after the occupation of the floors. In other areas such as Units 2, 3, 5, and 1, the small amount of shell on the floors may have been deposited during their occupation. Most species in the assemblage are present on the floors.

By definition, component 2b contains most of the shell in the site. This component is separable into distinct episodes of shell deposition on the basis of stratigraphy and variability in midden contents. Table 5 is a summary of the variability detected between 11 stratigraphically and/or spatially distinct midden deposits. The midden samples described in Table 5 are groups of column samples lumped on the basis of recorded stratigraphy. It is apparent that even relatively tenuous stratigraphic boundaries recorded in the profiles reflect real differences in midden content and structure. The methods used in this analysis provide a means for describing and justifying stratigraphic distinctions in quantitative terms. This is particularily important in archaeological sites such as shell middens, where stratigraphy is complex, and feature boundaries are often indistinct and difficult to delineate.

TABLE 5: Comparison of Eleven BgDr 48 Midden Deposits.

Provenience:	U7				U4			U8		U9	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
# of Samples:	10	10	5	1	2	2	1	7	3	1	2
Total Volume (X 1000 cc.):	8	8	4	2.2	6	3.4	3.2	14.6	6.6	1.7	5
# of Species:	8	13	8	12	10	12	7	9	11	9	11
Mya arenaria shell:	49*	30	37	33	40	47	40	48	39	42	60
Mya arenaria meat:	74	55	60	60	64	70	66	70	65	66	79
M. modiolus shell:	32	42	31	54	34	32	44	21	44	35	17
M. modiolus meat:	15	25	17	32	18	16	24	10	23	18	8
M. edulis shell:	11	13	13	8	5	4	5	8	4	2	3
M. edulis meat:	4	6	5	3	2	2	2	3	2	1	1
N. lapillus shell:	6	9	12	4	3	3	+	6	2	3	3
N. lapillus meat:	5	10	13	4	3	3	0	6	2	3	3
S. droebach. shell:	2	6	5	+	15	15	10	18	11	17	17
S. droebach. meat:	2	5	5	0	12	10	8	12	8	12	10
Other species shell:	+	+	1	1	1	+	1	1	+	+	+
Other species meat:	0	0	0	0	0	0	0	0	0	0	0

* all subsequent numbers are percentages

\+ indicates present but less than 1%

Examples of variability in midden contents and variations between areas of the site are obvious. Middens II, IV, VII, and IX, contain higher proportions by shell weight of horse mussel than of soft-shelled clam. The Atlantic dogwhelk occurs more frequently in the middens in Units 7 and 8 than in those in Units 4 and 9. The common mussel occurs with greatest frequency in the middens in Unit 7.

The green sea urchin is least common in midden IV, which is located between component 1 and component 2a living floors, and can be associated with the earlier occupations of the site on stratigraphic grounds. A very low proportion of sea urchin remains also occurs in midden I, which is immediately above component 1. Only slightly larger amounts are present in middens II and III.

Discussion of Marine Shell Remains:

If the proportions of marine shell species presented here are at all indicative of those in Passamaquoddy Bay/West Isles sites in general, then it is plausable to conclude that the importance of the soft-shelled clam as a subsistence staple relative to other shellfish has been exaggerated in previous discussions of aboriginal subsistence in the area. However, until further quantitative studies are undertaken at other sites, alternate interpretations of the data should be considered. One possibility is that the relative proportions of shellfish species are determined primarily by the local ecology and physiography of each site; thus, the shell assemblage at BgDr 48 would be interpreted simply as a reflection of the greater productivity of mussels and gastropods relative to clams on the rocky shores of the northern West Isles. Another possibility is that the season(s) of occupation of a site determine the proportions of species present; seasons having greater tidal range fluctuations would result in the exploitation and deposition of more low intertidal zone and subtidal animals. A third possibility is that species variability increases with the length of time a site is occupied. This point of view has been expressed in the literature (for example, Sutton 1980), and in the present case it would suggest that BgDr 48, BgDs 6, and BgDs 10 were occupied for longer periods of time than those sites where less species diversity has been reported. Finally, it is possible that temporal variations in settlement location and/or shellfishing practices and preferences have resulted in inter-site variations in marine shell content.

It should be obvious that these speculative explanations are not mutually exclusive, and that any explanation of this phenomenon will almost certainly be multi-variate. Further speculation along these lines is futile in the absence of further detailed midden analyses.

The data presented here give a general indication of the relative importance of different intertidal substrates and zones to the subsistence activities of the aboriginal inhabitants of BgDr 48. About 65-70% of the invertebrate meat was probably gathered from muddy substrates, the other 30-35% coming from rocky areas of the shoreline. The single surf clam individual is the only indication of gathering on sandy substrates. Similarily, about 65% of the invertebrate meat was gathered from the mid-intertidal zone, while 15% or more came from near the low water line. Perhaps as much as 20% came from subtidal gathering. These observations suggest that the inhabitants of BgDr 48 scheduled a significant proportion of their littoral gathering activities to coincide with low tide intervals, and may have invested considerable energy in subtidal gathering.

While the marine species exploited at Partridge Island in the past are probably all currently present in the area, it is apparent that the productivity of soft-shelled clams must have been greater in the past. This interpretation substantiates the reconstruction of past shorelines at Partridge Island which indicated larger expanses of low gradient intertidal zone.

The inhabitants of BgDr 48 seem to have practiced differences in selectivity toward different invertebrate species. It appears that only the largest horse mussel and common mussel individuals were exploited, while soft-shelled clams and sea urchins of all sizes were gathered.

This analysis casts some doubt on Snow's (1978:113) assertion that there is no evidence for routine exploitation of gastropods by aboriginal peoples on the northeast coast (see also Dow 1971:6). Snow's statement may be true for the

New England sites he examined, but clearly, gastropods (especially dogwhelks) were routinely exploited throughout most or all of the occupation of BgDr 48.

There is no evidence at BgDr 48 for the major changes in shellfish exploitation observed in some Maine and New England shell middens (Snow 1978:213; Dow 1971:7; Yesner 1980: 67), although many of the species identified at BgDr 48 are found in New England sites. The only detectable temporal variability in the BgDr 48 assemblage is the relatively low proportion of sea urchin remains associated with component 2a, indicating that this may not have been a significant prey species at that time. The main difference between New England and New Brunswick shell assemblages remains the absence of oysters and quahogs from the northern sites.

It is worth re-emphasizing the evidence for shellfish exploitation during the component 1 occupation, as early occupations at other Passamaquoddy Bay sites have been regarded as having no shell associations by some authors (for example, Davis 1978:31). This evidence also substantiates the reconstruction of the past water levels which suggested that tidal amplitude had already approached modern levels during the Early Maritime Woodland period, and intertidal resources were available at that time.

There is little evidence to support the contention that significant amounts of sea urchin shell are added to the site assemblage as a result of bird predation. If this were the case one would expect the densest concentrations of sea urchin remains to occur in component A. At BgDr 48, sea urchin remains were most frequent at the lower levels of components 2b and 2c, not at the surface of the site. In contrast, the evidence from this site suggests that bird predation is a major factor in the addition of northern whelks to faunal assemblages in the area.

The contrast between the shell remains in BgDr 48 and those in BgDr 49 is instructive. At no point in BgDr 48 could a 2000 cc. sample of shell have been obtained which contained only one marine species. This suggests that baiter's mounds may be distinguishable from aboriginal sites by their low species variability. This interpretation, if substantiated, may be useful in site evaluation during archaeological surveys in the area.

In concluding this chapter, some questions about shellfish exploitation at BgDr 48 can be raised which are presently unanswerable.

Why did the site's inhabitants exploit the relatively inaccessable, almost exclusively subtidal, horse mussel to so much greater a degree than the relatively accessable common mussel? Is this an indication of cultural preference -- perhaps because of the larger size of the horse mussel? Does the practice indicate a difference in biostratigraphy at Partridge Island in the past? Was this a location where horse mussels were fortuitously more accessable than is generally the case?

Given that horse mussels were a preferred species, how were they harvested? The possibilities include diving, dragging, and pulling up kelp with mussels attached to their holdfasts.

It is worth noting that a shellfish assemblage in which horse mussel is very common has been reported from a site on the Roque Islands off the northern Maine coast (Sanger and Chase 1983). The layers in which horse mussels are common are located stratigraphically below a shell deposit in which soft-shelled clam is the dominate invertebrate species.

Another series of questions can be posed with reference to the dogwhelk shells. Were they exploited as food, or for some other purpose such as dye making? Does the difference noted between the occurrence of scattered whole shells, and concentrations of fragmented shells, indicate two different uses or treatments of the species?

A final question can be raised with respect to the assemblage as a whole. Does the diversity of species exploited represent the actions of a group who were willing to, or needed to, eat any animal they could get their hands on? Or, does the assemblage represent the choices of a group to some extent dependent on intertidal resources, and presented with a productive, but diverse, environment?

Terrestrial Gastropods:

Land snail remains at BgDr 48 fall into two groups which are specially and stratigraphically distinct from one another; for convenience these are referred to as large land snails and small land snails. Land snails are attracted to alkaline environments (Burch 1962:12), and the shell midden provides a choice habitat for numbers of them to live and for their shells to have been preserved.

The large land snails include two identified species, *Anguispira alternata*, and *Cepaea hortensis*, the former being by far the more common of the two. These snails were recovered only from samples containing very high proportions of marine shell, and have not been observed in living floor contexts. Some species of large land snails have been reported to have been eaten by native people, but the presence of immature *A. alternata* shells in BgDr 48 suggests that the large land snails are intrusive. Concentrations of these snails occur in the site, but these probably result from the natural gregariousness of the animals. Both of the large species have been reported from other Passamaquoddy Bay sites (Matthew 1884:24; Burns 1970b). The present study revealed no stratigraphic significance to the distribution of large land snails except that they are mainly associated with the middens in component 2b.

The distribution of small land snails does appear to be stratigraphically significant. This category includes five identified species, Columella edulenta, Cionella lubrica, Vallonia pulchella, Discus chronkhitei, and Euconulus fulvus, as well as several unidentified species. These small snails are almost exclusively restricted to the topsoil layers of the site, where their shells often occur in dense concentrations. Thus, it is reasonable to assume that they are a post-depositional addition to the faunal assemblage. Their distribution suggests that they are intolerant of both the acidity associated with coniferous trees and the extreme alkalinity of the shell middens.

In three cases concentrations of small land snails were found within the cultural layers at BgDr 48. In one case (layer U5/6, sample 7:8) several snails occurred about 25 cm. below the site surface in a matrix of brown soil also containing numbers of fungal sclerotia and scattered marine shell fragments. In the second case, several small snails were recovered from each of two successive samples (20:13 and 20:14, layers U4&7/2,3) in Unit 4. The third case also involved column 20 from Unit 4; in layer U4&7/10 (sample 20:7) a considerable concentration of small land snails was found in a matrix of shell, black soil, gravel, and fire-cracked rock. Eighteen large land snails were also recovered from the same sample.

In Unit 5, the deposit in which the small snails occur probably represents the original soil formation in that area of the site, into which cultural material has been mixed.

In Unit 4 the presence of small land snails at the boundary between components 2a and 2b may indicate a hiatus in deposition between the two components. Layer U4&7/10 contains the densest concentration of vertebrate faunal remains observed at the site; the layer is below a series of living floors and pits. The presence of the snails may indicate a period of soil formation subsequent to the deposition of the shell midden and prior to the construction of the living floors, during which the vertebrate remains accumulated on the surface of the midden.

These tentative interpretations indicate that distributions of small snails may be useful in further stratigraphic analyses of West Isles shell middens. Matthew (1884:24) is the only previous researcher who has reported the occurrence of small snail species from a Passamaquoddy Bay site; he made no comments on their distribution.

No terrestrial gastropod remains were recovered from the BgDr 49 site or from the off-site soil samples.

CHAPTER 6:

VERTEBRATE FAUNAL REMAINS.

The sea is the lands edge also,
the granite
Into which it reaches, the beaches
where it tosses
Its hints of earlier and other creation.
(T.S. Eliot, The Dry Sauvages)

Introduction:

The faunal assemblages discussed in this chapter refer only to BgDr 48; no vertebrate remains were recovered from BgDr 49 or from the off-site column samples.

Vertebrate remains were recovered from BgDr 48 in both the excavation units and the column samples. In the discussion below, bones from the column samples are considered separately, at first, because these can most accurately be assigned to the stratigraphic components; later, all of the bones recovered are grouped by stratigraphic component and discussed.

The vertebrate remains are quantified by counting each piece of bone recovered -- a piece can be any size, and can vary from a complete element, to a portion of an element, to a very small fragment. This procedure has the unfortunate effect of equating very dissimilar sizes of bones and bone fragments. However, quantification by any other measure,

<u>Vertebrate Remains from Column Samples</u>:

Four hundred and twelve pieces of bone were recovered from column samples. Details of the distribution and identification of these bones are contained in Appendix F. Table 6 indicates the relative frequency with which bones occurred in each stratigraphic component; Table 7 shows the relative identifiability of the bones from each stratigraphic component.

Several observations can be made from these data. Fish remains predominate in component 1, occurring in all of the samples assigned to this component. Bones occur with a high relative frequency in this component, although it should be noted that this is partly a reflection of the small size and large number of bones per individual of fish bones in comparison to other vertebrate classes. Most of the identifiable elements in component 1 belong to the cod family (Gadidae). There is no evidence for avian bone and only a small amount of evidence for mammal remains.

Fish remains also predominate in component 2a, where, once again, bones are present in all samples, and have a high relative frequency. In this case a number of elements represent each of two fish families, cods and herrings (Culpeidae). Only a small amount of mammal bone is present, and no avian bone at all.

Component B samples contained only four pieces of bone; these are all probably intrusive from components 1 or 2a.

TABLE 6: Frequency of Vertebrate Remains in Column Samples (by Stratigraphic Component).

Component:	Number of Samples:	Bones Present: # of samples	Bones Present: % of samples	Relative Amount:*
A	41	3	7	0.16
2c	68	16	24	0.40
2b	83	22	27	0.26
2a	7	7	100	3.90
1	8	8	100	3.58
B	36	2	6	0.03
totals	243	58	24	0.48

* number of bone pieces per 500 cc. volume

TABLE 7: Identifiability of Vertebrate Remains in Column Samples (by Stratigraphic Component).

Component:	Number of Bone Pieces:	Identifications: # identified	% identified
A	27	10	37
2c	99	54	55
2b	77	22	29
2a	117	14	12
1	93	17	18
B	4	0	0
totals	412	117	28

In component 2b all three zoological classes are represented. Fish remains are only slightly predominant; both cod and herring elements are present. Mammal bones are quite common, including deer, seal and canid elements. Avian bones are present and one species can be identified. However, bones were present in only 27% of the samples assigned to this component, and the relative frequency of bone is much lower than in components 1 and 2a.

Mammal bones predominate in component 2c, including those of beaver, deer, seal, and canids. Avian bones are much more common than in the previous components, and one species is identifiable. A considerable number of fish bones occur, of both herrings and cods. The proportion of samples in which bones were present (24%) is lower than in component 2b, although the relative frequency of bone occurrence is higher. The relative frequency is still much lower than in components 1 and 2a.

The bones from component A follow the same general pattern as regards proportions as component 2c except that there is a much smaller relative frequency of bones in the component. Cod and herring elements are present, as are canid and muskrat elements. The similarity between components 2c and A suggest that the bones in the latter are largely or completely intrusive from the former.

These data suggest that components 1 and 2a contain faunal assemblages distinct from one another, and from the faunal assemblages in components 2b and 2c. The differences between the latter two assemblages are more difficult to assess, but it appears that fish remains are more common in 2b. The similarities between the component 2b and 2c assemblages substantiate the stratigraphic evidence suggesting that these two components were deposited simultaneously.

Unfortunately, because of the small sample size from component 2a, and the sampling design used, it is impossible to test the significance of these observations statistically. Nevertheless, the patterns exhibited by the column sample data are distinct enough to serve as a model against which to evaluate the distribution of the other vertebrate remains recovered from the site.

BgDr 48 Vertebrate Faunal Assemblages:

The faunal assemblages described in this section include bone pieces recovered both from the column samples, and from the excavation units. The details of the distribution and identification of bones from excavation units are presented in Appendix G; in the appendix the bones are grouped by unit/level/matrix proveniences. Table G-1 indicates to which stratigraphic component each unit/level/matrix subdivision was assigned. It must be emphasized that because of the nature of arbitrary levels, the faunal assemblages derived in this way must be considered to be approximations of the faunal assemblages which characterized each of the stratigraphic components in the site.

Tables 8, 9, and 10, summarize the identified portions of the assemblages.

Bones occurred mainly in a few dense concentrations in the site. Figure 15 indicates that the correlation between the volumes of the column samples, and the number of bone pieces recovered from each, is very weak (correlation coefficient = 0.12); Figure 16 indicates a similarily poor correlation between level volume and number of bone pieces recovered. In fact, 22% of the site assemblage occurred in level 2 of Unit 4, and another 20% of the assemblage in levels 6 and 7 of Unit 4 (see Figure G-9). Considerable concentrations of bone pieces also occurred in Unit 3, especially level 2 (see Figure G-3), and in Unit 5, level 2 (see Figure G-5). Many other areas of the site, notably layer U4&7/5, and layers U8/4,5, contained only very small amounts of bone.

The complete vertebrate faunal assemblage from BgDr 48 consists of 4260 pieces of bone. Of these, 33% are fish bones, 10% are avian bones, 56% are mammal bones, and 1% are unidentifiable as to class. As regards the distribution of bones by stratigraphic component, 4% are in component A, 41% are in component 2c, 27% in 2b, 6% in 2a, 22% in 1, and 0.025% in component B. In Figure 14, the six faunal assemblages are compared in terms of the relative proportions of each faunal class in each component. The assemblages fall naturally into two groups, a lower one composed of components B, 1, and 2a,

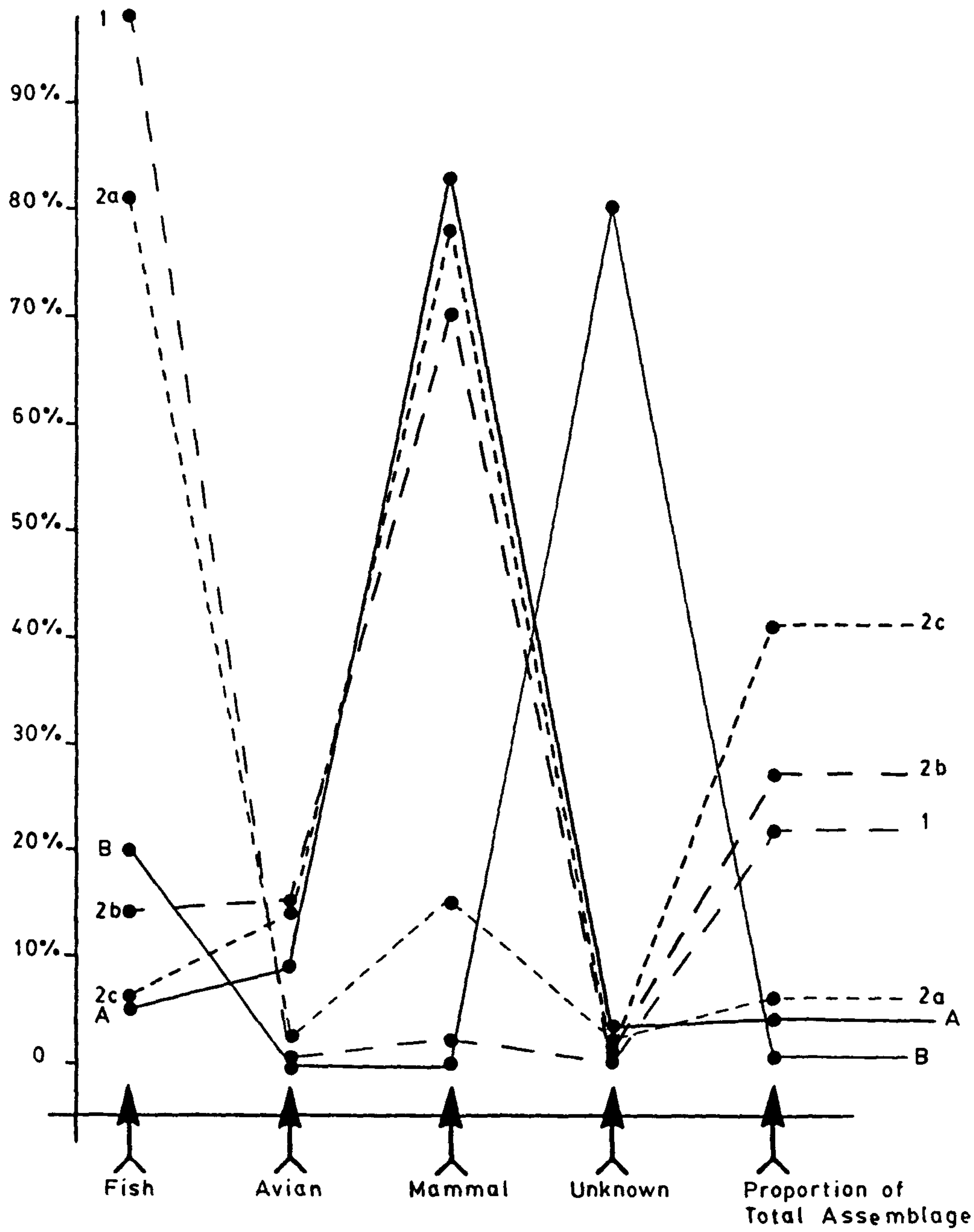

FIGURE 14: Comparison of BgDr 48 Faunal Assemblages.

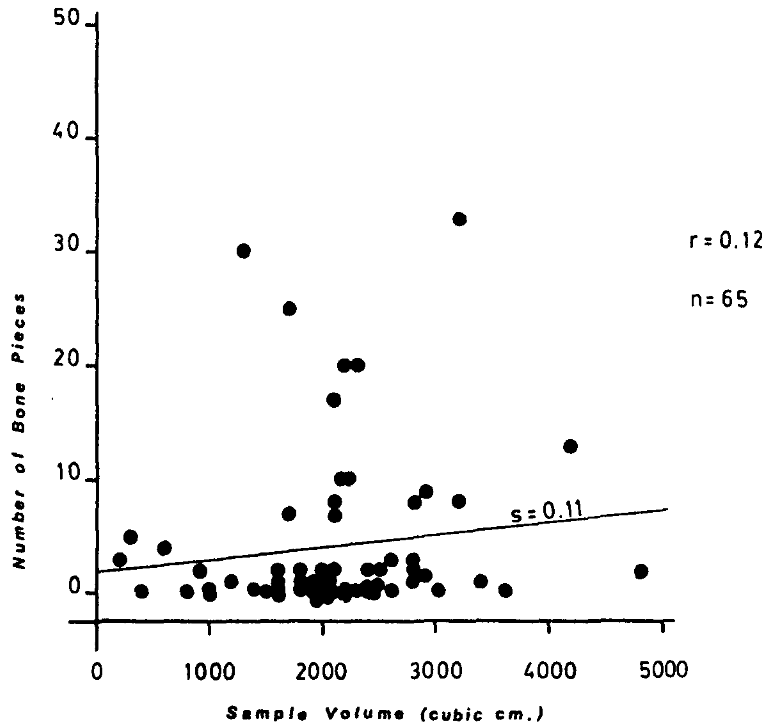

FIGURE 15: Relationship between Sample Size and Number of Bone Pieces.

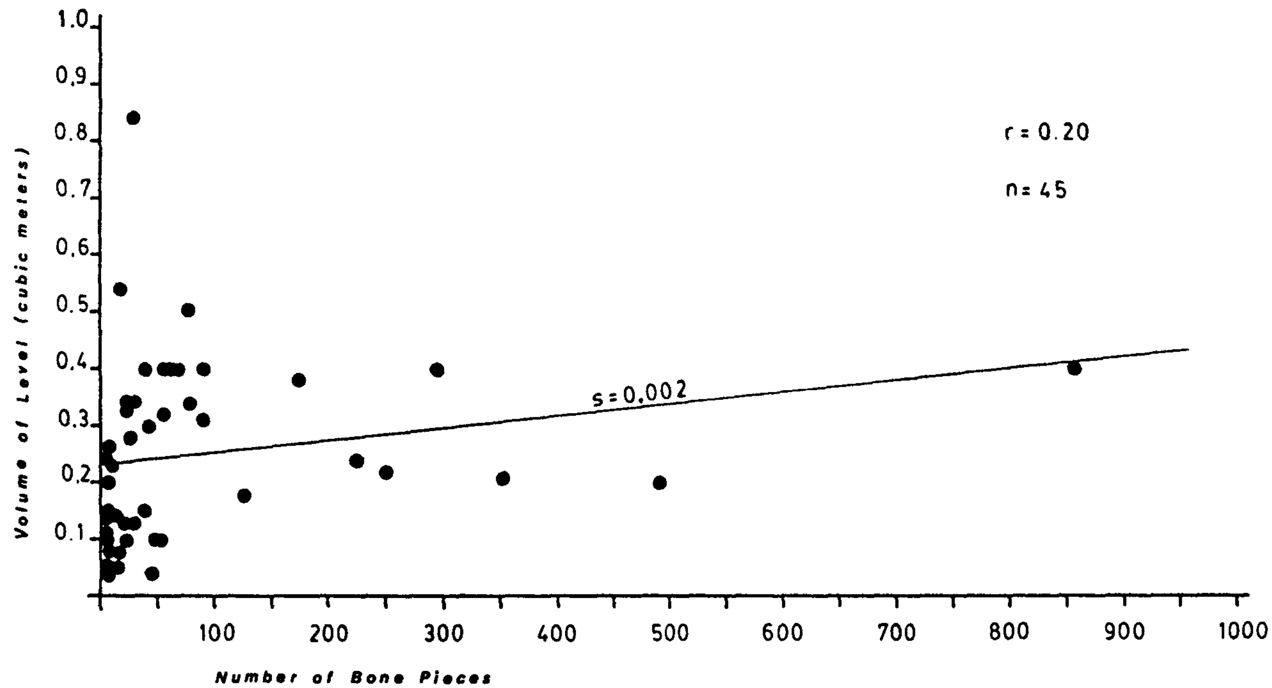

FIGURE 16: Relationship between Level Volume and Number of Bone Pieces.

TABLE 8: Vertebrate Identifications from Component 1.

Taxonomic Classification:	Number of Pieces:	Number of Elements:	MNI (element):
Osteichthyes:			
G. morhua	11	9	5 (left pre-maxilla)
P. virens	1	1	1 (dentary)
Gadidae	176	117	
Small Fish	4	4	
Mammalia:			
Large Sea Mammal	3	2	
Mustela sp.	2	1	1 (mandible)
Small Mammal	1	1	

TABLE 9: Vertebrate Identifications from Component 2a.

Taxonomic Classification:	Number of Pieces:	Number of Elements:	MNI (element):
Osteichthyes:			
G. morhua	1	1	1 (left pre-maxilla)
P. virens	3	3	2 (left pre-maxilla)
Gadidae	21	17	
Culpeidae	12	12	
Avians:			
C. brachyrhynchos	1	1	1 (right hum-erus)
Mammalia:			
C. canadensis	4	3	1 (left man-dible)
P. vitulina	1	1	1 (right humerus)
Large mustelid	1	1	

TABLE 10: Vertebrate Identifications from Components 2b, 2c, and A.

Taxonomic Classification:	Number of Pieces:	Number of Elements:	MNI (element):
Osteichthyes:			
P. virens	2	2	1 (right otolith)
M. aeglefinnus	1	1	1 (left otolith)
Gadidae	53	41	
C. harengus	9	9	4 (left pro-otic)
Culpeidae (small)	36	36	
Culpeidae (large)	12	12	
Small Fish	2	2	
Avians:			
G. immer	4	4	2 (right ulna)
P. gravis	1	1	1 (right ulna)
A. sponsa	1	1	1 (left cor-acoid)
B. bernicla	3	3	2 (left cor-acoid)

TABLE 10: continued.

Taxonomic Classification:	Number of Pieces:	Number of Elements:	MNI (elements):
Avians (continued):			
B. clangula	1	1	1 (left coracoid)
S. mollissima	2	2	1 (left radius)
P. impennis	1	1	1 (left humerus)
U. lomvia	1	1	1 (left ulna)
U. aalge	1	1	1 (left ulna)
Large Birds	2	2	
Medium size Birds	9	9	
Small Birds	1	1	
Alcidae	1	1	
Mammalia:			
O. zibethicus	1	1	1 (molar)
C. canadensis	121	28	8 (left I_1)

TABLE 10: continued.

Taxonomic Classification:	Number of Pieces:	Number of Elements:	MNI (elements):
Mammalia (continued):			
Canis sp. (large)	66	37	2 (left mandible)
Canis sp. (small)	10	8	1 (left humerus)
M. americana	2	2	1 (mandible)
Mustela sp.	1	1	
Large Mustelid	1	1	
P. vitulina	10	8	2 (right maxilla)
Phoca sp.	6	6	
H. grypus	4	4	1 (premolar)
Large Seal	1	1	
Seal	16	10	
O. virginianus	91	50	2 (left petrus)
A. alces	1	1	1 (carpal radiale)
Cervidae	12	10	

and an upper group composed of components 2b, 2c, and A. This pattern is very similar to the one indicated by the column bone data.

Components 1 and 2a contain high proportions of fish remains, and very low proportions of avian, mammal, and unidentifiable bones. Component B reflects this pattern except for the much higher proportion of unidentifiable bones. The three upper components are very similar to one another; all contain higher proportions of avian remains, and much higher proportions of mammal remains than the lower components. The upper components also contain much lower proportions of fish bones, and much higher proportions of unidentifiable bones.

Some differences are apparent between the upper components; these may result from sampling biases, or may reflect meaningful but subtle differences between the assemblages. Component 2b contains more fish bones and less unidentifiable bones than 2c or A. Component A contains a smaller proportion of avian bones than 2b or 2c.

It should be noted that the numbers of, and the proportion of, fish bones actually present in component 2a are almost certainly several magnitudes larger than this graph indicates, because small fish bones were recovered only from the column samples. The bones of Culpeid fishes are virtually all less than 5 mm. in length, and pass easily through the mesh used to screen material from the excavation units. Some of these small fish bones are illustrated in Plate A-7.

The amount of fish remains in components 2b and 2c may be underestimated for the same reasons. However, the upper components were much more extensively sampled than the lower ones, and the data indicate that small fish bones occurred relatively rarely in the upper components.

Table 8 summarizes the identified bone elements from component 1. Large cod fish are represented by at least 6 individuals, 5 of which are identifiable as Atlantic cod, and the sixth as pollock. The large number of fish elements identified to the family Gadidae probably relate to these same individuals. The cod and pollock individuals were differentiated on the basis of dentition (see Plate A-8). No attempt was made to separate skeletal elements into separate cod species except premaxillae, dentaries, and vomers. Four elements from component 1 are identified as small fish bones; no further identification was possible due to the unavailability of comparative skeletons, but these elements do not appear to represent Culpeid fishes.

No avian remains from component 1 are identifiable -- the four pieces in the assemblage may be intrusive.

One large sea mammal, probably a seal, is represented by 2 pieces of a rib (which fit together), and the transverse process from a lumbar vertebra. These specimens cannot be further identified, but the vertebral element suggests an adult individual in the size range of hooded seal.

A portion of the left mandible of a mustelid, probably a mink, is also present in this assemblage. The element may be intrusive since mustelid bones are present in component 2a as well. One other mammal element, the proximal phalanx of a small mammal, may relate to the same animal.

Faunal assemblages similar to the component 1 assemblage have not been reported from other Passamaquoddy Bay sites. However, similar assemblages have been reported beneath shell middens and associated with Early Maritime Woodland artifacts, from sites on the islands in Casco Bay on the southern Maine coast (Yesner 1982).

Table 9 summarizes the identified elements from component 2a. In this assemblage at least 1 Atlantic cod and 2 pollock individuals are represented; the elements identified to the cod family probably relate to these same individuals. Twelve elements, all of them vertebrae, are identified to the herring family. The lack of cranial elements in the assemblage prevents a positive identification to genus or species; however, the most likely candidate is the Atlantic herring (Culpea harengus). Two of the vertebrae resemble alewife (Alosa pseudoharengus) more than those of Atlantic herring. Many of the small fish bones from component 2a which cannot be identified further than to class probably relate to these vertebral elements.

One avian element, a portion of the right humerus of a common crow is present in component 2a.

A portion of the right humerus of a large immature mustelid, possibly representing the extinct sea mink species, Mustela macrodon, is also present. The crow and mink remains occurred in layer U4&7/2 and are unequivocally associated with the component 2a occupation.

Both herring and cod elements are present in the living floor layer U8/1 which is assigned to component 2a on the basis of stratigraphic evidence. Three elements representing a beaver individual, and one element representing a harbour seal individual, are also associated with the surface of this floor. These mammal elements almost certainly relate to beaver and seal individuals from component 2c (layer U4&7/10). The mammal elements are considered to be intrusive because, like those in component 2c, they have been gnawed by carnivore/scavangers; they are also etched on their surfaces by root growth indicating that they were exposed at or near the surface of the site for some time. This is in accordance with the evidence presented previously for a significant depositional hiatus between the occupation of the living floor (layer U8/1) and the deposition of the overlying shell (layers U8/4,5). With the exception of these elements, the faunal assemblage from this living floor is very similar to that from component 2a in Unit 4, being characterized by a very small amount of avian and mammal bone, and fish remains of both cod and herring.

Bourque has reported faunal assemblages similar to the component 2a assemblage from his central Maine shell midden sites (1971:103,107); these assemblages apparently occurred in well defined living floor contexts similar to those at BgDr 48. Sanger may have encountered a similar assemblage in the BgDs 10 site (McCormick 1980:67). Matthew also reported herring bones from BgDr 25 (1884:24) but did not specify the context in which they occurred.

During the analysis of BgDr 48 it became obvious that the distinction made during the excavation between shell contexts and gravel contexts was an arbitrary one with respect to vertebrate faunal remains. Elements apparently relating to the same individuals occurred both in midden and floor contexts. As a result, the elements identified from components 2b, 2c, and A, are presented as a single assemblage in Table 10. A total of 3093 bone pieces representing 73% of the site assemblage, occur in the three components; 9% of these are fish bones, 14% are avian bones, 75% are mammal bones, and 2% are unidentifiable.

The faunal assemblage summarized in Table 10, unlike those in components 1 and 2a, is very similar to other faunal assemblages reported from Passamaquoddy Bay sites. Some of the obvious similarities include: high proportions of mammal bone and low proportions of fish bone; low proportions of burned and calcined bone (5%); the extremely fragmentary condition of the bones, even large mammal elements; the large number of beaver incisors, usually artifactual; the predominant mammal species being canid, deer, beaver, and seal; low MNI counts for all identified species; significant numbers of avian bones; identified avian elements being predominantly wing elements; the majority of avian elements being splinters or tubular sections of the diaphysis portions of extremity bones. The component 2b/2c assemblage from BgDr 48 differs from other Passamaquoddy Bay faunal assemblages mainly by virtue of the somewhat greater proportion of fish bones in it; again, this may reflect the recovery of small fish bones, and the method of quantification used in this study, rather than "real" differences between the assemblages.

Both cod and herring elements are present in the component 2b/2c assemblage, but the fish remains occur in definite clusters rather than being generally distributed throughout the components.

Ten of the 11 positively identified avian species from the site are present in this assemblage; most are identified from single elements.

All of the positively identified rodent remains are included in this assemblage, except the probably intrusive beaver elements discussed above. One muskrat individual is identifiable from a single element. Several small rodent bones are present in the assemblage, probably representing mice or voles. These bones may have been added to the assemblage after the aboriginal occupation of the site.

Beaver elements are very common, numbering at least 28; however, all of these except 3 are cranial elements.

The minimum number of individuals (MNI) of beaver varies considerably depending on the element used to calculate this statistic: if lower left incisors are used, 8 individuals are counted; left mandibular condyles indicate 4 individuals; post-cranial elements indicate only one (adult) individual. McCormick (1980:148) has reported similar findings from other Passamaquoddy Bay sites, as have Sanger and Chase (1983:3) for a site in northern Maine.

Further consideration of the beaver teeth is instructive. Of the 41 beaver molars and incisors recovered, 25 are mandibular, 7 are maxilliary, and 9 cannot be classified. Since virtually all of the incisors for which crown portions were recovered are artifacts, it seems probable that most of the beaver elements were brought on-site as tools rather than as the result of subsistence activities. Beavers must have been brought from at least as far away as Deer Island.

An examination of the roots of the beaver cheek teeth suggest the following age classification for the remains: no deciduous premolars are present, so individuals less than 9 months in age are unlikely; several molars with completely open roots suggest at least 2 individuals between 1 and 2.5 years of age; several molars with partially closed roots suggest at least 2 individuals between 2.5 and 4 years of age; the remaining molars have completely closed roots, and indicate at least 4 adult individuals greater than 4 years of age.

The remains of at least 3 canid individuals are present in the component 2b/2c assemblage. The mandibles recovered suggest that these individuals are domestic dogs, but this identification cannot be made with assurance. Of these canid individuals, one is a juvenile, one a subadult (adult sized mandible with open tooth roots), and one an adult (mandible with closed tooth roots). There is evidence that both of the large canids were butchered and consumed; there is no evidence that the juvenile canid was butchered.

Pinnipeds are represented by at least three individuals in components 2b and 2c; these include 1 grey seal (adult); one subadult harbour seal (adult sized teeth with open roots); and one adult harbour seal (teeth with closed roots). A fourth seal individual may be represented by a large canine tooth which has been partially perforated at the root, probably for use as a pendant. The latter element may relate to the large sea mammal remains discussed in component 1, but this association cannot be demonstrated with assurance.

A mustelid individual is represented by one element.

The Cervid family is represented by three individuals: one moose (represented by only one positively identified element), probably a small animal; one immature white-tailed deer; and one other white-tailed deer, probably also a small young animal. These animals must have been brought to the site from as far away as Deer Island, and perhaps as far away as the mainland.

The distribution of identified species in components

2b and 2c is best considered by site area.

The living floors in Unit 1 yielded no identifiable bone elements, and are thus an enigma from the point of view of the present analysis. It is worth noting, however, that living floors (house-pits) from which the faunal recovery was negligible have been reported from BgDs 10 as well (McCormick 1980:65).

In Unit 5 only a very few fish bones were recovered; several of these are identifiable to the cod family. Deer, moose, beaver and marten remains are identifiable among the mammal bones. This is the only site area in which moose and marten elements are positively identified. The greater shearwater, both Brant geese, the common murre and the thick-billed murre also come from this unit.

In the living floors and middens in Units 2, 3, and 9, the faunal assemblage consists mainly of deer, canid, beaver and seal remains. The only fish remains recovered from this area are two otoliths, one identified as pollock, and one as haddock (see Plates A-9 and A-10). Two small fish elements were recovered from a column sample adjacent to Unit 2 in a midden context.

The presence of the otoliths in this area of the site is interesting, since these were the only otoliths recovered, and this is the only site area where other fish remains are absent. It is possible that the otoliths were curated for some artifactual purpose, although this interpretation is based only on their provenience. The relationship between these otoliths and the other cod remains in the site cannot be determined.

Elements of both the subadult and the adult canids are present in Units 2, 3, and 9, as are some of the beaver incisors and mandibles. Portions of two large Cervid elements may relate to the moose individual identified in Unit 5.

Three birds are identified from Unit 3; these are a loon, the wood duck, and the great auk.

The similarities between the faunal remains from each of these three units substantiates the notion that the midden deposits adjacent to these living floors were built up during the occupation of the floors.

In Unit 8, where the shell deposits contain deer, seal, and beaver elements, and only a trace of fish bone, the midden probably also accumulated during the occupation of the Units 2 and 3 living floors.

In Units 4 and 7 some stratification of the component 2b/2c faunal assemblage is discernable. The grey seal remains are present in a thin shell layer immediately above the component 2a floors; in Unit 7 these are associated with the juvenile canid remains. This is probably stratigraphically the earliest part of components 2b/2c, and may represent a depositional event distinct from the others. This layer (U4&7/3) is also notable for the relative scarcity of fish remains associated with it.

The middle levels of Units 4 and 7 contain large numbers of deer, canid (both the adult and subadult individuals), beaver (most of the artifactual incisors), and harbour seal elements. These levels are probably associated with the occupation of Units 2 and 3 living floors, as the same species, and possibly the same individuals, are present. Avian elements are common in this area but few are identifiable. The common goldeneye is present, as is a large avian radius which may represent an immature bald eagle individual.

The final group of faunal remains associated with components 2b/2c occurs in the floors near the surface of Unit 4; this is stratigraphically the latest occupation observed at the site. Most of the cod and all of the herring remains from this assemblage are associated with this area. The sardine-sized herring, which can be positively identified as Atlantic herring (because some cranial elements are present), were recovered from two column samples in one area of the floors, while the large herring elements were recovered from two samples in another part of the same deposit.

One loon individual and the eider duck are associated with these floors as well.

Deer, canid, beaver, and seal elements may relate to the occupation of these floors, or may be intrusive into them from the layer below.

Minimally, then, there are three stratigraphically separable occupations in components 2b and 2c, one associated with the grey seal, one associated with the bulk of the mammalian and avian remains, and one associated with the cod and herring remains. The amount of faunal remains and the complexity of their distribution suggests that the second of these at least is a composite of several occupations.

Discussion of Vertebrate Remains:

The data presented here suggest that it is possible to distinguish distinct faunal assemblages representing particular cultural occupations at BgDr 48. Most of the problems associated with defining these assemblages precisely appear to result, not from depositional and post-depositional disturbance of the site, but from the lack of precision in stratigraphic control where arbitrary 10 cm. levels were used to excavate non-arbitrary layers of less than 10 cm. in depth. As well, the distribution of vertebrate remains suggests that shell midden sites should be treated as series of surfaces consisting of both living floors and shell dumps, rather than as alternating layers of shell midden and floor deposit.

It should be noted that component 2a would have been archaeologically invisible as a distinct faunal assemblage in the absence of the column sample data.

Within the limits of precision allowed by the present data there is little evidence for serious post-depositional disturbances of the stratigraphic integrity of the BgDr 48 site. This observation is congruent with those made by some other researchers. For instance, an experimental and comparative study (Hughes & Lampert 1977) of different types of archaeological matrices has shown that a shell matrix inhibits rather than increases the mixing effects of cultural and natural activity on archaeological assemblages. Similarily, Koike (1979) has shown that disturbances in shell matrices take place mainly on a horizontal rather than a vertical plane, and are mainly the result of cultural activity rather than post-depositional effects.

The few definite instances of stratigraphic disturbance noted in this study (for example, the mixing of fish remains from component 1 into an overlying shell deposit, and the movement of shell and bone from components 2b and 2c into A) were easily detectable and interpretable. In general, the present study supports Sanger's (1981) arguments for stratigraphic integrity in the Passamaquoddy Bay middens, and contradicts Brennan's (1981:136) concerns about "the radical displacement caused by the natural dissolution of shell".

In spite of the evidence for the dissolution of shell at the edges and at the base of BgDr 48, the stratigraphic integrity of depositional units and faunal assemblages remains, and much more dissolution would have to take place before this integrity disappeared.

CHAPTER 7:

STRATIGRAPHY, SEASONALITY, AND SUBSISTENCE.

> When winter cometh, all fishes are astonished, and shun the storms and tempests, everyone where he may.... The same cod leaveth off biting after the month of September is passed, but retireth himself to the bottom of the broad sea... (Lescarbot 1928:282)

Seasonality of Shellfishing and Shell Middens at BgDr 48:

Several types of evidence can be brought to bear on the question of the seasonality of shellfish gathering at BgDr 48, and to evaluate the conflicting opinions of Stewart and Burns (see page 7). The crux of Stewart's argument is that shellfish gathering would not be practiced in the summer months of June, July, and August, due to the danger of Paralytic Shellfish Poisoning (PSP) during those months -- thus, shellfish remains can be equated to autumn/winter/spring occupations. While it is true that PSP is a serious problem in the southern Bay of Fundy area, there are several reasons to suggest that it would not have mitigated against aboriginal shellfishing in the absolute manner Steward has suggested.

First, there is little consistency in either the levels or the timing of PSP toxin presence from year to year, and PSP attributed deaths have been recorded in all seasons except midwinter (Prakash et al. 1971:5). Also, poisonous clams cannot be distinguished from non-poisonous ones by sight, smell, or taste (Prakash _et al_. 1971:30). Thus, if aboriginal people recognised the connection between PSP deaths and shellfish consumption at all, they would probably have avoided their consumption in all seasons except winter. This was clearly not the case in Acadia at the time of European contact since most ethnohistoric sources describe shellfishing as a spring/summer activity (Christianson 1979:113).

Second, there is evidence that shore residents are less susceptable to PSP toxin than are non-shore residents (Prakash _et al_. 1971:71), and that the susceptability decreases with age. This tolerance seems to build up over the lifetimes of individuals as a result of repeated slight exposures to PSP toxin (Prakash _et al_. 1971:15). This was almost certainly true of the aboriginal inhabitants of the Atlantic coast as well.

A third consideration is the evidence that the PSP problem may be aggravated by the pollution of near shore waters (White 1980). Toxin levels may be higher now than in the past. It is also interesting to note that the soft-shelled clam, although it does concentrate the PSP toxin, is generally the least affected of the common food mollusks which are affected by the toxin, because it is low on the food chain and is not submerged for a considerable time at each tidal cycle. Toxicity is related to the length of exposure to sea water (Medcof _et al_. 1947).

Seasonal dating of soft-shelled clams from sites on the central Maine coast (Hancock 1982), and of various cockles from sites on the lower mainland of British Columbia (Keen 1980), indicates that shellfish gathering took place in these areas in the summer months in spite of the dangers of PSP.

Hancock presents a second type of information relevant to this question by emphasizing the problems involved in gathering soft-shelled clams from frozen intertidal zones during the winter months (1982:26-27).

Finally, given that the native inhabitants of the Passamaquoddy Bay area did perceive the dangers of PSP, it seems reasonable that they would also be aware of the intertidal species which are unaffected by the toxin, and simply switch their subsistence emphasis to those species during the dangerous seasons. The possibilities include all of the intertidal grazers such as limpets, chitons, periwinkles, and sea urchins. Even given indisputable evidence that these people did avoid shellfish in the summer, it would require a considerable leap of faith to assume that this would lead to a seasonal shift to interior residence or exploitation, unless one were willing to grant that shellfish gathering was the primary determinant of coastal residence in the first place. As the ecological data make clear, summer/autumn is the most productive season on the coast, and many other resources would be available.

In order to further address the question of shellfish seasonality at BgDr 48, a sample of 50 soft-shelled clam valves were selected from various column samples and their growth annuli analysed. The valves selected were complete and their posterior edges and surfaces showed little or no evidence of chipping or erosion.

Each valve was sectioned perpendicular to the growth annuli and the edges of the sections were polished with several grades of fine sandpaper. The polished edges were then cleaned and wetted using isopropyl alcohol and examined under 10X-25X magnification. The growth annuli appeared as single, or narrow bands of, thin dark lines interrupting areas of white or translucent shell. The terminations of the annuli usually coincided with growth checks on the surface of the shell.

At this point in the analysis the 50 valves were sorted into two groups, those in which the growth lines appeared distinct and interpretable, and those in which the lines were so indistinct, so irregularily spaced, or so closely packed, that they were considered uninterpretable.

The width of each annulus on each interpretable valve was then measured, as was the final growth increment between the last growth annulus and the edge of the shell. The widths of the complete annuli were used to predict the width of the annulus which was forming when the clam was harvested, by calculating the relative reduction in valve growth with each year of age. Then the measured width of the final growth increment was compared to the predicted width to obtain an estimate of the proportion of annual growth which had occurred prior to harvesting.

This methodology is similar to one of those described and tested by Hancock (1982:28), but it is not the preferred method upon which the results of that study were based. It would be desirable to apply the acetate peel methodology preferred by Hancock (1982:29) to shells from Passamaquoddy Bay and West Isles sites in order to further substantiate the results obtained here.

Hancock determined that growth annuli observed in modern soft-shelled clams form during the period between early May and late June each year. Shell growth was observed to begin in the spring before annulus formation, and to continue throughout the summer months at a rapid rate. Shell growth occurs during the autumn months at a reduced rate, and is negligible from December until March (Hancock 1982:38-39).

Hancock classified both the archaeological shells and their modern analogues into two categories:

> The first category (I) includes those shells in which the width of the most recent increment is equal to or less than 100% of the average width of the preceeding bands... The second category (II) includes those shells in which the width of the recent band is greater than 100% of the average width of the previous bands (1982:139).

Category I shells were interpreted as having been harvested in the months of active growth (May to November) and category II shells to have been harvested in the inactive growth phase

(December to March) (Hancock 1982:39).

Table 11 indicates the results of the measurements made on the 50 valves from BgDr 48. The categories used are conformed to Hancock's as much as possible given the differences in sectioning and measurement methods.

Two classifications are given: the ≥100% test, and the 25-75% test. In the first test all shells in which the most recent growth increment is less than 100% of the predicted growth increment are considered to have been harvested during the active growth period (I); shells in which the most recent increment is greater than the predicted increment are considered to have been harvested in the inactive growth period (II). Using these criteria, 52% of the valves sectioned are interpreted as summer/autumn harvested, 24% as winter/spring harvested, and 24% as uninterpretable.

In the second test an attempt is made to isolate valves which could be more exclusively interpreted as summer harvested clams, and also to offset some possible misinterpretations resulting from variations in the growth patterns of individual clams. In this case only those valves in which the most recent increment is between 25% and 75% of the predicted increment are placed in category I. Using these more conservative criteria, 34% of the valves are still interpretable as summer harvested clams, while 42% are interpretable as having been harvested in other seasons. The uninterpretable valves are as in the previous test.

TABLE 11: Seasonality Interpretation of *Mya arenaria* Valves from BgDr 48.

Provenience:	Valve Number:	≥100% Test: I	≥100% Test: II	25-75% Test: I	25-75% Test: II	Uninterpretable Valves:
8:1	1		X		X	
8:5	1	X		X		
	2		X		X	
8:6	1	X		X		
8:7	1	X			X	
8:8	1	X		X		
8:9	1		X		X	
	2		X		X	
8:10	1	X			X	
8:11	1	X			X	
8:12	1		X		X	
	2	X		X		
9:3	1		X		X	
13:4	1	X		X		
14:2	1					X
16:4	1	X		X		
17:4,5	1					X
17:6	1	X		X		
	2	X		X		
17:7	1					X

TABLE 11: continued.

Provenience:	Valve Number:	≥100% Test: I	II	25-75% Test: I	II	Uninterpretable Valves:
17:7	2					X
	3	X		X		
17:8	1	X			X	
	2	X		X		
18:1	1					X
18:2	1					X
	2	X		X		
18:3	1					X
	2					X
	3	X		X		
18:4	1	X			X	
18:5	1		X		X	
18:6	1					X
	2	X			X	
18:7	1					X
	2	X			X	
18:9	1					X
	2					X
18:12	1	X			X	
U1/2	1		X		X	

TABLE 11: continued.

Provenience:	Valve Number:	≥100% Test: I	II	25-75% Test: I	II	Uninterpretable Valves:
20:9	1	X		X		
	2		X		X	
	3		X		X	
20:11	1		X		X	
20:12	1	X		X		
20:14	1	X		X		
20:15	1	X			X	
	2	X		X		
	3		X		X	
	4	X		X		
totals:	50	26	12	17	21	12
proportions:	100%	52%	24%	34%	42%	24%

Sea urchin remains have usually been interpreted as evidence of winter/early spring occupation where they have been observed in archaeological sites in Maine (see Snow 1972: 213; Bourque 1973:Fig. 6). Bourque relates their exploitation to the spawning season (spring), while Snow relates it to the period when urchins are full of eggs (winter). Harvey (1956: 59) indicates that in New England populations of S. droebachiensis are full of unripe eggs in January and February, full of ripe eggs in March and April, have spawned by the middle of May, and remain empty for several months thereafter.

An examination of the literature dealing with Passamaquoddy Bay sea urchin populations suggests a somewhat different interpretation of their presence in archaeological deposits. This may reflect slight differences in the ecology of New England and New Brunswick urchins, since gonad development and spawning in urchins are triggered by factors such as exposure to light and water temperature (Boolootian 1962:167).

MacKay (1976:45) presents data indicating that the gonads of urchins in the northern West Isles area begin to develope in late summer and are fully developed in January and February. The peak commercial harvesting season for sea urchin roe is from October to January. From March until the summer months roe quality is poor due to spawning, and in late spring and summer most urchins exhibit minimal gonad development.

Thus, it seems probable that aboriginal people would have exploited urchins during the autumn/winter seasons rather than in the spring or the summer. This interpretation assumes, of course, that ecological factors affecting the reproductive patterns of urchins have not changed in the past 2000 years.

Coutts and Jones (1974) have described a technique for determining the seasonality of sea urchin remains from archaeological sites in New Zealand using growth annulus analysis. MacKay (1976:33-34) observed the growth increments of Passamaquoddy Bay urchins in order to determine their ages. This suggests that it may be possible to use archaeological urchin tests to determine site seasonality. This was not attempted in any detail in the present study. However, several sea urchin test sections were embedded in epoxy resin, their surfaces ground with fine sand paper, and their growth increments examined at 25X magnification.

Thin translucent bands alternating with wider opaque bands were observed; these have been interpreted as summer and winter bands respectively by MacKay (1976:33). The urchin tests observed indicated that the BgDr 48 sea urchins were probably harvested during the formation of the winter bands. This observation substantiates the seasonality interpretation made above.

The application of growth annulus analysis to samples of urchin tests from several sites would be desirable before a great deal of emphasis is placed on this interpretation.

The small bivalve species, <u>C. borealis</u> and <u>A. castanea</u>, are also probably amenable to growth annulus analysis. The latter species has been subject to some study in this respect (Rhoads and Pannella 1970:152-153). Two valves of each of these species were selected from the BgDr 48 assemblage, sectioned, embedded in epoxy resin, ground, and examined microscopically. Unfortunately, growth annuli were indistinct in all of these specimens, and no seasonality interpretation can be offered. It is probable that the use of etching and acetate peels would facilitate the analysis of these small bivalves. However, the question of how these small bivalve species were added to the archaeological assemblage would have to be resolved before any information so obtained could be considered particularily useful.

It is possible that the seasonality of mussel exploitation could be determined using growth annulus analysis, although the concensus in the literature seems to be that mussel shell is more difficult to prepare and analyse than clam shell. The extreme fragmentation which mussel shell undergoes in most archaeological contexts also mitigates against the application of such methods.

Several sources (MacKay <u>et</u> <u>al</u>. 1978; Ganong 1889) indicate that horse mussel exploitation would most likely have taken place during the lowest spring tides, but it is difficult to attach any seasonal significance to this observation, at least in the West Isles area.

Snow (1973:213) has equated common mussel exploitation on the central Maine coast with the occurrence of low spring tides during the winter. This line of reasoning is clearly inapplicable to the West Isles, where common mussels are exposed during almost every low tide cycle in every season.

Finally, with respect to the seasonality of shellfish exploitation at BgDr 48, it is necessary to briefly note some current research which may clarify the seasonality of dogwhelk exploitation. Whitehead (1982,1983:p.c.) has experimented with producing purple dye from dogwhelks. At this preliminary stage the reseach indicates two points relevant to the present study. First, there is some indication that the concentrations of fragmented dogwhelk shells observed at BgDr 48 may derive from dye production. Second, the research indicates that the colour factor is produced seasonally by these gastropods, and that if the whelks were gathered for dye rather than food, they would most likely have been exploited in the spring (April-May).

Seasonality of Vertebrate Faunal Remains and Stratigraphic Components at BgDr 48:

Component 1.

The two identified fish species provide the most useful information for determining the seasonality of this component. Pollock are an excellent seasonal indicator, entering the Bay of Fundy during the summer months, and migrating to the southern Gulf of Maine in the winter to spawn (Leim and Scott

1966:213-214). Large pollock are especially common at the mouth of Passamaquoddy Bay during the summer (Steele 1963: 1310). The most precise seasonal interpretation for this species is summer/autumn.

The Atlantic cod is also a relatively precise seasonal indicator. These fish move inshore in the summer and offshore in the winter (Leim and Scott 1966:197). Sanger (1982:202) suggests a summer seasonality for cod remains in the central Maine coastal sites, while Bourque (1971:229) equates cod remains with autumn seasonality in the same area. Atlantic cod are best interpreted as a summer/autumn seasonal indicator in the West Isles; this interpretation is reinforced by the probability that cod and pollock remains in component 1 result from the same fishing episode(s).

The mustelid remains are of uncertain association and are not useful seasonal indicators.

The large sea mammal remains are of little value as seasonal indicators in the absence of a more precise identification.

In summary, component 1 reflects a single activity with certainty -- groundfishing; this activity probably involved the use of hook and line tackle in moderately deep water. The fact that the fish assemblage from this component consists almost exclusively of cranial elements and trunk vertebrae, suggests that the fish may have been filleted and the meat consumed elsewhere. The bones recovered are those commonly discarded when fish are filleted for drying or smoking. The large amount of charcoal associated with the component 1 floor may indicate that the fish were smoked on-site.

Cumbaa (1983) has described similar assemblages of cod bones resulting from historic filleting and preservation of fish; the present author has observed exactly the same type of assemblages on modern shorelines in southern New Brunswick resulting from modern processing of groundfish.

The small amount of shell remains indicates minor intertidal exploitation associated with this occupation. The sea mammal remains suggest a possible third subsistence orientation, which would have been carried out in the same environmental zone as the groundfishing. There is no indication of terrestrial exploitation beyond the presence of a few small mammal bones.

The small number of artifacts, the absence of features, and the small number of species in the faunal assemblage, suggest that component 1 represents a short-term, specialized, occupation.

Component 2a.

Fish remains are the most useful seasonal indicators in this component as well. The cod and pollock remains again indicate a summer/autumn seasonality, and this is further substantiated by the Culpeid fish remains.

The general biological literature usually emphasizes spring/summer seasonality for herring (for example, Leim and

Scott 1966:96; Berrill and Berrill 1981:285-286). More specific sources indicate that in the Passamaquoddy Bay area summer/autumn is a more probable seasonal interpretation for archaeological herring remains. Herring are most common at the mouth of the Bay of Fundy in the summer (Scattergood and Tibbo 1959), and move into and out of Passamaquoddy Bay during the summer and autumn (McKenzie and Scud 1958:1329).

Bigelow and Schroeder(1953:98) indicate that large herring in particular are summer/autumn migrants into Passamaquoddy Bay; sardine-sized herring are apparently present in the bay throughout the year but remain in deep water during the winter.

The presence of alewife in this assemblage, if it could be demonstrated, would not change this interpretation. In general, alewife are even more strongly associated with spring seasonality because they are anadromous (see Christianson 1979:97-98). Bourque (1971:230) has reported finding alewife remains scattered on living floors in central Maine coastal sites; these were interpreted as having been fished in open water, or transported from river mouth sites. However, Leim and Scott (1966:88-90) report that alewife may be caught "incidentally" in weirs among catches of herring in the summer and autumn.

The crow is not a useful seasonal indicator. Crows are present in the area throughout the year, but are more common in the summer (Squires 1952:92).

The mustellid remains are also not useful seasonal indicators.

In summary, component 2a probably represents a longer term occupation of the site than the previous component; it may represent a series of occupations, as indicated by two groups of stratified features, and a wider range of faunal remains.

Three orientations toward marine exploitation are indicated: off-shore fishing for groundfish, inshore (weir?) fishing for Culpeid fishes, and intertidal gathering of shellfish.

Only a small amount of evidence for the exploitation of terrestrial or avian resources exists in this component.

In light of the seasonality interpretation suggested previously for sea urchin remains, their virtual absence from component 2a strengthens the case for a summer, rather than autumn, season of occupation.

Components 2b/2c.

Evidence for the seasonality of the component 2b/2c occupations can be drawn from three sources, the migratory fish, the migratory birds, and the sea mammals.

The terrestrial mammals identified in these layers are probably the predominant subsistence resources present, but their value in seasonality determination is minimal. Marten, mink, muskrat, and beaver are available throughout the year (Peterson 1966:177,247; Banfield 1974:197,316).

The deer and moose are also available in all seasons, and although the absence of antlered parietals in the assemblage is weak evidence for a winter seasonality interpretation of these remains (Banfield 1974:392), the sample of individuals is so small that this consideration is probably best ignored (Monks 1981:184). The canid remains are also not seasonally specific, although, given that these represent domestic dogs, one might associate the eating of dogs with climatically severe seasons (that is, winter and early spring).

Pollock remains indicate a summer/autumn seasonality as discussed previously; in these components, this interpretation is further substantiated by the presence of haddock, a groundfish species which also migrates into Passamaquoddy Bay in the summer, and returns to the Gulf of Maine to spawn in the winter (McCracken 1960:17). The large herring remains also suggest a summer/autumn interpretation, although the sardine-sized herring may be less seasonally specific, indicating spring/summer/autumn seasonality.

The grey seal remains present a problem in interpretation. The biological sources (for example, Peterson 1966: 305-307; Mansfield 1967:8-9) suggest that the grey seal is a summer visitor to the southern Bay of Fundy as the seals move inshore to follow sculpin and herring. Mansfield notes that minor summer breeding occurs at Grand Manan (1967:9). However, on the basis of ethnohistoric accounts of a winter grey seal hunt coinciding with the January calving season (Christianson

1979:113), archaeologists have generally considered the grey seal to be a winter seasonal indicator.

Some faunal analysts (for example, Churcher 1963) have considered all seal remains to be winter indicators. The biological literature indicates that harbour seals move inshore in the summer and offshore in the winter following the movements of herring (Peterson 1966:305; Boulva and McLaren 1979). Thus, it is reasonable to suggest that aboriginal people would have come in contact with seals, and preyed on them, during the fishing season.

The avian species identified from components 2b/2c include mainly migratory birds. Some of the birds, the loons, the goldeneye, the eider duck, and the possible bald eagle, are of questionable value in interpreting seasonality. Loons nest on freshwater lakes during the spring, summer, and autumn in the Maritimes, and are rare winter residents on the coast (Squires 1952:19). Stewart (1974) interpreted the loon remains at BgDr 5 as winter kills. However, given the proximity of freshwater lakes and ponds to the coast of Passamaquoddy Bay it seems more prudent to consider the loon an all season resident of the southern coast of New Brunswick (as does McCormick 1980:139).

The common goldeneye is also a year-round resident of the area (Squires 1952:38).

Two subspecies of eider duck occur in the area, one a summer resident, the other a winter resident (Squires 1952:38).

Since the two probably cannot be distinguished on skeletal criteria, this bird must be considered a year-round resident.

The bald eagle is also represented by two subspecies in New Brunswick which are present in all seasons (Squires 1952:45-46).

The greater shearwater is an uncommon visitor to the New Brunswick coast; Squires (1952:22) cites reports of it during the summer/autumn period at the mouth of the Bay of Fundy. The presence of this bird in the assemblage substantiates the seasonality interpretation suggested by the fish remains.

The wood duck is a spring/summer/autumn indicator, which, like the loon, inhabits freshwater lakes and ponds (Stewart 1974:31-32).

The other four identified birds represent the seasonality generally ascribed to Passamaquoddy Bay shell midden sites -- autumn/winter/spring. The Brant goose is a spring/autumn migrant which has been noted on Grand Manan in large numbers in the spring (Squires 1952:29-30). The thick-billed murre has been reported on the N.B. coasts during autumn/winter/spring (Squires 1952:72-73), while the common murre is even more seasonally specific, having been reported only in winter/spring (Squires 1952:72). Finally, the great auk, although it is extinct and little is known of its behavior (Squires 1952:72), has usually been considered to indicate winter seasonality (Godfrey 1963:195; Burns 1978; Sanger 1982).

In summary, components 2b/2c represent a lengthy and complex series of occupations in which indicators of occupation in all seasons are present. This should not be taken to mean that these components represent year-round occupation of the site. The stratigraphic evidence suggests several occupations, in different seasons, some perhaps separated by distinct hiatuses.

The layer in which the grey seal occurs may represent either a summer or a winter occupation. The relative absence of fish bones and the considerable concentrations of sea urchin remains in the layer make a winter interpretation somewhat more tenable.

The firmest evidence for spring or autumn exploitation of migratory birds comes from Unit 5, while the seasonally unspecific birds occur mainly in Units 4 and 7. The great auk lends some credence to a winter interpretation for the housepit in Units 2 and 3, but this is directly contradicted by the wood duck in the same feature. The association in this area between loon and wood duck remains suggests freshwater resources exploited during the spring, summer, or autumn, and brought out to the coast.

In general, the virtual absence of fish remains in Units 2, 3, and 9, Unit 5, the shell layers of Unit 8, and the middle layers of Units 4 and 7, is negative evidence suggesting occupation in non-fishing (probably winter/early spring) seasons.

The living floor at the surface of Unit 4 may be another example of a summer/autumn occupation, although spring is a possibility as well.

In general, the variability in vertebrate seasonal indicators substantiates the data indicating invertebrate exploitation in all seasons.

Without finer resolution of, and larger samples of, the faunal assemblages associated with particular layers, it is impossible to specify the seasonality of particular component 2b/2c occupations further. The resolution achieved here is good enough only to hint a particular interpretations.

Discussion of BgDr 48 Seasonality Interpretations:

A final summary of the stratigraphic and seasonality interpretations of BgDr 48 is presented in Figure 17; this schematic is a refinement of the stratigraphic schematic presented in Figure 10, and is based on both stratigraphic and faunal information. The stratigraphy has been slightly reinterpreted on the basis of the faunal remains. The inferred seasonality of each of the strata is given at the right of the diagram.

Stewart (1974:38) has argued that the seasonality of archaeological faunal assemblages can never be positively identified because of the problem of faunal elements being carried over from one season to another. While this concern is a legitimate one, it is possible to suggest that some types

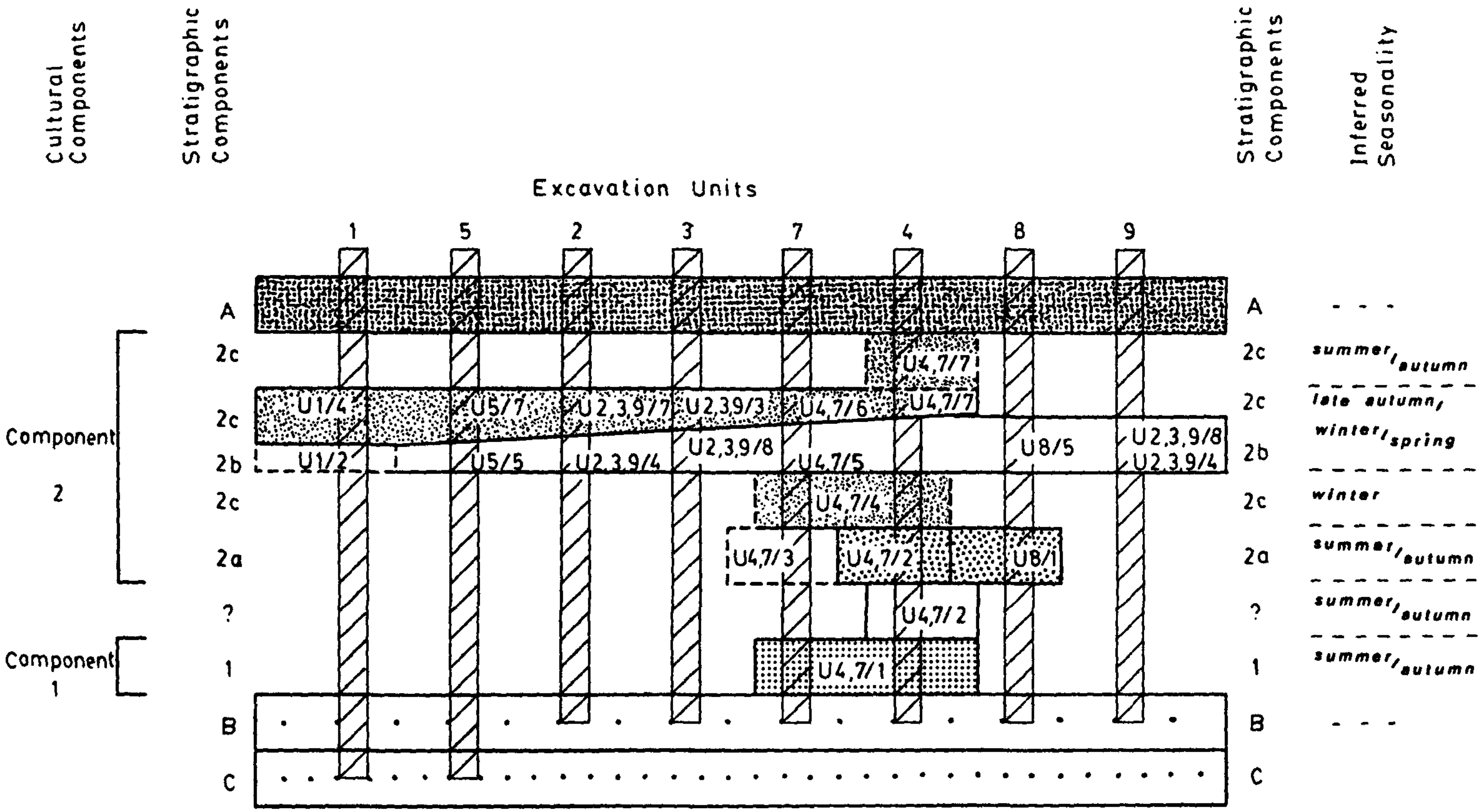

FIGURE 17: Composite Schematic Diagram of BgDr 48 Stratigraphy and Seasonality.

of faunal remains are less susceptable to carry over than others. In the present case, virtually all of the terrestrial mammal and many of the avian elements must have been brought to Partridge Island from Deer Island, one of the other large islands, or from the mainland. Many of these, especially the beaver elements, which were selected as artifacts, the moose elements, which are few in number, and the avian elements, which are easily transportable, may have been carried over from other seasons. On the other hand, it is very probable that the marine resources represented at the site were procured in the immediate vicinity of Partridge Island. Thus, emphasis should be placed on the evidence provided by the seals, the fish, and the shellfish, in reaching conclusions about seasonality. This evidence was emphasized in arriving at the inferred seasonalities presented in Figure 17.

Monks (1981:223) has emphasized that the most important question to be answered in any seasonality study is the question of what unit of analysis (time of year, activity, location, residence, particular species) is seasonality being specified for. The seasonality of particular species has been discussed previously in this chapter. In Figure 17 an attempt has been made to specify the time of year at which aboriginal people were residing on the coast at particular points in the overall history of occupation at the BgDr 48 site.

The seasonality indicators at BgDr 48 tend to substantiate Sanger's (1982:202) hypothesis that summer occupations would be found in Ceramic Period (= Maritime Woodland) sites on the West Isles. However, if the similarities noted in this study, and in Bishop's (1983) study, between BgDs 6, BgDs 10, and BgDr 48, can be further substantiated, it may be shown that insular location was not the only determinant of summer residence locations at that time.

Furthermore, there is evidence to suggest stratigraphically separate components representing different seasons at BgDr 48, and possibly a transition over time from summer/autumn to autumn/winter/spring seasons of occupation. One West Isles site is not enough upon which to base firm conclusions, but given that there is some evidence for winter occupation at BgDr 48, and some evidence for summer occupation in the Passamaquoddy Bay sites (Stewart 1982), then a reasonable interpretation of aboriginal settlement pattern in the area may be one of short-term occupations of the coast in most or all seasons in both the Passamaquoddy Bay and West Isles areas. The central tendancies in the pattern would be for warm season occupations to be more frequent in the West Isles, and cold season occupations to be more frequent on the north shore of Passamaquoddy Bay.

The question of whether seasonal movements between the interior and the coast were a part of the settlement pattern is a moot one until more is known about interior Woodland Period sites in proximity to the south shore of New Brunswick. As Christianson (1979:120) has pointed out, part of the problem involved in determining residence patterns is a definitional one. It would be entirely possible for the aboriginal inhabitants of Passamaquoddy Bay to exploit both interior and coastal resources while maintaining coastal residences throughout the year. There is no *a priori* reason to assume the presence of a coastal/interior dichotomy in settlement during the prehistoric period (as Snow (1980) appears to have done with respect to the New England data).

CHAPTER 8:

SUMMARY, HYPOTHESES, AND RECOMMENDATIONS.

> The iterating of these lines brings gold,
> The framing of this circle on the ground
> Brings tempests...
> (Mephistophilis, in Marlowe's Dr. Faustus)

To some extent all sciences which endeavour to reveal aspects of the past are sophisticated sorcery. In archaeology, the images that return are inextricably bound up in the methods (the magic) that are used to reconstruct (resurrect?) those images. This thesis has considered several aspects, methodological and substantial, of the coastal archaeological record of Passamaquoddy Bay and the West Isles. It should be emphasized, at this point, that the images reconstructed during the present study must be considered tentative, since they are based on data gathered from only a few sites. Accordingly, by way of a summary, the conclusions are restated below as testable hypotheses, and recommendations are made for the testing of these hypotheses.

1) This study suggests that the preservation of intact coastal cultural deposits dating to the Early Maritime Woodland Period on the shores of Passamaquoddy Bay and the West Isles is related to local site geomorphology. The effects of such factors must be controlled for before firm judgements

concerning the settlement patterns of Woodland Period peoples can be made.

Specifically, it is hypothesized that intact Early Maritime Woodland components will be found in areas where foreshore slopes are at a high gradient, but not in areas where foreshore slopes are at a low gradient.

It is recommended that foreshore slopes adjacent to sites be accurately measured during future site surveys in the area. This can easily and rapidly be accomplished using a minor surveying instrument such as an Abney clinometer or a Brunton compass. These data could be correlated to radiocarbon dates from the sites to determine whether the relationship suggested here can be substantiated or refuted.

2) This study has suggested that it is possible to subdivide shell midden sites into stratigraphic components smaller than site size, and that such components are culturally meaningful. The components defined in this study were based on stratigraphic profile analysis, content analysis, and the distribution of faunal remains -- the analysis is congruent with, and substantiated by, radiocarbon analysis and the cultural historical record at the site. One of the components defined is essentially invisible to the arbitrary level/¼ in. screen excavation methodology most often used at area shell middens in the past.

The BgDr 48 stratigraphic analysis leads to three recommendations. First, wherever and whenever possible, shell midden deposits should be excavated according to natural and cultural stratigraphy and not according to arbitrary levels. Analytical units should be kept as small as possible.

Secondly, it is recommended that future faunal analyses be conducted in terms of such analytical units.

Third, it is recommended that, wherever and whenever possible, future excavators employ such methods as water screening, fine-mesh dry screening, and/or extensive column sampling, in order to maximize the recovery of small faunal remains, and, parenthetically, carbonized plant remains.

3) It has been hypothesized that seasonality and subsistence changes can be detected between cultural historical components in shell midden sites, and in some cases similar changes may be detectable within cultural historical components. Evidence has been cited which suggests similarities between the BgDr 48 faunal record and that of sites on the northern, central, and southern Maine coasts.

It is recommended that species identifications of small fish remains be refined by the collection and preparation of a complete series of appropriate skeletal materials.

It is recommended that hypotheses concerning the seasonality of specific animal species and particular faunal assemblages be tested using such methods as growth increment analysis. In the case of BgDr 48, for example, at least 4 species of shellfish may be amenable to the methods discussed above, the beaver, deer, and seal teeth may be amenable to the methods discussed by Bourque, Morris, and Speiss (1978), and at least 2 species of fish vertebrae may be amenable to the methods described by Casteel (1976). Using such methods the strength of particular seasonality interpretations could be evaluated in comparison to results from other methods.

A modest beginning to this type of research has been presented in the present study, involving the growth increment analysis of soft-shelled clams. The evidence from this analysis was used to substantiate the hypothesis that shellfishing was carried on during all seasons of the year during the prehistoric period.

4) The data presented in this study suggest that the importance of the soft-shelled clam, M. arenaria, relative to that of other shellfish species exploited during prehistory on the southern New Brunswick coast, has been overemphasized in previous reports of shell midden sites. Specifically, it is suggested that 30% or more of the invertebrate meat collected by the inhabitants of BgDr 48 came from other species, principally the sea urchin, S. droebachiensis, and the horse mussel, M. modiolus.

It is recommended that further quantitative midden analyses be undertaken in the area in order to test this hypothesis, and to further explore aboriginal shellfishing practices.

5) The faunal assemblage from BgDr 49 has been hypothesized to result from historic shellfish exploitation, and it

has been suggested that small single species deposits of shell may result from historic rather than prehistoric exploitation.

It is suggested that historic shellfish exploitation on the southern New Brunswick coast is a phenomenon worthy of more archaeological attention than it has received in the past. Research into this phenomenon is recommended.

6) On the basis of the distribution of faunal remains, artifacts, and other structural components in the BgDr 48 site, it has been hypothesized that there is little evidence for post-depositional movement of cultural materials through coarse shell matrices. Some evidence has been presented which suggests that the weathering of shell leads to some homogenization of contents within particular midden deposits, but there is no evidence for extensive mixing between deposits. Evidence from other studies has been presented which substantiates this hypothesis.

Since, as Sanger (1981:41) has pointed out, "Shell middens can combine component separation with alkaline environment that can do much to "flesh out" the [archaeological] ... record", it is recommended that excavation strategies be devised which maximize rather than minimize this potential. (Some relevant suggestions have been made in section 2 above.)

No assurance can be given that relatively good component separation is the rule in all shell middens; however, in the case of Passamaquoddy Bay/West Isles middens, component separability should be assumed to be possible until proven otherwise, and not *vice versa*.

This analysis of the stratigraphy, faunal remains, and seasonality, of the Partridge Island archaeological sites reinforces Sanger's (1981:41) conclusion that "the shell midden is indeed a wondrous storehouse of information awaiting our skills to interpret", and McCormick's (1980:128) feeling that the Passamaquoddy Bay archaeological record "... holds tremendous potential as a research tool..." The present study has presented some of that information and indicated some of that potential.

NOTES.

1. The present author prefers Keenlyside's cultural historical nomenclature and will use it throughout the balance of the thesis.

2. Bishop (1983 and n.d.) has identified the site now designated by the Borden number BgDr 25 as the Phil's Beach or Bocabec site excavated by Matthew in 1883. An examination of the site location records of the Historical Resources Administration of New Brunswick has convinced the present author that BgDr 1 is more probably the site excavated by Matthew. BgDr 25 is used throughout this thesis to designate the Bocabec site, in order to maintain continuity with Bishop's publications. Probably only re-survey and re-excavation of the Bocabec estuary can resolve this controversy.

3. This is probably a good point at which to clarify the uses of the term 'component' in this thesis. The term is used in three different contexts: structural components, stratigraphic components, and cultural components. A structural component is a constituent of an archaeological deposit (for example, gravel, shell, charcoal, bone, and so on); this use of the term equals that of McManamon (1982:113). A stratigraphic component is a subdivision of site stratigraphy in which several layers and/or features are grouped according to similarities in stratigraphic position and structural components. A cultural component is the manifestation of a particular culture at a particular site (Willey and Phillips 1958: 21).

4. Figures 1, 2, and 8, are based on the following marine and topographic charts:
Canadian Hydrographic Service Chart #4331 -- St. Croix Estuary and Passamaquoddy Bay.
Canadian Hydrographic Service Chart #4111 -- Letete Passage, New Brunswick.
New Brunswick Land Registration Chart #21G/02-RI -- St. George/Lord's Cove, New Brunswick.

5. I must express my thanks to Mrs. Irene Ockenden of the Life Sciences Department at McMaster University for her help in making this identification.

6. Bone was identified to class using criteria of surface structure and density. The criteria used are given in the chart below, which is based on one prepared by Dr. Howard Savage of the Department of Anthropology at the University of Toronto.

Criteria:	Fish:	Avian:	Mammalian:
1) Weight	light	light	heavy
2) Appearance	semi-translucent	not trans-lucent	not trans-lucent
3) Surface Structure	moderately developed	sharply outlined	well developed
4) Cortex	no cancel-lous bone	thin	thick
5) Marrow Cavity	absent	large	small
6) Bone Epiphyses	absent	distinguish-able in some species until nearly adult	distinguish-able until young adult

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APPENDIX A

Plates

Plate A-1:

BgDr 48, the Partridge Island Site, viewed from the southern shore of the island.

Plate A-2:

Partridge Island, the southern tide pool.

Plate A-3:

Partridge Island, the northern tide pool.

Plate A-4:

BgDr 48, excavation unit 4, the western stratigraphic profile, illustrating the correlation between observed stratigraphy, and the stratigraphic zones used as analytical units.

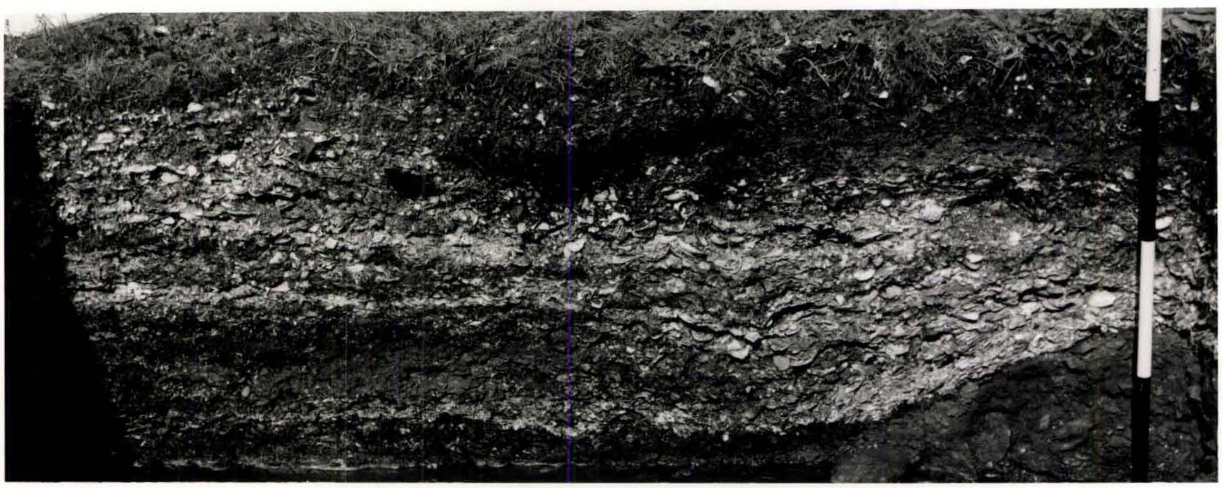

Plate A-5:

BgDr 48, carbonized berries from stratigraphic unit U4&7/7, column sample 20:5.

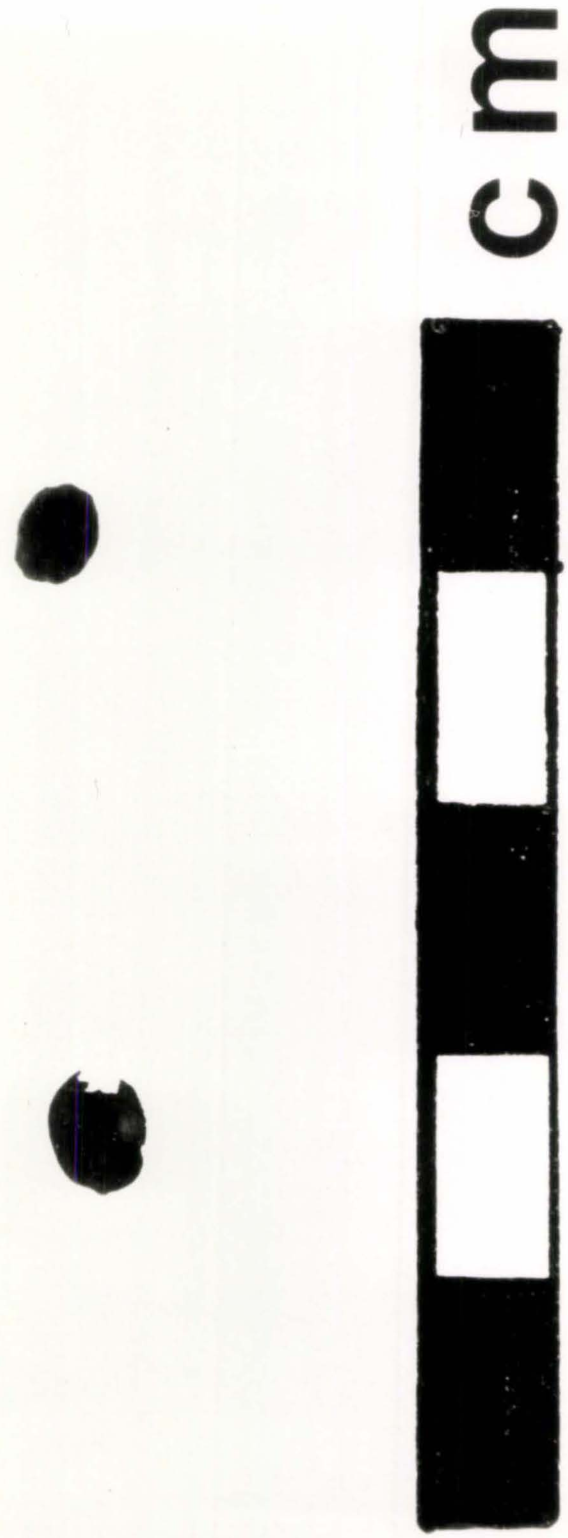
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Plate A-6:

BgDr 48, preserved shellfish periostrachum from Component 2c living floors.

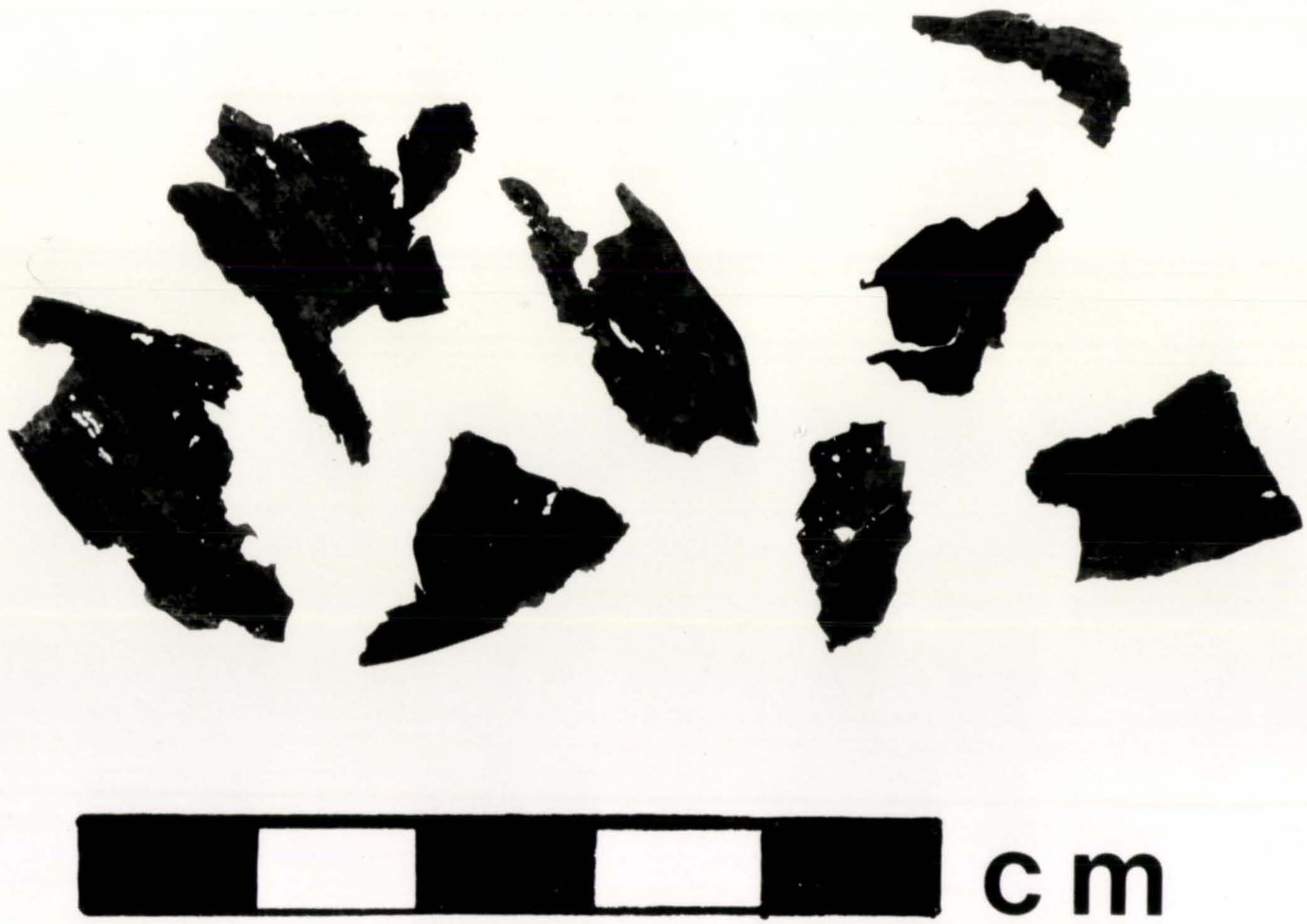
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Plate A-7:

BgDr 48, small fish remains: at left, six archaeological small fish (Culpeidae) vertebrae from Component 2a living floors; at right, six modern herring (*Culpaea harengus*) vertebrae for comparison.

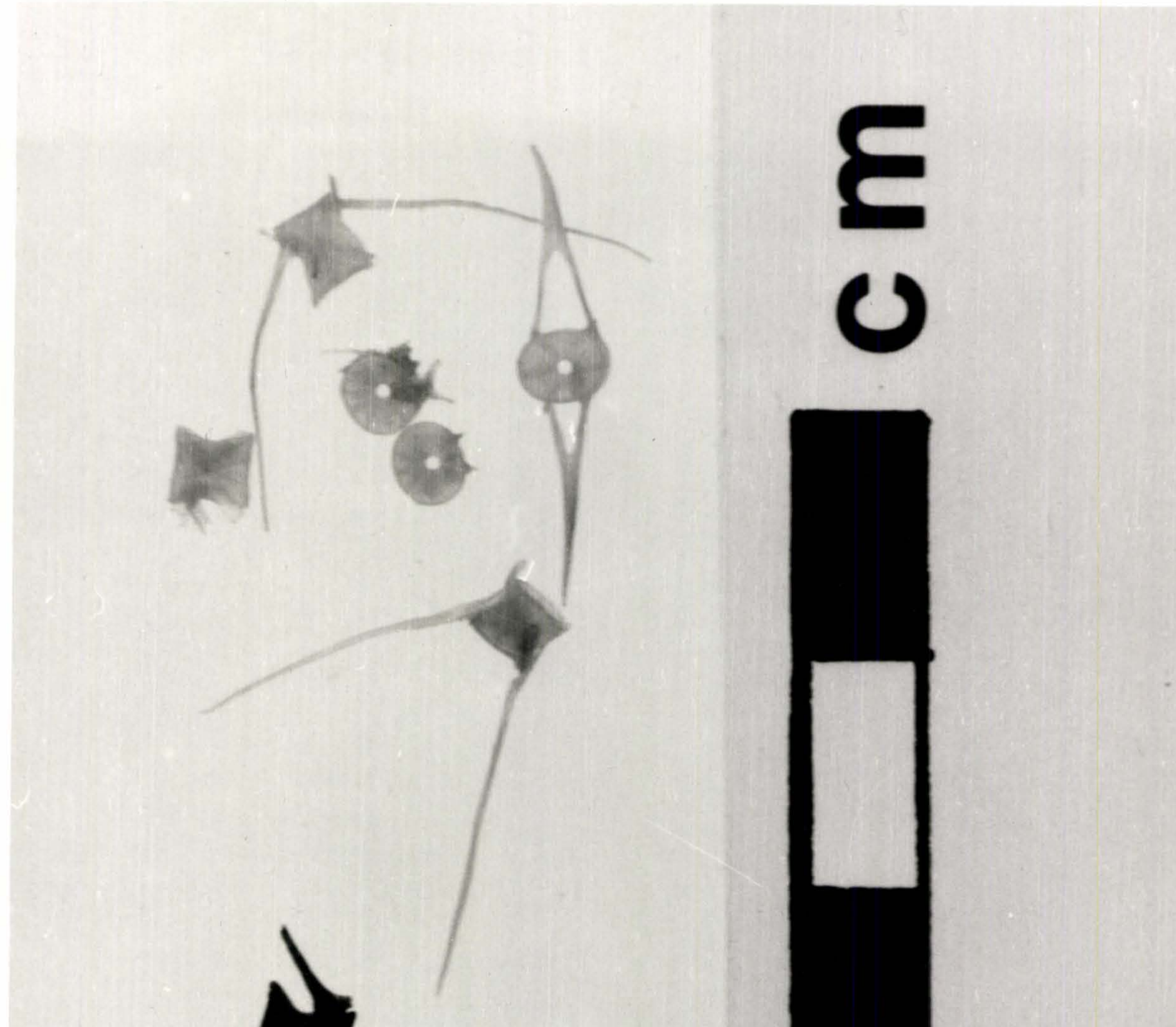
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Plate A-8:

BgDr 48, large fish remains: a comparison of the dentition of Atlantic cod (*Gadus morhua*) and harbour pollack (*Pollachius virens*) in archaeological specimens from Component 1 living floors.

a) left dentary, *P. virens*

b) left dentary, *G. morhua*

c) portion of left premaxilla, *P. virens*

d) left premaxilla, *G. morhua*


a
b
c
d
cm

Plate A-9:

BgDr 48, archaeological otoliths: comparison of the otoliths of harbour pollack (*P. virens*) and haddock (*Melanogrammus aeglefinus*) in archaeological specimens from Component 2c living floors.

left -- *P. virens*, right otolith

right -- *M. aeglefinus*, left otolith

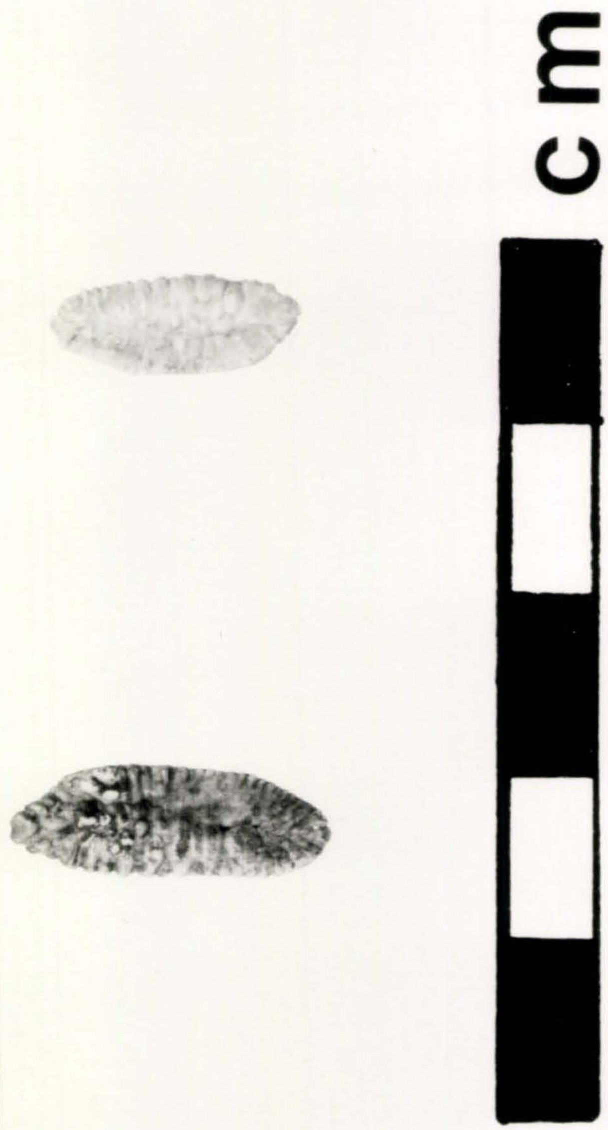

cm

Plate A-10:

Opposite surfaces of the otoliths shown in Plate A-9.

left -- *P. virens*, right otolith

right -- *M. aeglefinus*, left otolith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APPENDIX B

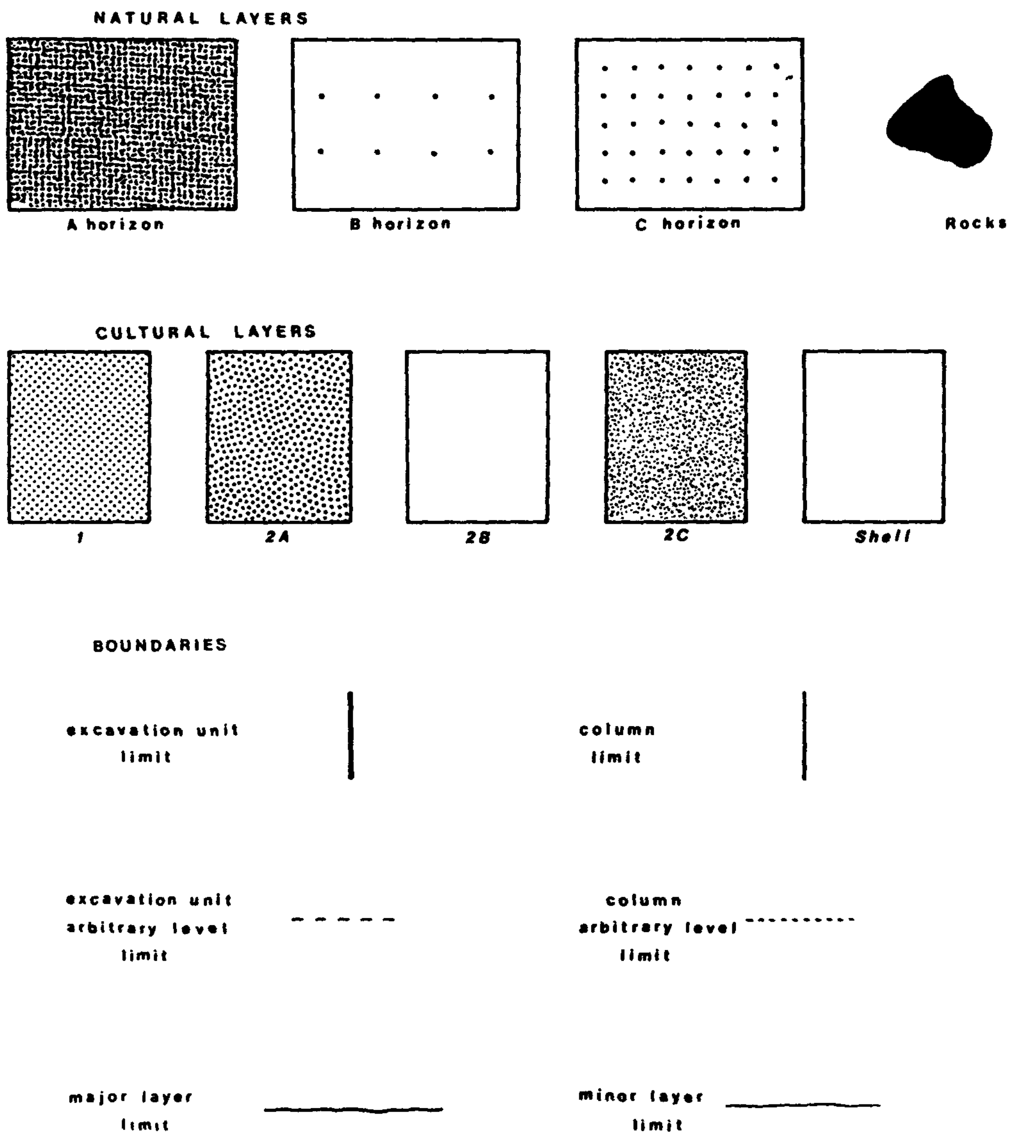
Stratigraphic Details

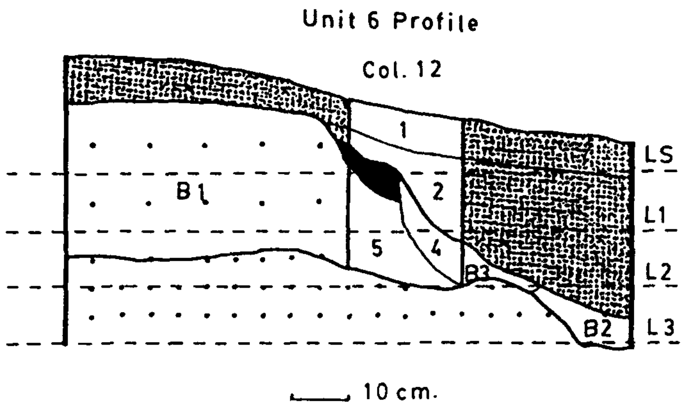
Introduction:

The purpose of the data in this appendix is to provide detailed information about the stratigraphy and depositional sequences at Partridge Island, and especially to show the relationships between the various units of analysis (arbitrary levels, natural layers, cultural layers, excavation units, column samples, and stratigraphic components) defined and used during the excavation and analysis.

A sample profile, a composite stratigraphic diagram, and a series of matrix descriptions, are provided for each excavation unit. A key to the profile drawings is included below. This key also applies to the profiles in Appendix D.

Key to Profiles in Appendicies B and D.





Deposits:	Events:
U6/A1 organic litter and black humic soil; trace of gravel; no shell; unstratified.	soil formation and accumulation.
U6/A2 black humic peat soil, trace of gravel; no shell; unstratified.	
U6/B3 yellow-red silty gravel with black soil and fragments of bedrock.	slight mixing of A and B.
U6/B2 yellow-red silty gravel with fragments of bedrock.	geological deposition; pedogenic illuviation.
U6/B1 light olive-grey fine clay subsoil.	
U6/C bedrock.	geological deposition.

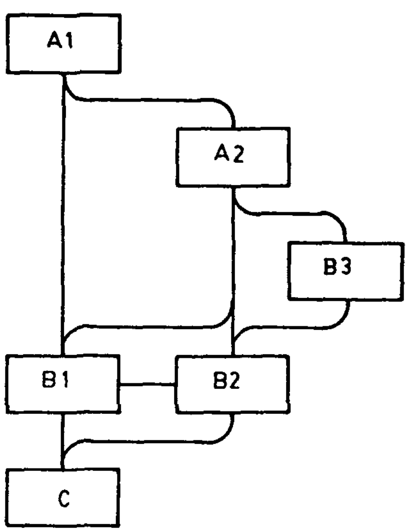
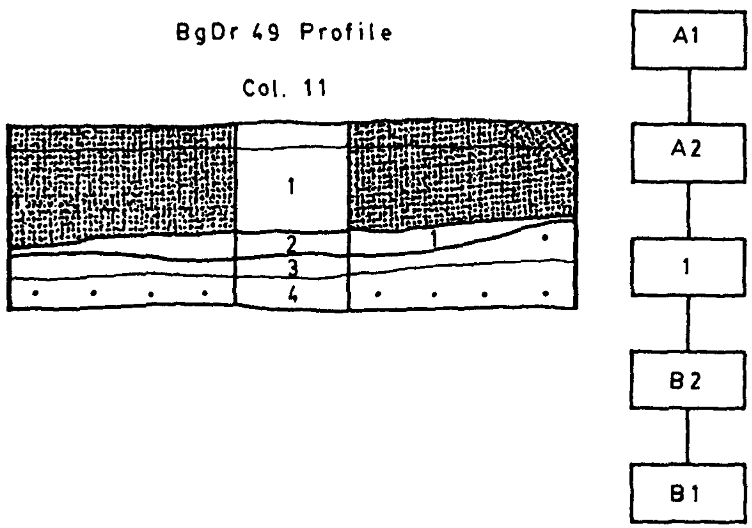


FIGURE B-1: Off-site Stratigraphy.



Deposits:	Events:
49/A1 fine gravel mixed with brown soil and organic litter; small amount of shell; unstratified.	beach erosion. soil formation
49/A2 fine gravel; trace of shell; slightly stratified.	storm beach deposition.
49/1 shell mixed with brown soil; unstratified.	shell accumulation. (soil formation)
49/B2 light olive-green fine silt.	
49/B1 yellow-brown fine silt.	geological deposition; pedogenic illuviation.

FIGURE B-2: BgDr 49 Stratigraphy.

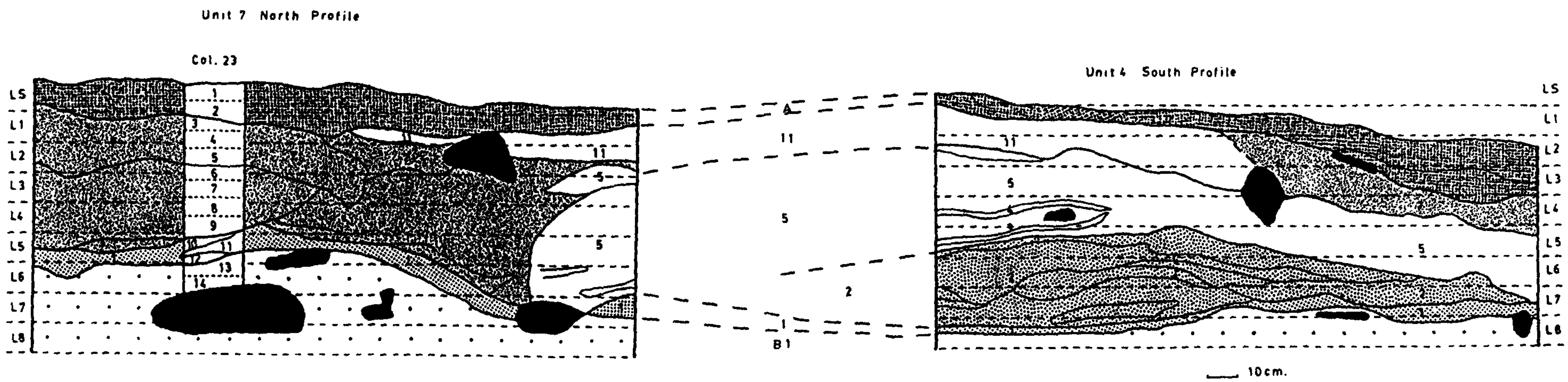


FIGURE B-3. Units 4 & 7 stratigraphy.

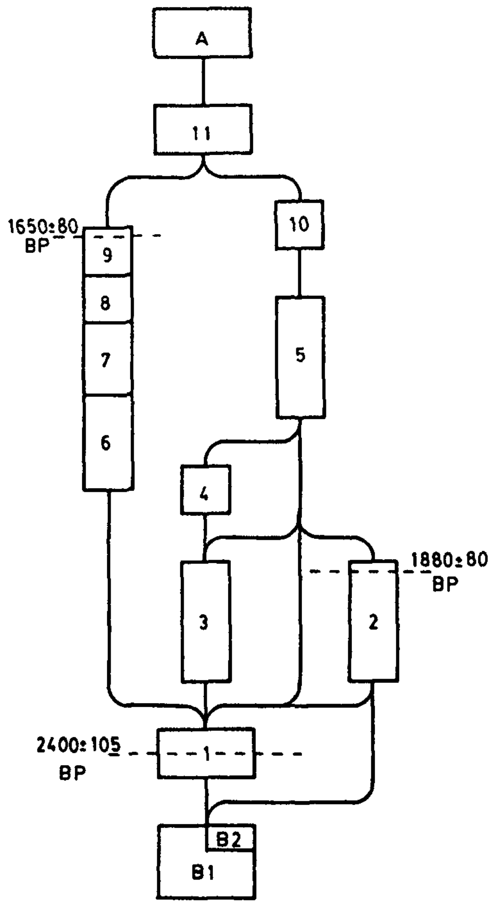


FIGURE B-4: Stratigraphy of Units 4 & 7.

Deposits:	Events:
U4&7/A organic litter and [illegible] humic soil; small amount of shell; tr[illegible] of gravel.	[illegible] development and accumulation.
U4&7/11 black humic soil; some fragmented shell; small amount of gravel; unstratified.	shell from [illegible] mixed [illegible] into soil; small pits filled.
U4&7/10	several small pits excavated into 5. (contemporary to 7?)
U4&7/9 sequential small lenses of gravel mixed with black or brown soil; no shell.	deep excavations filled.
U4&7/8	deep pits excavated through 5 and 1 to B1.
U4&7/7 fine gravel deposits mixed with black soil; varying amounts of shell; stratified.	living floor constr- uction and occupation.
U4&7/6 thin gravel and shell lenses; interdigitated and stratified.	episodic living floor construction and oc- cupation; shell dep- osition.
U4&7/5 whole and crushed shell; trace of gravel; few small lenses of black soil and gravel; stratified.	episodic shell depos- ition (contemporaneous to 6 and 7?)
U4&7/4 thin lenses of gravel and black soil; stratified.	occupation of surface of 3.
U4&7/3 whole and crushed shell mixed with black soil; stratified.	episodic shell depos- ition (contemporary to 2?)
U4&7/2 fine gravel and black soil; traces of shell and shell lenses; stratified.	living floor construc- tion, occupation; shell deposition.
U4&7/1 thin layer of greasy black humic soil; trace of shell; few small associated lenses of gravel; slightly stratified.	living floor occupation (original soil form- ation)
U4&7/B2 intermittent rounded granitic rocks.	(natural deflation) geological deposition.
U4&7/B1 yellow-red silty gravel mixed with fragments of bedrock.	geological deposition. pedogenic illuviation.

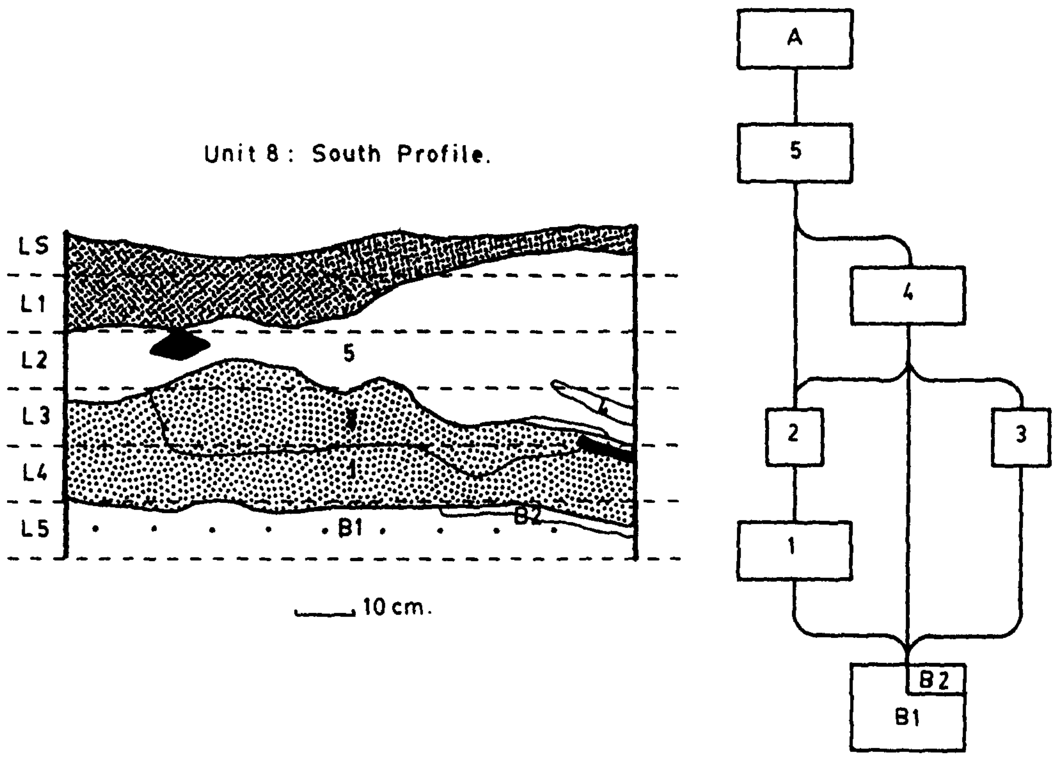


FIGURE B-5: Unit 8 stratigraphy

<u>Deposits</u>: <u>Events</u>:

U8/A
organic litter and black humic soil; few fragments of shell.

recent soil development.

U8/5
finely fragmented shell; small amounts of gravel and black soil; stratified.

episodic shell deposition.

U8/4
whole shell valves; some fragmented shell; trace of gravel; no black soil; unstratified.

shell deposition

U8/3
fine gravel; no shell or soil particles; unstratified.

living floor construction. (occupation?)

U8/2
fine gravel, small amount of shell; no black soil.

mixing of 3 and 4.

U8/1
course gravel; small amount of black soil; no shell; unstratified.

living floor construction and occupation.

U8/B2
fine olive-green silt.

U8/B1
yellow-red silty gravel.

Unit 5: North Profile

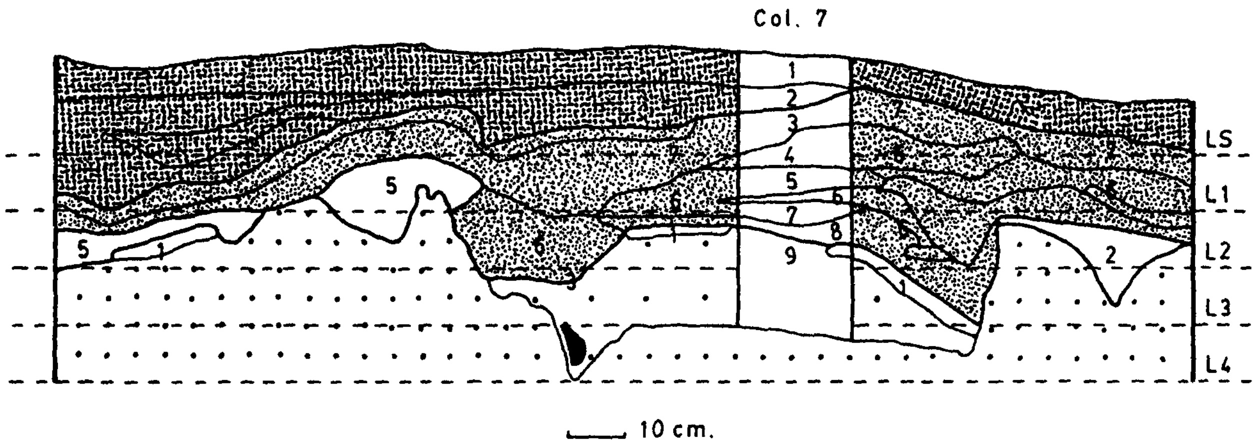
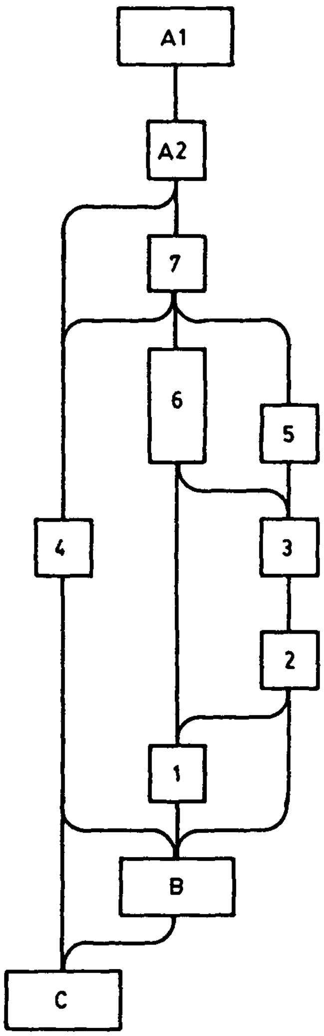


FIGURE B-6: Unit 5 stratigraphy.



Deposit:	Event:
U5/A1 organic litter and black soil; small amount of gravel; trace of shell; unstratified.	recent soil development.
U5/A2 dark brown peat soil; no gravel or shell; slightly stratified.	peat accumulation.
U5/7 fine gravel mixed with black soil; unstratified.	living floor construction and occupation. (excavation into 6?)
U5/6 fine gravel mixed with large amount of black soil; trace of shell; complexly stratified.	construction and occupation of small superimposed living floors.
U5/5 several small shell lenses.	sporadic shell deposition. (contemporary to 6?)
U5/4 yellow-red silty gravel mixed with fragments of bedrock and whole and crushed shells.	deposit resulting from event 3.
U5/3	excavation through 2 to B.
U5/2 crushed shell; small amounts of gravel and black soil.	shell midden deposition.
U5/1 sporadic thin lenses of black humic soil.	(original soil development)
U5/B yellow-red silty gravel mixed with fragments of bedrock.	geological deposition; pedogenic illuviation.
U5/C bedrock.	geological deposition.

FIGURE B-7: Unit 5 Stratigraphy.

Unit 1: West Profile

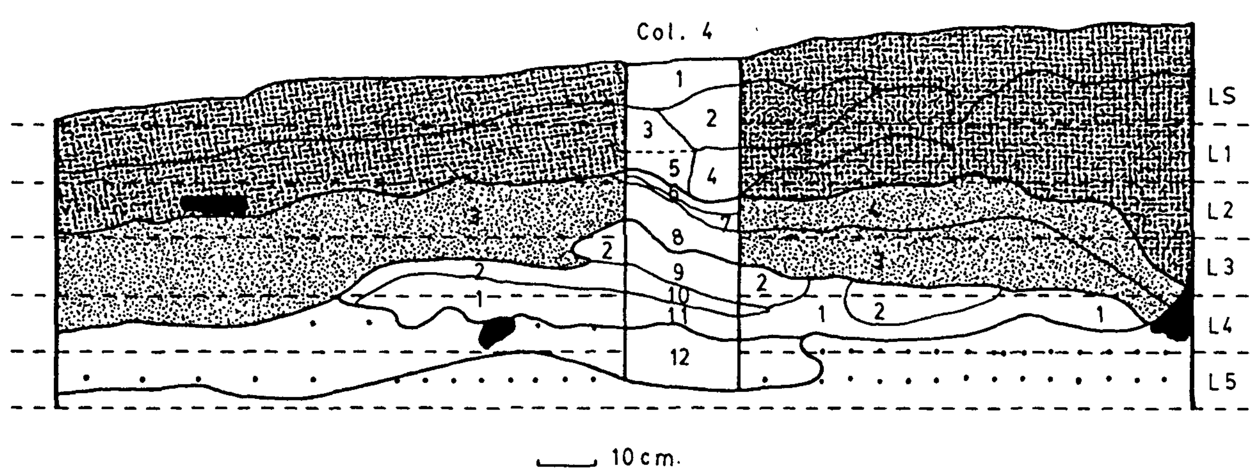
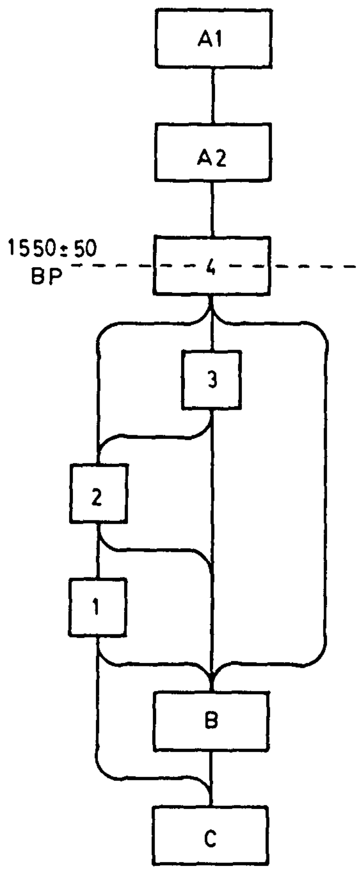


FIGURE B-8: Unit I stratigraphy.



Deposits:	Events:
U1/A1 organic litter and black humic soil; small amount of gravel; unstratified.	recent soil development and accumulation.
U1/A2 red, brown, and grey, peat soils; no shell or gravel; stratified.	peat development and accumulation.
U1/4 thin layer of fine gravel; black and brown humic soil; some large pieces of rock; trace of shell; slightly stratified.	living floor construction and occupation.
U1/3 thick layer of gravel; small amount of black soil; trace of shell; unstratified.	living floor construction.
U1/2 several small isolated lenses of shell; some gravel and black soil; stratified.	episodic shell deposition.
U1/1 black soil, yellow-brown soil, and bedrock fragments; trace of shell.	subsoil disturbed during initial cultural occupation.
U1/B yellow-brown silty gravel mixed with angular bedrock fragments.	geological deposition; pedogenic illuviation.
U1/C bedrock.	geological deposition.

FIGURE B-9: Unit I Stratigraphy.

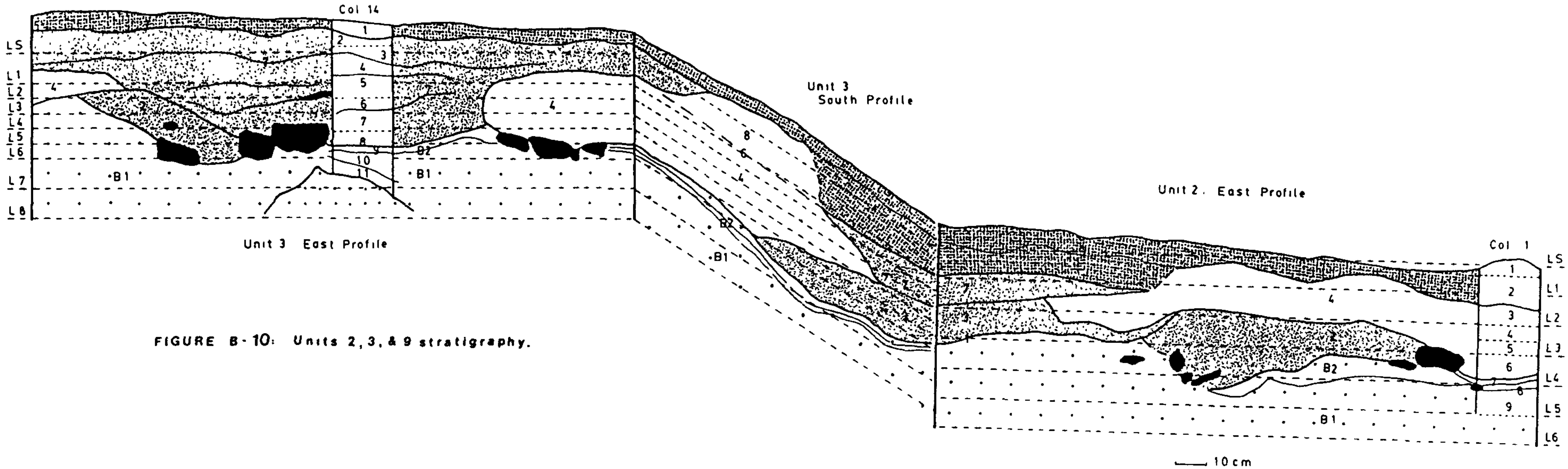
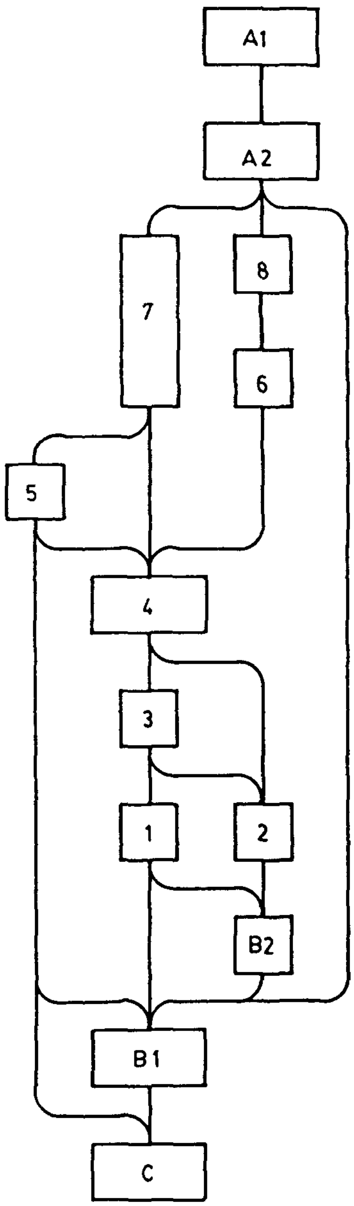


FIGURE B-10: Units 2, 3, & 9 stratigraphy.



Deposits:	Events:
U2,3&9/A1 organic litter and black humic soil; small amount of shell and gravel.	recent soil development.
U2,3&9/A2 black soil mixed with fragmented shell.	trampling of soil over 7.
U2,3&9/8 fragmented shell; small amount of black soil; considerable gravel; stratified.	shell deposition. filling of post-holes in surface of 6.
U2,3&9/7 fine gravel and black soil; traces of shell; stratified.	living floor construction and occupation.
U2,3&9/6 thin layer of gravel and black soil.	occupation of surface of 4; excavation of post-holes. (contemporary to 7?)
U2,3&9/5	several excavations through 4 into B1.
U2,3&9/4 whole shell valves and some fragmented shell; very small amounts of soil and gravel; unstratified.	shell midden deposition.
U2,3&9/3 fine gravel and black soil; no shell; stratified.	living floor construction filling 1; other small sporadic floors on B1.
U2,3&9/2 yellow-red silty gravel mixed with black soil.	deposits resulting from 1.
U2,3&9/1	excavations into B1.
U2,3&9/B2 sporadic thin layers of black soil and rocks.	original soil development. (natural deflation)
U2,3&9/B1 yellow-red silty gravel.	
U2,3&9/C bedrock.	geological deposition.

FIGURE B-11: Units 2, 3 & 9 Stratigraphy.

APPENDIX C

Summary of pH Measurements Taken on Soils
and Cultural Deposits from Partridge Island

Introduction:

The acidity of 38 matrix samples from two off-site and four on-site locations was measured with the object of detecting variability in the potential for bone preservation between off-site and on-site deposits, and between the various types of cultural deposits. The results of these measurements are recorded in Table C-1. Columns 10 and 12 include natural A and B horizons, while columns 2, 4, 7, and 20 include gravel, shell, and humic cultural deposits, and topsoils, peats, and subsoils in contact with cultural deposits. Table C-2 indicates the average pH measured for each of these types of deposit.

It would have been most desirable for pH to have been measured in the field; however, this was not possible at BgDr 48. Instead, 25 cc. subsamples of the dried matrix samples were rehydrated by mixing them with 50 cc. of distilled water. The pH of each resulting mixture was measured using a Corning Model 5 Electronic pH Meter, which had been calibrated using a buffered reagent of pH 7.0.

The drying and rewetting of the samples may have had some effect on the results obtained, but, since all of the samples were treated similarily, it is expected that the results are consistent with one another.

TABLE C-1: pH Measurements of Partridge Island Deposits.

Sample #	Matrix Description	pH
10:1	sod (A horizon)	7.5
10:2	gravel (A horizon)	7.2
10:3	humic (A horizon)	7.3
10:4	grey silt (B horizon)	6.4
12:1	sod (A horizon)	6.3
12:2	humic black (A horizon)	6.4
12:4	brown (B horizon)	5.8
12:5	yellow-brown (B horizon)	6.0
7:8	yellow-brown (B horizon)	8.0
7:9	yellow-red (B horizon)	7.7
2:1	sod	7.4
2:2	shell	7.5
2:3	shell	8.0
2:4	black humic	7.7
2:5	black humic	7.7
2:6	gravel	7.5
2:7	subsoil	7.7
2:8	gravel	7.5
4:1	sod	5.5
4:2	brown peat	5.2
4:3	grey peat	5.7
4:4	red peat	6.1
4:5	grey peat	7.1
4:6	black humic and gravel	7.8
4:7	shell	7.7
4:8	gravel	8.0
4:9	shell and gravel	8.2
4:10	yellow-red subsoil	8.0
4:11	black humic	8.05
4:12	grey subsoil	7.7

TABLE C-1: continued.

20:1	sod	7.4
20:3	shell	8.3
20:5	shell and gravel	8.15
20:7	shell	7.2
20:9	shell	8.9
20:11	gravel and shell	9.0
20:13	shell	8.75
20:15	shell	8.9

TABLE C-2: Average pH Measurements by Matrix Type.

Matrix	#Samples	Average pH	S.D.
Off-site:			
A horizons	5	6.94	0.55
B horizons	3	6.07	0.31
On-site:			
Peat	4	6.03	0.81
Topsoils	3	6.77	1.10
Subsoils	5	7.82	0.16
Shell middens	8	8.16	0.66
Gravel living floors	6	8.06	0.56
Humic cultural layers	4	7.80	0.17

APPENDIX D

Detailed Data Concerning the Intra-site Distribution, and Quantification, of Invertebrate Faunal Remains in the BgDr 48 Faunal Assemblage

Introduction:

The invertebrate faunal contents of four columns, comprising 70 samples, were analysed in detail. The data from this analysis are presented in tabular and graphic form. An explanation of the tables and graphs follows.

Table D-1 gives the total dry weight of each sample, and summarizes the proportions of the three main matrix components, shell, gravel, and fine particles, in each sample. Shell includes all shell remains except those (less than 1 mm. diameter) too small to be identified. Gravel includes all mineral particles greater than 5 mm. in diameter. Fine particles include all other components of the sample, including small mineral and organic particles, soil, soil aggregates, and very fine shell fragments. The subsequent graphs further analyse the shell fraction of each of these samples.

Table D-2 is a master species list keyed to the graphs following it; on the graphs each species is designated by number. The horizontal axis of each graph is divided into eight segments: the first segment identifies the sample and calibrates the graph; the final segment gives additional information pertaining to the sample; the middle six segments are labelled 1, 2, 3, 4, 5, and Other. There numbers refer to the five most common species from Table D-2; the remaining species are lumped in the Other category, and those present are identified by number above the Other graph bar.

A separate diagram is included for each column. Each diagram consists of a series of graphs, one for each column sample, and one or more subsequent graphs for combined samples. Each graph is calibrated for 100 units at the left side. For each of the major shellfish species and the Other category, four data are given by a series of four vertical bars joined at the base by a horizontal bar. These data are: a) the number of grams of shell per 500 cc. of sample volume; b) the proportion of the total sample shell assemblage this represents; c) the number of grams of meat per 500 cc. of volume this shell represents; d) the proportion of the total sample meat weight represented by the species.

At the upper right of each graph five further data are given for each sample. These data are: SV) total sample volume in cubic centimeters; TS) total shell weight in grams; TM) total meat weight in grams; NM) (not <u>Mya</u>) the proportion of meat weight represented by species other than soft-shelled clam; NS) the number of <u>marine</u> shell species in the sample.

Shell and meat weights have been expressed as grams per 500 cc. volume in order to make the weight data comparable for all samples, and to fit the data to the scale of graph used here. In some cases the amount of shell in the sample is greater than 100 gm. per 500 cc. Where this occurs the shell weight bar is truncated and the datum is entered numerically at the top.

The smallest amounts which can be shown at the scale of these graphs are one percent, and one gram per 500 cc. Thus all numerical data were rounded to the nearest whole number when graphed. There are two consequences of this rounding. First, it is possible for a species to have no weight data indicated, but to have proportion data recorded. Thus, the absence of a graph bar cannot be interpreted as a zero datum; it should be interpreted as "less than 1%" or "less than 1 gm. per 500 cc. Second, the percentages in each assemblage do not necessarily add up to 100% (they vary from 98% to 102%). Exact figures to one decimal place were used in all calculations involving these data.

TG, where it appears in the Other category indicates the presence of land snails. The weight of land snail shell is included in the Other category, but no meat equivalent was calculated for this species, because they were considered to be intrusive.

Each set of graphs is followed by a stratigraphic diagram illustrating the column described.

Following the distribution graphs and column diagrams is an explanation of the meat:shell ratios used to calculate the equivalent meat weights given in the graphs.

TABLE D-1: Proportions of Major Matrix Constituents.

	Sample Number	Sample Size (in grams)	Gravel (%)	Fine Particles (%)	Shell (%)
	13:1	701.1	24	34	41
	13:2	1898.3	36	20	44
	13:3	1881.0	34	18	48
	13:4	701.3	42	18	40
	13:5	1553.1	33	14	53
Unit 9	13:6	3688.2	36	6	58
	13:7	1533.7	24	5	69
	13:8	1660.2	24	4	72
	13:9	1251.1	14	6	80
	13:10	86.6	34	52	14
	13:11	536.3	95	4	1
	17:1	516.7	22	42	36
	17:2	1527.9	43	21	36
	17:3	2055.9	43	8	48
Unit 8	17:4,5	3378.2	46	5	49
	17:6	1653.3	32	3	64
	17:7	830.6	9	2	89
	17:8	1112.9	24	2	73
	17:9	2533.5	93	2	3
	20:1	557.1	15	63	21
	20:2	1602.7	27	53	19
	20:3	1925.2	22	54	24
	20:4	382.5	26	61	13
	20:5	672.2	8	39	53
Unit 4	20:6	901.5	9	52	39
	20:7	3334.1	41	12	47
	20:8	1856.2	18	9	73
	20:9	1475.7	31	7	62
	20:10	910.0	22	10	68

TABLE D-1: continued.

	Sample Number	Sample Size (in grams)	Gravel (%)	Fine Particles (%)	Shell (%)
Unit 4	20:11	691.8	47	20	33
	20:12	1948.7	13	37	50
	20:13	1891.3	23	11	66
	20:14	1812.1	49	19	32
	20:15	2737.0	17	14	69
	20:16	422.3	40	50	10
Unit 7	21:1	477.0	18	34	48
	21:2	725.4	27	20	52
	21:3	545.0	26	23	51
	21:4	489.3	22	24	54
	21:5	583.4	20	25	53
	21:6	781.0	24	31	45
	21:7	520.3	14	34	52
	21:8	314.7	17	28	54
	21:9	413.5	16	30	52
	21:10	444.8	17	30	52
	21:11	385.3	22	32	44
	21:12	396.9	13	46	39
	21:13	319.2	8	56	35
	21:14	509.9	11	47	40
	21:15	346.1	15	35	48
	21:16	410.3	21	37	40
	21:17	450.6	21	39	38
	21:18	396.2	13	40	48
	21:19	453.5	37	33	31
	21:20	341.0	24	23	53

TABLE D-1: continued.

	Sample Number	Sample Size (in grams)	Gravel (%)	Fine Particles (%)	Shell (%)
Unit 7	21:21	368.4	20	21	58
	21:22	426.1	13	16	70
	21:23	355.0	12	19	67
	21:24	374.6	10	11	77
	21:25	452.5	15	15	67
	21:26	380.7	17	20	58
	21:27	353.5	15	25	59
	21:28	328.1	19	18	61
	21:29	307.1	25	15	56
	21:30	251.2	5	13	80
	21:31	278.0	2	10	84
	21:32	194.1	3	24	67
	21:33	186.6	29	56	12
	21:34	95.0	4	93	3
	21:35	116.0	0	99	1

TABLE D-2: Master Invertebrate Species List.

1	*Mya arenaria*
2	*Modiolus modiolus*
3	*Mytilus edulis*
4	*Nucella lapillus*
5	*Strongylocentrotus droebachiensis*
6	*Buccinum undatum*
7	*Acmaea testudinalis*
8	*Astarte castanea*
9	*Cyclocardia borealis*
10	*Ischnochiton ruber*
11	*Littorina saxatilis*
12	*Balanus* sp.
13	*Crenella glandula*
14	*Hiatella arctica*
15	*Littorina obtustata*
16	*Placopecten magellanicus*
17	*Neptunia decemcostata*
18	*Spisula solidissima*
TG	Terrestrial gastropods

FIGURE D-1: Shell Analysis, Unit 7, Column 21.

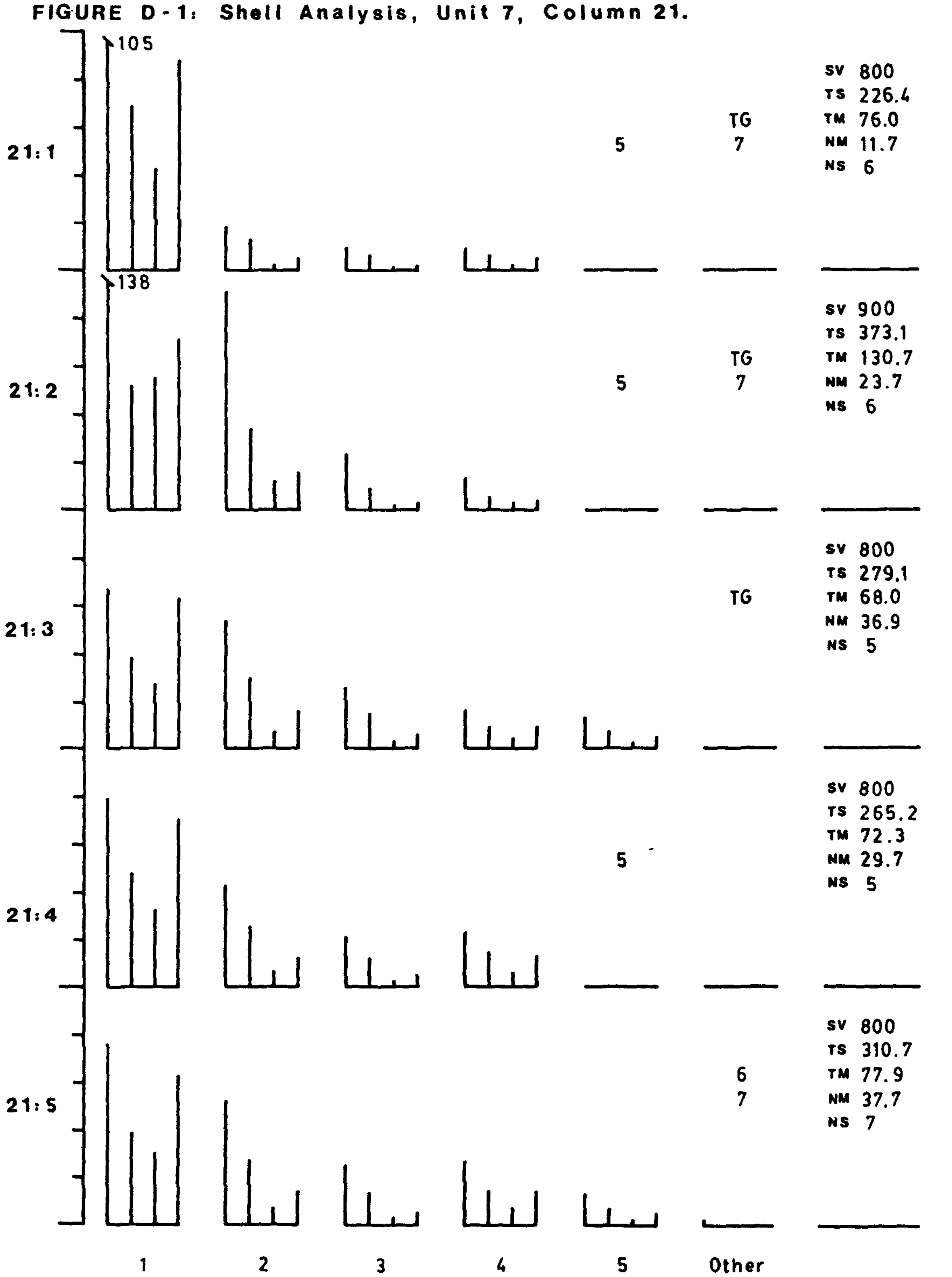


FIGURE D-1: Shell Analysis, Unit 7, Column 21.

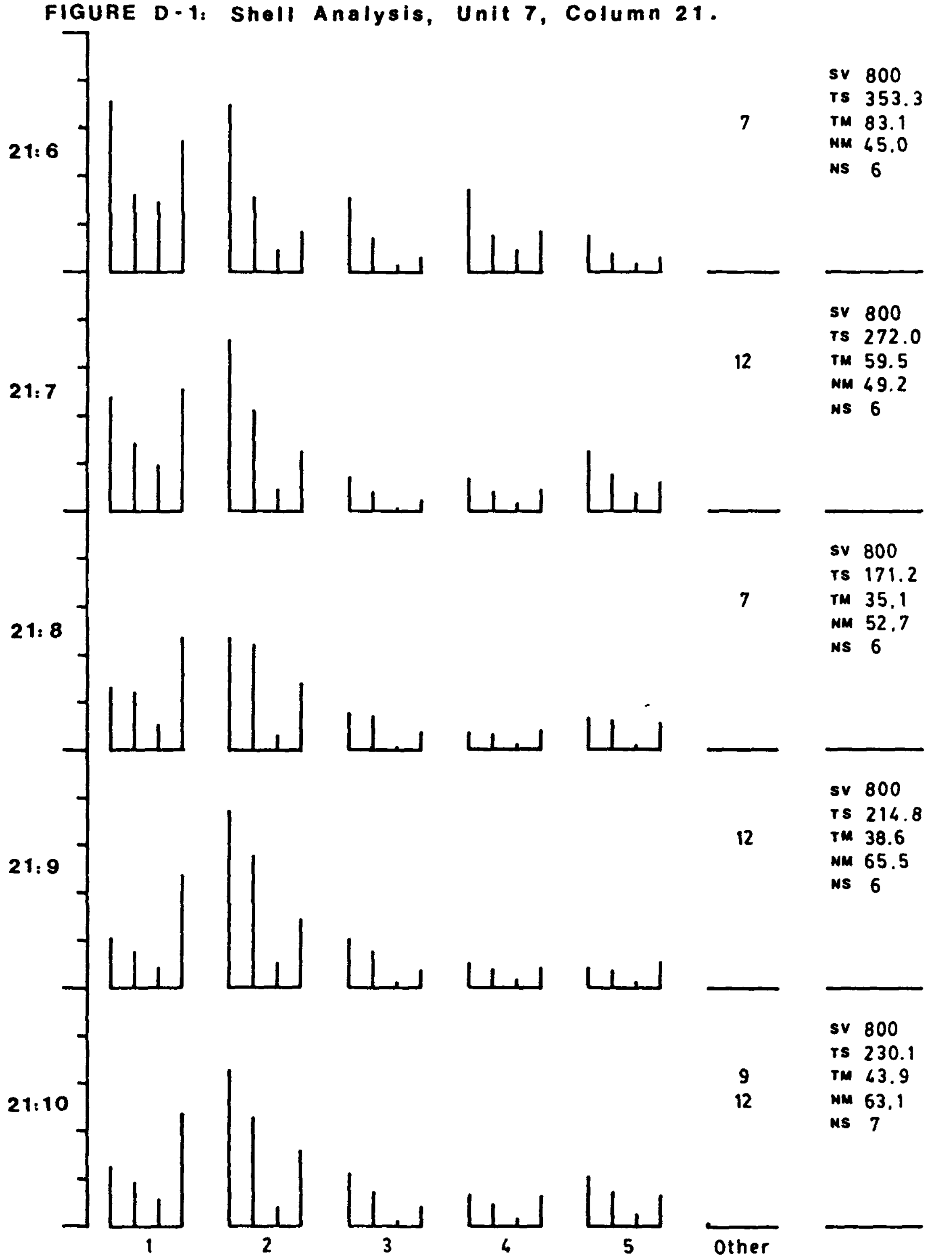


FIGURE D-1: Shell Analysis, Unit 7, Column 21.

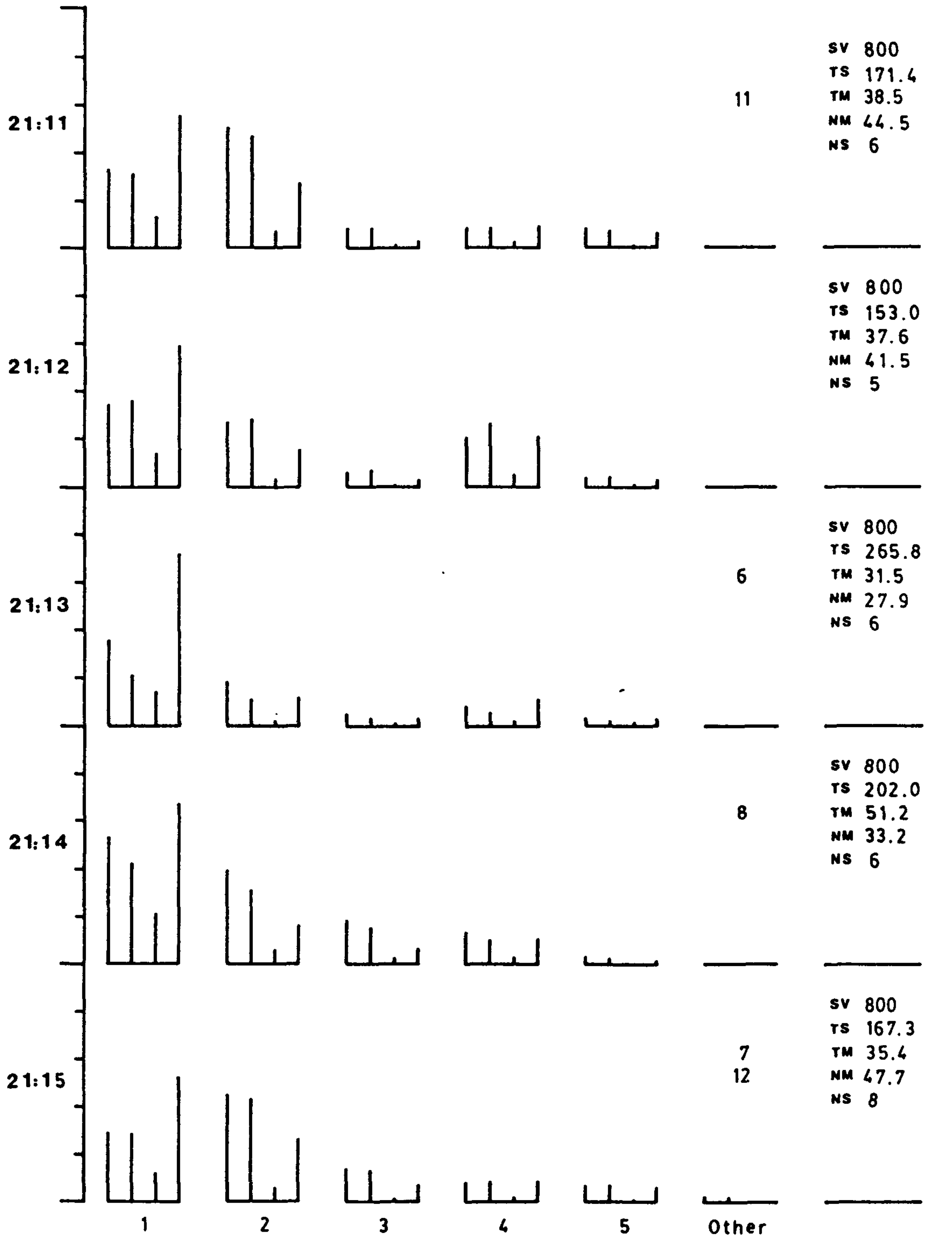


FIGURE D-1: Shell Analysis, Unit 7, Column 21.

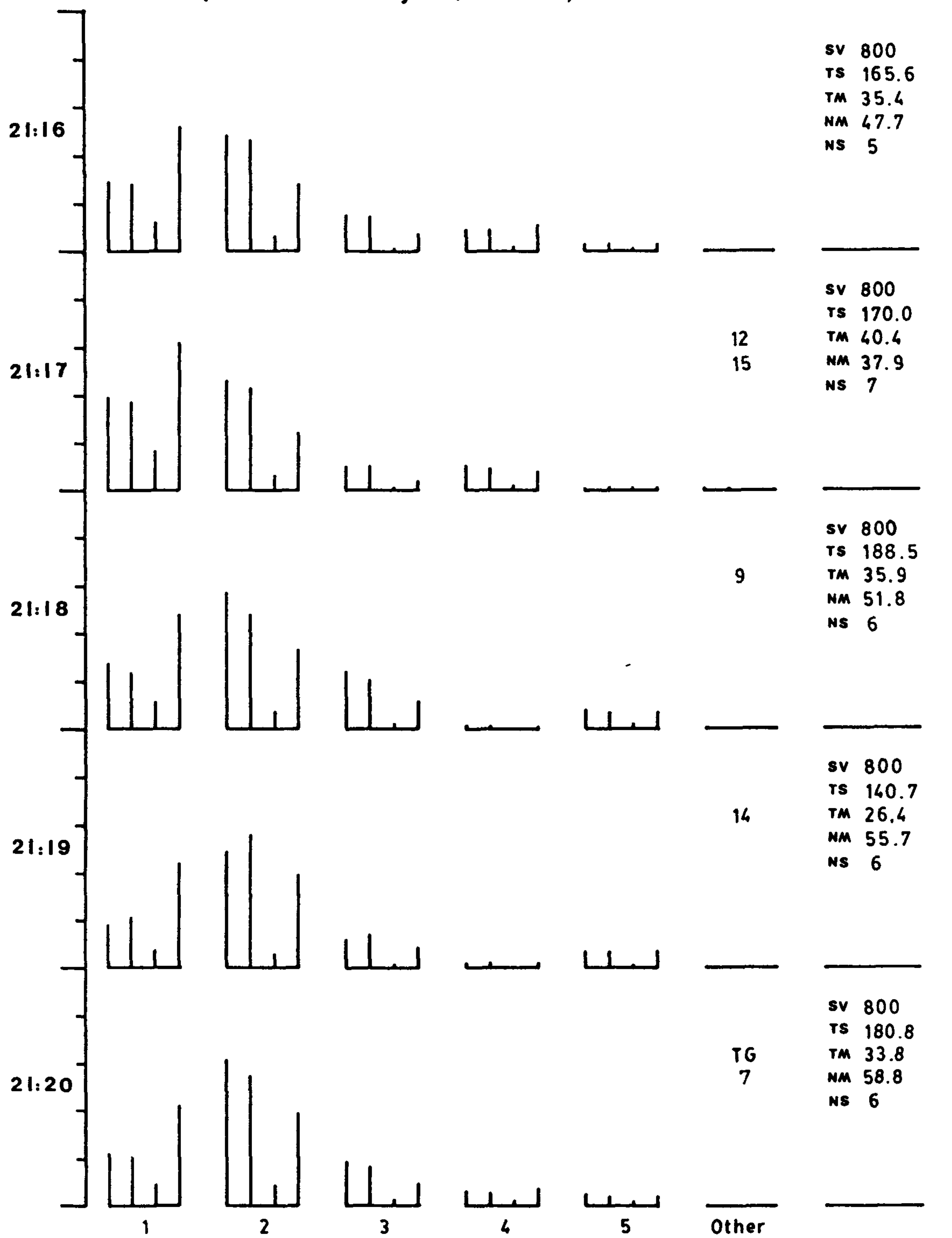


FIGURE D-1: Shell Analysis, Unit 7, Column 21.

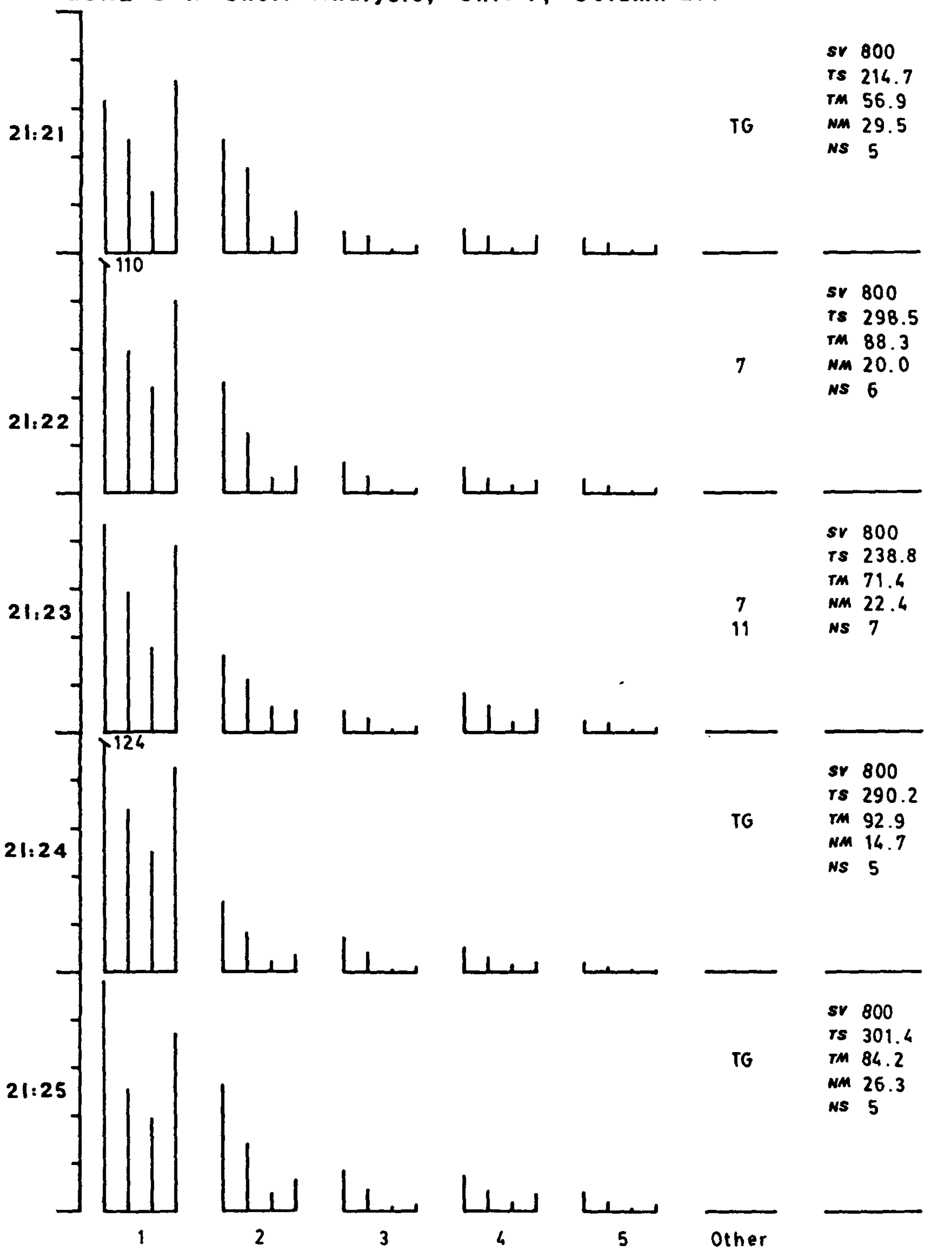


FIGURE D-1: Shell Analysis, Unit 7, Column 21.

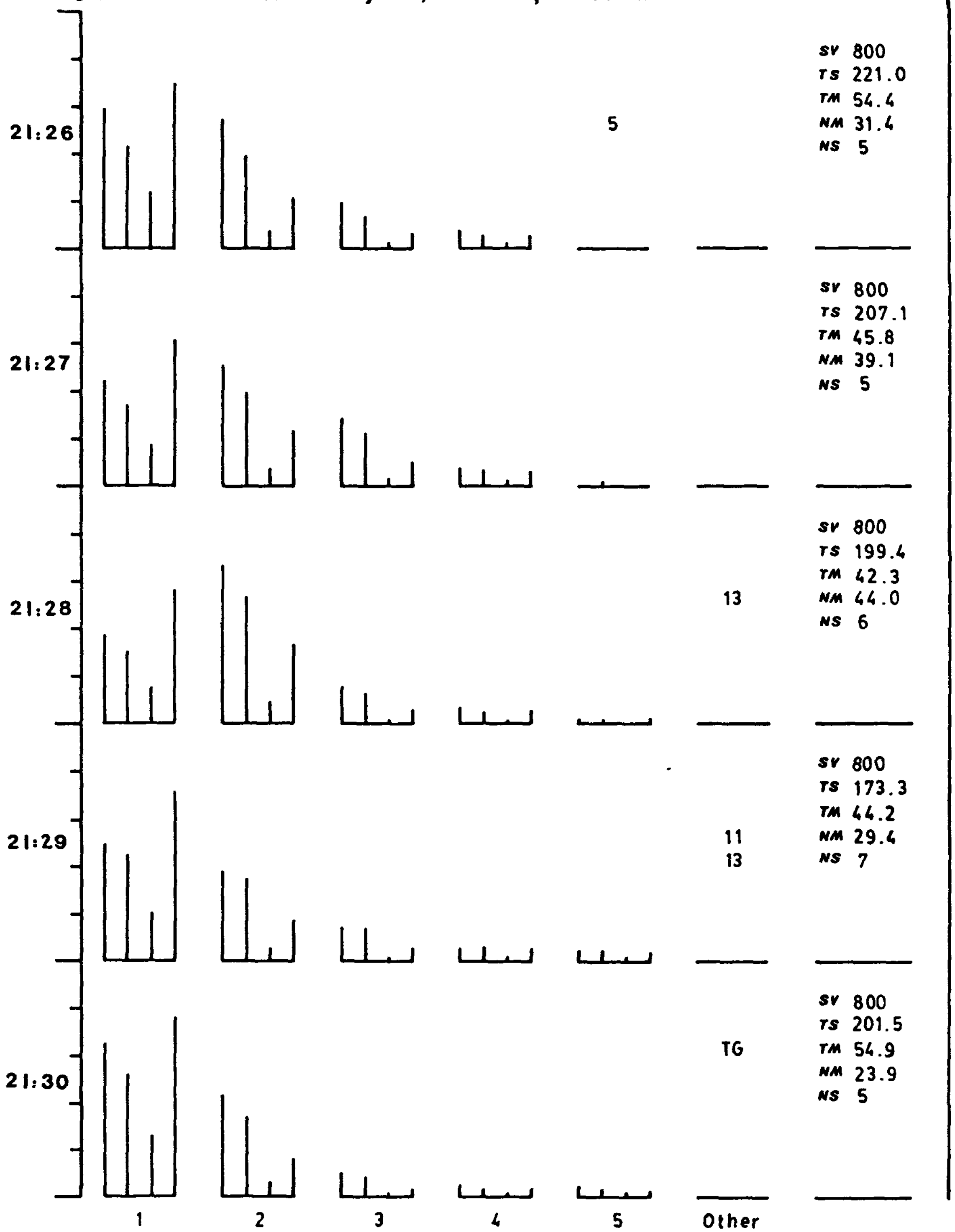


FIGURE D-1: Shell Analysis, Unit 7, Column 21.

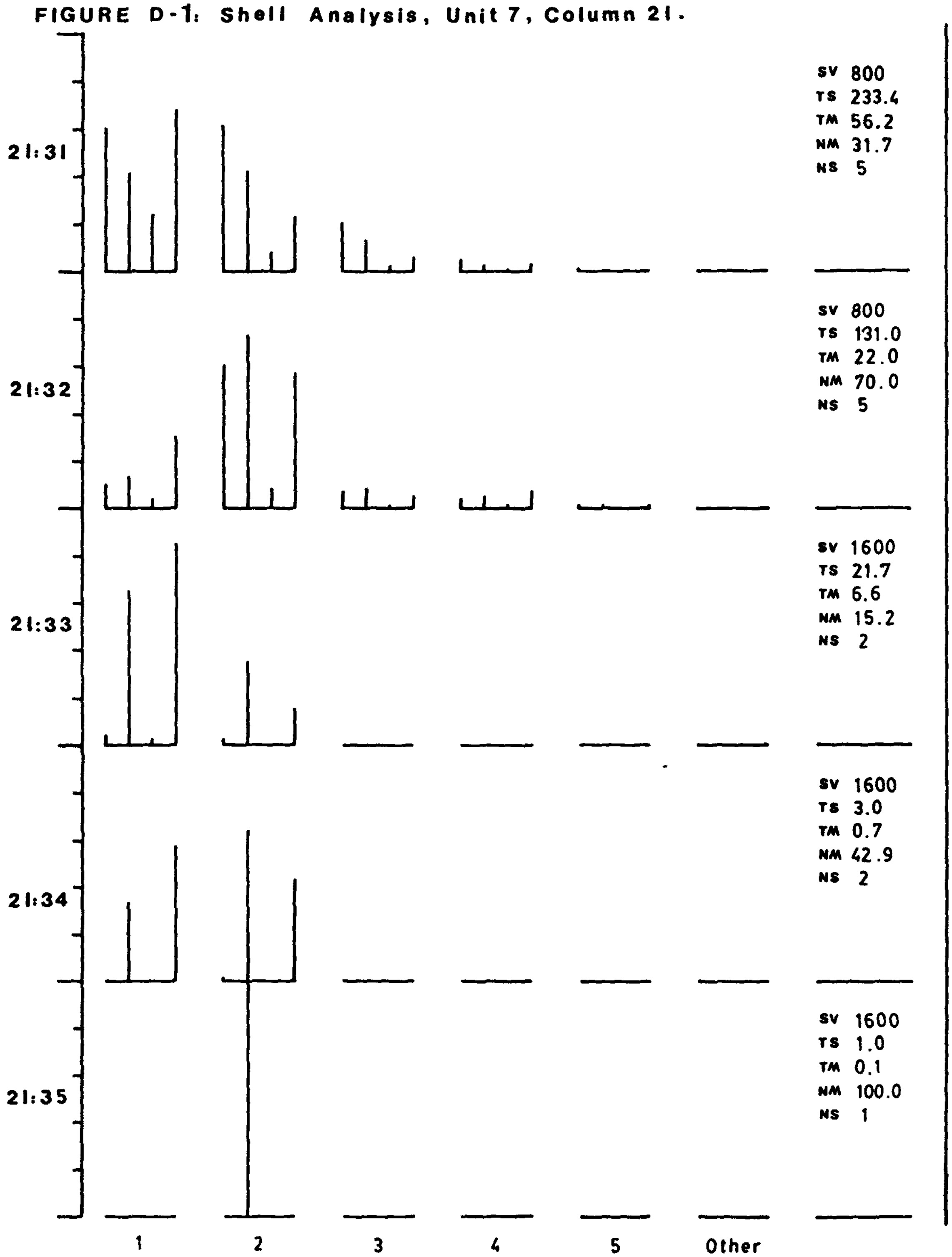
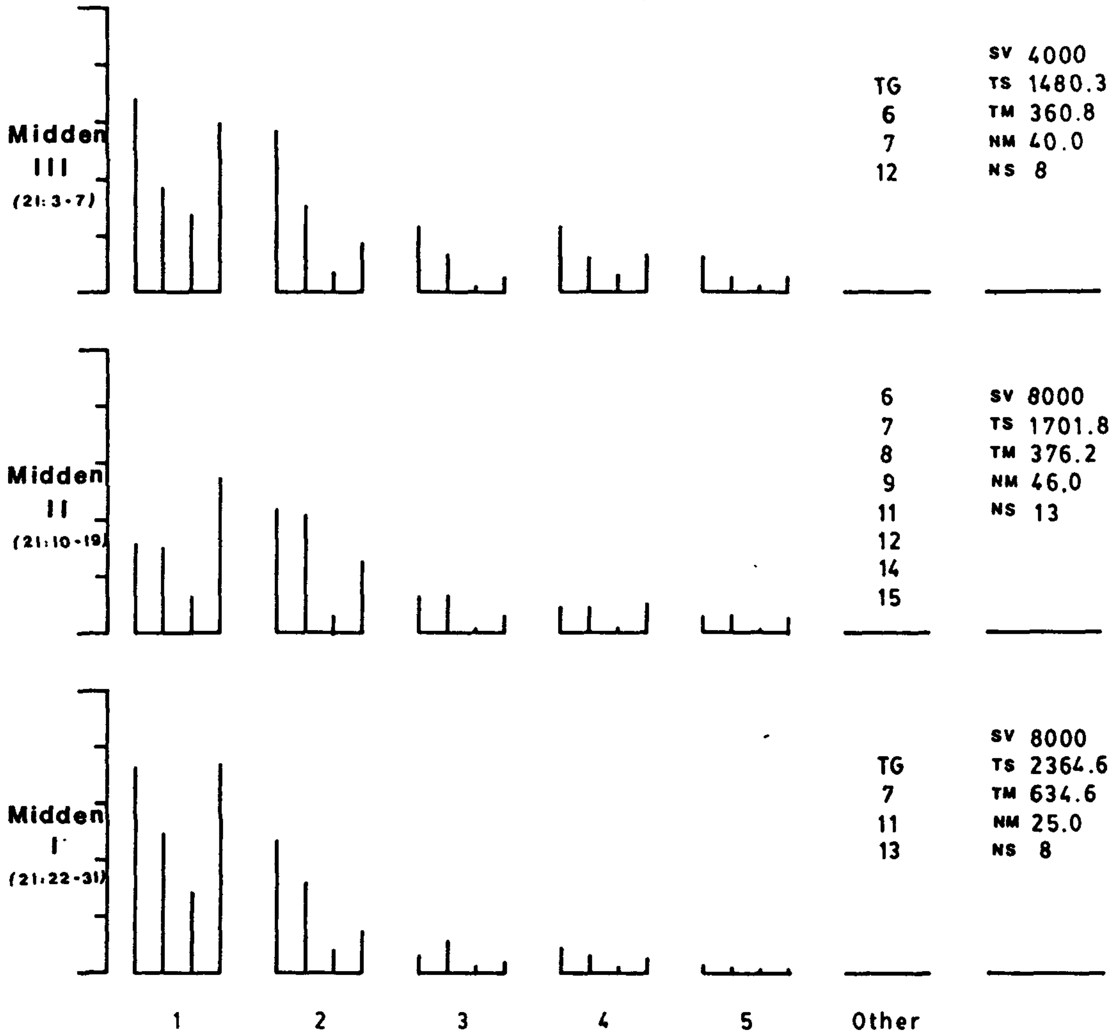


FIGURE D-1: Shell Analysis, Unit 7, Column 21.



Unit 7: South Profile.

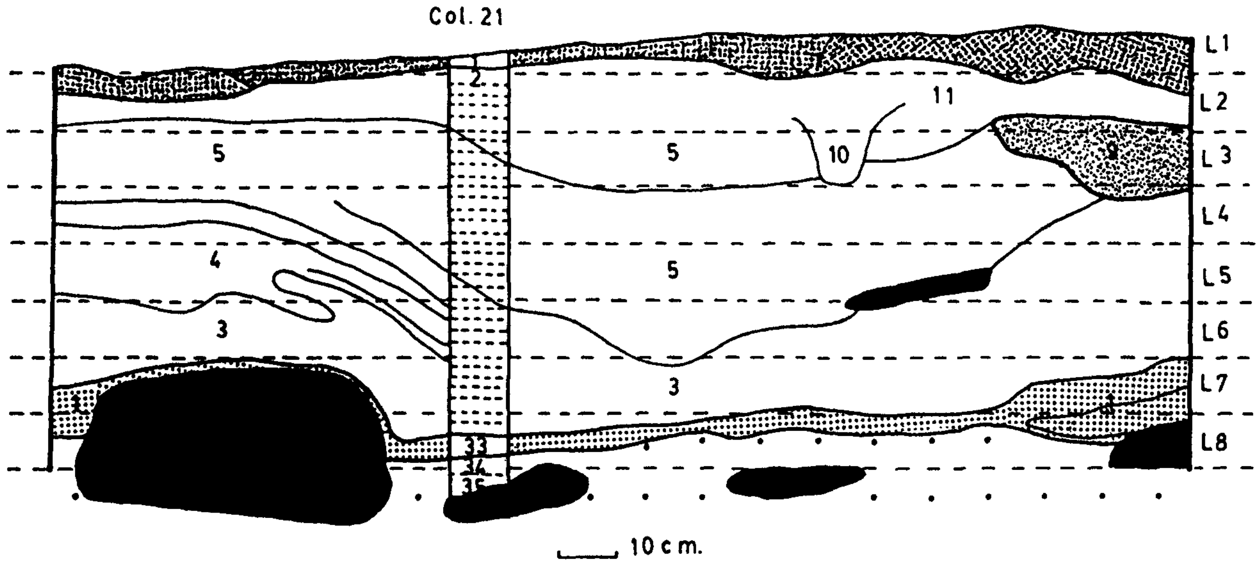


FIGURE D-2: Column 21 and associated stratigraphy.

FIGURE D-3: Shell Analysis, Unit 4, Column 20.

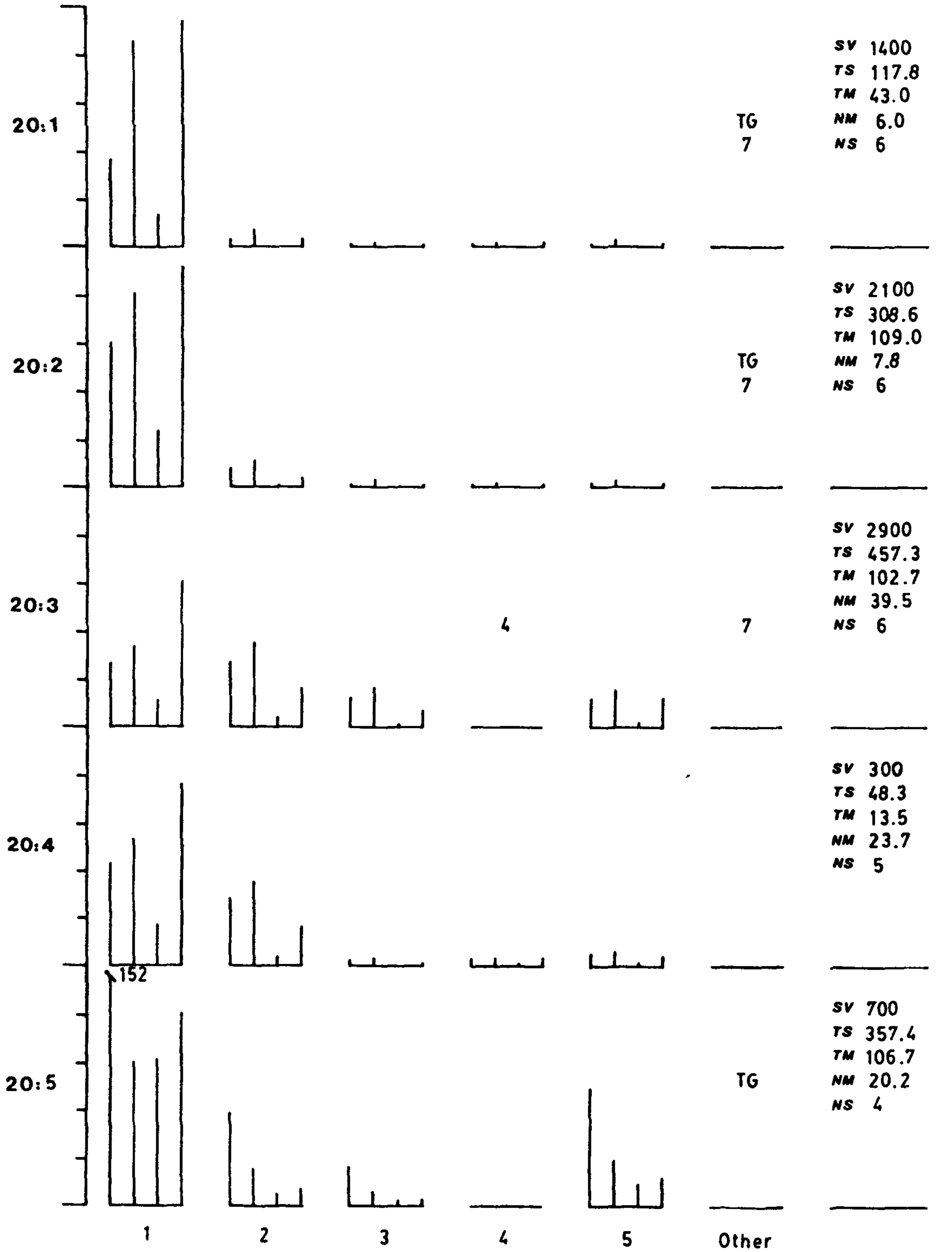


FIGURE D-3: Shell Analysis, Unit 4, Column 20.

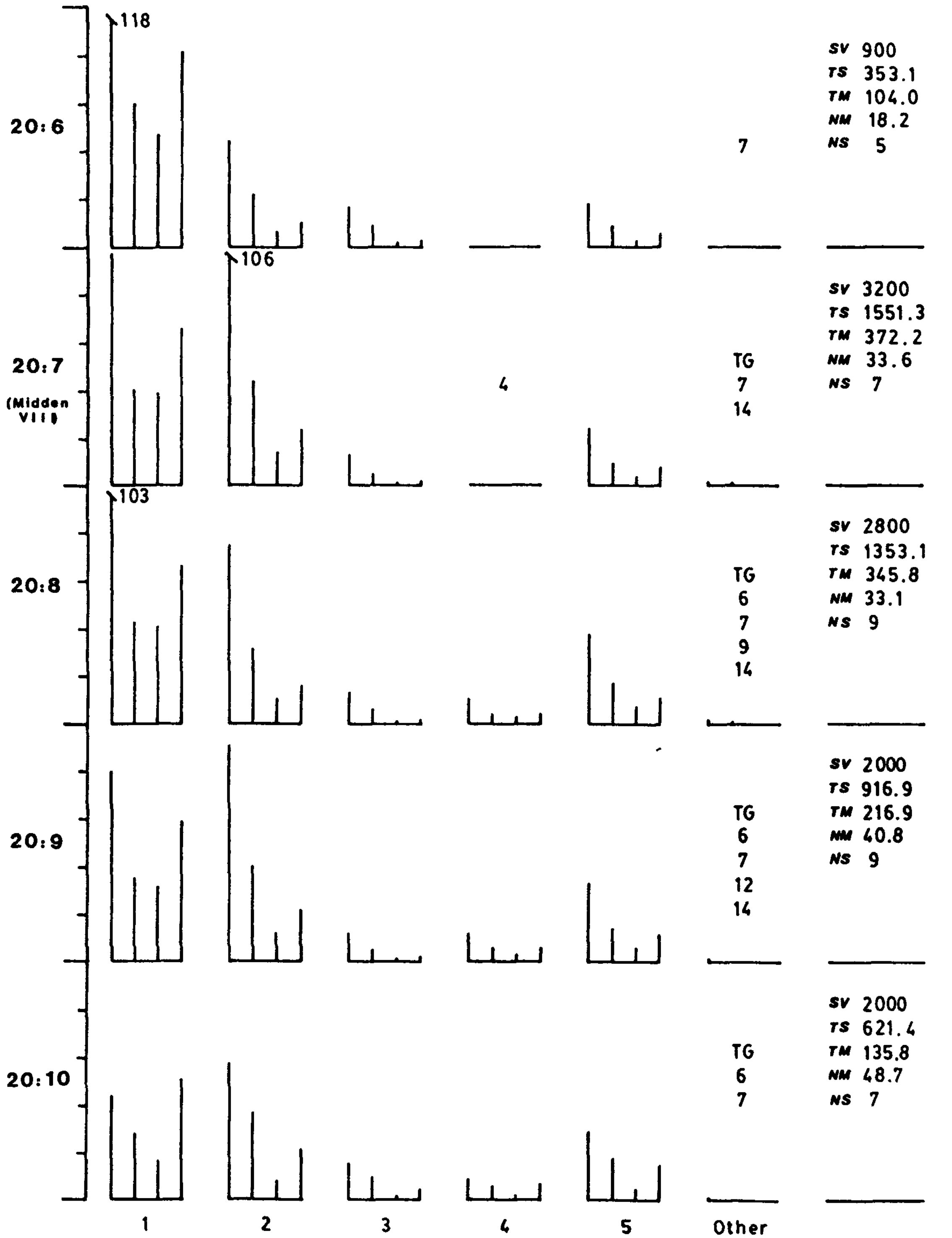


FIGURE D-3: Shell Analysis, Unit 4, Column 20.

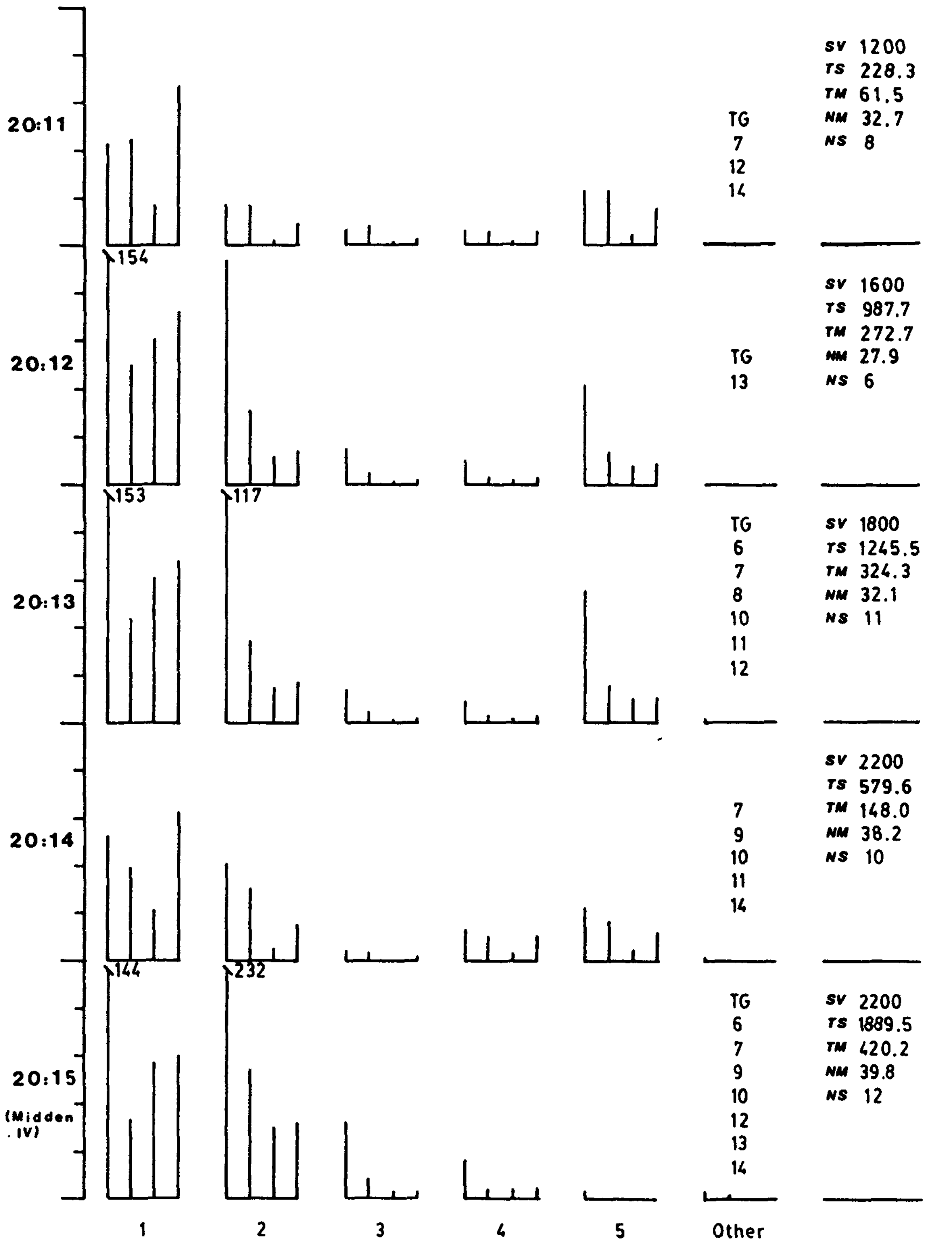
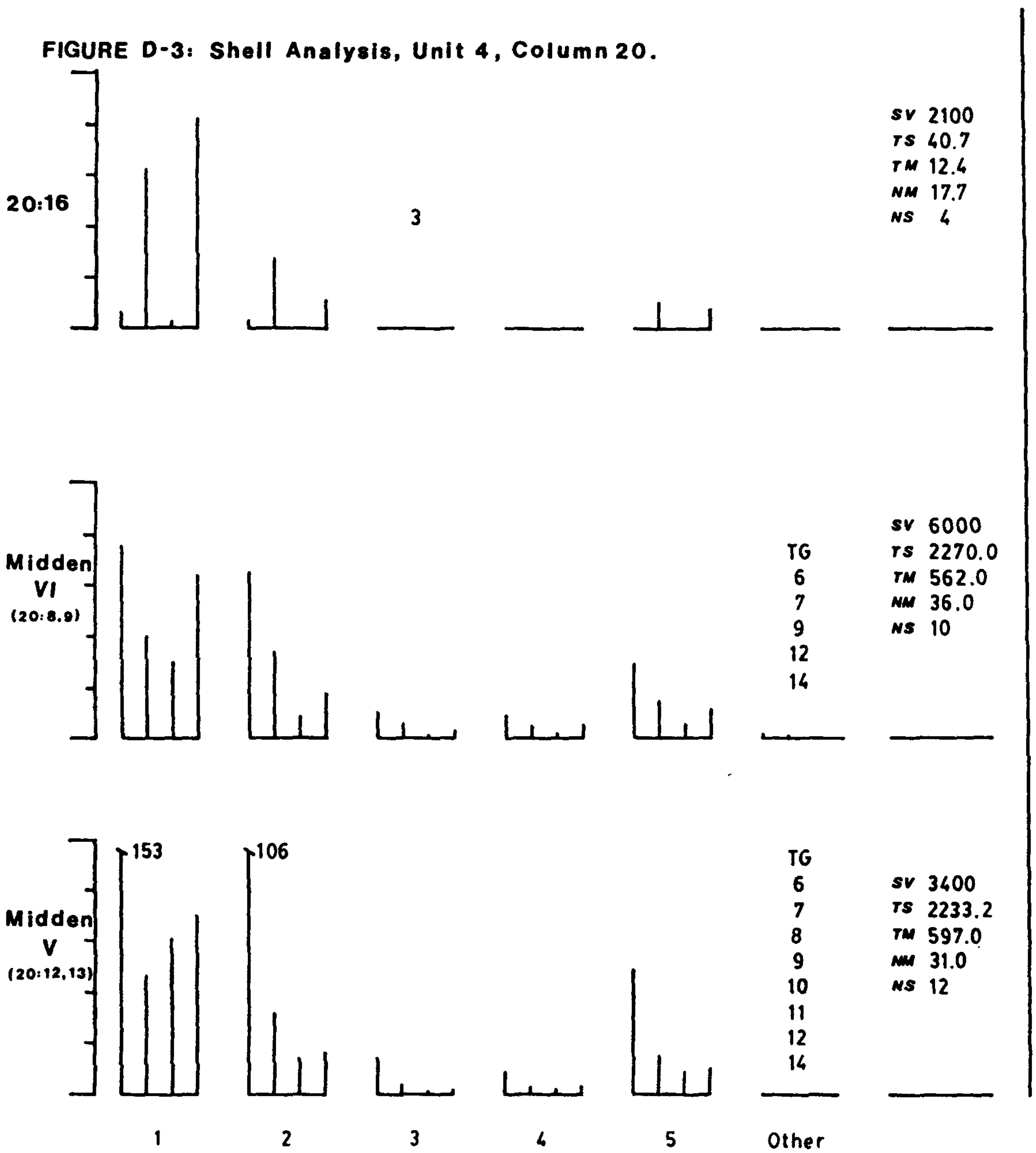


FIGURE D-3: Shell Analysis, Unit 4, Column 20.



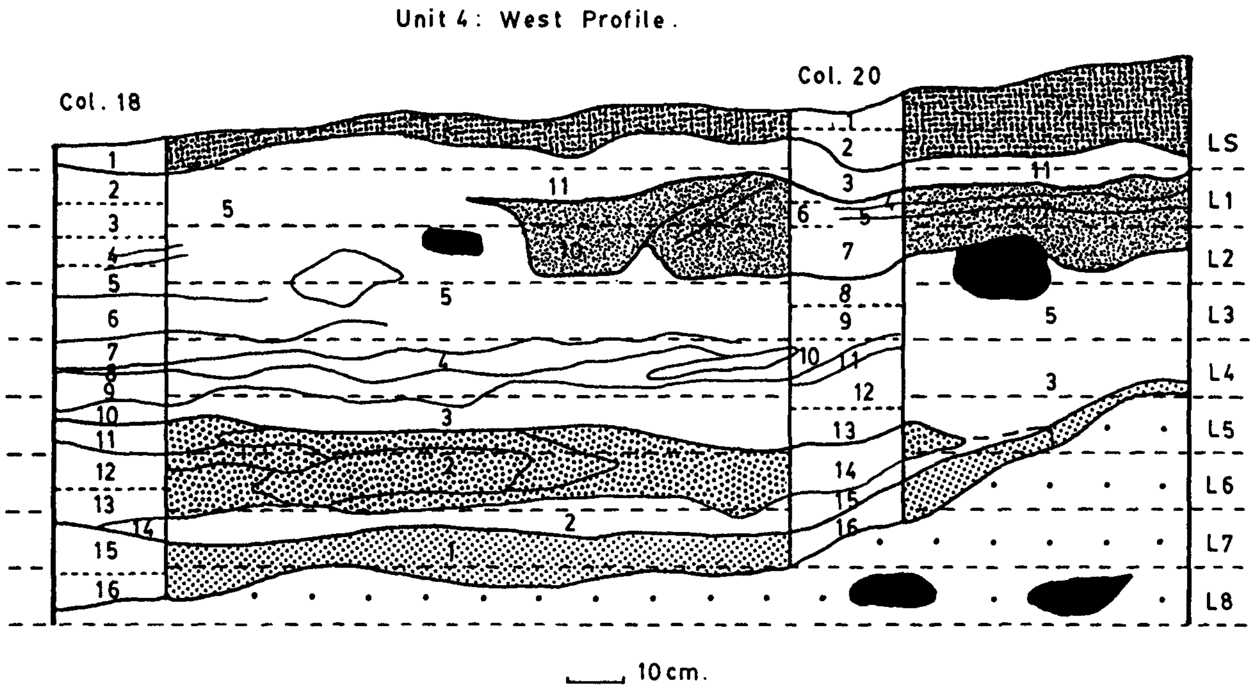


FIGURE D-4: Column 20 and associated stratigraphy.

FIGURE D-5: Shell Analysis, Unit 8, Column 17.

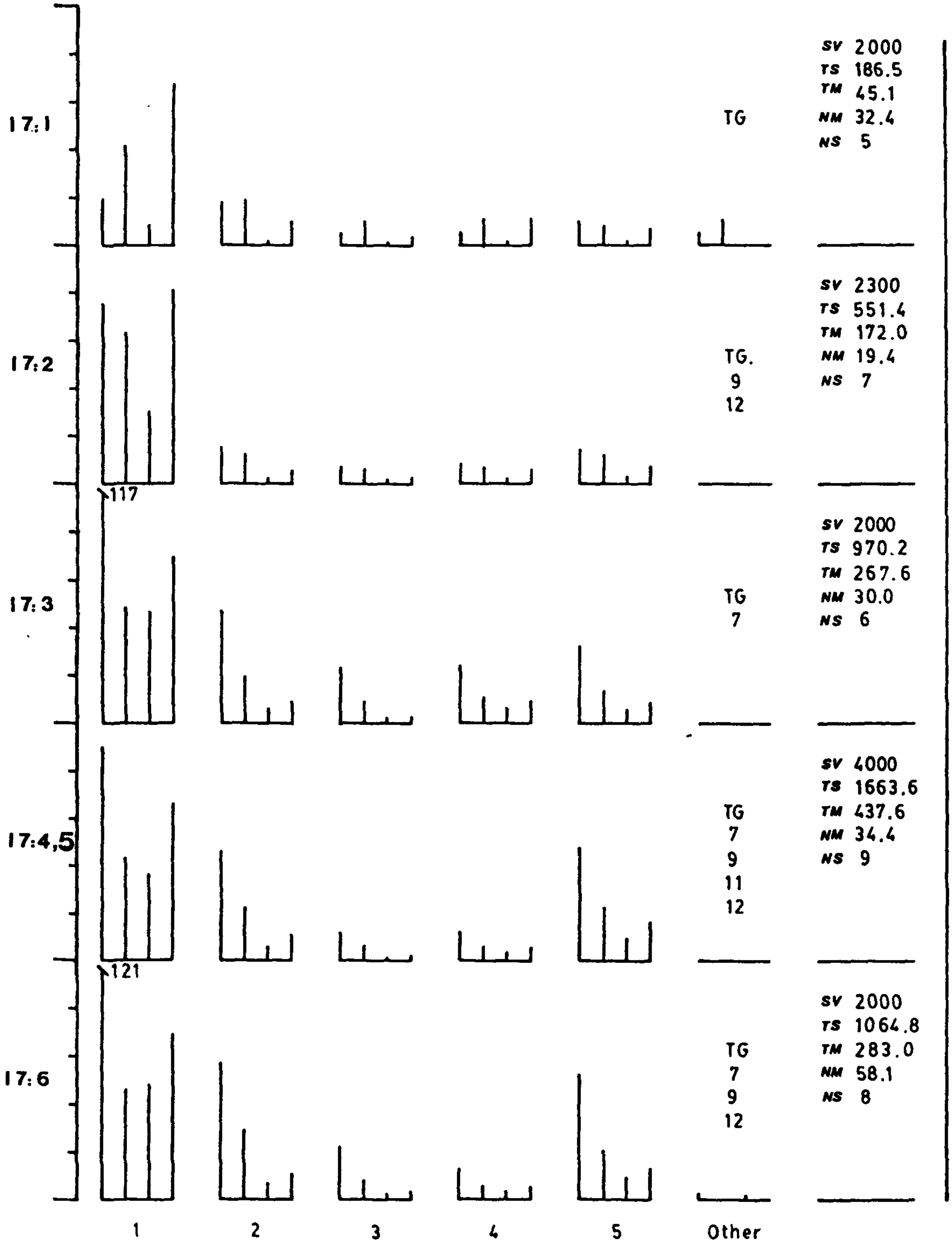
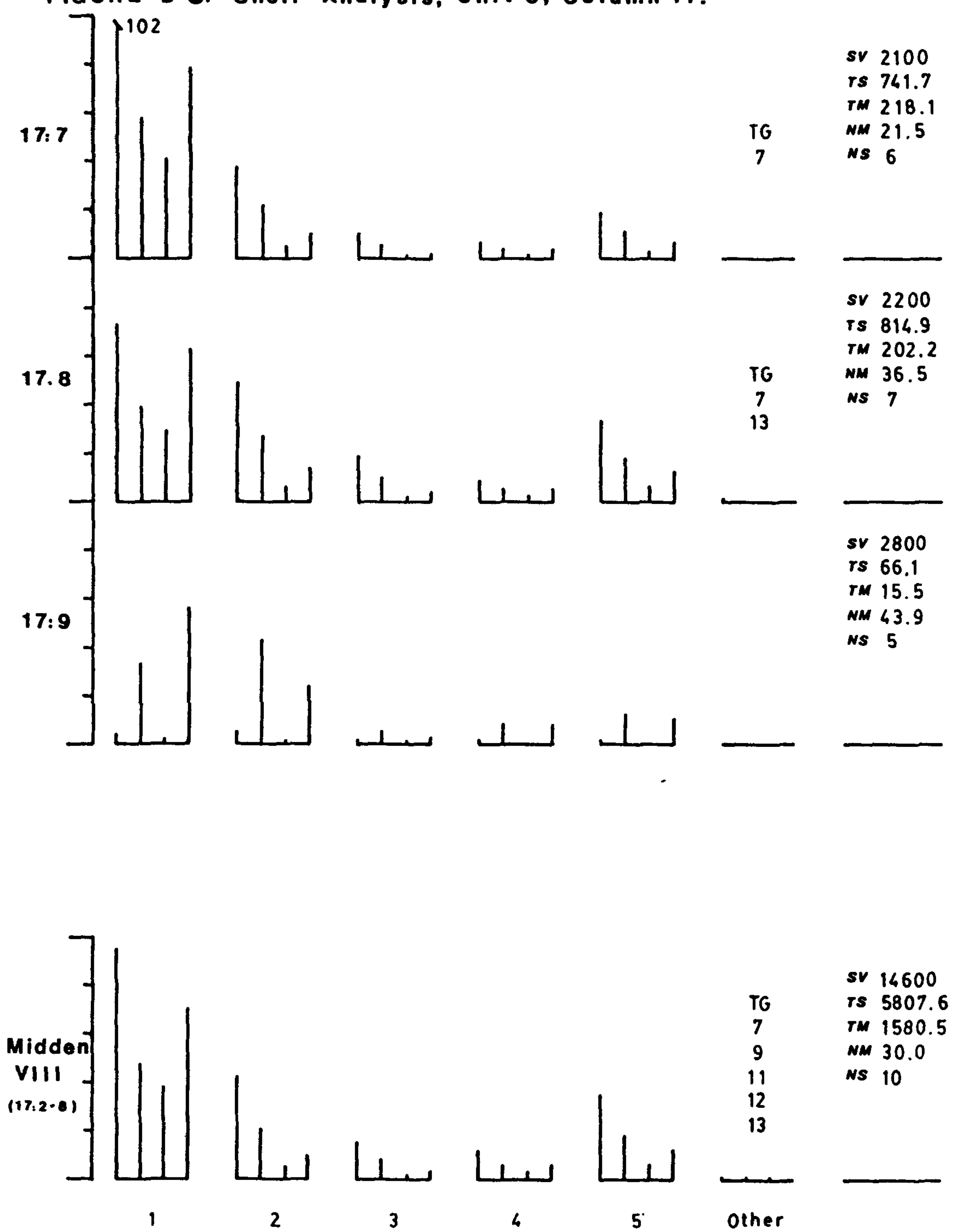


FIGURE D-5: Shell Analysis, Unit 8, Column 17.



Unit 8: West Profile

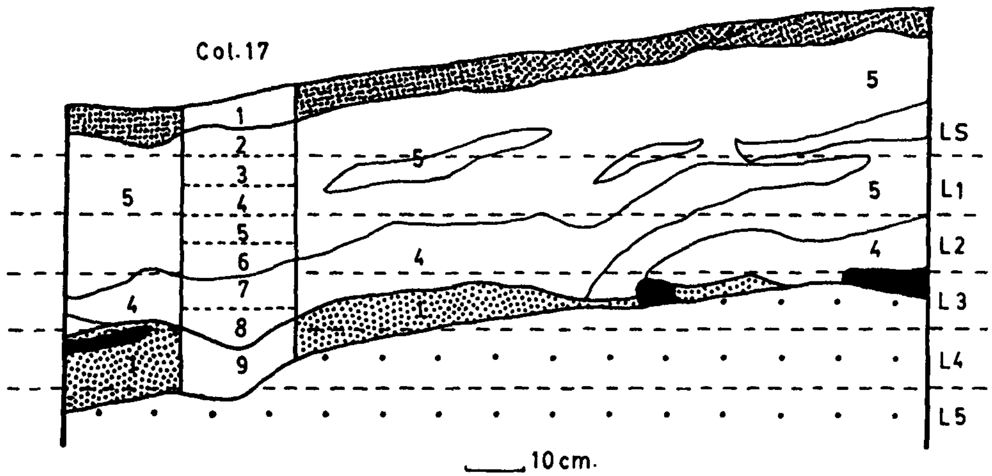


FIGURE D-6: Column 17 and associated stratigraphy.

FIGURE D-7: Shell Analysis, Unit 9, Column 13.

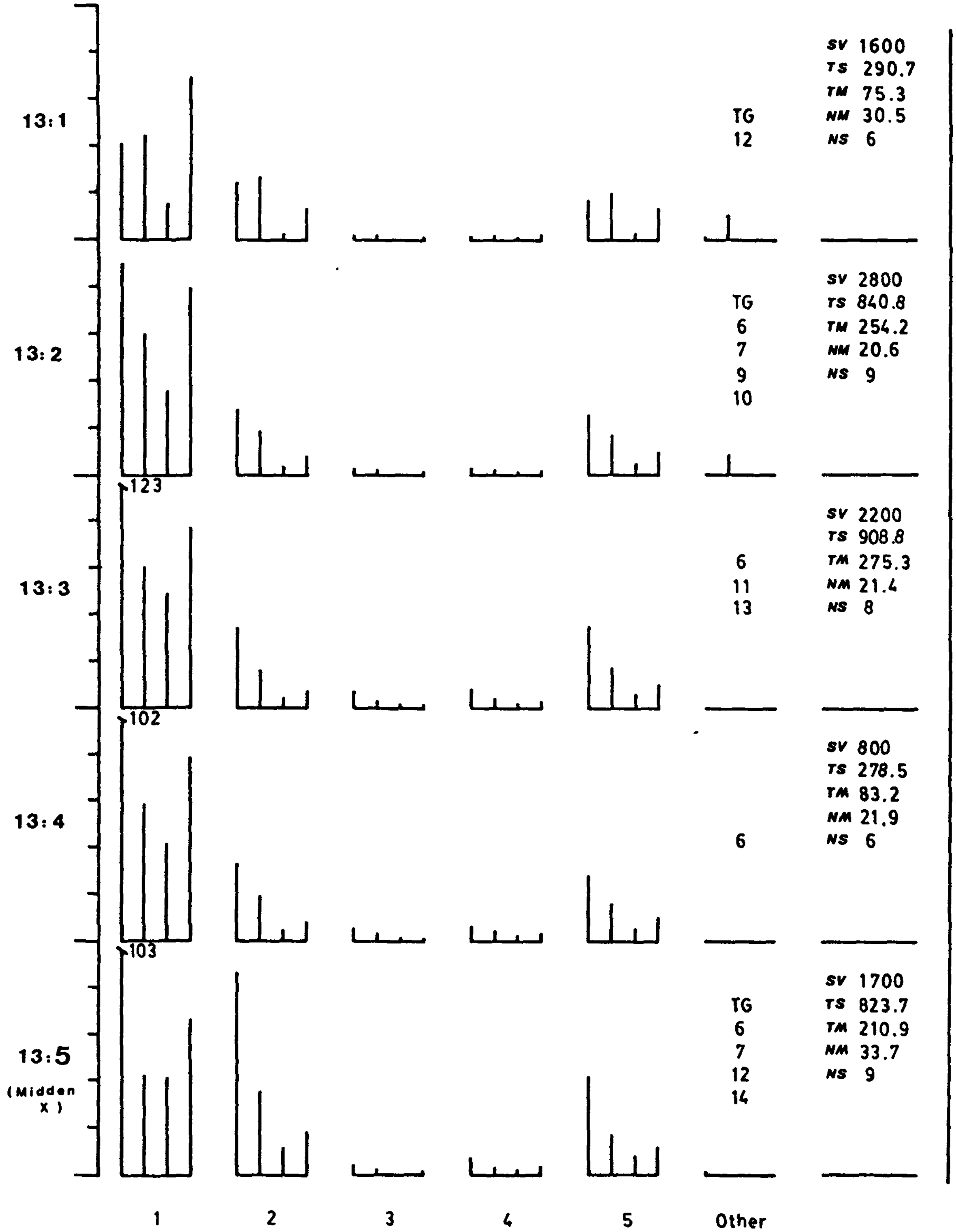


FIGURE D-7: Shell Analysis, Unit 9, Column 13.

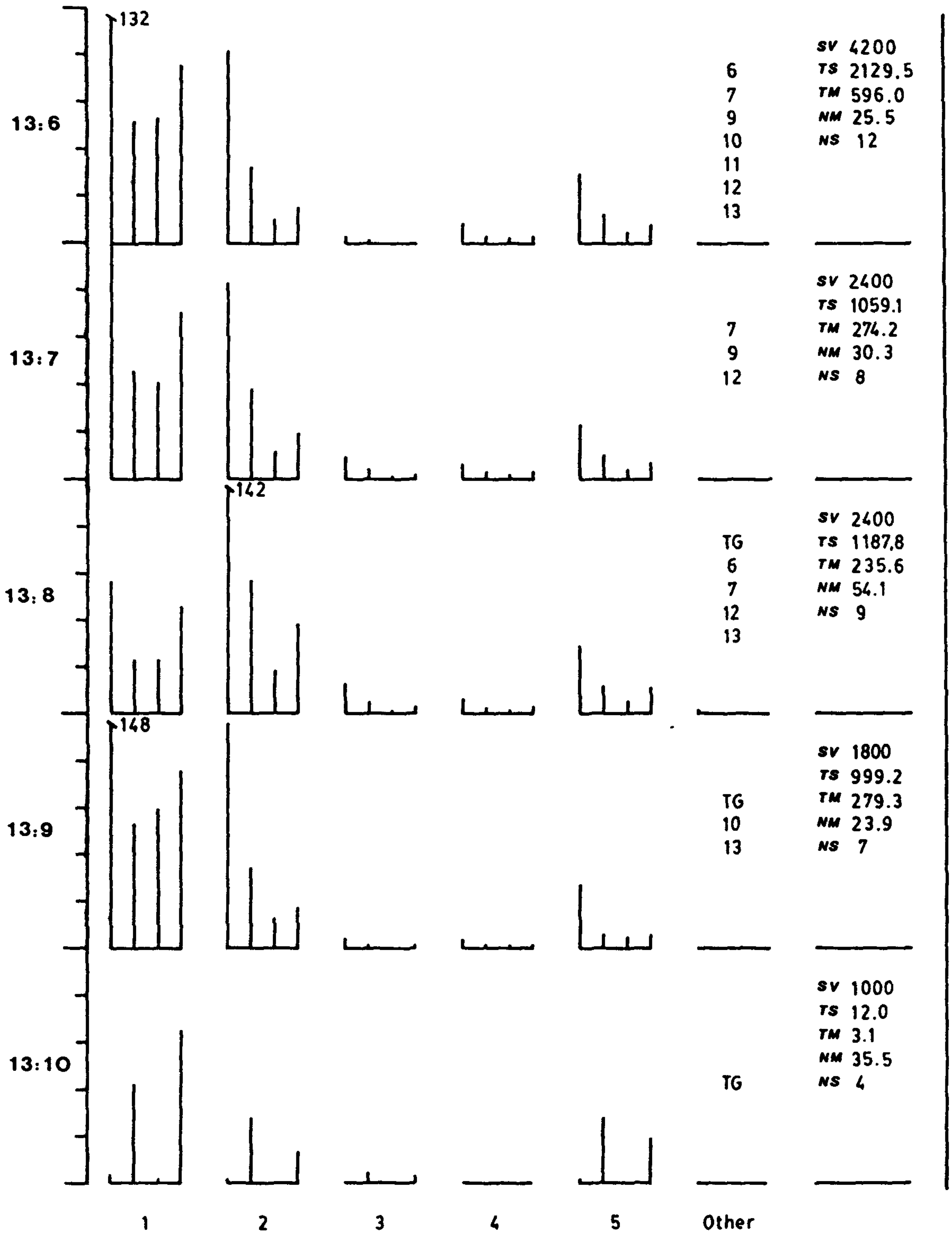
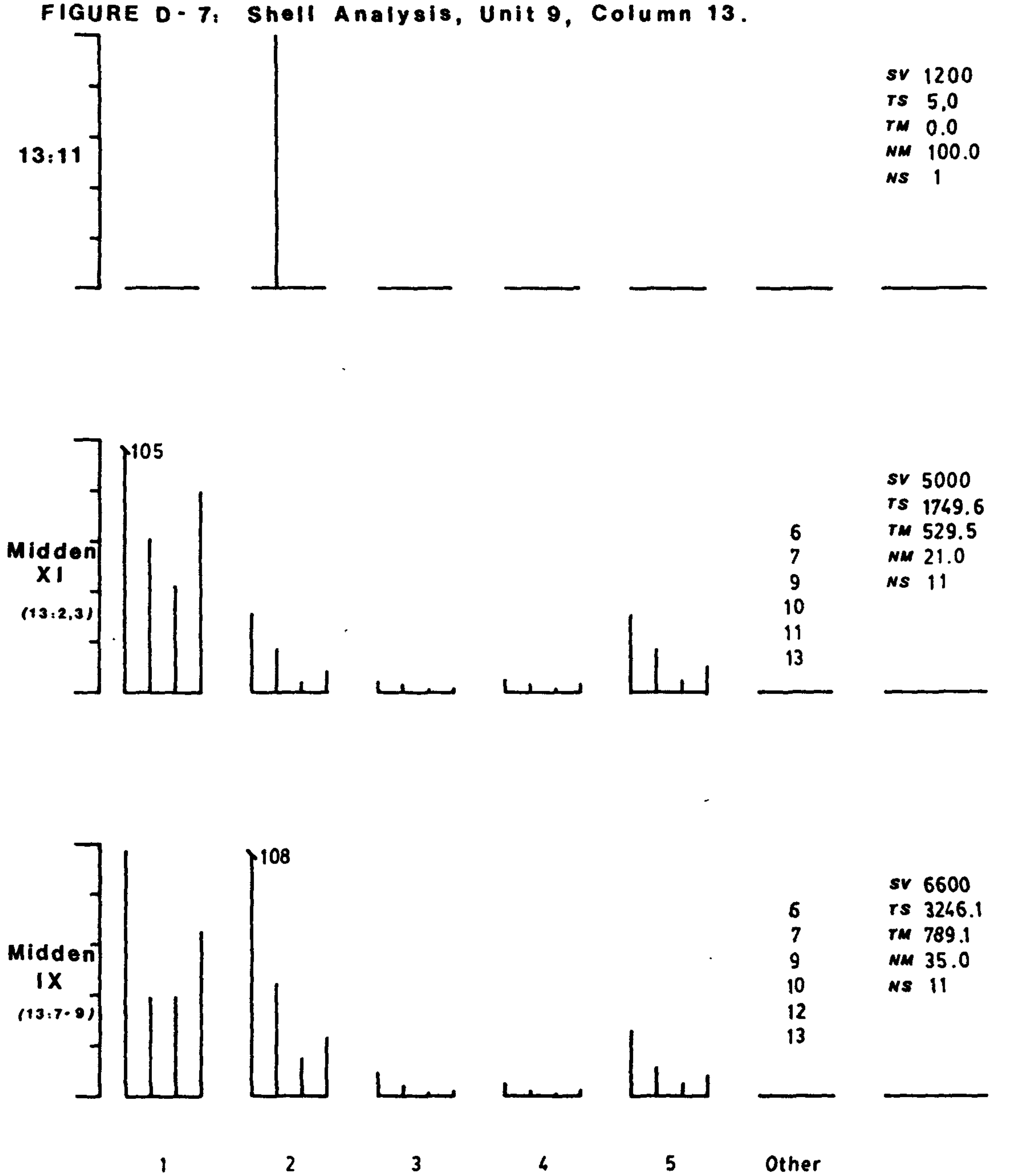


FIGURE D-7: Shell Analysis, Unit 9, Column 13.



Unit 9: East Profile.

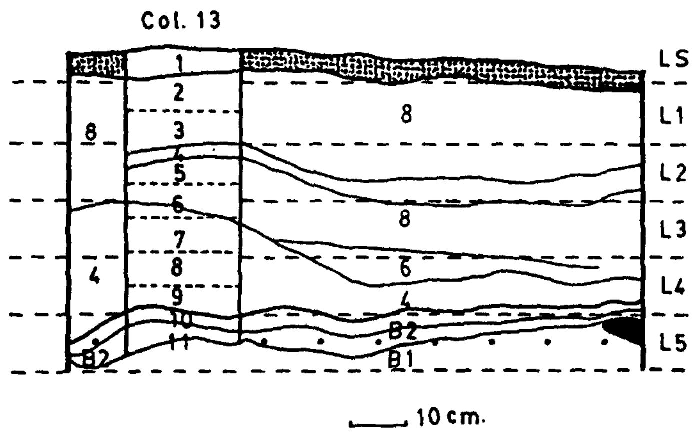


FIGURE D-8: Column 13 and associated stratigraphy.

Measurement of Meat:Shell Ratios:

It was deemed desirable for the purposes of this study to obtain meat:shell ratios for the common shell species in Passamaquoddy Bay area shell middens, in order to provide a common denominator for comparisons of the relative importance of the various species. However, in practice, the acquisition of these ratios proved to be somewhat problematic. In all, meat:shell ratios were obtained for eight species; these are summarized in Table D-2. Of these species, one, L. littorea, is not present in BgDr 48, and two, B. undatum and A. testudinalis, are present in relatively small amounts.

In all of the cases except S. droebachiensis and M. modiolus a fairly straightforward method of measurement was used. Ten live specimens of each species were obtained, the animals were killed in boiling water, and the meat shucked from the shells. Both meat and shells were then dried for 24 hours. The meat:shell ratio was obtained by dividing the dry meat weight of the ten animals by the dry shell weight of the same animals.

Calculating a meat:shell ratio for M. modiolus proved problematical because no live specimens of this predominantly subtidal species could be obtained. However, an estimate of the meat:shell ratio was derived by measuring the volumes of dead M. modiolus shells, and estimating the size of the animals they contained. The meat weight to shell volume ratio for M. edulis (0.5 gm. wet meat per 1 cc. volume) was used to make this estimation, as was the shrinkage rate for M. edulis (0.18). This calculation assumes that there are no significant differences in structure and water content between the two mussel species. The result suggests that the meat:shell ratio for M. modiolus is slightly higher than that for M. edulis because the latter's shell is somewhat denser than the former's.

Obtaining a meat:shell ratio for S. droebachiensis was a problem because of the marked seasonality of gonad growth in the sea urchin. During some parts of the year (especially late spring and early summer) there may be no edible parts in the urchin, while at other times (August to January) the urchin's gonads may account for up to 2/3 of its tissue weight (Moore 1976:75-76). A sample of five urchins taken during August was used to obtain the ratio used in this study. The urchins were shucked alive, rather than cooked, as this is how they are harvested commercially (MacKay 1976:45,47). A shrinkage ratio of 0.70 was used to adjust for the water content of the meat. A published shrinkage ratio of 0.50 (MacKay 1976:50) was noted, but was not used, because the roe measured in MacKay's study was completely cured. The more conservative figure should make the value of the sea urchin tissue roughly comparable to the values adopted for the mollusk meat.

The meat:shell ratio for sea urchins probably varies between 0.05:1 and 0.40:1 over the year. The value used in this study (0.18:1) is a compromise figure, because no certain indications of the season of sea urchin exploitation at BgDr 48 were available.

TABLE D-3: Summary of Meat:Shell Ratios.

Species	Ratio
Mya arenaria	0.40:1
Modiolus modiolus	0.13:1
Mytilus edulis	0.10:1
Nucella lapillus	0.25:1
Strongylocentrotus droebacheinsis	0.18:1
Acmaea testudinalis	0.13:1
Buccinum undatum	0.60:1
Littorina littorea	0.17:1

APPENDIX E

A Key to the Identification of, and Inter-site Distribution of, Archaeological Invertebrate Species in the Passamaquoddy Bay Area.

<u>Introduction</u>:

This appendix contains a summary of information relating to the identification of, and condition of, archaeological shell in Passamaquoddy Bay area shell middens. It is largely restricted at this point to species identified in the BgDr 48 assemblage, but is intended to be expanded to include data from other sites.

The contents of the appendix are arranged as follows:

Table E-1: a species list arranged taoxomically.

The body of the key containing species descriptions.

Figure E-1: ecological position of the species.

Figure E-2: illustrations of the species.

Table E-2: marine shell species reported from other Passamaquoddy Bay sites but not from BgDr 48.

Table E-3: notes on some common shellfish not found in the archaeological sites.

Table E-4: terrestrial gastropod species identified in the BgDr 48 assemblage.

Table E-5: bibliography for the key.

This key concentrates on archaeological information. The references listed in Table E-5 provide further biological and ecological information on the relevant species. The data contained in the body of the key are arranged as follows:

1) the complete scientific nomenclature for the animal; previous designations and alternatives are bracketed.

2) common names referring to the animal.

3) the range in which the animal occurs on the Atlantic coast of North America.

4) a brief description of the preferred habitats of the animal.

5) an indication of the availability of the animal to littoral gatherers.

6) the amount of the species present at BgDr 48. The first line contains a qualitative evaluation on a scale using the descriptors very abundant, abundant, common, present, rare, and very rare. The second line indicates quantitative assessments of the amount present (the more common species in terms of proportion of total shell content, the less common species in number of individuals per cubic meter of deposit). The third line indicates relative value (meat:shell ratio) where this is available.

7) a description of the distribution of the species at BgDr 48.

8) a description of the condition of the shell at BgDr 48.

9) an indication of whether the species is currently present in the Partridge Island area.

10) a list of other Passamaquoddy Bay/West Isles sites at which the species has been identified.

The terminology used is greatly simplified; definitions of terms such as apex, periostrachum, etc., can be found in most keys to invertebrates. This key is intended to supplement, not to replace, the use of biological keys.

TABLE E-1: BgDr 48 Marine Shell Assemblage by Taxonomic Classification.

Family:	Class:	Species:	Species#:
Mollusca	Amphineura	Ischnochiton ruber	10
	Gastropoda	Nucella lapillus	4
		Buccinum undatum	6
		Acmaea testudinalis	7
		Neptunea decemcostata	17
		Littorina saxatilis	11
		Littorina obtustata	15
	Pelecypoda	Mya arenaria	1
		Modiolus modiolus	2
		Mytilus edulis	3
		Astarte castanea	8
		Cyclocardia borealis	9
		Crenella glandula	13
		Hiatella arctica	14
		Placopecten magellanicus	16
		Spisula solidissima	18
Arthropoda	Crustacea	Balanus sp.	12
Echinodermata	Echinoidea	Strongylocentrotus droebachiensis	5

1) <u>Ischnochiton ruber</u> Linn.

2) northern red chiton

3) Arctic to Connecticut

4) under rocks and other hard objects; lower intertidal zone to 145 meters depth; epifauna; herbivorous

5) exposed briefly at most low tides

6) very rare

   circa 40 valves per cubic meter

7) valves present in some shell deposits

8) only complete central valves were identified

9) common at present

10) not reported from other sites

1) *Nucella lapillus* (*Thais lapillus*) Linn.

2) Atlantic dogwinkle, northern dogwinkle, dogwhelk

3) Labrador to New York

4) on rocks and ledges and under rockweeds; mid-intertidal zone to 4 meters depth; epifauna; carnivorous

5) exposed for some time at every low tide

6) common

about 5-6%

0.25:1

7) present in almost all shell deposits; scattered as whole shells throughout other debris, or as small concentrations of fragmented shells

8) whole shells and fragments identified; outer lip, spire, and spiral column were commonly identified fragments.

9) common at present

10) BgDr 25, BgDs 6, BgDs 10

1) *Buccinum undatum* Linn.

2) waved whelk, northern whelk, edible whelk

3) Arctic to New Jersey

4) low water line to 30 meters depth on all substrates; epifauna; carnivorous

5) present at low water line on many low tides

6) present; distinctive and noticeable due to its size; *circa* 20 shells per cubic meter
0.60:1

7) most numerous in topsoils near the treeline, where the largest specimens usually occur; scattered occurrence in shell deposits

8) whole shells and fragments identified; shells tend to be complete, but with broken lips; fragments easily identified by distinctive radial sculpture

9) occurs at present

10) BgDs 1, BgDs 6, BgDs 10, BgDr 11, BgDr 25

1) *Acmaea testudinalis* Müller

2) tortoise-shell limpet, Atlantic plate limpet

3) Arctic to New York

4) on rocks and other hard objects; at and just below the average low water line; epifauna; herbivorous

5) exposed briefly at almost every low tide

6) common

   circa 800 shells per cubic meter

   0.31:1

7) present in all shell deposits

8) shells usually incomplete; distal edges broken away; apex of shell easily recognised

9) common at present

10) BgDs 6, BgDs 10

1) *Neptunea decemcostata* Say

2) ten-ridged whelk

3) Nova Scotia to Massachusetts

4) low water to 90 meters depth on all substrates; epifauna; carnivorous

5) occasionally present at the low water line

6) very rare
   0.08 per cubic meter (1 specimen recovered)

7) Unit 7, level 5, shell matrix

8) complete shell; probably not beach collected

9) observed as a dead shell on beaches at present

10) BgDs 6

1) *Littorina saxatilis* Olivi

2) northern rough periwinkle

3) Arctic to New Jersey

4) on rocks and under rockweeds; higher part of the intertidal zone; epifauna; herbivore

5) exposed for a considerable time at each tidal cycle

6) very rare
   circa 83 shells per cubic meter

7) an occasional inclusion in shell deposits; where present usually several shells occur

8) only whole shells identified

9) common at present

10) BgDr 25

1) *Littorina obtustata* Linn.

2) smooth periwinkle, round periwinkle

3) Labrador to New Jersey

4) on seaweeds, especially *Fucus*; middle to lower intertidal zone; epifauna; herbivorous

5) exposed for considerable time at each tidal cycle

6) very rare

   circa 20 shells per cubic meter

7) an occasional inclusion in shell deposits

8) only complete shells identified

9) common at present

10) not reported from other sites

1) *Mya arenaria* Linn.

2) soft-shelled clam, long-necked clam, steamer clam

3) Labrador to North Carolina

4) gravelly muds; intertidal zone to 75 meters depth; infauna; siphon feeder

5) exposed for a considerable time at every tidal cycle

6) very abundant

   circa 43% of the shell assemblage

   0.40:1

7) present in all shell deposits and frequently on living floors.

8) whole valves and fragments identified; most pieces larger than 5 mm.; periostrachum sometimes present; individuals of all sizes present

9) common at present

10) generally considered to be present and the dominant species in all sites in the area

1) *Modiolus modiolus* (*Volsella modiolus*) Linn.

2) horse mussel, red mussel, northern horse mussel

3) Arctic to North Carolina

4) attached by a byssus to rocks and other hard objects; in holdfasts at the surface of sands and gravels; at and immediately below the extreme low water line; epifauna; filter feeder

5) may be exposed briefly at the most extreme low tides

6) abundant

circa 34% of the shell assemblage

0.13:1 (estimate)

7) present in all shell deposits and often on living floors

8) complete shells very rare; fragments of large individuals almost exclusively; many fragments less than 5 mm.; periostrachum often present; beaks commonly identified;

9) common at present

10) BgDs 1, BgDs 6, BgDs 10, BgDr 11, BgDr 25

1) *Mytilus edulis* Linn.

2) common mussel, blue mussel, edible mussel

3) Greenland to South Carolina

4) attached to rocks and hard objects by a byssus; in holdfasts on the surface of sands and gravels; at and immediately below the average low water line; epifauna; filter feeder

5) exposed briefly at most low tides

6) common

circa 8-9% of the shell assemblage

0.10:1

7) present in all shell deposits

8) complete valves very rare; fragments of distinctive color; beaks commonly identified; fragments of large individuals almost exclusively; periostrachum sometimes present

9) common at present

10) BgDs 1, BgDs 6, BgDs 10, BgDr 11, BgDr 25

1) *Astarte castanea* Say

2) smooth astarte

3) western Nova Scotia and Bay of Fundy

4) muddy and sandy substrates; low water to 150 meters depth; infauna; siphon feeder

5) exposed briefly at most low tides

6) rare

circa 14 individuals per cubic meter

7) present in some but not all shell deposits; where found, usually several valves present

8) only complete valves identified; valves articulated in several cases

9) not observed or recorded at present

10) not reported from other sites

1) *Cyclocardia borealis* (*Venericardia borealis*) Conrad

2) northern cardita, cod clam, northern heart shell

3) Arctic to Cape Hatteras

4) under stones; low water to 460 meters depth; infauna; siphon feeder

5) exposed briefly at most low tides

6) rare

circa 97 individuals per cubic meter

7) an occasional inclusion in shell deposits; where present, usually several valves occur

8) only complete or slightly broken valves identified; valves articulated in several cases

9) not observed or recorded at present

10) not reported from other sites

1) _Crenella_ _glandula_ Totten

2) glandular crenella, glandular bean mussel

3) Labrador to North Carolina

4) on stoney and muddy substrates and in kelp holfasts; from low water to 60 meters depth; epifauna; filter feeder

5) exposed briefly on some low tides

6) very rare

   circa 80 individuals per cubic meter

7) an occasional inclusion in shell deposits; where present, usually several valves occur

8) only complete or slightly fragmented valves identified

9) not observed or reported at present

10) not reported from other sites

1) *Hiatella arctica* Linn.

2) Arctic saxicave, Arctic rock borer

3) Arctic to the Carribean

4) under stones, and in burrows in all substrates including soft rocks, or in mussel holdfasts; low water to 185 meters depth; infauna; siphon feeder

5) exposed briefly at some low tides

6) rare

   circa 97 individuals per cubic meter

7) occasional inclusion in shell deposits; where present, usually several valves occur

8) only complete or slightly broken valves identified; small pieces indistinguishable from *Mya*

9) occurs at present

10) not reported from other sites

1) *Placopecten magellanicus* Gemelin

2) giant scallop, deep-sea scallop

3) Labrador to North Carolina

4) on sandy and gravelly substrates; low water to 165 meters depth; epifauna; filter feeder

5) only occasionally observed in shallow water

6) very rare

   0.17 individuals per cubic meter (3 specimens recovered)

7) 2 valve fragments on the living floors in Unit 3; 1 valve in the shell deposit in Unit 8

8) large fragments and one almost complete valve

9) present in deep water

10) BgDs 6, BgDs 10, BgDr 25

1) *Spisula solidissima* Dillwyn

2) Atlantic surf clam, bar clam, hen clam

3) Nova Scotia to South Carolina

4) in sandy substrates on exposed ocean beaches; from low water to 75 meters depth; infauna; siphon feeder

5) exposed at most low tides for a brief time

6) very rare
   0.08 individuals per cubic meter (1 fragment recovered)

7) Unit 5, layer 5 shell deposit

8) large fragment including distinctive adductor muscle attachment; small pieces would be indistinguishable from *Mya*

9) apparently present but uncommon

10) BgDs 1, BgDs 6, BgDr 11

1) *Balanus* sp. (*B. balanoides* Linn., *B. balanus* Linn., *B. crenatus* Bruguière)

2) barnacles, acorn barnacles

3) Arctic to New Jersey

4) attached to rocks and hard objects from high water to 100 meters depth (*B. balanoides* in the intertidal zone, *B. balanus* and *B. crenatus* below the average low water line); epifauna; filter feeder

5) *B. balanoides* exposed for a considerable period at every tidal cycle; *B. balanus* and *B. crenatus* exposed occasionally at extreme low tides

6) rare

   circa 111 fragments per cubic meter

7) present in most but not all shell deposits and occasionally on living floors

8) usually only 5 mm. or larger fragments of plates identified; large size of the individuals suggests most belong to the subtidal species

9) all common at present

10) BgDs 6, BgDs 10

1) *Strongylocentrotus* *droebachiensis* Müller
2) green sea urchin
3) Arctic to Massachusetts
4) on algal beds in protected areas on rocky substrates; low water to 1170 meters depth; epifauna; herbivorous
5) exposed briefly at most low tides
6) common

   circa 9% of the shell assemblage

   0.18:1
7) present in almost all shell deposits
8) tests are completely disarticulated; all body parts identified; scattered throughout shell deposits, and occasionally in small concentrations; sometimes on living floors; individuals of all sizes present
9) abundant at present
10) BgDs 1, BgDs 6, BgDs 10, BgDr 25

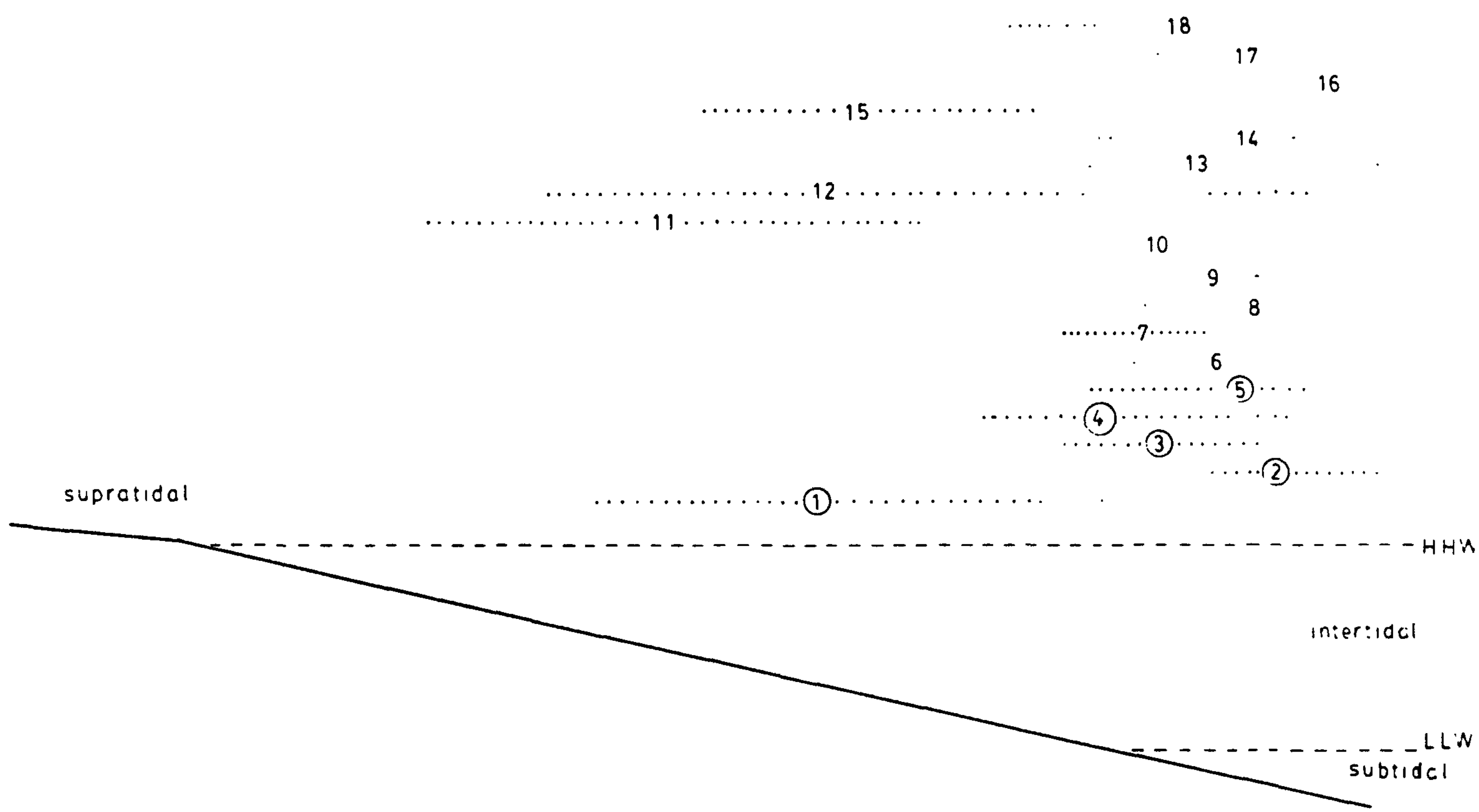


FIGURE E-1: Position of Invertebrate Species.

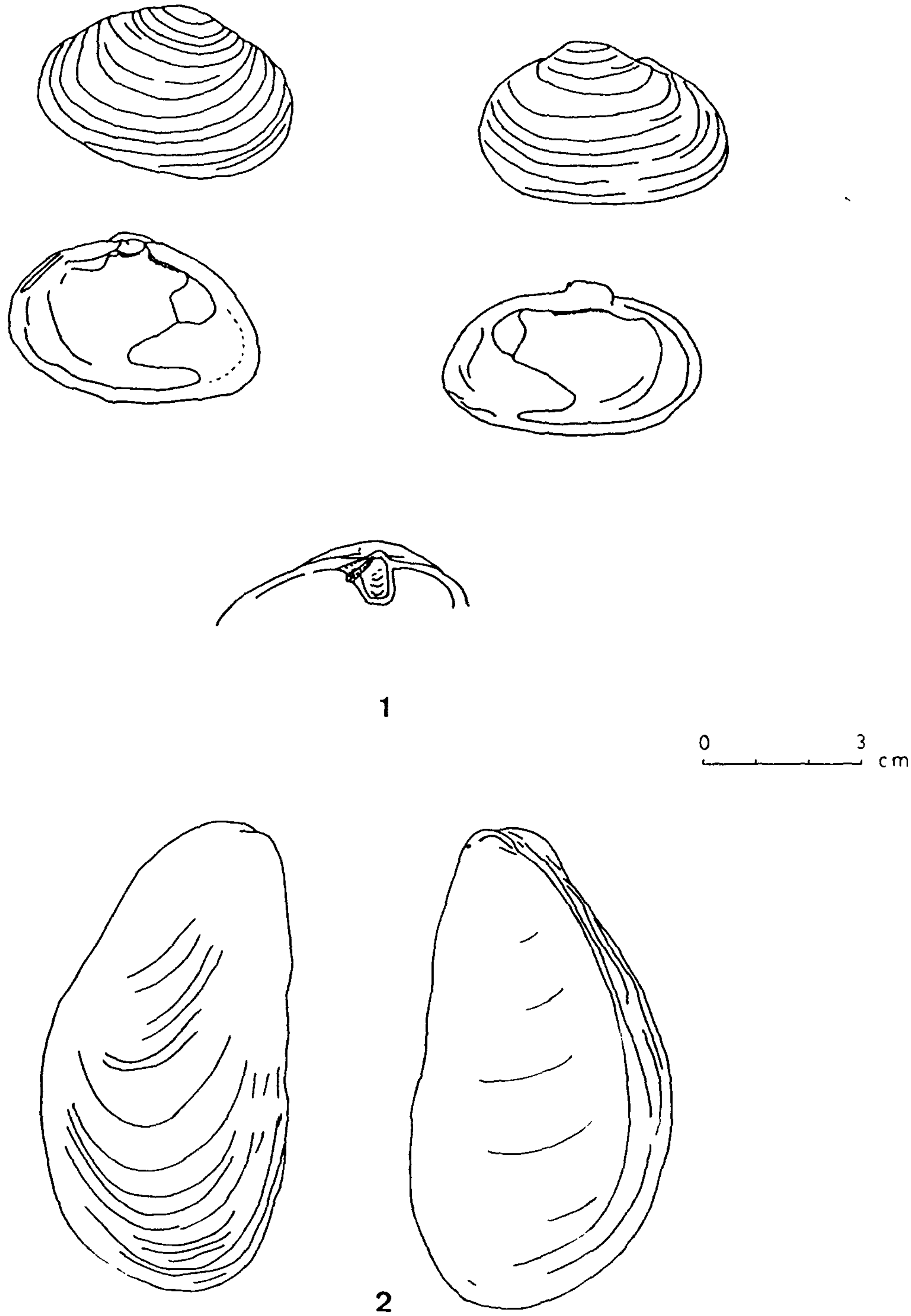
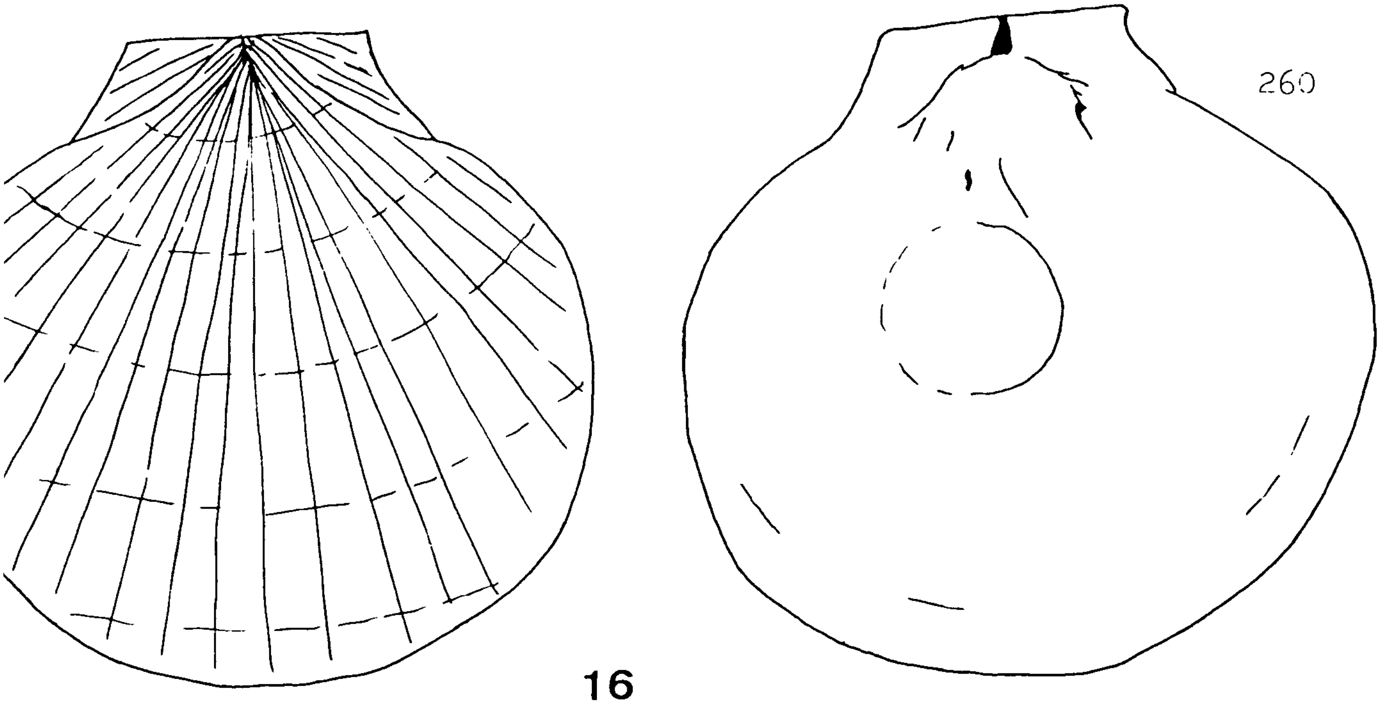


FIGURE E-2



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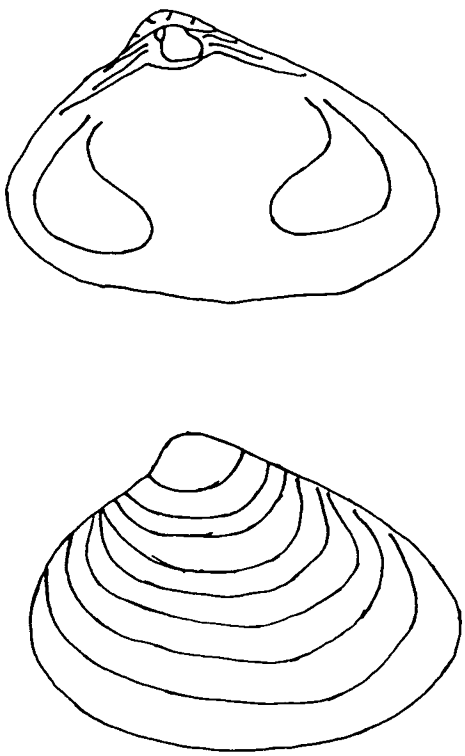

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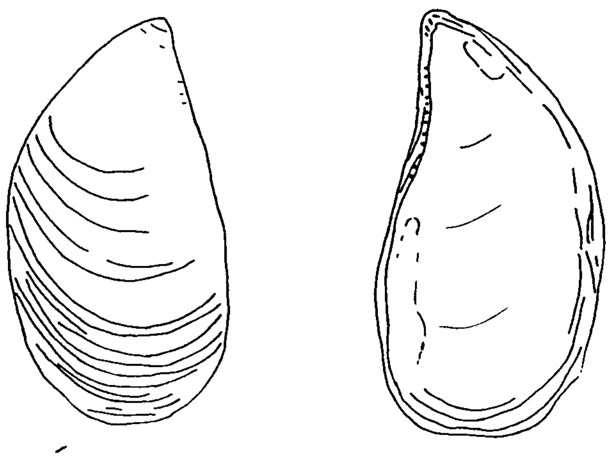


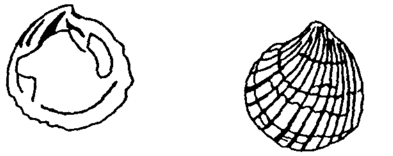
3

0 3 cm

FIGURE E-2

11

15



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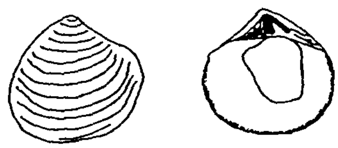

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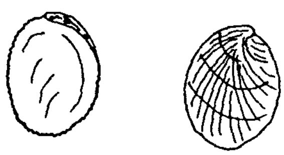


13

14

0 1 2 cm

FIGURE E-2

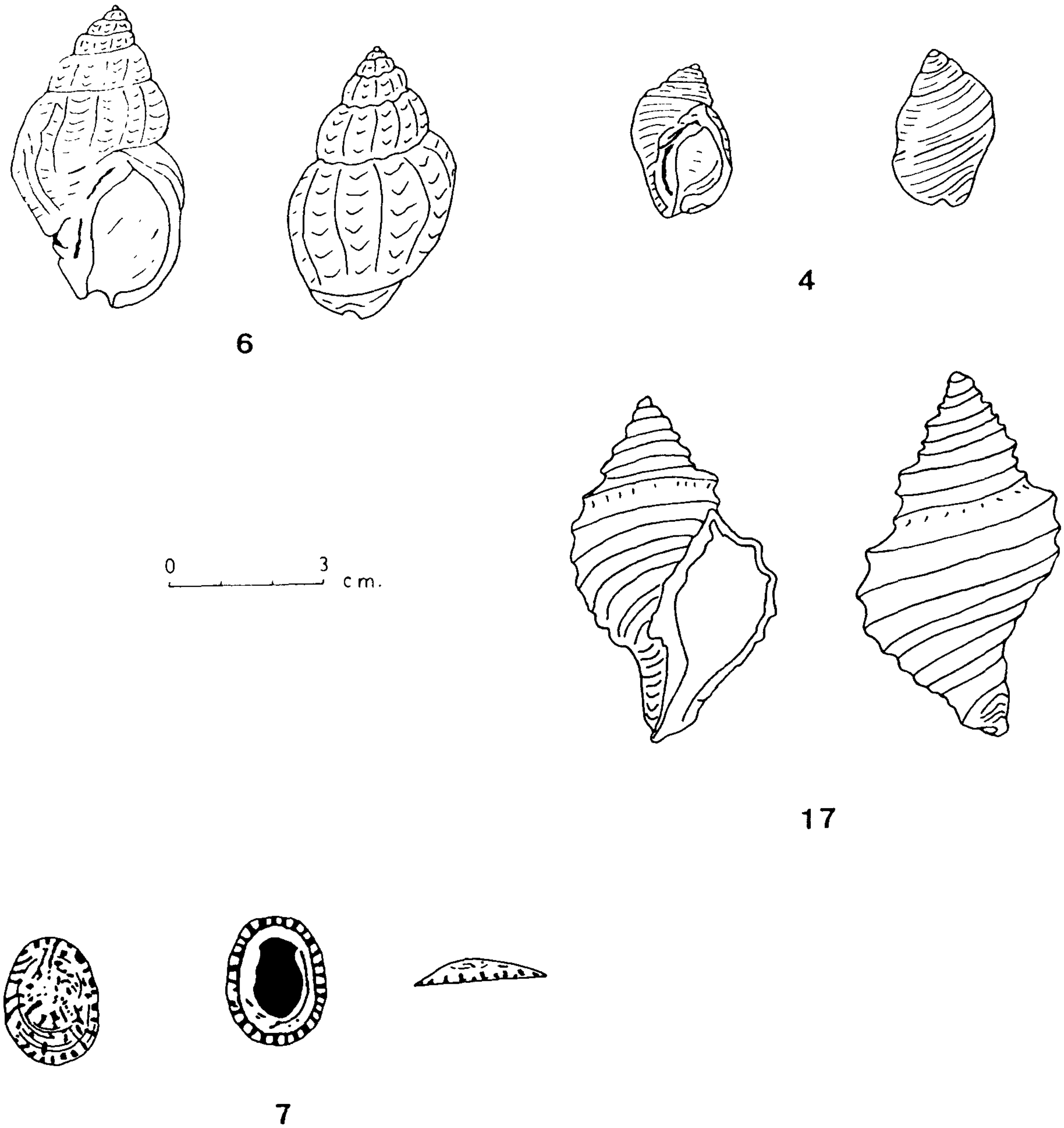
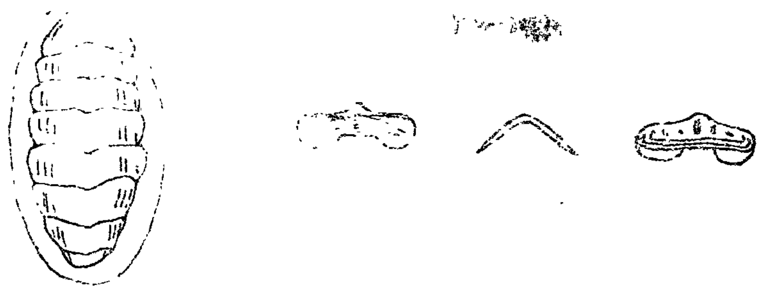
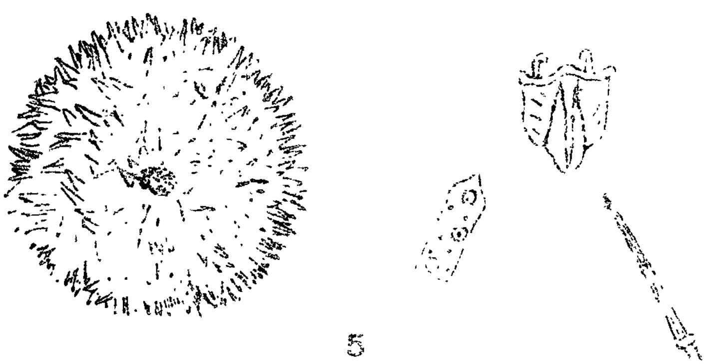


FIGURE E-2



10

12



5

FIGURE 2

TABLE E-2: Shellfish Species found at Other Passamaquoddy Bay Sites but not at BgDr 48.

Classification:	Description:	Sites:
Pelecypoda		
Astarte undata	the wavey astarte; similar to *A. castanea* but having a raised concentric sculpture; infauna; filter feeder	BgDs 10
Gastropoda		
Crepidula fornicata	the slipper limpet; a large rounded limpet with a partially enclosed lower surface; epifauna; herbivorous	BgDr 25
Lunatia heros	the moon snail; a large rounded snail with a deep umbilicus but no canal; epifauna; carnivorous	BgDs 6 BgDs 10
Littorina littorea	the common periwinkle; a large periwinkle	BgDs 10

TABLE E-3: Some Interesting Absences from the BgDr 48 Invertebrate Faunal Assemblage.

Mya truncata and Chalmys islandica:

There are several shellfish species which are common in the Passamaquoddy Bay/West Isles area at present which are conspicuous by their absence from archaeological contexts in the area. Two of these are the truncate soft-shelled clam, *Mya truncata*, and the Iceland scallop, *Chalmys islandica*. The former is present as a dead shell on the beaches of Partridge Island at the present time. It could be argued that the similarity of the truncate *Mya* shell to other *Mya* shells has precluded its identification. However, the flared edge of the shell is quite distinctive, and its absence from all reported assemblages suggests that it was not present in aboriginal times, or that it was avoided by shellfish gatherers.

Mya truncata is a common late Pleistocene fossil in the area and has been dated to 13,000 B.P. at Grand Manan.

The Iceland scallop is also a common dead shell on exposed beaches in the area at present. It has never been reported from an archaeological context in New Brunswick although it has been reported from sites on the central Maine coast (Snow 1973). This evidence suggests that the species is a recent introduction to the area.

Littorina littorea:

The common periwinkle L. littorea is known to be a recent introduction to the local fauna (introduced during the early historic period), but has, none-the-less, been reported from archaeological shell midden contexts. For example, Sanger reported periwinkle shells at a depth of 35-40 cm. at BgDs 10. Sanger has attempted on two occasions to date common periwinkle shells to "pre-Norse" contexts at the site (Wilmeth 1978). The results of both of these dating attempts (410±130 B.P. and 650±130 B.P.) suggest these shells resulted from post-depositional disturbance of the site.

It is suggested that the absence of this species from BgDr 48, in spite of the vast numbers of them now inhabiting the Partridge Island shoreline, is a measure of the stratigraphic integrity of the site. It is further suggested that the presence of this species in apparently prehistoric contexts be considered a prime indicator of site disturbance.

TABLE E-4: Terrestrial Gastropod Species Identified from the BgDr 48 Faunal Assemblage.

Large Species:

Anguispira alternata, the striped forest snail

Cepaea hortensis, the common garden snail

Small Species:

Columella edulenta, a pupa snail

Cionella lubrica, the appleseed snail

Vallonia pulchella, the handsome vallonia

(several others present)

TABLE E-5: Bibliography of Shell Keys and Relevant Biological Sources.

Berrill and Berrill 1981

Bousfield 1960

Brinkhurst *et al*. 1975

Emerson and Jacobson 1976

MacKay *et al*. 1978

Morris 1973

APPENDIX F

Data Pertaining to Bones from Column Samples

Introduction:

This appendix summarizes detailed information relating to bones and bone fragments recovered from the column samples taken from BgDr 48. The data are presented in graphic and tabular form.

In Figure F-1 the assemblage is quantified by stratigraphic component and zoological class. The scale at the left of each graph equals 100 units, and at the extreme left the stratigraphic component to which the data apply is identified. The four vertical columns represent: 1) fish remains; 2) avian remains; 3) mammal remains; and 4) bone unidentifiable to class. In each class/component category the bars represent quantity of bone pieces recovered (first 1, 2, 3, or 4 bars), proportion of the component sample these represent (penultimate bar), and proportion of all bones in the class recovered from column samples these represent (ultimate bar). Values of less than one unit are not shown. Five further data are given at the upper right for each component. These are: SV) volume of all the samples assigned to the component in $m.^3$; TP) total number of bone pieces recovered from the component samples; RF) the relative frequency of bone occurrence (number of bone pieces per 500 cc. volume -- this measurement was used to make the frequency of bone comparable to the frequency of shell); PC) the proportion these bones represent of the total column bone assemblage; ID) the number of pieces identified to a smaller taxon.

Table F-1 shows the stratigraphic component to which each of the column samples was assigned. Details of the faunal identifications from column bones are presented in Table F-2.

TABLE F-1: Column Sample to Stratigraphic Component Assignments.

Sample	Component	Sample	Component	Sample	Component
1:1	A	4:5	A	7:5	2c
1:2	A	4:6	2c	7:6	2c
1:3	2b	4:7	2c	7:7	2c
1:4	2b	4:8	2c	7:8	B
1:5	2b	4:9	2c	7:9	B
1:6	2b	4:10	2c	8:1	A
1:7	B	4:11	B	8:2	2b
1:8	B	4:12	B	8:3	2b
1:9	B	5:1	A	8:4	2b
2:1	A	5:2	A	8:5	2b
2:2	2c	5:3	A	8:6	2b
2:3	2c	5:4	A	8:7	2b
2:4	2c	5:5	2c	8:8	2b
2:5	2c	5:6	2c	8:9	2b
2:6	2c	5:7	2c	8:10	2b
2:7	B	5:8	B	8:11	2b
2:8	B	6:1	A	8:12	2b
3:1	A	6:2	A	9:1	A
3:2	2b	6:3	A	9:2	A
3:3	2b	6:4	A	9:3	2c
3:4	2b	6:5	A	9:4	B
3:5	B	6:6	2c	10:1	-
3:6	B	6:7	2c	10:2	-
3:7	B	6:8	B	10:3	-
4:1	A	7:1	A	10:4	-
4:2	A	7:2	A	11:1	-
4:3	A	7:3	2c	11:2	-
4:4	A	7:4	2c	11:3	-
				11:4	-

TABLE F-1: continued.

Sample	Component	Sample	Component	Sample	Component
12:1	-	15:4	2c	18:4	2b
12:2	-	15:5	2c	18:5	2b
12:3	-	15:6	2c	18:6	2c
12:4	-	15:7	2c	18:7	2b
12:5	-	15:8	2c	18:8	2c
13:1	A	15:9	2c	18:9	2b
13:2	2b	15:10	2c	18:10	2a
13:3	2b	15:11	B	18:11	2a
13:4	2b	16:1	A	18:12	2a
13:5	2b	16:2	2b	18:13	2a
13:6	2b	16:3	2b	18:14	2a
13:7	2b	16:4	2b	18:15	1
13:8	2b	16:5	2b	18:16	1
13:9	2b	16:6	2b	19:1	A
13:10	B	16:7	B	19:2	2c
13:11	B	16:8	B	19:3	2c
14:1	A	16:9	B	19:4	2c
14:2	2c	16:10	B	19:5	2c
14:3	2c	17:1	A	19:6	2c
14:4	2c	17:2	A	19:7	2c
14:5	2c	17:3	2b	19:8	2b
14:6	2c	17:4	2b	19:9	1
14:7	2c	17:5	2b	19:10	1
14:8	2c	17:6	2b	19:11	B
14:9	B	17:7	2b	19:12	B
14:10	B	17:8	2b	20:1	A
14:11	B	17:9	2a	20:2	A
15:1	A	18:1	A	20:3	A
15:2	2c	18:2	2b	20:4	2c
15:3	2c	18:3	2b	20:5	2c

TABLE F-1: continued.

Sample	Component	Sample	Component	Sample	Component
20:6	2c	21:19	2b	22:13	2c
20:7	2c	21:20	2b	22:14	2c
20:8	2b	21:21	2b	22:15	B
20:9	2b	21:22	2b	22:16	B
20:10	2b	21:23	2b	22:17	B
20:11	2b	21:24	2b	22:18	B
20:12	2b	21:25	2b	22:19	B
20:13	2b	21:26	2b	23:1	A
20:14	2a	21:27	2b	23:2	A
20:15	1	21:28	2b	23:3	2c
20:16	1	21:29	2b	23:4	2c
21:1	A	21:30	2b	23:5	2c
21:2	2b	21:31:	2b	23:6	2c
21:3	2b	21:32	2b	23:7	2c
21:4	2b	21:33	1	23:8	2c
21:5	2b	21:34	B	23:9	2c
21:6	2b	21:35	B	23:10	2c
21:7	2b	22:1	A	23:11	2c
21:8	2b	22:2	A	23:12	1
21:9	2b	22:3	2c	23:13	B
21:10	2b	22:4	2c	23:14	B
21:11	2b	22:5	2c		
21:12	2b	22:6	2c		
21:13	2b	22:7	2c		
21:14	2b	22:8	2c		
21:15	2b	22:9	2c		
21:16	2b	22:10	2c		
21:17	2b	22:11	2b		
21:18	2b	22:12	2b		

FIGURE F-1: Column Bone by Class and Component.

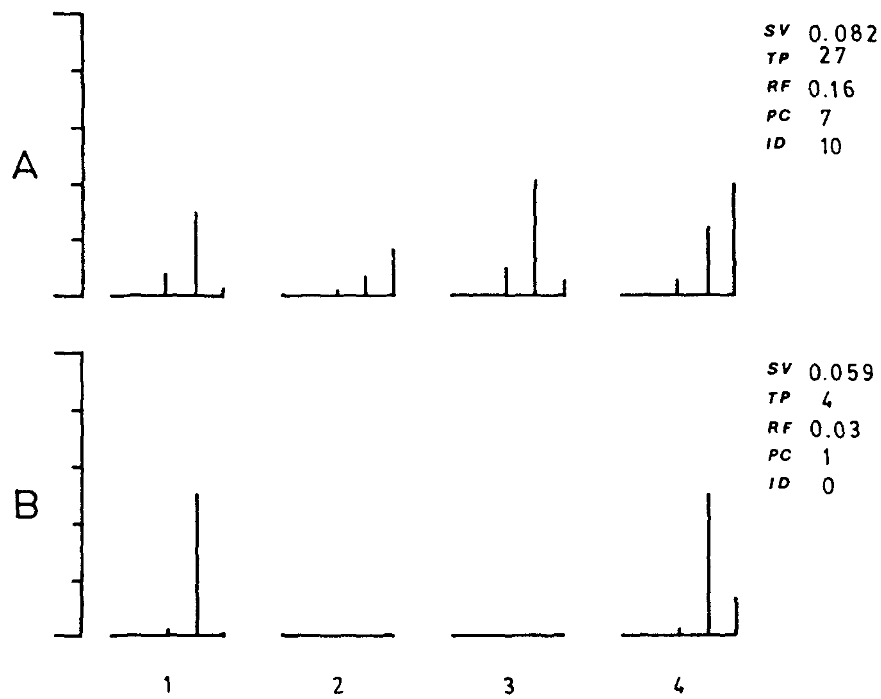


FIGURE F-1: Column Bone by Class and Component.

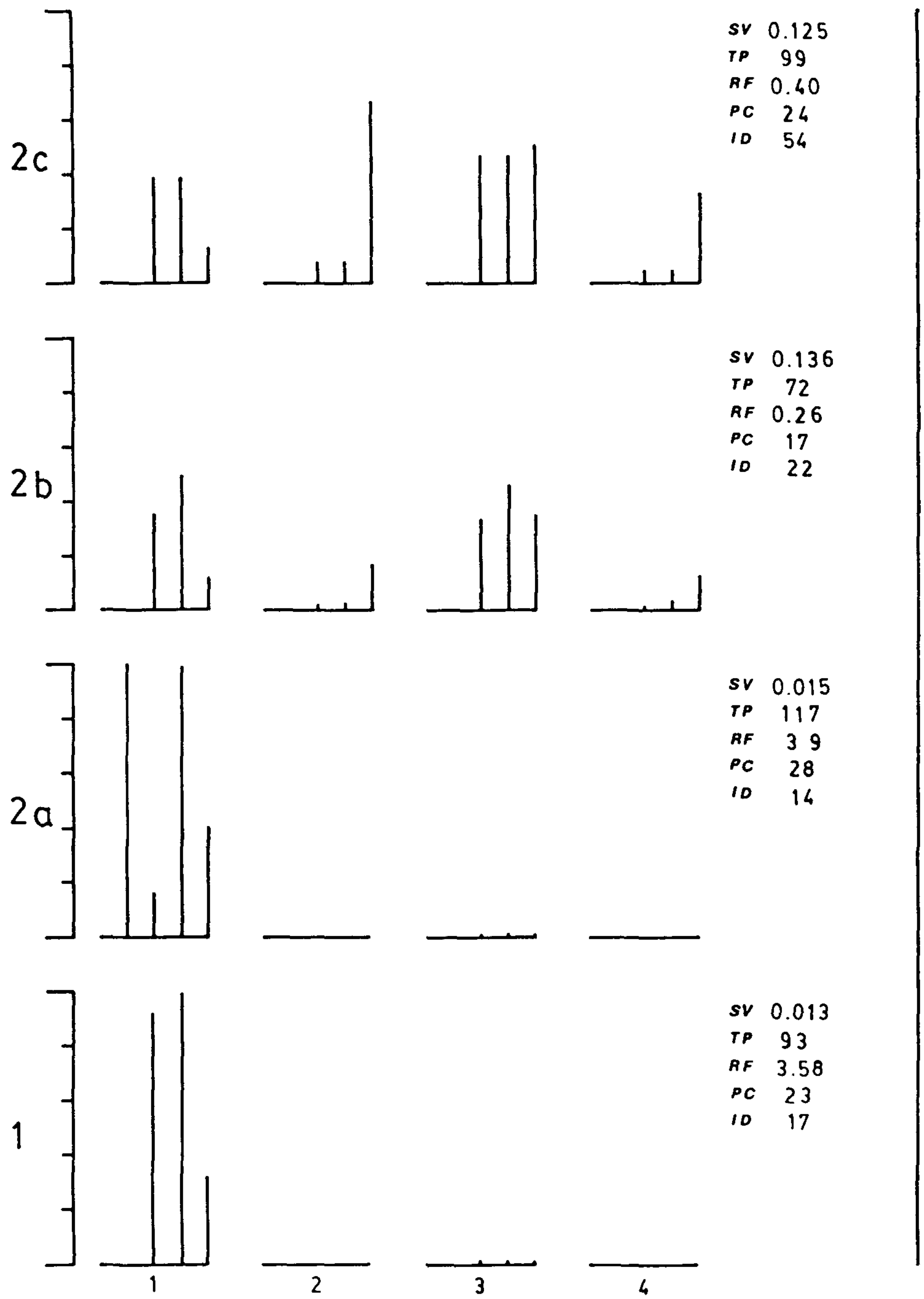


TABLE F-2: Identified Bones From Column Samples.

Classification:	Element: Description:	Sample:
Component A.		
1) Large Fish	vertebra; trunk; centrum and dorsal spine.	20:2
2) Large Fish	spines; bases and midsections of 2.	20:3
3) Culpeidae	vertebrae; trunk; 3 centra.	20:3
4) *Canis* sp.	proximal phalanx; complete.	20:3
5) *Ondatra zibethicus*	$M_{\overline{1}}$; left; complete; open root.	23:1
Component 2c.		
6) Small Fish	spines; 2 complete.	4:9
7) Culpeidae	vertebra; caudal; centrum and spines.	19:7
8) *Culpaea harengus*	vertebrae; trunk and caudal; 35 centra.	19:2
9) *Culpaea harengus*	pro-otics; 10; complete.	19:2
10) *Culpaea harengus*	pro-otic; 1; complete.	19:3
11) Alcidae	ulna; distal end; calcined, fragmentary.	20:5
12) *Pinguinus impennis*	humerus; left; proximal end.	2:3
13) *Odocoileus virginianus*	sesamoid; complete	20:7
14) *O. virginianus*	$M^{\underline{1}}$; right; complete.	20:7
15) *Castor canadensis*	distal phalanx; complete.	20:3
16) Sea Mammal	proximal phalanx; distal portion; calcined.	20:4

TABLE F-2: continued.

Classification:	Element: Description:	Sample:
Component 2b.		
17) Small Fish	angular; left; complete.	13:7
18) Small Fish	hyomandibular; left; central portion.	13:7
19) Culpeidae	vertebra; trunk; centrum.	19:8
20) Culpeidae	vertebra; caudal; centrum with dorsal and haemal spines.	22:11
21) Gadidae	spine; base.	17:7
22) Gadidae	vertebra; centrum; fragmentary.	18:2
23) Gadidae	rib; proximal end.	18:2
24) *Uria aalgae*	ulna; distal end and diaphysis.	8:12
25) *Canis* sp.	4th carpal; left; complete.	13:6
26) *Canis* sp.	carpal ulnare; left; complete.	13:6
27) *Canis* sp.	carpal radiale; left; complete.	13:6
28) *Canis* sp.	metacarpal V; left; complete.	13:6
29) *Canis* sp.	metacarpal IV; left; 3 pieces.	13:6
30) *Canis* sp.	metacarpal III; left; 2 pieces.	13:6
31) *Canis* sp.	metacarpal II; left; 2 pieces.	13:6
32) *Canis* sp.	proximal phalanx; complete.	13:6
33) *O. virginianus*	distal phalanx; complete.	20:9
34) Large Sea Mammal	sternal segment; pathalogical; complete.	22:11

TABLE F-2: continued.

Classification:	Element: Description:	Sample:
Component 2a.		
35) Culpeidae	angular; midsection portion.	18:12
36) Culpeidae	vertebrae; trunk; 7 centra.	20:14
37) Culpeidae	vertebrae; trunk; 4 centra.	17:9
38) Gadidae	brachiostegal ray; proximal portion.	18:13
39) Gadidae	spine; base.	18:13
Component 1.		
40) Small Fish	basioccipital; complete.	19:9
41) Small Fish	vertebrae; trunk; 3 centra.	21:33
42) Gadidae	vertebra; centrum; complete.	19:10
43) Gadidae	spines; 3 bases.	19:10
44) Gadidae	rib; proximal portion.	19:10
45) Gadidae	pterygiophore; midsection portion.	19:10
46) Gadidae	spine; base.	18:16
47) Gadidae	vertebra; centrum; 2 pieces.	20:16
48) _Gadus morhua_	dentary; midsection with toothed surface.	20:15
49) _Gadus morhua_	premaxilla; midsection with toothed surface.	20:15
50) _Gadus morhua_	interoperculum; left; articular facet and adjacent portion.	20:15
51) Small Mammal	proximal phalanx; complete.	21:33

APPENDIX G

Data Pertaining to Bones from Excavation Units

Introduction:

This appendix summarizes detailed information relating to bones and bone fragments recovered from the excavation units located in BgDr 48. The data are presented in tabular and graphic form.

In Figures G-1 to G-8 the assemblage is quantified by unit/level/matrix provenience, a separate figure being used for each excavation unit, and a separate graph for each level/matrix subdivision. The scale at the left of each graph equals 100 units, and at the extreme left the provenience unit to which the graph applies is identified. The four vertical columns represent: 1) fish remains; 2) avian remains; 3) mammal remains; and 4) bone unidentifiable to class. In each class/level category the bars represent the quantity of bones and bone pieces recovered (first 1,2,3, or 4 bars), the proportion of the level assemblage these represent (penultimate bar), and the proportion of all bones in the class recovered from excavation units these represent (ultimate bar). Values of less than one unit are not shown. Five further data are given for each level assemblage at the upper right. These are: LV) volume of the level, or level/matrix subdivision, (in $m.^3$); TP) total number of bone pieces from the provenience unit; RF) relative frequency of bone occurrence (number of bone pieces per 500 cc. volume -- this measurement was used to make the frequency of bone comparable to the frequency of shell); PA) the proportion these represent of the total bone assemblage;

ID) the number of pieces identified to a smaller taxon.

Table G-1 shows the stratigraphic component to which each of the unit/level/matrix proveniences was assigned. In Table G-1, and in Figures G-1 to G-8, the following symbols are used: S indicates a layer when used in the level column of Table G-1; elsewhere S indicates a shell matrix; G indicates a gravel matrix; H indicates a humic matrix; and C indicates that the level was not subdivided by matrix.

The details of faunal identifications from the excavation unit bone assemblage are given in Tables G-2 to G-9; a separate table is used for each excavation unit. Abbreviations used in the Side column are: L = left, R = right, and A = axial. In the Age column, Juv = juvenile, Imm = immature, Sub = subadult, and Ad = adult. The complete taxonomic classifications, and the common names, of the vertebrate species identified in the BgDr 48 assemblage are listed in Table G-10.

TABLE G-1: Arbitrary Level to Stratigraphic Component Assignments.

Unit:	Level:	Matrix:	Component:
1	S	C	A

TABLE G-1: continued.

Unit:	Level:	Matrix:	Component:
4	4	G	2c
		S	2b
	5	G1	2c
		S	2b
		G2	2a
	6	G	2a
		S	1
		H	1
	7	C	1
	8	C	1
5	S	C	A
	1	C	2c
	2	G	2c
		S	2b
	3	C	2c
	4	C	2c
7	S	C	A
	1	G	2c
		S	2b
	2	G	2c
		S	2b
	3	G	2c
		S	2b
	4	G	2c
		S	2b
	5	G	2c
		S	2b
	6	G	2c
		S	1
	7	S	1
		H	1
	8	C	B

TABLE G-1: continued.

Unit:	Level:	Matrix:	Component:
8	S	C	A
	1	C	2b
	2	S	2b
		G	2a
	3	S	2b
		G	2a
	4	S	2b
		G	2a
	5	C	2a
9	S	C	A
	1	C	2b
	2	C	2b
	3	C	2b
	4	C	2b
	5	C	B

FIGURE G-1: Unit 1 Bone Distribution.

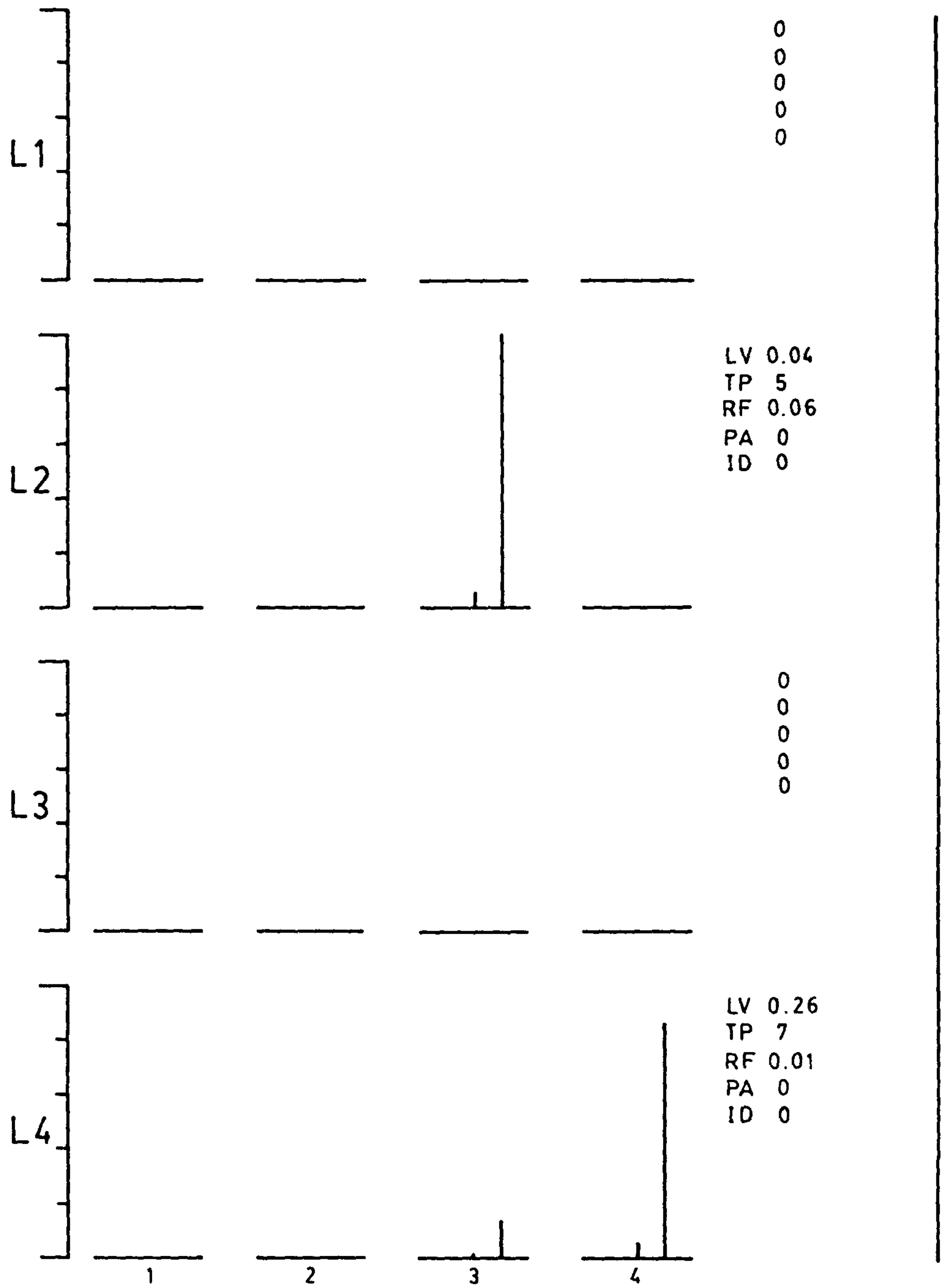


TABLE G-2: Unit 1 Vertebrate Faunal Identifications.

Level S.

no identifications

Level 1.

no identifications

Level 2.

no identifications

Level 3.

no identifications

Level 4.

no identifications

Level 5.

no identifications

FIGURE G-2: Unit 2 Bone Distribution.

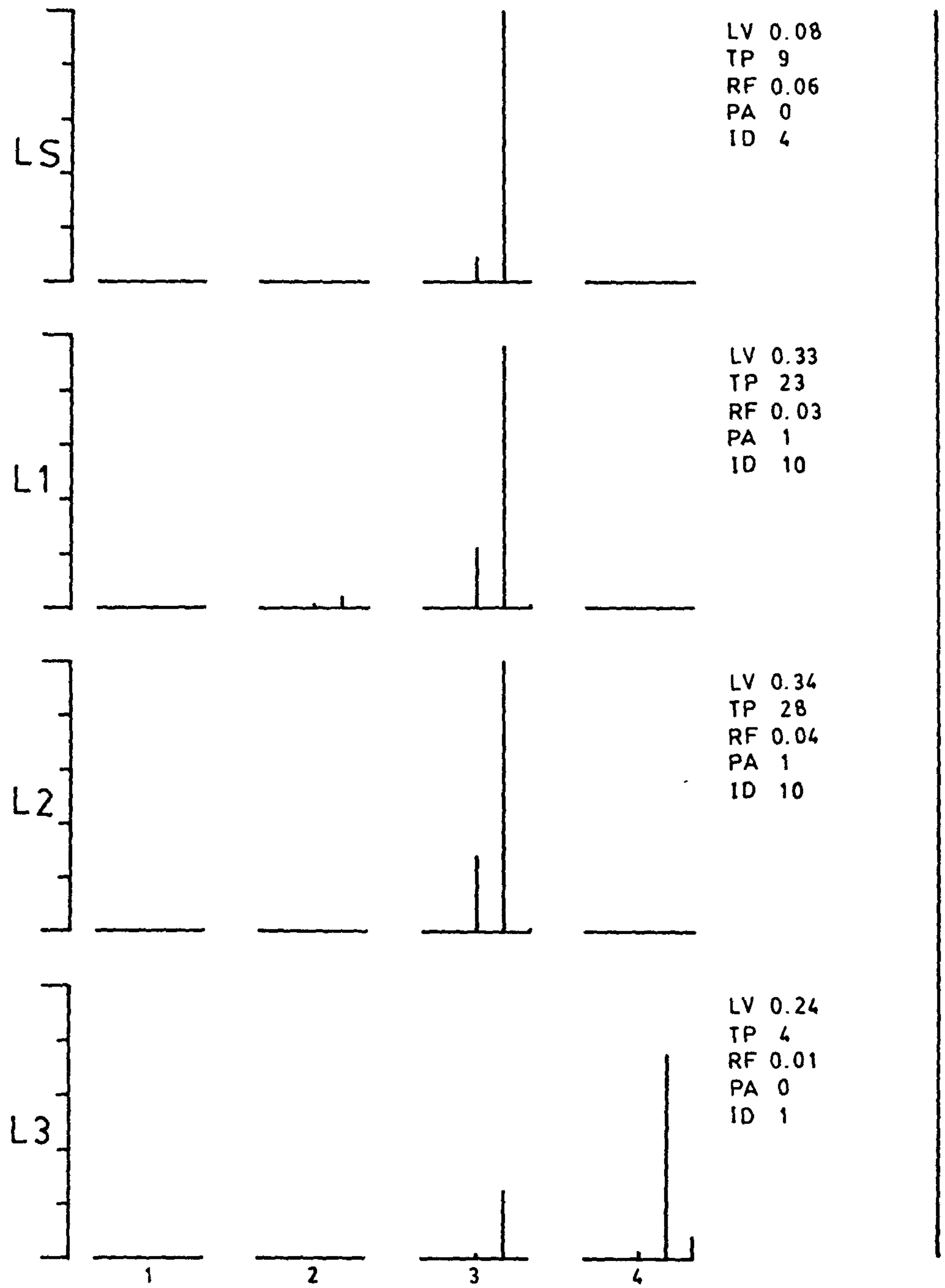


FIGURE G-2:

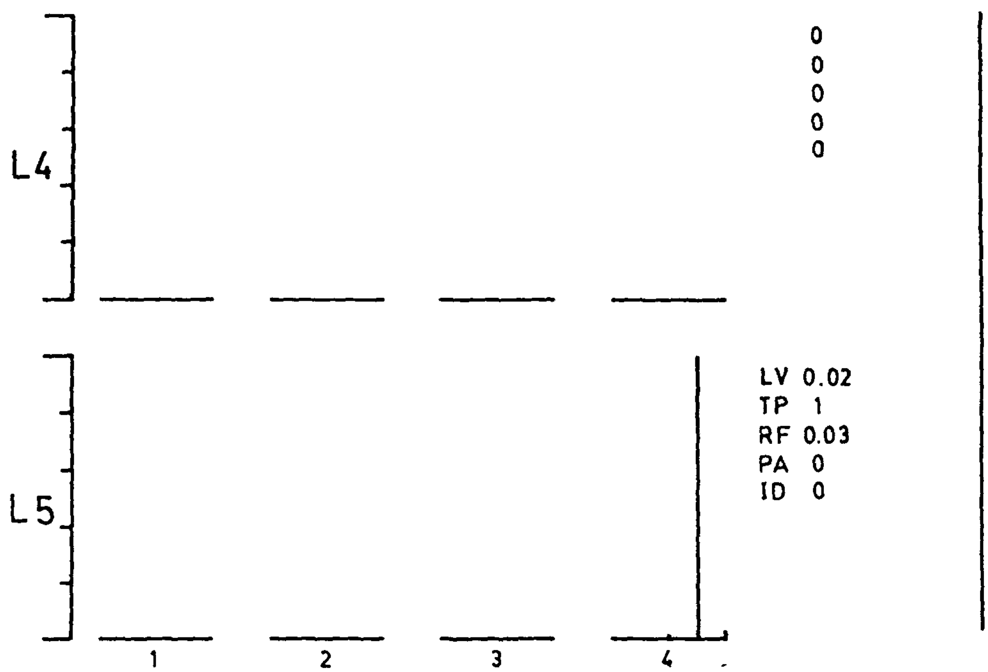


TABLE G-3: Unit 2 Vertebrate Faunal Identifications.

	Classification:	Element: Description:	Side:	Age:
Level S.				
1)	C. canadensis	mandible; condyle	L	
2)	C. canadensis	mandible; condyle and portion of ramus	L	
Level 1.				
3)	G. immer	ulna; diaphysis	R	
4)	C. canadensis	mandible; body	L	
5)	C. canadensis	$M_{\overline{2}}$; complete; open root	R	Imm
6)	C. canadensis	$M_{\overline{1}}$; crown portion	R	
7)	C. canadensis	$P_{\overline{4}}$; complete; root open	R	Imm
8)	C. canadensis	molar; $M^{\underline{1}}$ or $M^{\underline{2}}$; root partly closed	R	Sub
9)	Canis sp.	$C_{\overline{1}}$; complete; large; root open	R	Sub
10)	Canis sp.	$I^{\overset{3}{\underline{2}}}$; complete; large; root open	R	Sub
11)	Canis sp.	mandible; body; butcher marked	R	
12)	O. virginianus	petrus; complete	L	
Level 2.				
13)	Canis sp.	mandible; body including $P_{\overline{2}}$, $P_{\overline{3}}$, $P_{\overline{4}}$ roots closed; butcher marked	L	Ad
14)	Canis sp.	metatarsal; proximal end		
15)	Canis sp.	vertebrae; 3 thoracic; complete; chewed	A	
16)	Canis sp.	vertebra; 1 sacral; anterior end; 2 pieces chewed	A	

TABLE G-3: continued.

Classification:	Element:	Description:	Side:	Age:
Level 3.				
17) *Canis* sp.	vertebra;	thoracic; complete but chewed	A	
Level 4.				
no identifications				
Level 5.				
no identifications				

FIGURE G-3: Unit 3 Bone Distribution.

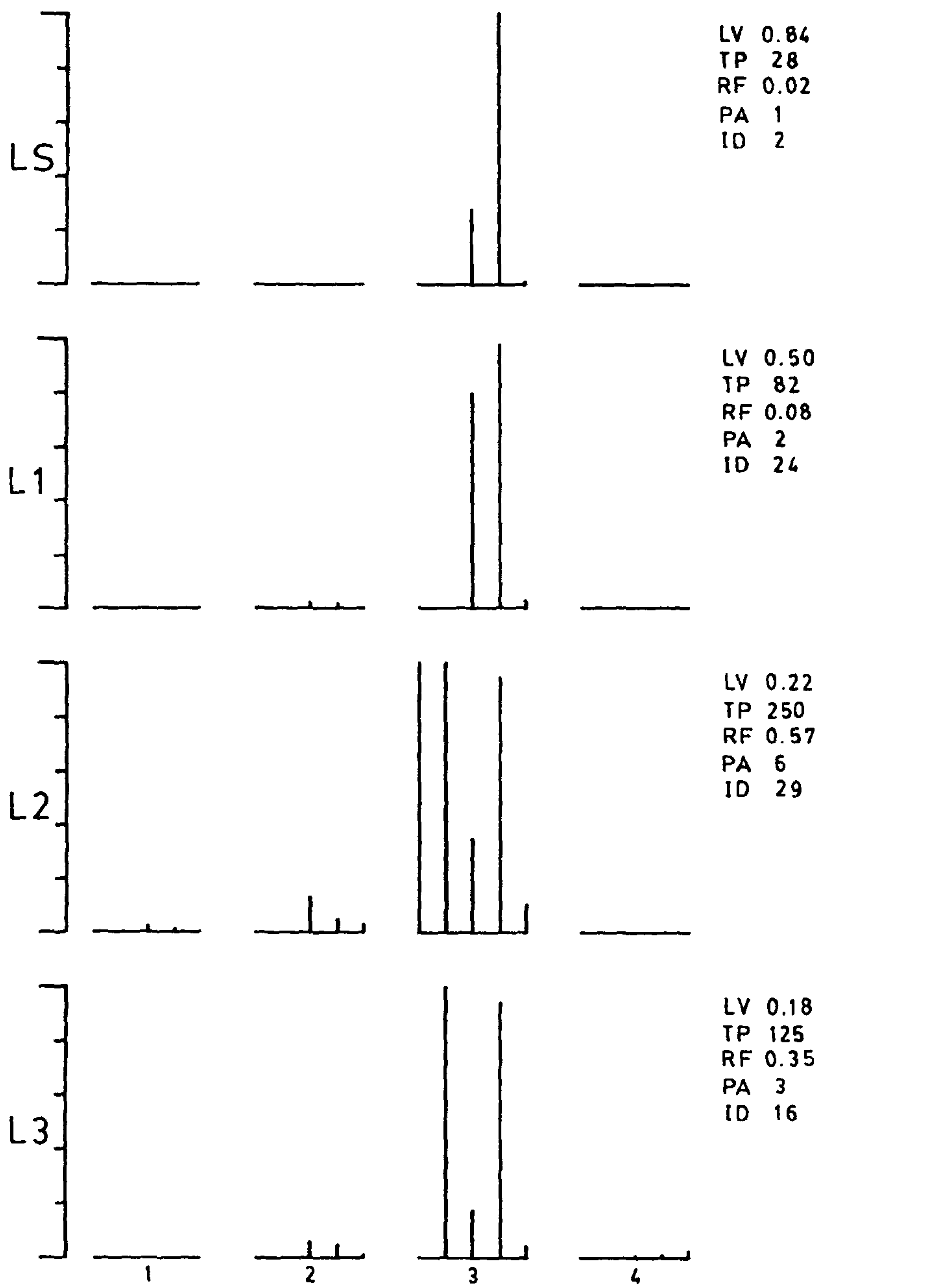


FIGURE G-3:

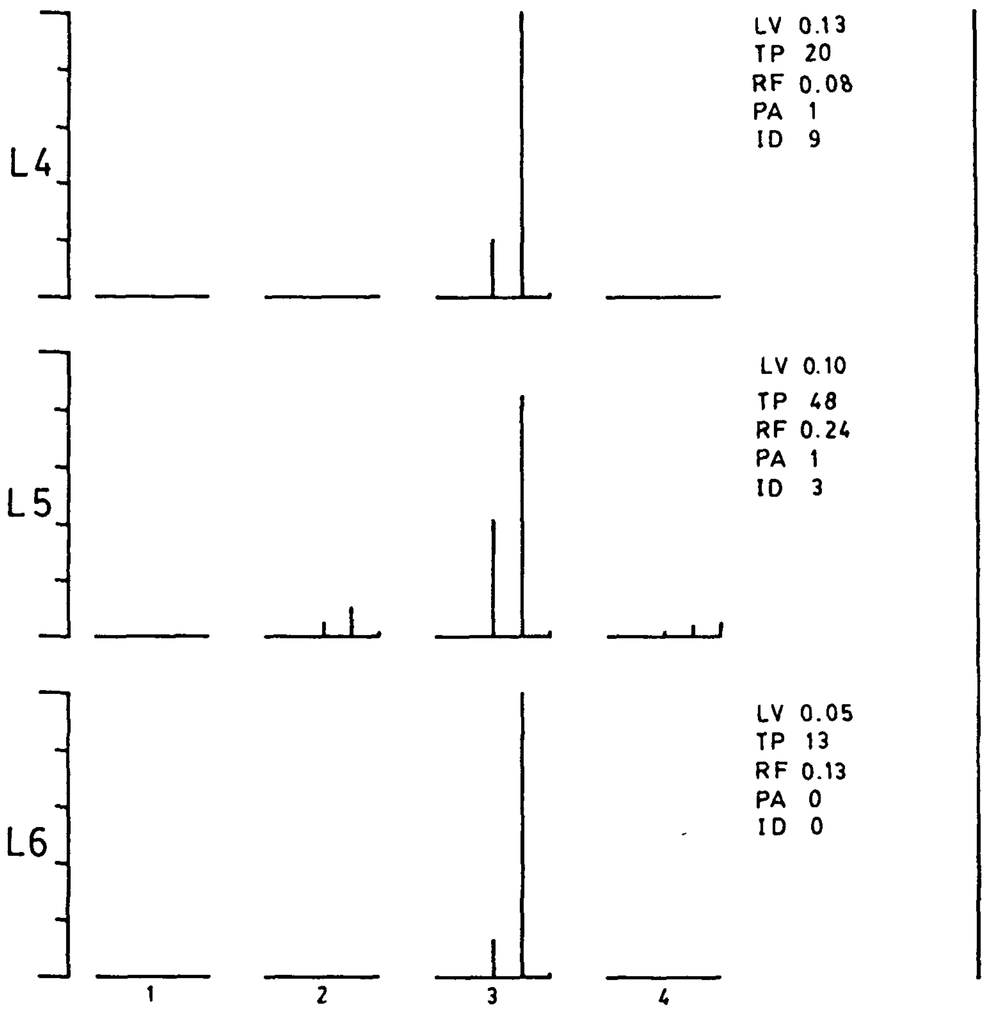

LV 0.13
TP 20
RF 0.08
PA 1
ID 9
L4
LV 0.10
TP 48
RF 0.24
PA 1
ID 3
L5
LV 0.05
TP 13
RF 0.13
PA 0
ID 0
L6
1
2
3
4

TABLE G-4: Unit 3 Vertebrate Faunal Identifications.

	Classification:	Element: Description:	Side:	Age:
Level S.				
18)	*C. canadensis*	mandible; portion of body and P_4; root partly closed	L	Sub
19)	*Canis* sp.	P_3; complete; large; root open	L	Sub
Level 1.				
20)	*C. canadensis*	I^1; midsection; 2 pieces	L	
21)	*C. canadensis*	I_1; complete; artifact	R	
22)	*C. canadensis*	I_1; midsection; 6 pieces, 1 calcined	R	
23)	*C. canadensis*	molar; root only; partly closed		Sub
24)	*C. canadensis*	P_4; complete; root closed	R	Ad
25)	*C. canadensis*	molar; complete; M_1 or M_2; root open	L	Imm
26)	*C. canadensis*	I_1; complete; artifact	L	
27)	*C. canadensis*	molar; complete; M_1 or M_2; root open	R	Imm
28)	*C. canadensis*	mandible; portions of body and ramus; 6 pieces	L	
29)	*Canis* sp.	canine tooth; complete; large; open root	?	Sub
30)	*Canis* sp.	M^1; complete; large; root open	R	Sub
31)	*Canis* sp.	maxilla; including sockets for P^2, P^3, and P^4, and infraorbital foramen	L	
32)	*O. virginianus*	proximal phalanx; distal end		
33)	Cervidae	metatarsal; portion of diaphysis		
34)	*P. vitulina*	C^1; complete; root closed; gnawed	L	Ad

TABLE G-4: continued.

	Classification:	Element: Description:	Side:	Age:
Level 2.				
35)	<u>P. virens</u>	otolith; complete	R	
36)	<u>M. aeglefinnus</u>	otolith; complete	L	
37)	<u>Aix sponsa</u>	coracoid; portion of diaphysis and proximal end; 3 pieces	L	
38)	Anseriform	humerus; portion of diaphysis; 4 pieces	L	
39)	<u>C. canadensis</u>	I^1; crown portion; artifact	L	
40)	<u>C. canadensis</u>	incisor; midsection; 3 pieces		
41)	<u>C. canadensis</u>	P_4; complete; root closed	L	Ad
42)	<u>C. canadensis</u>	M_2; complete; root closed	L	Ad
43)	<u>C. canadensis</u>	M_3; crown portion	L	
44)	<u>C. canadensis</u>	molar; M_1 or M_2; root closed	R	Ad
45)	<u>C. canadensis</u>	molar; M_1 or M_2; root open	R	Imm
46)	<u>C. canadensis</u>	M^1; complete; root closed	R	Ad
47)	<u>C. canadensis</u>	mandible; condyle and portion of ramus	L	
48)	<u>Canis</u> sp.	P^4; complete; root open; large	R	Sub
49)	<u>Canis</u> sp.	proximal phalanges; 4 complete		
50)	<u>O. virginianus</u>	molars; maxilliary; 2 complete	R	
51)	<u>O. virginianus</u>	metacarpal; proximal portion; 2 pieces		
52)	<u>O. virginianus</u>	2nd and 3rd tarsal; complete	L	
53)	<u>O. virginianus</u>	proximal phalanges; 3 complete; 5 pieces; 1 calcined		

TABLE G-4: continued.

Classification:	Element: Description:	Side:	Age:
54) *O. virginianus*	distal phalanx; distal portion		
55) Large Cervid	incisor; crown and labial surface; possibly moose	R	
Level 3.			
56) *C. canadensis*	incisor; enamel; midsection; 1 piece; charred		
57) *C. canadensis*	$I_{\overline{1}}$; midsection; 3 pieces; charred	L	
58) *Canis* sp.	proximal phalanx; distal portion; 2 pieces		
59) *Canis* sp.	phalanges; 1 proximal, 1 medial, 1 distal; probably a single digit		
60) *O. virginianus*	molar; mandibular; crown	R	
61) *O. virginianus*	mandible; ramus and angle; 2 pieces	R	
62) *O. virginianus*	metatarsal; distal portion		
63) *O. virginianus*	distal phalanx; complete except epiphysis		Imm
64) *O. virginianus*	distal phalanx; complete		
Level 4.			
65) *Canis* sp.	mandible; body including $P_{\overline{2}}$, $P_{\overline{3}}$, $P_{\overline{4}}$, $M_{\overline{1}}$, $M_{\overline{2}}$ roots closed; butcher marked	L	Ad
66) *O. virginianus*	carpal radiale; complete	R	
67) *O. virginianus*	carpal ulnare; complete	R	
68) Medium size Mammal	canine tooth; complete except chipped crown; possibly Felidae		

TABLE G-4: continued.

Classification:	Element:	Description:	Side:	Age:
Level 5.				
69) Large Bird	humerus;	portion of diaphysis; possibly G. immer	L	
70) Large Cervid	longbone;	circular disc of the diaphysis of a large bone; very thick cortex; possibly moose		
71) Phoca sp.	canine tooth;	crown only; hollow	?	
Level 6.				
no identifications				
Level 7.				
no identifications				
Level 8.				
no identifications				

FIGURE G-4: Unit 4 Bone Distribution.

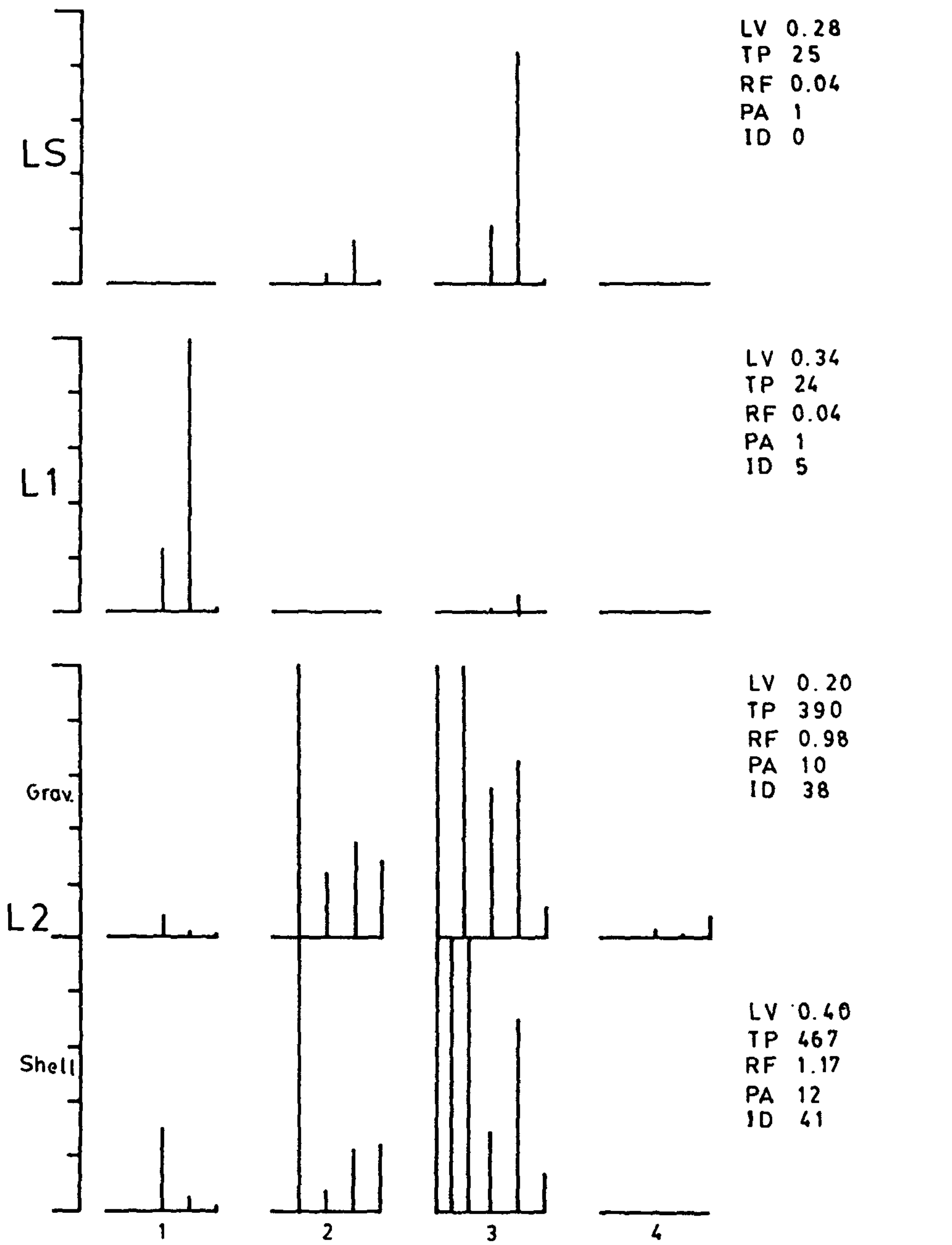
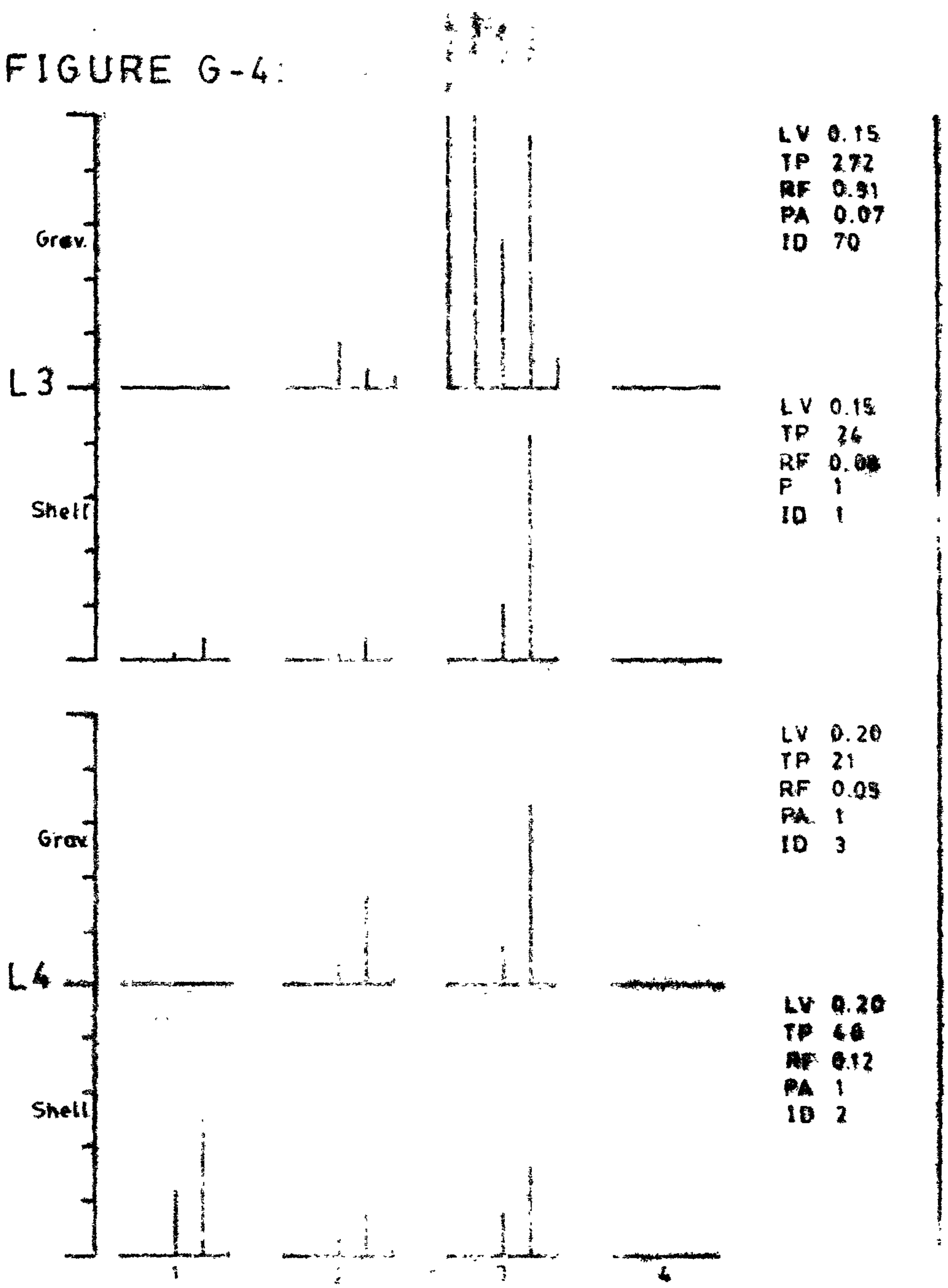


FIGURE G-4: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TP 272
RF 0.91
PA 0.07
ID 70
LV 0.15
TP 24
RF 0.08
P 1
ID 1
LV 0.20
TP 21
RF 0.05
PA 1
ID 3
LV 0.20
TP 48
RF 0.12
PA 1
ID 2
Grav.
L3
Shell
Grav.
L4
Shell
1
2
3
4

FIGURE G-4:

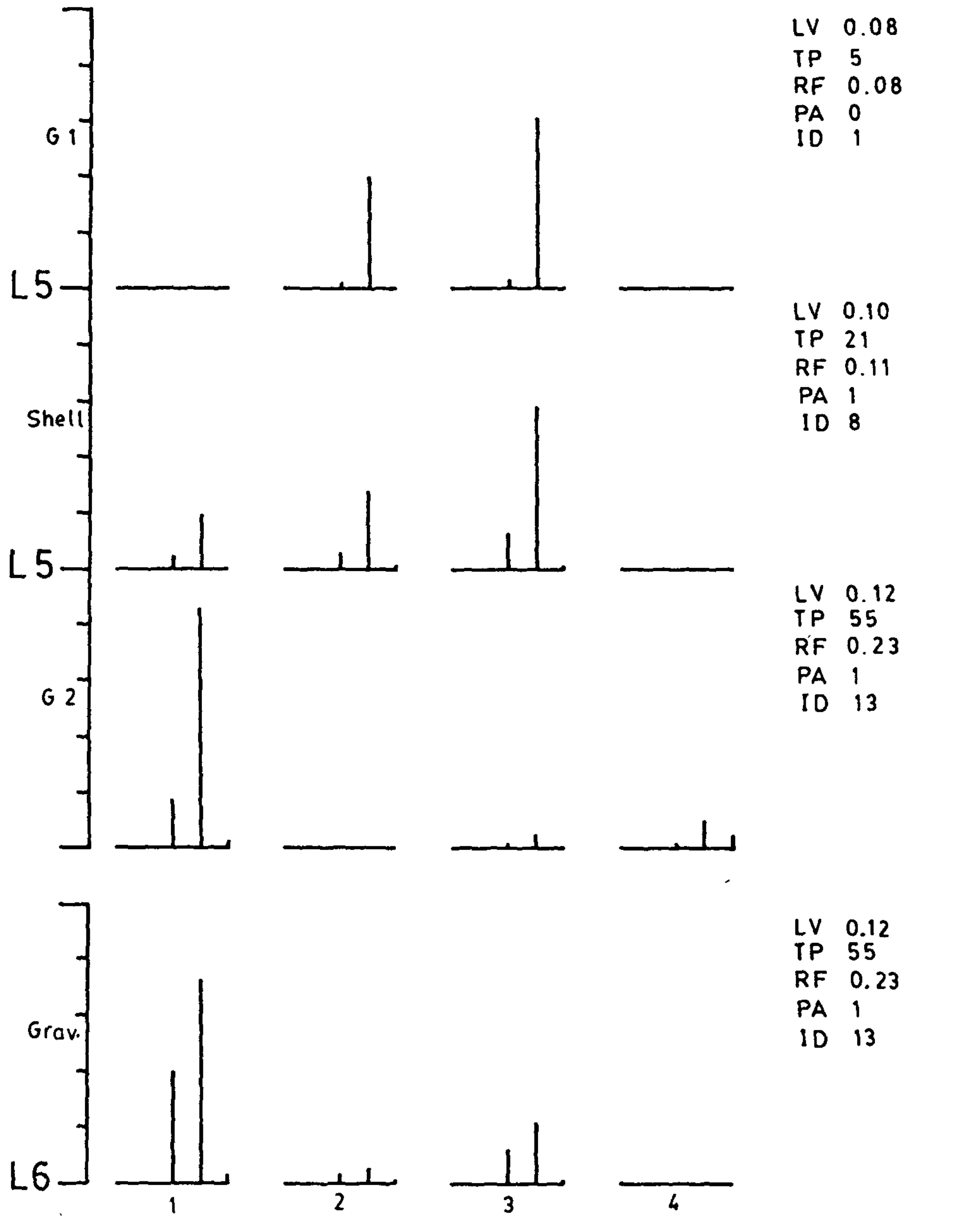
G1
L5
Shell
L5
G2
Grav.
L6
1
2
3
4
LV 0.08
TP 5
RF 0.08
PA 0
ID 1
LV 0.10
TP 21
RF 0.11
PA 1
ID 8
LV 0.12
TP 55
RF 0.23
PA 1
ID 13
LV 0.12
TP 55
RF 0.23
PA 1
ID 13

FIGURE G-4:

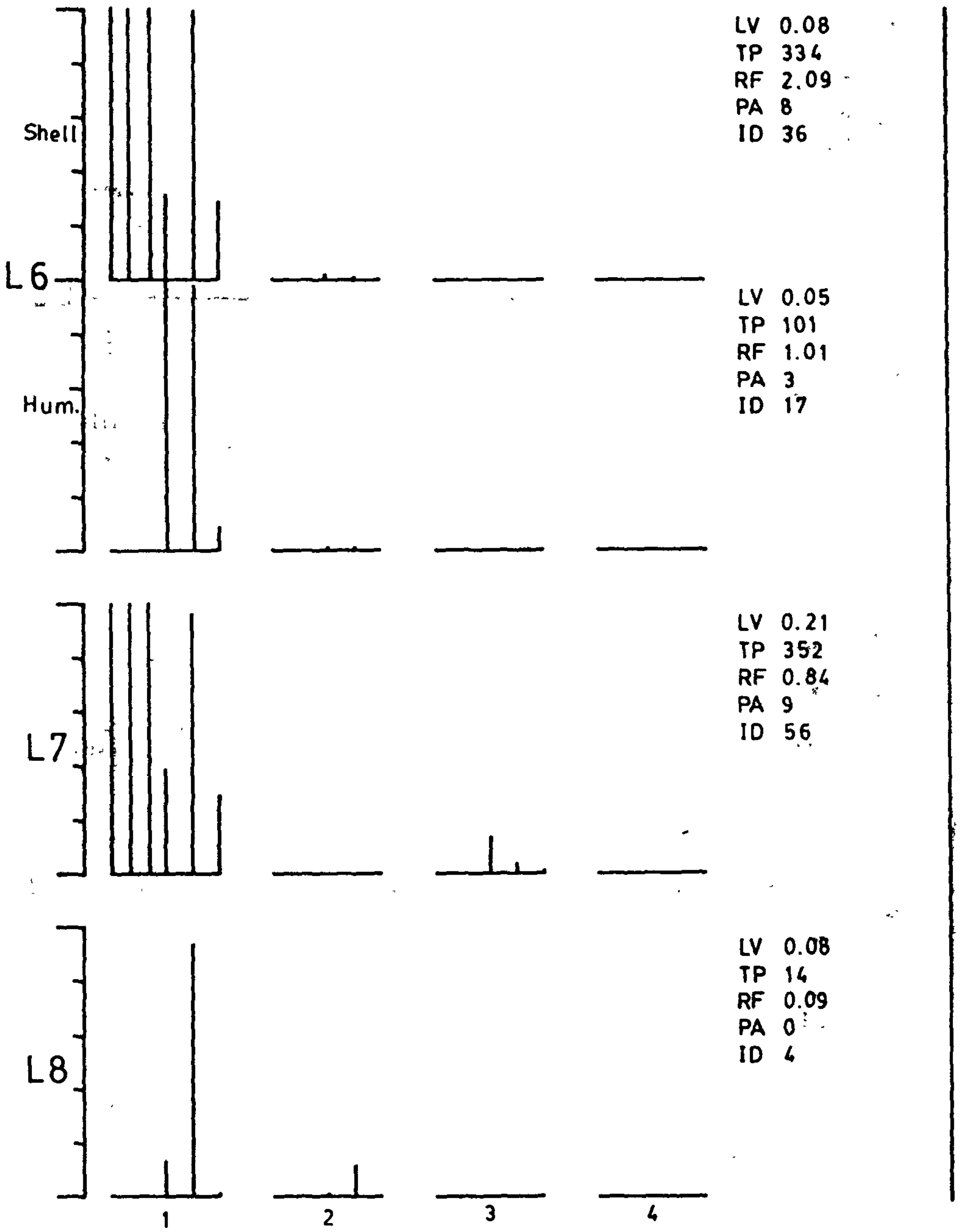
Shell
L6
Hum.
L7
L8
1
2
3
4
LV 0.08
TP 334
RF 2.09
PA 8
ID 36
LV 0.05
TP 101
RF 1.01
PA 3
ID 17
LV 0.21
TP 352
RF 0.84
PA 9
ID 56
LV 0.08
TP 14
RF 0.09
PA 0
ID 4

TABLE G-5: Unit 4 Vertebrate Faunal Identifications.

Classification:	Element:	Description:	Side:	Age:
Level S.				
	no identifications			
Level 1.				
72) Gadidae	vertebrae;	trunk; 4 centra	A	
73) *C. canadensis*	I_1;	crown portion; artifact	R	
Level 2G.				
74) Gadidae	premaxilla;	midsection with toothed surface; probably haddock	L	
75) Medium size Bird	synsacrum;	medial portion	A	
76) Anseriform	humerus;	small portion of distal end	L	
77) Anseriform	humerus;	small portion of distal end	L	
78) *S. mollissima*	radius;	proximal end and diaphysis	L	
79) *S. mollissima*	carpo-metacarpus;	proximal end and diaphysis	L	
80) *G. immer*	ulna;	midsection of diaphysis	R	
81) *G. immer*	tarsometatarsus;	diaphysis	L	
82) Medium size Mammal	scapula;	12 pieces; artifact; possibly *Canis* sp.	?	
83) *C. canadensis*	I^1;	crown portion; artifact	L	
84) *C. canadensis*	M_3;	complete; root closed	L	Ad
85) *Canis* sp.	incisors;	3 complete; roots closed; large I_2, I_3, I_3	R L	Ad
86) Cervidae	petrus;	small portion; probably deer	?	

TABLE G-5: continued.

	Classification:	Element: Description:	Side:	Age:
87)	Cervidae	radius; small portion of distal end; probably deer	L	
88)	O. virginianus	premolars; 2 complete; P_3, P_4	R	
89)	O. virginianus	P^3; complete	L	
90)	O. virginianus	molars; 2 crown portions	?	
91)	P. vitulina	maxilla; 2 pieces;		
Level 2S.				
92)	Gadidae	vertebrae; 7 centra; 4 complete; 3 fragmentary	A	
93)	Gadidae	dentary; anterior end; toothed surface missing	R	
94)	Gadidae	post-temporal; posterior process	?	
95)	G. immer	tarsometatarsus; diaphysis	L	
96)	Small Mammal	proximal phalanx; complete		
97)	C. canadensis	I_T; crown portion; large	L	
98)	C. canadensis	I_T; crown and midsection; small; 2 pieces	L	
99)	C. canadensis	incisor; midsection; 4 pieces	?	
100)	C. canadensis	molar; complete; root partly closed	?	Sub
101)	C. canadensis	I_T; crown portion; artifact	R	
102)	C. canadensis	I_T; crown portion; artifact	L	
103)	C. canadensis	I_T; crown portion; artifact	L	
104)	C. canadensis	I_T; crown portion; artifact	R	

TABLE G-5: continued.

Classification:		Element: Description:	Side:	Age:
105)	C. canadensis	$I_{\overline{1}}$; crown portion; artifact	L	
106)	C. canadensis	$I_{\overline{1}}$; crown portion; artifact	L	
107)	C. canadensis	incisor; midsection; artifact	?	
108)	C. canadensis	incisor; midsection	?	
109)	O. virginianus	premolars; 2 complete; $P_{\overline{3}}$, $P_{\overline{4}}$	R	
110)	O. virginianus	molars; 1 complete; 2 fragments		
111)	O. virginianus	sesamoids; 2 complete		
112)	O. virginianus	proximal phalanx; proximal end		
113)	O. virginianus	distal phalanx; complete		
114)	O. virginianus	calcaneous; complete; 2 pieces; epiphysis unfused; butcher marked	R	Imm
115)	Cervidae	antler tine; 2 pieces; artifact; probably deer		
116)	Phoca sp.	innominate; portion of illium and acetabulum; chewed	R	
117)	Phoca sp.	humerus; diaphysis; ends chewed off	L	
118)	Phoca sp.	femur; diaphysis; ends chewed off	R	
Level 3G.				
119)	Large Bird	radius; proximal end and part of diaphysis; possibly immature bald eagle	L	
120)	C. canadensis	incisor; crown portion; artifact	?	
121)	C. canadensis	incisor; midsection	?	
122)	C. canadensis	$I_{\overline{1}}$; crown portion; 2 pieces	R	

TABLE G-5: continued.

Classification:		Element: Description:	Side:	Age:
123)	C. canadensis	molars; 2 complete; $M_{\overline{2}}$, $M_{\overline{3}}$; roots closed	R	Ad
124)	C. canadensis	mandibles; 33 pieces; ramus and body	L&R	
125)	Canis sp.	femur; epiphysis from head	R	Imm
126)	O. virginianus	proximal phalanx; distal end		
127)	O. virginianus	fibula; complete	R	
128)	O. virginianus	innominates; illium and acetabulum; 5 pieces	L&R	
129)	O. virginianus	petrus; complete	L	
130)	O. virginianus	distal phalanges; 4 complete		
131)	O. virginianus	incisors; crown portions; 2 pieces	L	
132)	O. virginianus	premolars; 2 complete; $P_{\overline{2}}$,$P_{\overline{3}}$	L	
133)	O. virginianus	premolar; 1 complete; upper	L	
134)	O. virginianus	molars; 3 complete, 6 partial		
135)	P. vitulina	$P^{\underline{2}}$; complete; root closed	L	Ad
136)	P. vitulina	$I^{\underline{3}}$; complete; root closed	R	Ad
Level 3S.				
137)	Cervidae	molar; portion of crown and root; probably deer		
Level 4G.				
138)	Anseriform	carpometacarpus; distal end	L	
139)	C. canadensis	molar; crown only; lower	R	
140)	Phoca sp.	$C_{\overline{1}}$; complete; large; root open	R	Sub

TABLE G-5: continued.

Classification:	Element: Description:	Side:	Age:
Level 4S.			
141) Gadidae	vertebra; centrum; complete	A	
142) *Canis* sp.	talus; complete	L	
Level 5G1:			
143) Large Seal	molar; complete; root closed	?	Ad
144) Large Seal	C^{1}; complete; root closed; probably grey seal	L	Ad
Level 5S.			
145) Gadidae	vertebrae; centra; trunk; 5 complete, 2 fragmentary	A	
146) Medium sized Bird	vertebrae; cervical; 2 portions	A	
147) *H. grypus*	premolars; 2 complete; roots closed	?	Ad
148) Large Seal	4th tarsal; complete; probably grey seal	R	
149) Large Seal	proximal phalanx; distal portion; probably grey seal		
Level 5G2.			
150) *P. virens*	premaxilla; anterior portion including toothed surface	L	
151) Gadidae	maxilla; midsection	L	
152) Gadidae	angular; posterior portion	L	
153) Gadidae	epihyal; posterior portion	L	
154) Gadidae	vertebrae; centra; 3 pieces	A	
155) Large Mustelid	humerus; complete except proximal epiphysis; juvenile cortex; may be sea mink	R	Imm

TABLE G-5: continued.

Classification:	Element: Description:	Side:	Age:
Level 6G.			
156) Gadidae	maxilla; anterior portion	R	
157) *G. morhua*	premaxilla; anterior portion including toothed surface	L	
158) Gadidae	quadrate; anterior portion	L	
159) *P. virens*	dentary; anterior portion including toothed surface	L	
160) Gadidae	rays; bases of 3		
161) Gadidae	vertebrae; centra; 5 fragments	A	
162) *C. brachyrhynchos*	humerus; distal end	R	
Level 6S.			
163) *Gadus morhua*	dentary; midsection with toothed surface	L	
164) *G. morhua*	premaxilla; anterior portion and toothed surface	L	
165) Gadidae	maxilla; anterior portion	L	
166) Gadidae	pterygiophore; dorsal portion	A	
167) Gadidae	operculum; anterior portion	R	
168) Gadidae	brachiostegal rays; proximal ends of 9		
169) Gadidae	vertebrae; centra; 11 complete	A	
170) Gadidae	parasphenoid; midsection	A	
171) Gadidae	brachiostegal rays; 1 proximal end, 8 midsections		
172) *P. virens*	dentary; midsection with toothed surface	?	

TABLE G-5: continued.

Classification:		Element: Description:	Side:	Age:
Level 6H.				
173)	*G. morhua*	premaxilla; anterior portion and toothed surface	R	
174)	*G. morhua*	premaxilla; anterior portion and toothed surface	L	
175)	*G. morhua*	dentary; posterior portion and toothed surface; 3 pieces	L	
176)	Gadidae	maxilla; anterior portion	R	
177)	Gadidae	quadrate; complete	R	
178)	Gadidae	post-temporal; posterior portion	?	
179)	Gadidae	operculum; anterior portion	R	
180)	Gadidae	brachiostegal ray; 1 proximal end		
181)	Gadidae	vertebrae; centra; 5 complete trunk, 1 complete caudal	A	
182)	Large Seal	vertebra; lumbar; transverse process	A	
Level 7.				
183)	*G. morhua*	premaxilla; midsection with toothed surface	R	
184)	Gadidae	maxilla; anterior portion	R	
185)	Gadidae	maxilla; midsection	L	
186)	Gadidae	maxilla; anterior portion	R	
187)	Gadidae	post-temporal; posterior process	L	
188)	Gadidae	angular; articular surface	L	

TABLE G-5: continued.

Classification:		Element: Description:	Side:	Age:
189)	Gadidae	post-temporal; posterior process	R	
190)	Gadidae	vertebrae; centra; 15 complete, 23 fragments	A	
191)	Gadidae	brachiostegal rays; 3 proximal ends, 3 midsections		
192)	Gadidae	spine; base		
193)	*Mustella* sp.	mandible; body including two premolars; probably a mink	L	
194)	Large Sea Mammal	rib; midsection; 2 pieces; may have been chewed		
Level 8.				
195)	Gadidae	vertebrae; centra; 4 pieces	A	

FIGURE G-5: Unit 5 Bone Distribution.

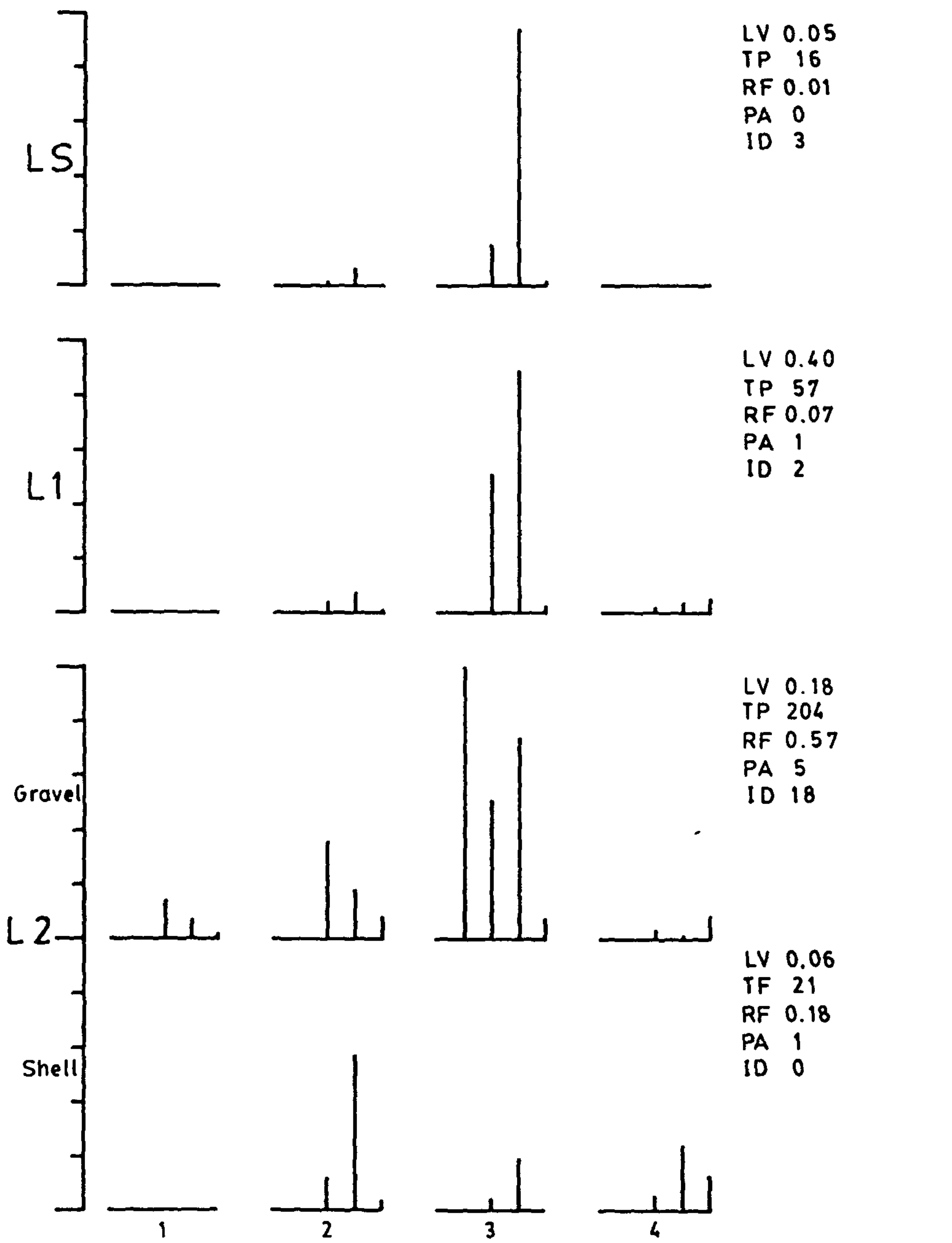

FIGURE G-5:

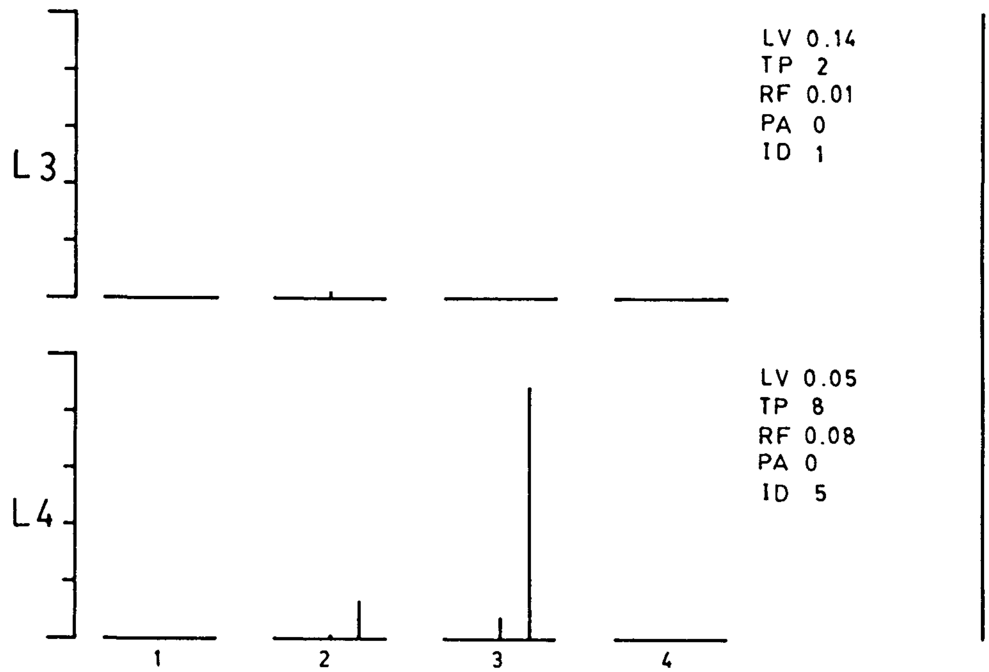

TABLE G-6: Unit 5 Vertebrate Faunal Identifications.

	Classification:	Element: Description:	Side:	Age:
Level S.				
196)	P. gravis	ulna; proximal end and diaphysis	R	
197)	C. canadensis	incisor; midsection; artifact	?	
198)	O. virginianus	I_1; crown portion	R	
Level 1.				
199)	Canis sp.	M^1; labial portion of crown and root	R	
200)	O. virginianus	distal phalanx; proximal end		
Level 2G.				
201)	Gadidae	vertebrae; centra; 12 pieces	A	
202)	Anseriform	carpometacarpus; distal portion and diaphysis	R	
203)	B. bernicla	coracoid; proximal portion and diaphysis	L	
204)	B. bernicla	coracoid; proximal portion and diaphysis	L	
205)	B. bernicla	radius; complete	R	
206)	Small Mammal	femur; complete; probably mouse or vole	R	
207)	Small Mammal	proximal phalanx; complete; calcined; possibly mink		
208)	C. canadensis	mandible; condyle, ramus, and body; 6 pieces	L	
209)	Canis sp.	I_3; complete; large	R	
210)	O. virginianus	metatarsal; distal portion; right condyle	R	
211)	O. virginianus	proximal phalanges; 3 epiphyses		Imm

TABLE G-6: continued.

	Classification:	Element:	Description:	Side:	Age:
Level 2S.					
		no identifications			
Level 3.					
212)	Anseriform	carpometacarpus;	complete except metacarpal III	L	
Level 4.					
213)	*U. lomvia*	ulna;	proximal end	L	
214)	*M. americana*	mandibles;	complete ramus and body including $P_{\bar{2}}$, $P_{\bar{3}}$, $P_{\bar{4}}$, and $M_{\bar{1}}$;	L&R	
215)	*A. alces*	carpal radiale;	complete; small	L	
Provenience Uncertain.					
216)	*C. canadensis*	mandible;	body including $M_{\bar{1}}$, $M_{\bar{2}}$, $M_{\bar{3}}$; roots closed	R	Ad

FIGURE G-6: Unit 7 Bone Distribution.

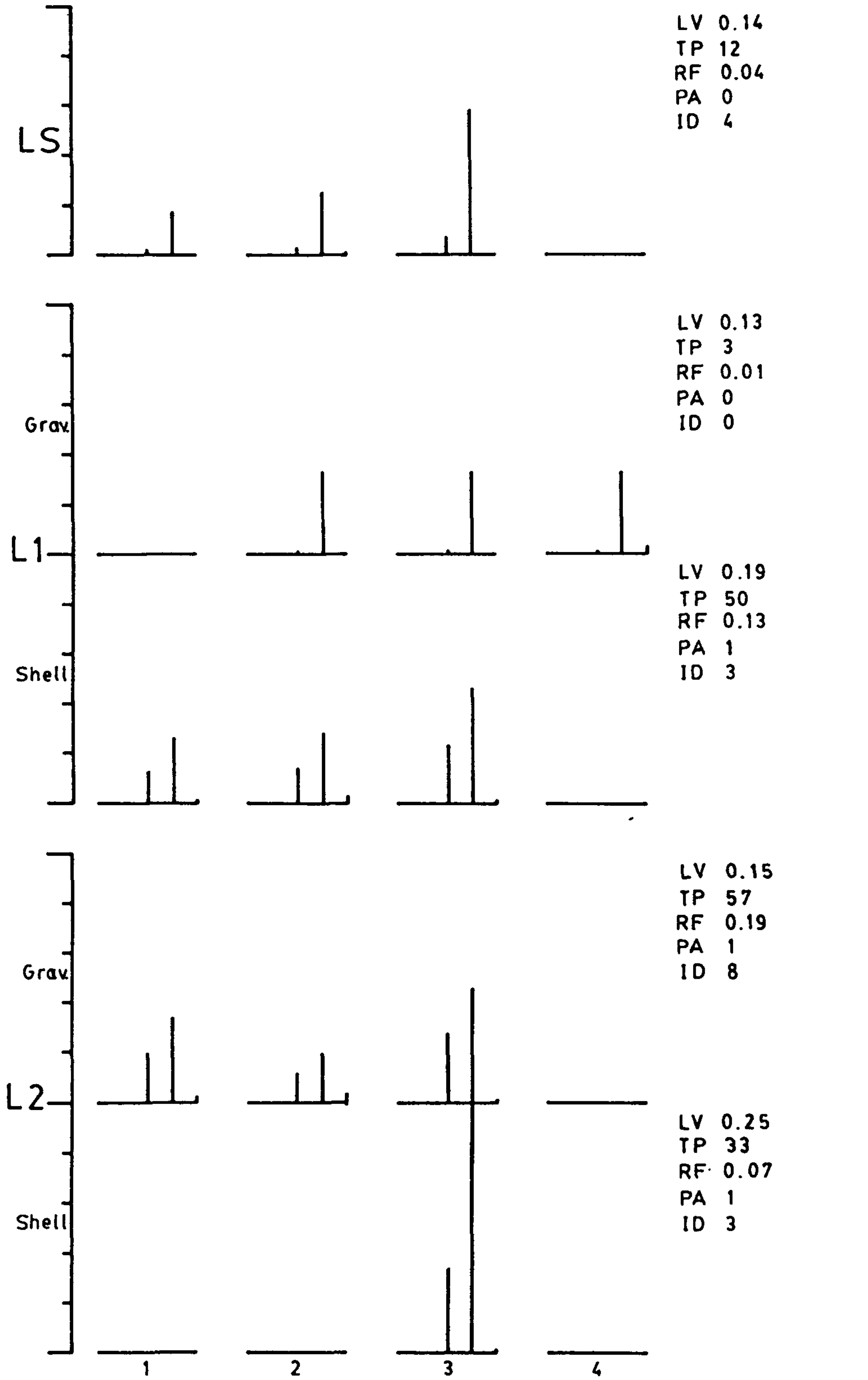

FIGURE G-6:

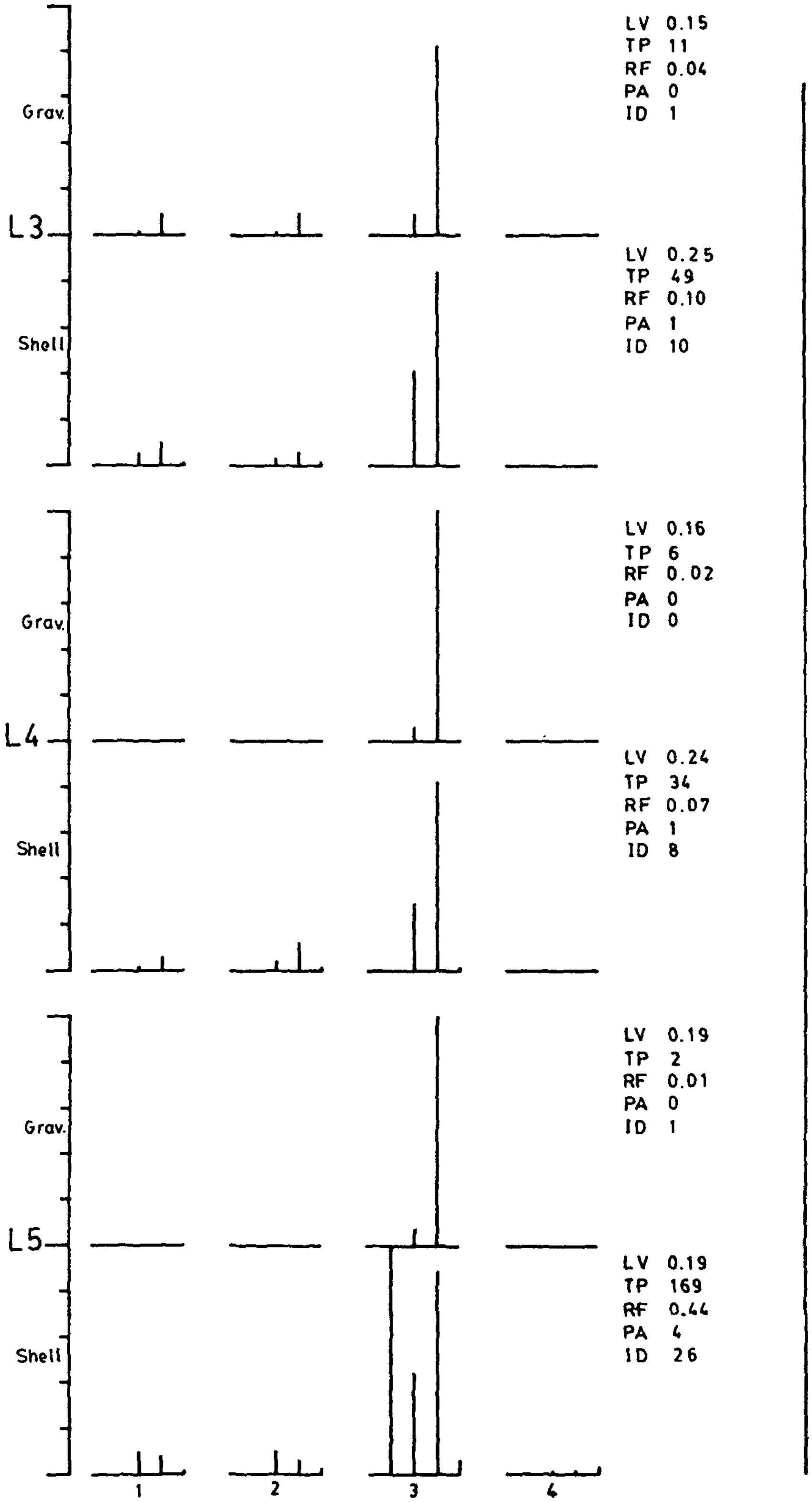
Grav.
L3
Shell
Grav.
L4
Shell
Grav.
L5
Shell
1
2
3
4
LV 0.15
TP 11
RF 0.04
PA 0
ID 1
LV 0.25
TP 49
RF 0.10
PA 1
ID 10
LV 0.16
TP 6
RF 0.02
PA 0
ID 0
LV 0.24
TP 34
RF 0.07
PA 1
ID 8
LV 0.19
TP 2
RF 0.01
PA 0
ID 1
LV 0.19
TP 169
RF 0.44
PA 4
ID 26

FIGURE G-6:

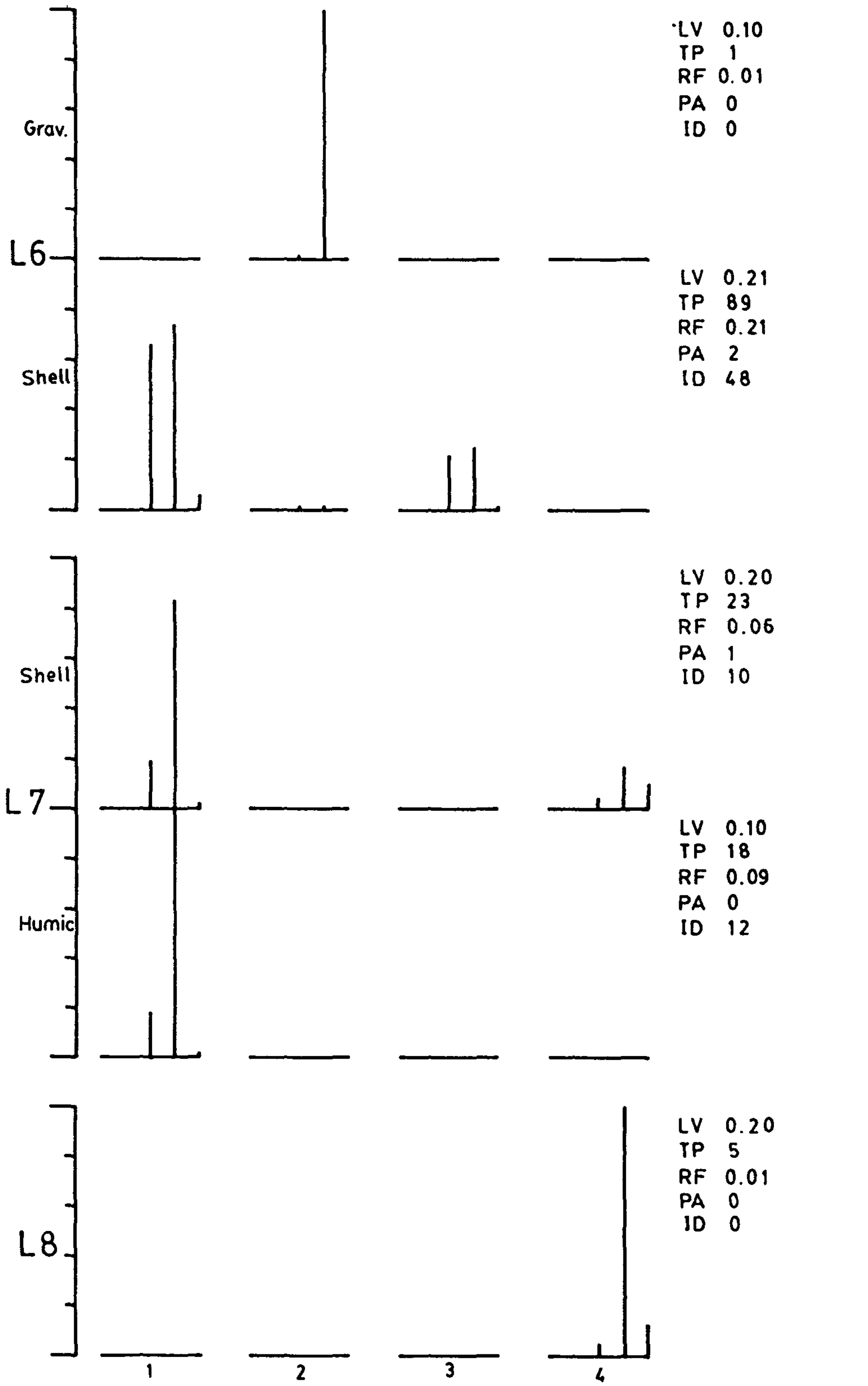
Grav.
L6
Shell
Shell
L7
Humic
L8
LV 0.10
TP 1
RF 0.01
PA 0
ID 0
LV 0.21
TP 89
RF 0.21
PA 2
ID 48
LV 0.20
TP 23
RF 0.06
PA 1
ID 10
LV 0.10
TP 18
RF 0.09
PA 0
ID 12
LV 0.20
TP 5
RF 0.01
PA 0
ID 0
1
2
3
4

TABLE G-7: Unit 7 Vertebrate Faunal Identifications.

	Classification:	Element: Description:	Side:	Age:
Level S.				
217)	Gadidae	vertebra; centrum; 1 fragment	A	
218)	Medium size Bird	vertebra; cervical; fragmentary	A	
219)	Medium size Bird	humerus; diaphysis portion	L	
220)	*Canis* sp.	P_3; complete	R	
Level 1G.				
		no identifications		
Level 1S.				
221)	Gadidae	vertebra; centrum	A	
222)	Medium size Bird	vertebra; cervical; complete	A	
223)	Small Mammal	tooth; complete; open roots; deciduous; probably a mustelid	?	Imm
Level 2G.				
224)	Gadidae	vertebra; centrum; 1 fragment	A	
225)	Medium size Bird	vertebra; cervical; complete	A	
226)	Medium size Bird	humerus; distal portion; fragmentary; calcined	L	
227)	Small Mammal	humerus; complete; probably mouse or vole	L	
228)	Large Mustelid	humerus; distal end and diaphysis; may be sea mink	L	
229)	*C. canadensis*	I^1; midsection	R	
230)	*C. canadensis*	molars; 1 complete; 1 crown portion; root closed	?	Ad

TABLE G-7: continued.

Classification:	Element: Description:	Side:	Age:
Level 2S.			
231) *C. canadensis*	M^3; complete; root closed	L	Ad
232) *Canis* sp.	vertebra; lumbar; complete except epiphyses; small	A	Juv
233) Cervidae	metapodial; distal end; probably deer	?	
Level 3G.			
234) *B. clangula*	coracoid; distal portion	L	
Level 3S.			
235) Gadidae	vertebrae; centra; 2 complete	A	
236) Anseriform	ulna; distal portion	L	
237) *C. canadensis*	M_3; complete; root partly closed	R	Sub
238) *Canis* sp.	femur; epiphysis from head; small	L	Juv
239) Artiodactyla	humerus; distal portion; small fragment	L	
240) Artiodactyla	metapodial; proximal portion	R	
241) Cervidae	molar; crown fragment; probably deer		
242) *O. virginianus*	fibula; complete	L	
243) *O. virginianus*	sesamoid; complete		
Level 4G.			
	no identifications		
Level 4S.			
244) Gadidae	vertebrae; centra; 2 complete	A	
245) *Canis* sp.	maxilla; body from P^1 to M^2	L	

TABLE G-7: continued.

Classification:		Element: Description:	Side:	Age:
246)	*Canis* sp.	canine; crown portion; 2 pieces	?	
247)	*Canis* sp.	zygomatic arch; complete	L	
248)	*Canis* sp.	sacrum; complete except epiphyses	A	
249)	Large Seal	canine tooth; complete except chipped crown; artifact; very large; root fused	?	Ad
Level 5G.				
250)	Cervidae	molar; complete; mandibular; probably deer	R	
Level 5S.				
251)	Gadidae	vertebrae; centra; 3 fragments	A	
252)	Culpeidae	vertebrae; trunk; 4 centra (many observed)	A	
253)	*Canis* sp.	innominate; acetabulum, illium, ischium; unfused	?	Juv
254)	*Canis* sp.	humerus; proximal portion, epiphysis not present; juvenile cortex	L	Juv
255)	*Canis* sp.	humerus; proximal portion, epiphysis not present; juvenile cortex	R	Juv
256)	*Canis* sp.	calcaneum; epiphyses not present	R	Juv
257)	*Canis* sp.	vertebrae; lumbar; 2 complete except epiphyses	A	Juv
258)	Seal	phalanges; 6 complete, 4 fragmentary		
259)	*H. grypus*	humerus; diaphysis; ends chewed away	L	
260)	*H. grypus*	ulna; midsection; ends chewed	R	
Level 6G.				
		no identifications		

TABLE G-7: continued.

Classification:		Element: Description:	Side:	Age:
Level 6S.				
261)	Gadidae	maxilla; anterior portion; charred	L	
262)	Gadidae	post-temporal; posterior process	R	
263)	Gadidae	vomer; anterior portion	A	
264)	Gadidae	parasphenoid; midsection	A	
265)	Gadidae	sphenotic; central portion	L	
266)	Gadidae	sphenotic; central portion	L	
267)	Gadidae	sphenotic; central portion	R	
268)	Gadidae	epihyal; anterior portion	R	
269)	Gadidae	brachiostegal rays; proximal ends and midsections; 11 pieces		
270)	Gadidae	vertebrae; centra; 25 fragments	A	
271)	Gadidae	quadrate; complete	R	
272)	Gadidae	parasphenoid; midsection	A	
273)	Gadidae	frontal; central portion; both sides	L&R	
274)	G. morhua	premaxilla; complete	L	
275)	G. morhua	premaxilla; complete	L	
276)	G. morhua	premaxilla; midsection including toothed surface	L	
Level 7G.				
277)	Gadidae	brachiostegal rays; proximal ends and midsections; 7 pieces		
278)	Gadidae	pterygiophore; midsection	A	

TABLE G-7: continued.

Classification:	Element: Description:	Side:	Age:
279) Gadidae	ray; base		
280) Gadidae	vertebra; centrum; complete	A	
Level 7S.			
281) Gadidae	post-temporal; posterior process	L	
282) Gadidae	angular; anterior portion	R	
283) Gadidae	parasphenoid; midsection	A	
284) Gadidae	pterygoid; posterior portion	L	
285) Gadidae	vertebra; centrum; 1 fragment	A	
286) Gadidae	brachiostegal rays; 2 proximal ends, 2 midsections		

Level 8.

no identifications

FIGURE G-7: Unit 8 Bone Distribution.

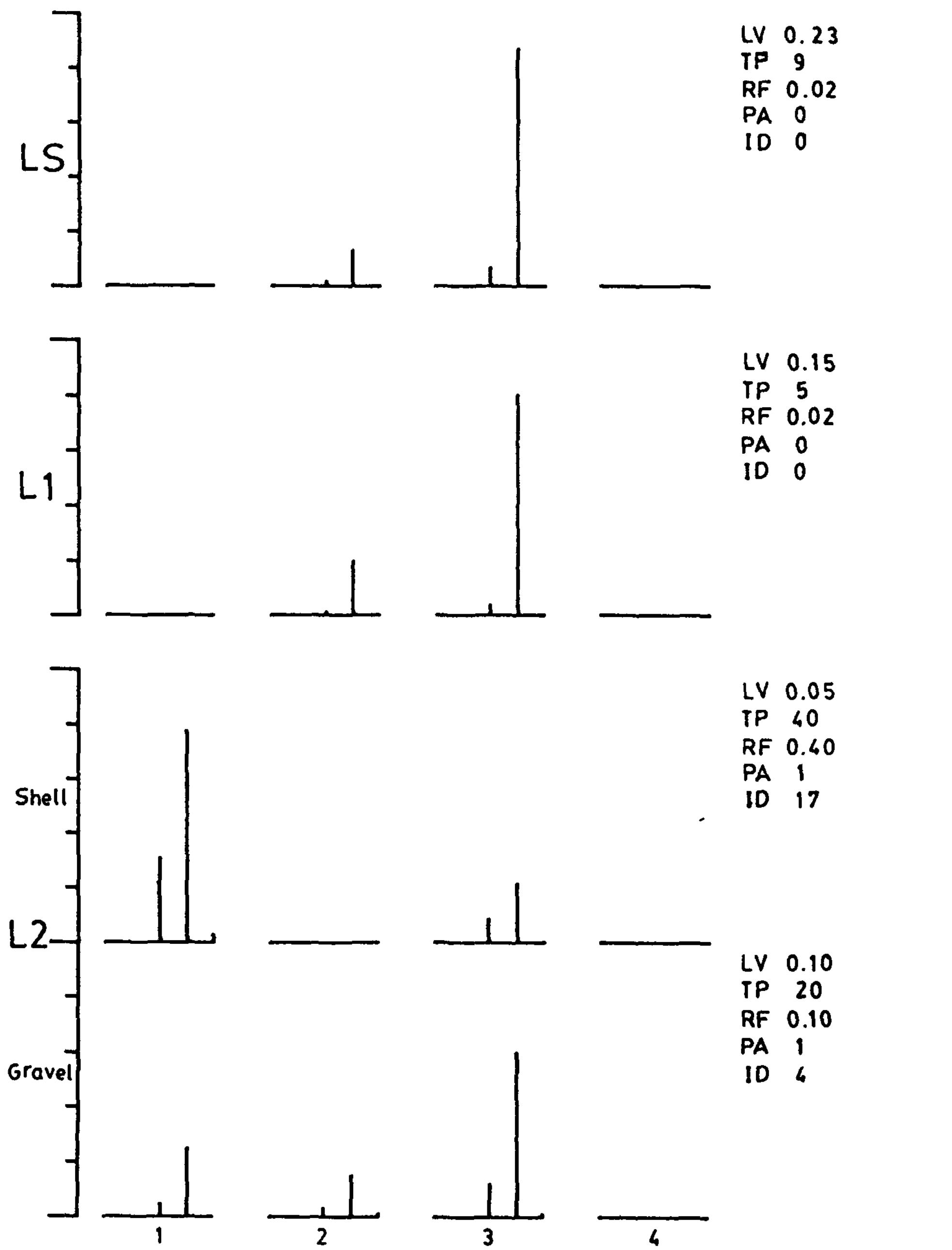

FIGURE G-7:

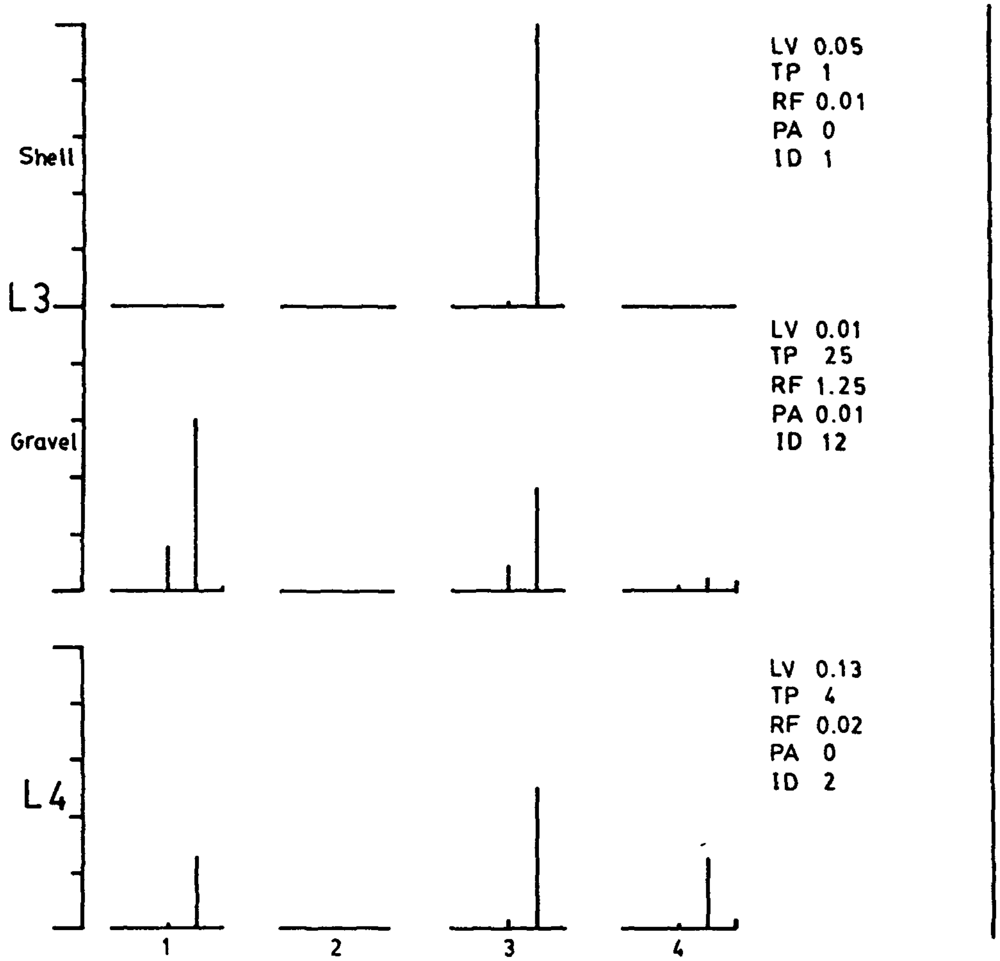
Shell
L3
Gravel
L4
1
2
3
4
LV 0.05
TP 1
RF 0.01
PA 0
ID 1
LV 0.01
TP 25
RF 1.25
PA 0.01
ID 12
LV 0.13
TP 4
RF 0.02
PA 0
ID 2

TABLE G-8: Unit 8 Vertebrate Faunal Identifications.

Classification:		Element: Description:	Side:	Age:
Level S.				
286)	Anseriform	ulna; proximal portion and diaphysis; calcined	R	
Level 1:				
		no identifications		
Level 2S.				
287)	*P. virens*	vomer; anterior portion including toothed surface	A	
288)	Gadidae	post-temporal; posterior process	?	
289)	Gadidae	brachiostegal rays; 1 proximal end, 1 midsection		
290)	Gadidae	vertebrae; centra; 9 pieces	A	
291)	*Phoca* sp.	innominate; portions of the ishium, pubis, acetabulum; chewed	L	
292)	*C. canadensis*	mandible; body including M_1 and root of P_4; 2 pieces; roots closed	L	Ad
293)	*O. virginianus*	astragalus; complete; soil marked; butcher marked	L	
Level 2G.				
294)	Gadidae	brachiostegal rays; 1 proximal end, 3 midsections		
Level 3S.				
295)	Cervidae	antler tine; point; 2 pieces; artifact; probably deer		

TABLE G-8: continued.

Classification:	Element: Description:	Side:	Age:
Level 3G.			
296) *P. virens*	premaxilla; anterior end and toothed surface	L	
297) *P. virens*	premaxilla; anterior end and toothed surface	R	
298) Gadidae	angular; posterior portion; 2 pieces	L	
299) Gadidae	vertebrae; centra; 2 complete; very large	A	
300) Gadidae	vertebrae; centra; 2 complete	A	
301) *C. canadensis*	incisor; crown portion; artifact	?	
302) *C. canadensis*	mandible; condyle and portion of ramus	L	
303) *C. canadensis*	femur; diaphysis; ends chewed away	R	
304) *P. vitulina*	humerus; diaphysis; soil marked; ends chewed away	R	
Level 4.			
305) Gadidae	brachiostegal ray; proximal end		
306) *C. canadensis*	scapula; glenoid cavity and body portion; soil marked; chewed	L	
Level 5.			
	no identifications		

FIGURE G-8: Unit 9 Bone Distribution.

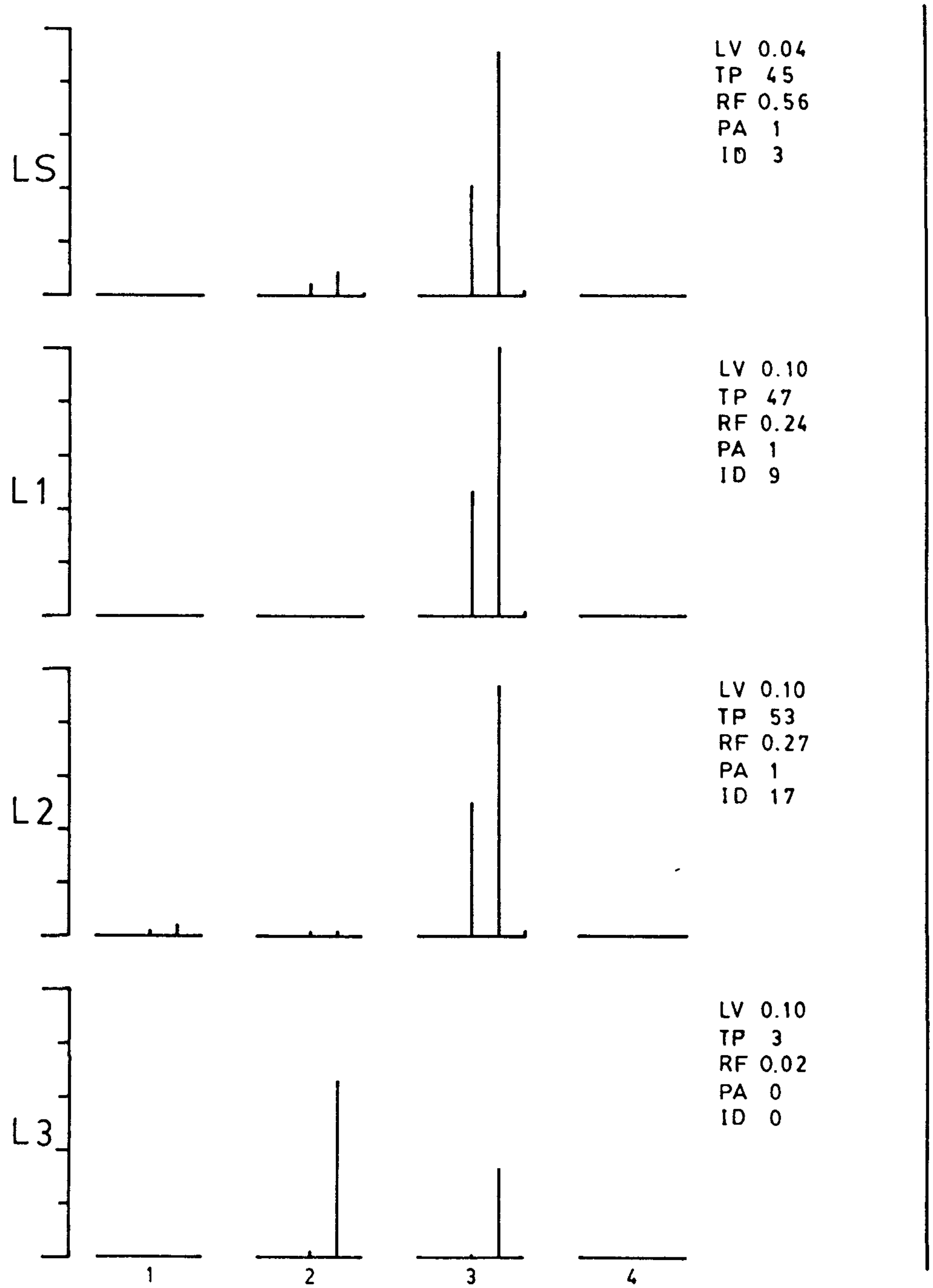

TABLE G-9: Unit 9 Vertebrate Faunal Identifications.

	Classification:	Element: Description:	Side:	Age:
Level S.				
307)	C. canadensis	M_1; complete; root closed	L	Ad
308)	C. canadensis	M_2; complete; root closed	L	Ad
309)	O. virginianus	distal phalanx; proximal portion		
Level 1.				
310)	C. canadensis	molar; root portion; root closed	?	Ad
311)	C. canadensis	I_1; midsection	R	
312)	Canis sp.	metacarpal II; complete	R	
313)	Canis sp.	proximal phalanx; complete		
314)	O. virginianus	P_2; complete	R	
315)	O. virginianus	P_3; complete	R	
316)	O. virginianus	molars; crown portions of 2		
317)	O. virginianus	distal phalanx; complete; charred		
Level 2.				
318)	Canis sp.	proximal phalanx; complete		
319)	Canis sp.	vertebrae; cervical; 3; 7 pieces	A	
320)	O. virginianus	P_4; complete; and portion of mandible	L	
321)	O. virginianus	molars; 3 complete; M^1, M^2, M^3	L	
322)	O. virginianus	molars; crown portions; 2 fragments		
323)	O. virginianus	proximal phalanx; distal portion		
324)	P. vitulina	maxilla; including palate and palatine canal; 2 pieces	R	

TABLE G-9: continued.

Level 3.

no identifications

Level 4.

no identifications

Level 5.

no identifications

TABLE G-10: Master Vertebrate Species List.

Class:	Order:	Family:	Species:	Common Name:
Osteichthyes				
	Culpeiformes			
		Culpeidae		
			Culpea harengus Linn.	Atlantic herring
	Gadiformes			
		Gadidae		
			Gadus morhua Linn.	Atlantic cod
			Melanogrammus aeglefinnus Linn.	haddock
			Pollachius virens Linn.	pollock
Avians				
	Gaviiformes			
		Gavidae		
			Gavia immer Brunnich	common loon
	Procellariiformes			
		Diomedeidae		
			Puffinus gravis O'Reilly	greater shearwater
	Passeriformes			
		Corvidae		
			Corvus brachyrhynchos Brehm	common crow

TABLE G-10: continued.

Class:	Order:	Family:	Species:	Common Name:
Avians (continued)				
	Anseriformes			
		Anatidae		
			Branta bernicla Müller	
				Brant goose
			Aix sponsa Linn.	
				wood duck
			Bucephala clangula Bonaparte	
				common goldeneye
			Somateria mollissima Sharpe	
				eider duck
	Charadriiformes			
		Alcidae		
			Pinguinus impennis Linn.	
				great auk
			Uria lomvia Linn.	
				thick-billed murre
			Uria aalge Pontoppidan	
				common murre
Mammalia				
	Rodentia			
		Castoridae		
			Castor canadensis Kuhl	
				American beaver
		Muridae		
			Ondatra zibethicus Linn.	
				muskrat

TABLE G-10: continued.

Class:	Order:	Family:	Species:	Common Name:
Mammalia (continued)				
	Carnivora			
		Canidae		
			Canis sp. -- either	
			Canis lupus Linn.	wolf
			or	
			Canis familiaris	domestic dog
		Mustelidae		
			Martes americana Turton	marten
			Mustela sp. -- either	
			Mustela vison Schreber	American mink
			or	
			Mustela macrodon Prentiss	sea mink
	Pinnipedia			
		Phocidae		
			Halichoerus grypus Fabricius	grey seal
			Phoca vitulina Linn.	
	Artiodactyla			
		Cervidae		
			Odocoileus virginianus Zimm.	white-tailed deer
			Alces alces Linn.	moose