Chapter 5

Discussion/Conclusions

Introduction

Cove Point fits Escoffier's (1954) model of a traveling foreland, but the geomorphic evidence indicates that the process of beach ridge progradation is episodic and variable rather than a constant, uniform process. Historic evidence and a comparative analysis of Flag Ponds indicates that phenomena such as erosion reversals and lateral spit growth are a common and integral part of foreland development. Prehistoric migration rates (e.g. 1.3 meters per year) differ from the migration rates derived through shoreline change analysis (e.g. 0.7 meters per year), indicating that sea level rise and especially bathymetry are playing an important role in recent advancement and morphology. The long-term morphology as indicated by vibracoring and radiocarbon dating reveals a linear pattern of migration which is driven primarily by a constant sediment supply regime and sea level rise. The beach ridges which make up the foreland are episodic in their constructional mechanism, although it is not clear what drives this cyclic behavior.

Cove Point, initial development.

The cuspate foreland which is Cove Point probably did not exist more than 3000 years ago. Relative sea level was approximately 6 meters below its present level and rising at a rate of about 2 meters per 1000 years, (Peltier and Jiang, 1997). As the transgression continued, the coastline achieved its approximate present-day configuration. The littoral cells which Downs (1993) defined began to establish their patterns. Cove Point probably began as a small projection on the coast of Calvert County north of today's cape, possibly at a resistant ironstone headland such as Rocky Point (see Figure 51).

Rocky Point or a similar feature interrupted the longshore sediment transport regime, causing the development of a recurved spit and eventually a local reversal in the normal southerly drift as the cuspate feature developed. Sediments accumulated in the form of spits which welded themselves onto the south shore of the cape to form beach ridges. At approximately 2500 years ago, Cove Point probably looked much like today's Flag Ponds. This process of accretion was rapid in the early stages of foreland development, with slower rates of erosion on the northern flank. This can be attributed to two factors. First, the young cape had not grown very far distally, and so was still in shallow water. Second, the rate of sea level rise was approximately 2 meters per 1000 years, much slower than present day rates (about 3.6 mm per year in the Chesapeake Bay due to a combination of glacial isostatic adjustment and eustatic sea level rise; Peltier and Jiang, 1997; Douglas, 1991).

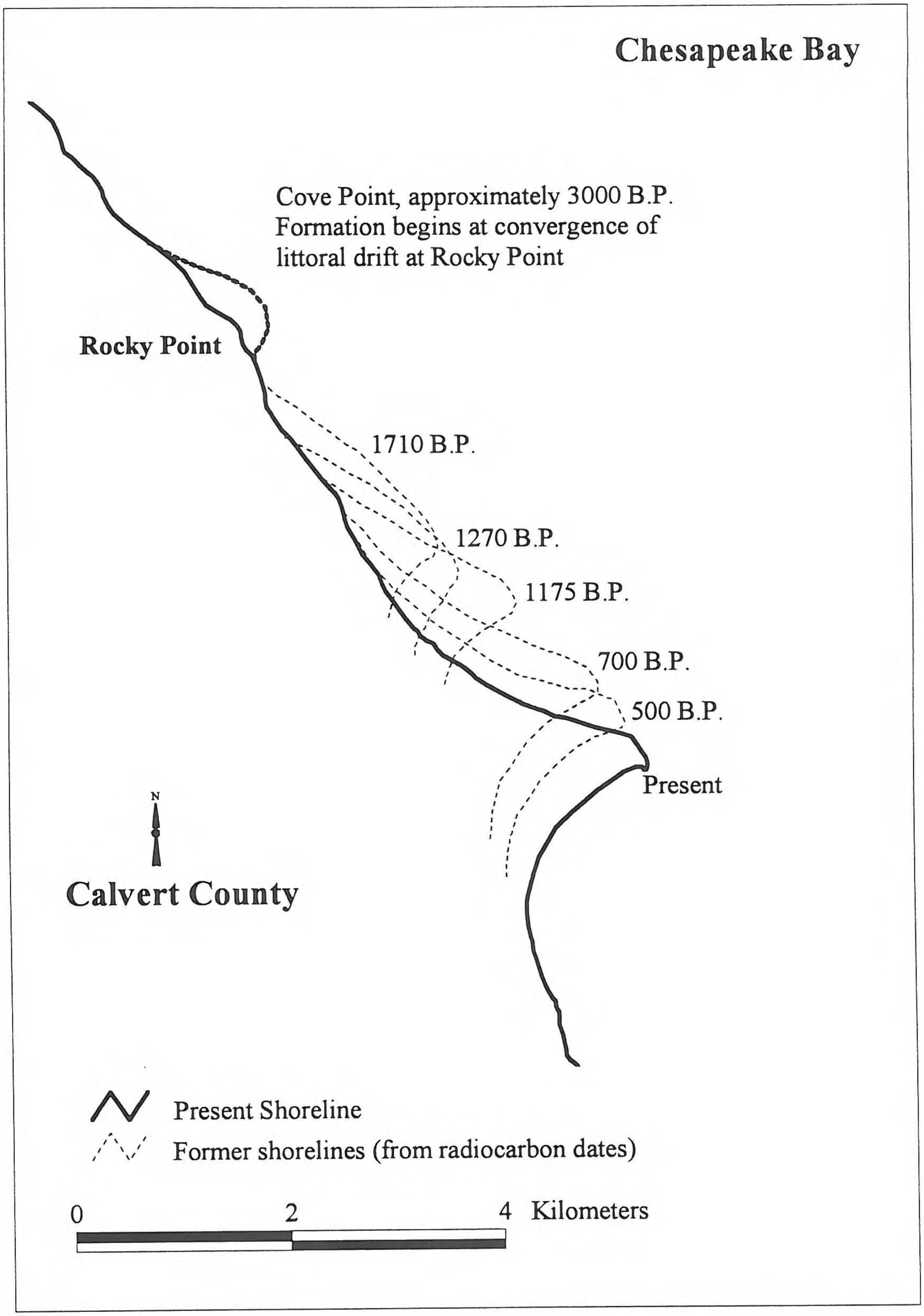


Figure 51. Cove Point initial inception and subsequent migration.

Cove Point, prehistoric development

Cove Point continued its migration south as seen in Figure 51, with accretion taking place more rapidly on the southern flank than the erosion rate of the northern flank. This rate of migration over the last 1760 years has been 1.3 meters per year, a rate which is comparable to the present day migration of Flag Ponds (1.6 meters per year). Flag Ponds is currently developing in shallow water, much as the early Cove Point did, and an analysis of aerial photographs for the Flag Ponds region reveals the recent construction of cat-eye ponds. These ponds can also be seen in aerial photographs of Cove Point. They were probably formed when spits wrapped around the front of the foreland, cutting off areas of deeper water. These ponds quickly turned to freshwater with rainfall input, and a freshwater marsh began to grow. No saltwater peats were cored, indicating that the barrier strand which forms the Chesapeake Bay border of Cove Point remains fairly intact during the migration of the cape.

At approximately 700 years ago (according to radiocarbon dating), the growth of Cove Point reached a threshold. Spits no longer curled around the front end to cut off deeper water and create cat-eye ponds as at the present day Flag Ponds. This process formed ridges at a spacing of 30 meters at an average interval of 31 years. Instead, the beach ridges of Cove Point were constructed in the foreshore and welded directly onto the existing beachface. This process is more time consuming, encompassing a mean interval of 35 years, and results in a closer spacing of the beach ridges (25 meters). The long construction interval and the apparent berm sequence found in the cores suggests that these ridges formed through a continual process of swash deposition as described by Tanner and Stapor (1972). This change in the constructional mechanism of the foreland is governed by the underlying Miocene surface of Cove Point which was previously the bottom of the Chesapeake Bay. This platform upon which the cape rests dips offshore gradually to the ancestral Susquehanna River channel. As the cape grew distally from the western shore of the Bay, it advanced into this deeper water. The Bay just south of the advancing flank was now at or below the depth of closure, limiting the movement of sediment for ridge construction. Also, the deeper this water becomes, the more sediment is required for each individual ridge. Hence there is an overall thickening from north to south in the wedge of littoral sediments as seen in the vibracores.

This increase in the amount of sediment required for each ridge is compounded by sea level rise. Sea level has risen approximately 2.0 meters during the last 1000 years (Peltier and Jiang, 1997), again increasing the water depth offshore of the advancing cape. This rising sea level produces the apparent tilting of the beach ridge plain (Figure 52). This tilting is not tectonic; it is due to the fact that the elevation of each ridge is controlled by the water level conditions present during the construction period. Thus, the older ridges are built at a lower sea level, while the higher ridges are built more recently. The oldest ridges have been completely drowned and covered by the vertically accreting marsh. This marsh, although not tidal, is controlled over the long-term by a rising water table

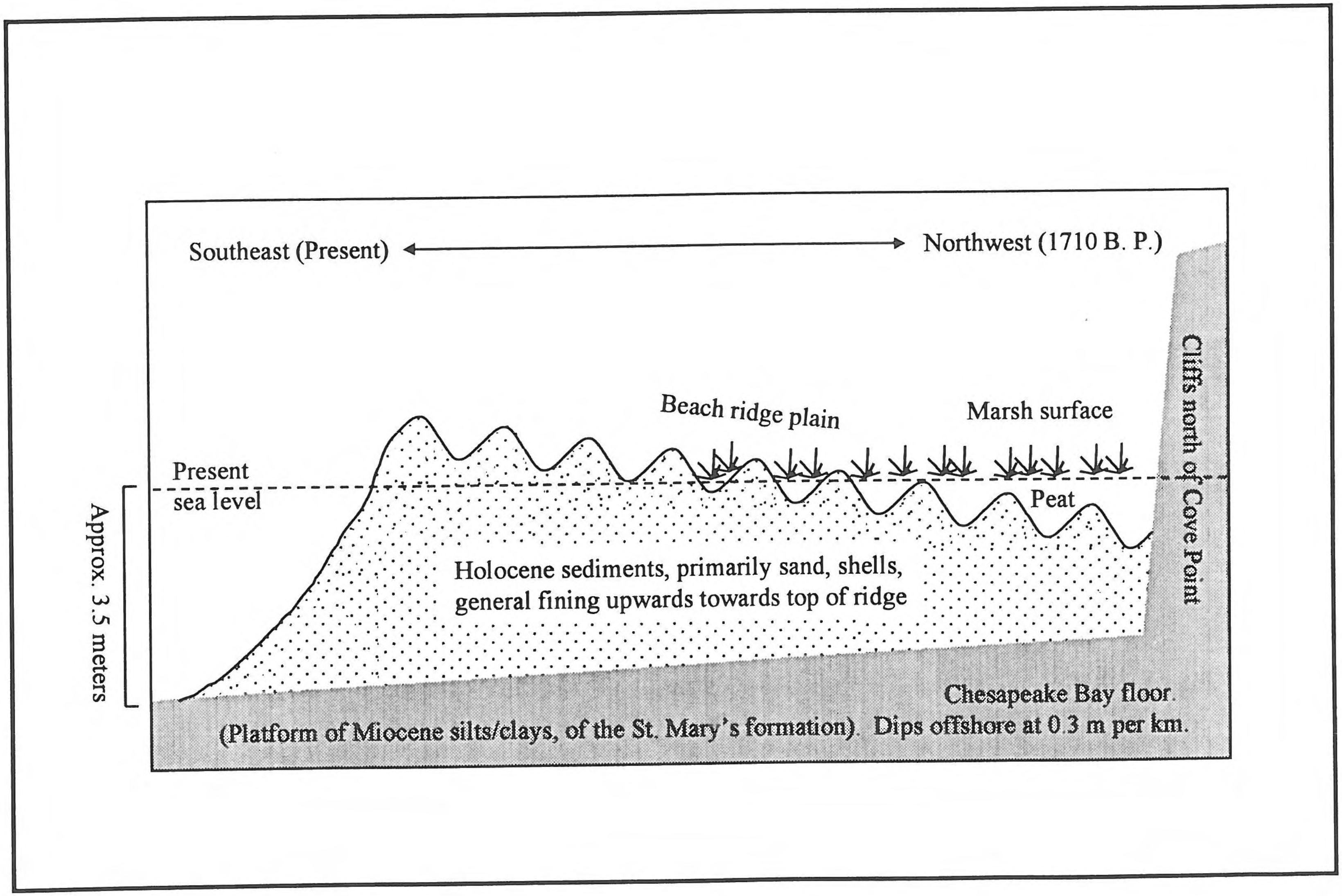


Figure 52. Diagram of vibracore transect cross-section stratigraphy

which is controlled by sea level. Over the last three thousand years the marsh has been able to build on top of its own detritus, maintaining an elevation with respect to sea level. Interior pond expansion between 1938 and 1990 are indicators that the recent acceleration in relative sea level rise will interrupt this natural process.

Cove Point, historic development

Historic shoreline records indicate that Cove Point has been shrinking for at least the last 100 years. The northern flank is eroding at 1.0 meters per year while the southern flank accretes at 0.7 meters per year. This has led to a reduction in the subaerial size of the cape feature. This is partially controlled by the offshore bathymetry which is limiting the growth of the foreland as it advances into deeper water. It is also a product of the change in the rate of sea level rise over the last century. Sea level was rising at approximately 2.0 mm per year in the Chesapeake Bay prior to 1850 (Peltier and Jiang, 1997). Since that time, sea level has risen at a rate of 3.6 mm per year in the Bay (Douglas, 1991). This recent rise in sea level is the sum of the global eustatic rate (1.8 mm per year) and regional subsidence (Douglas, 1997; Peltier and Jiang, 1997). This rise in water level means a reduction in accretion rates and an increase in erosion rates for Cove Point as well as a continued deepening of the waters adjacent to the advancing flank of the foreland.

It appears Cove Point has reached and crossed a threshold between overall accretion and erosion. Previous Holocene migration occurred at a rate of 1.3

meters per year; it is now only 0.7 meters per year. Residents of Cove Point will see little accretion along the southern shore of Cove Point while the interior marsh continues to convert upland into freshwater marsh, encroaching on residential properties. It is probable that the shoreline engineering structures which protect the lighthouse are having some affect on this process, further aiding the drop in accretion as sediment is shunted offshore and lost to the sand-sharing system. There is an arc of erosion just south of the lighthouse, which represents the limit of influence of the seawall and groins. As such, their impact on the cape's morphology is not large. However, it is possible that this arc of influence will extend further south and west as foreland migration continues and sediment eroded from the northern flank continues to move offshore. It is also likely that there is lag time built into the system which is masking the effect of these structures. A beach ridge presently requires 35 years to build; the sediment which is accreting onto the southern flank may have been stored in the shoal before the groins were built. As such, the effect of these groins may not be noticeable for years to come.

The beach ridges which make up Cove Point are presently being constructed at a rate of 35 years per ridge with an average spacing of 25 meters. Ridges in the older part of the foreland probably emerged as bars, cutting off deeper water (a process which can be inferred through an analysis of core #7). This process is similar to the mechanism described by Curray et al. (1967). As the foreland advanced into deeper water, ridges welded directly onto the beachface rather than emerging as offshore bars. These ridges are driven by a cyclical process; a certain threshold within the geomorphic system must be reached before a ridge is constructed. It is likely that this threshold is reached by the accumulation of sediment in the shoal at the tip of Cove Point. Once enough sediment is present, a high energy event such as a northeaster moves this sediment, distributing it alongshore so that it can be reworked as nearshore bars and eventually beach ridges (Figure 53).

It was not possible to draw any conclusions about the topography of the underlying Miocene surface. This surface may have been dissected by riverine channels which ran across the Susquehanna floodplain prior to the most recent transgression (Kerhin, 1997, pers. comm.). This is supported by the unusually thick littoral sequence found in core #5; however, it is not possible to map any undulations of this surface due to the poor sampling resolution. Errors in vibracore compaction/correction and elevational positioning also makes it difficult to draw solid conclusions about the dip of the Miocene strata. However, when the Miocene contact is plotted against depth, there does appear to be a slight dip to the south (approximately 0.3 meters per kilometer along the vibracore transect). A dip of 1.4 to 2.0 meters per kilometer is indicated by Kidwell (1997); this discrepancy can again be explained by the coarse sampling resolution and possible errors when accounting for vibracore compaction.

Cove Point is a unique feature which has developed under a set of conditions which are particular to that stretch of the Calvert County coastline. Dominant wave attack from the north drives erosion; frequent wave action from

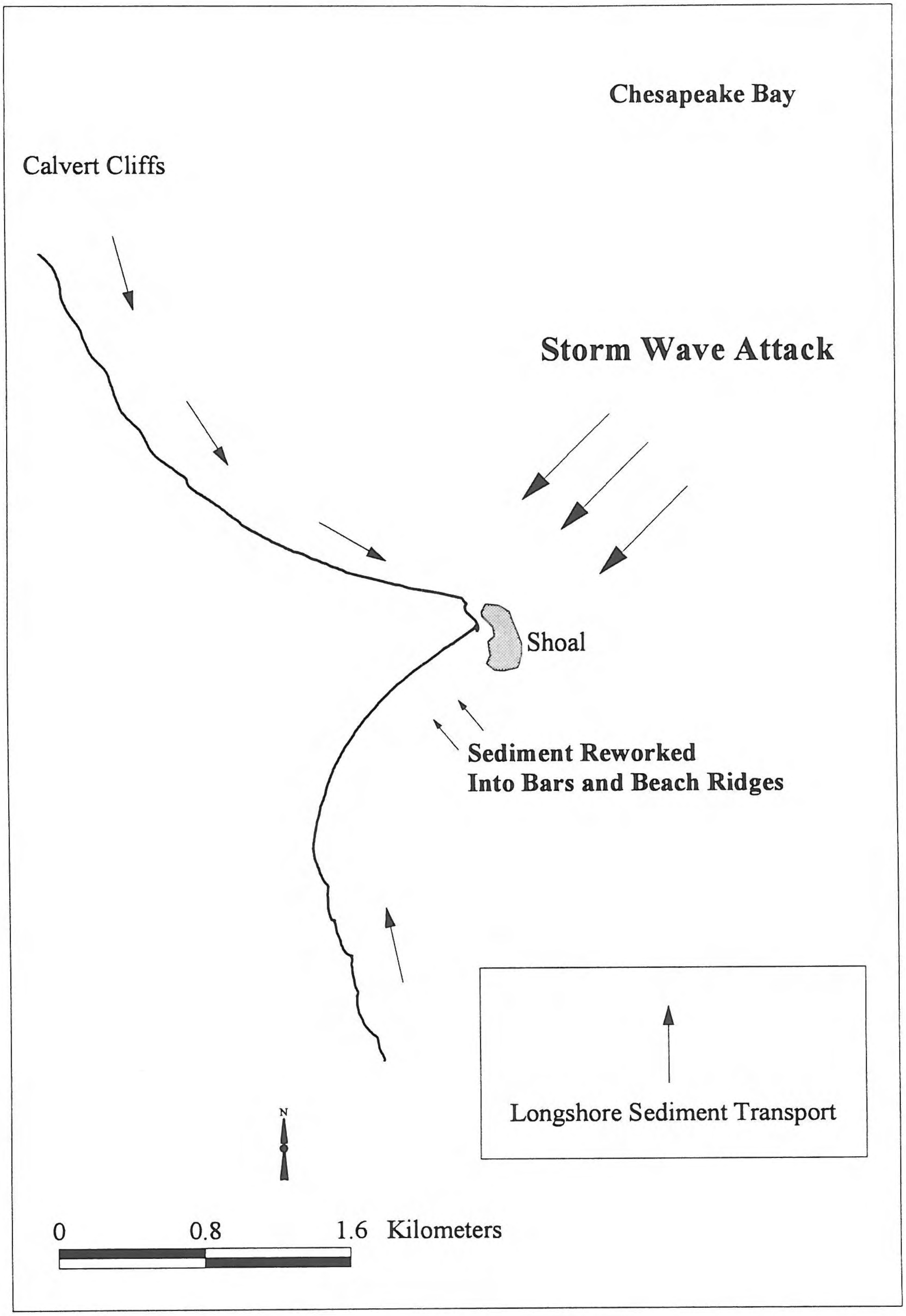


Figure 53. Map of Cove Point showing drift and ridge construction.

the south causes accretion (Escoffier, 1954). The restricting eastern shore of the Chesapeake Bay limits fetch and hence wave energy from the west, allowing distal extension of the cape feature into deeper water (Figure 54). It is interesting to compare Cove Point with other traveling forelands. Cape Hatteras and Flag Ponds have similar construction mechanisms (e.g. one flank progrades through the growth of beach ridges, while another flank is eroded), although in each case they are operating at different temporal and spatial scales. Cape Hatteras is several orders of magnitude larger than Cove Point, while Flag Ponds is an order of magnitude smaller (Figure 55).

The future of Cove Point

The present day morphology of Cove Point is governed primarily by the bathymetry off the southern flank of the cape which is limiting further growth. The shore engineering structures at the tip of the cape are also having an effect on morphology, possibly shunting sediment offshore before it can accrete onto the southern flank. Sea level rise is the least of these three factors; it has controlled the long-term elevational construction of the beach ridge plain and will continue to do so in the future; at present, it is causing increased rates of erosion on the northern flank and slower rates of accretion on the southern flank. In 50 years, Cove Point will look very similar as the same general trends of erosion and accretion continue; there will be an overall reduction in size of the subaerial cape. The tip of the spit may also thin down if the minor erosion noted on the southern

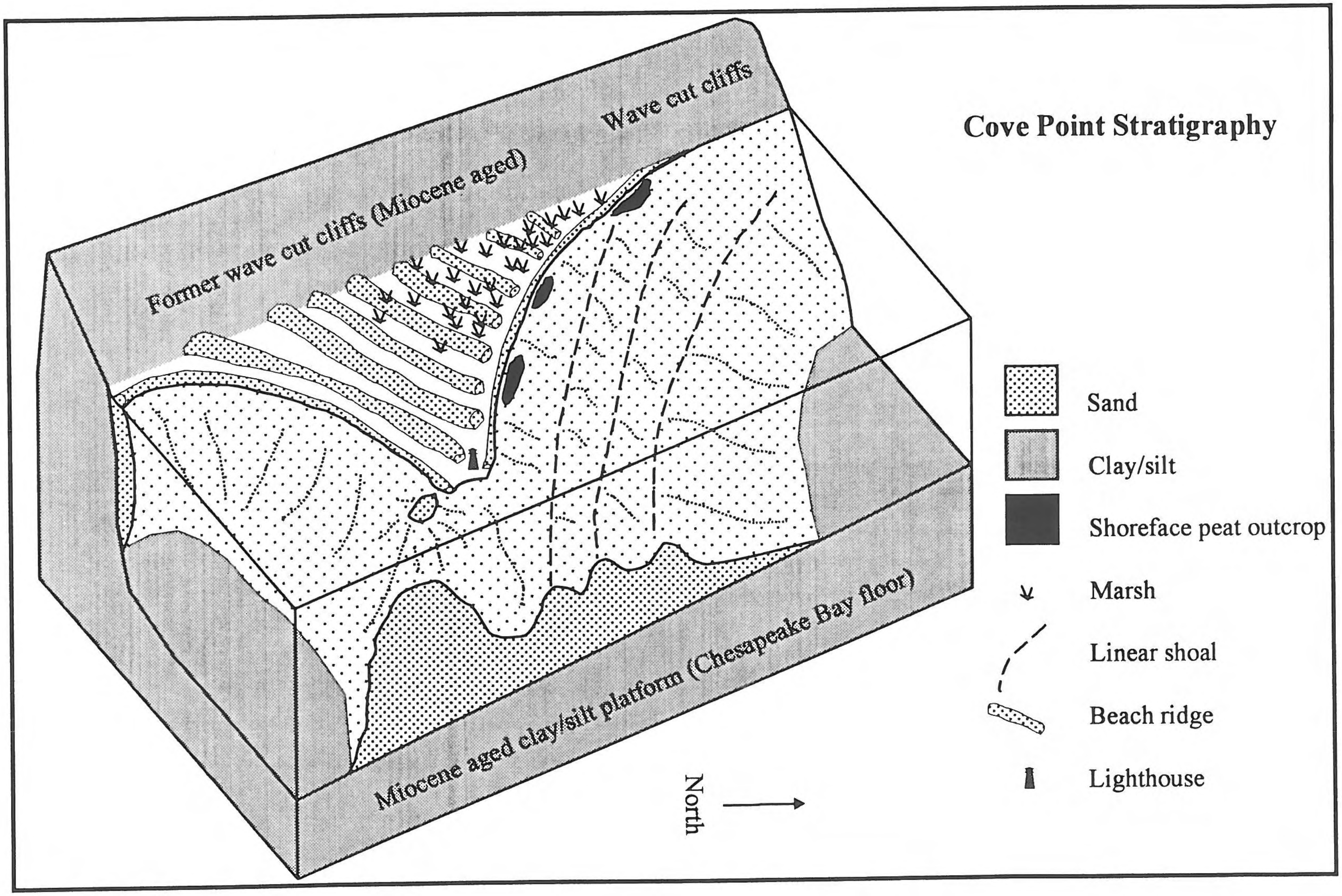


Figure 54. Block diagram of Cove Point stratigraphy.

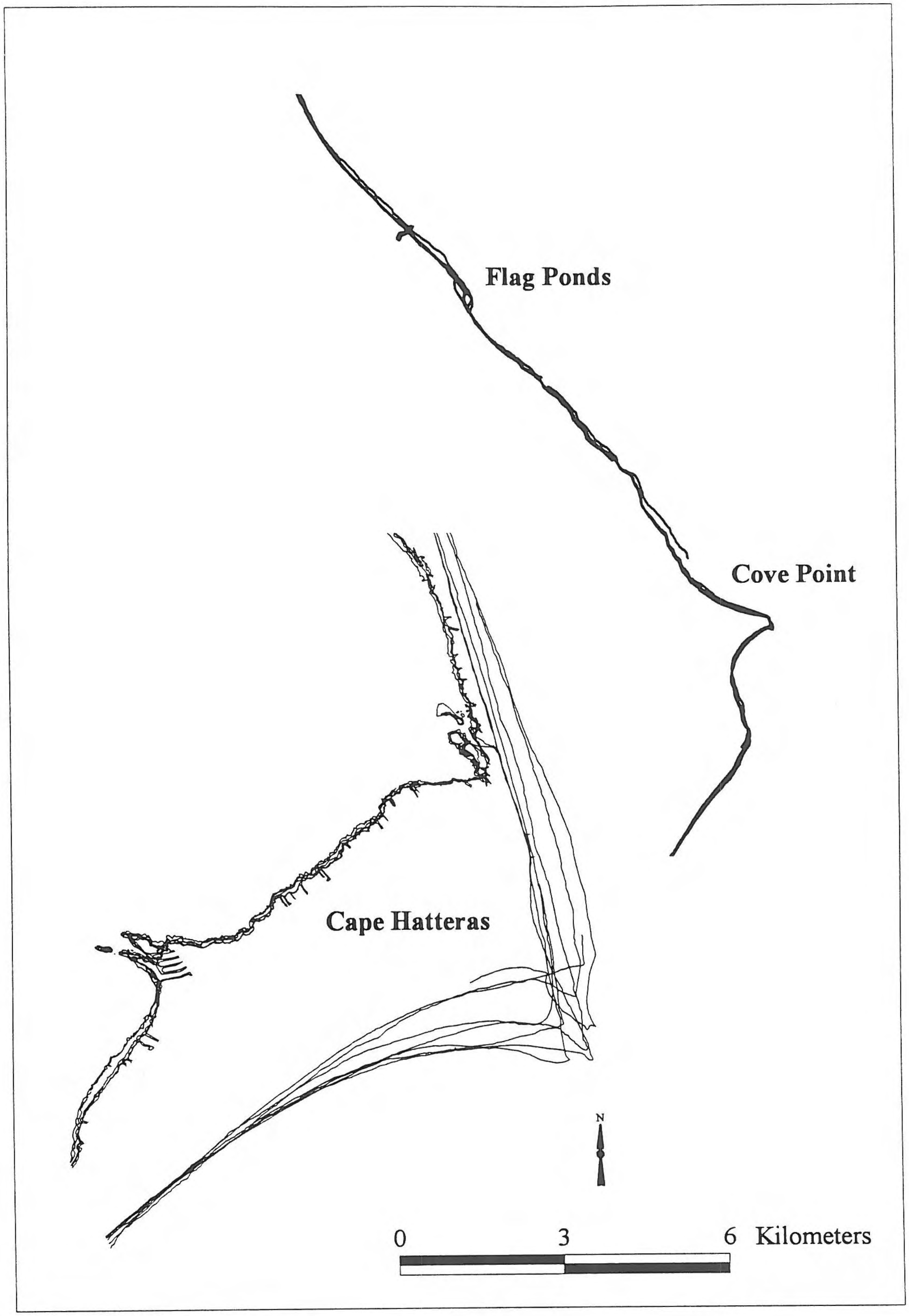


Figure 55. Comparison of cuspate forelands.

flank (just southwest of the tip) continues. Sea level rise will continue to cause the interior marsh to encroach on the residential community located on the youngest part of the cape feature.

Suggestions for further research

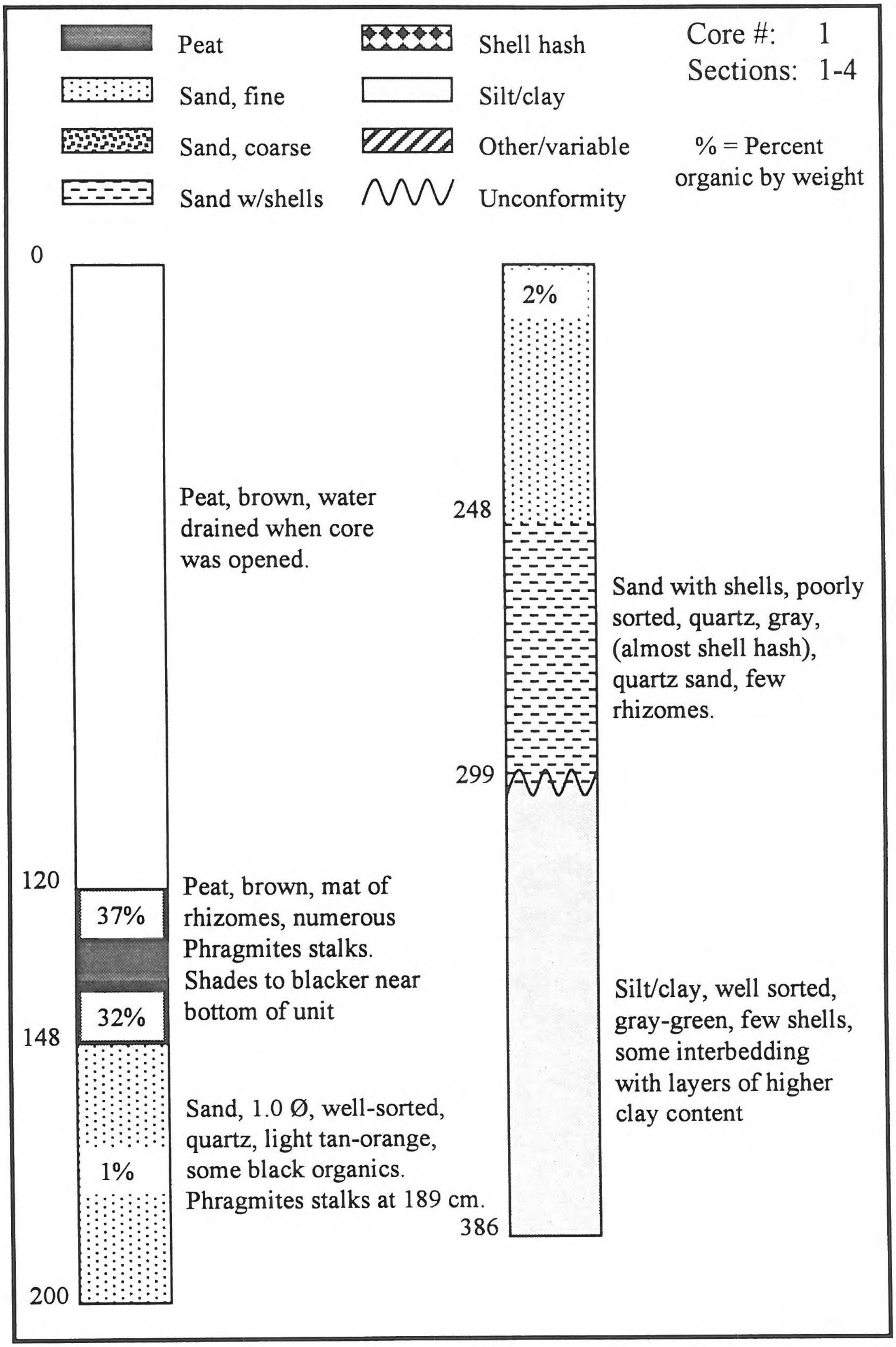
There is a great deal which remains to be discovered about the geomorphic development of Cove Point. Although beach ridge stratigraphy is investigated in this study, it was not possible to fully reconstruct the advance of these ridges for the entire foreland. This was particularly true for the oldest parts of the beach ridge plain which are covered by marsh. A comprehensive study of beach ridge topography would be very useful. Such surveys could be accomplished through the use of ground-penetrating radar. This area is ideal for such a project; this radar would easily penetrate the marsh and reveal the detailed topography of the beach ridge plain.

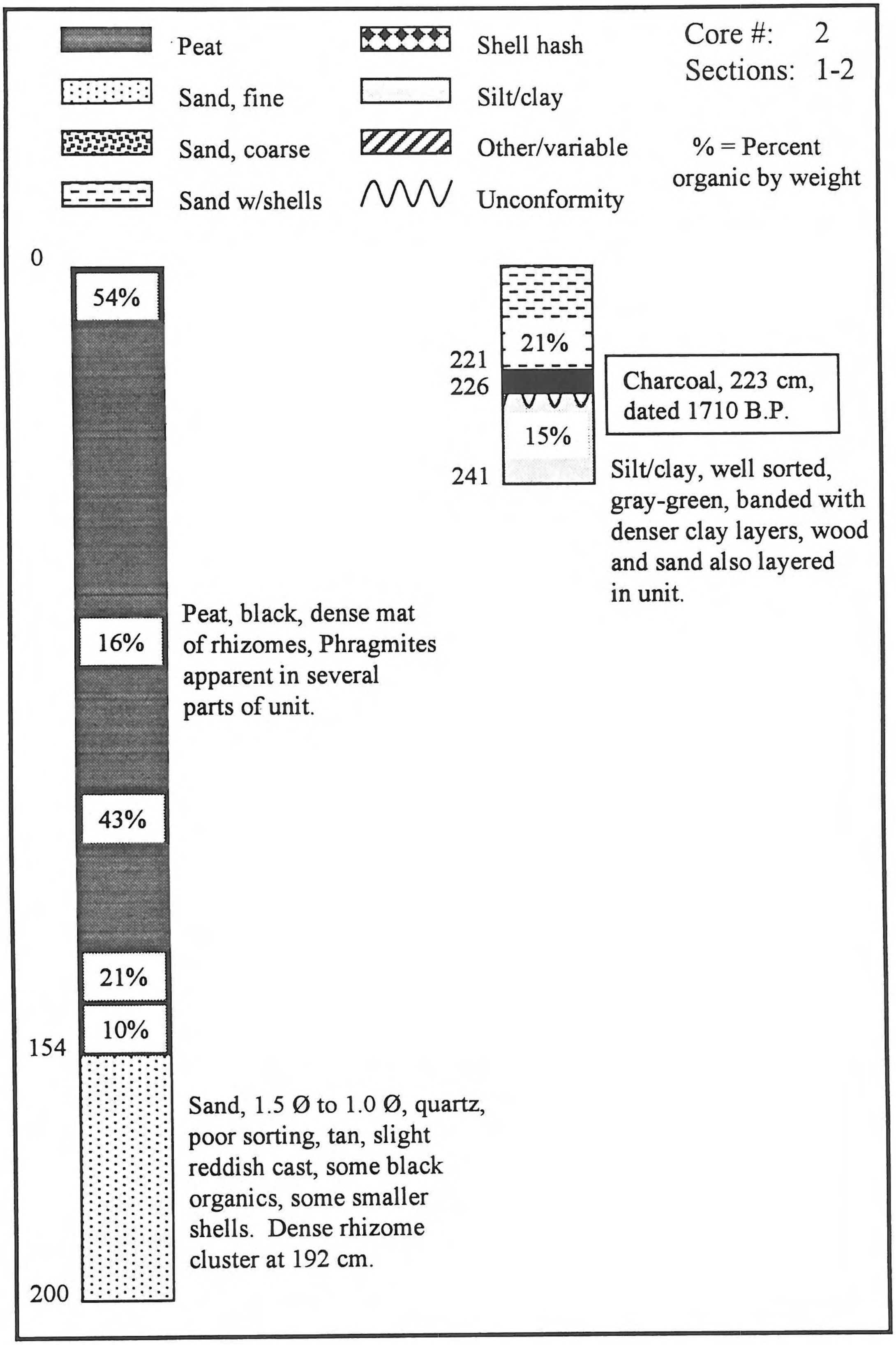
Other potential work includes more radiocarbon dates of vibracore organic materials, a more intensive coring program (possibly with other methods such as a Dutch auger), and creating a more temporally dense shoreline record database by incorporating other vertical aerial photographs. Other useful work would be a comparative study of Flag Ponds using vibracoring and radiocarbon dating. Flag Ponds is an incipient cuspate foreland probably similar to what Cove Point must have been a few thousand years ago. The conditions which shaped Cove Point are in an earlier stage of operation at Flag Ponds; a comparative study here would lend insight to the early evolution of Cove Point.

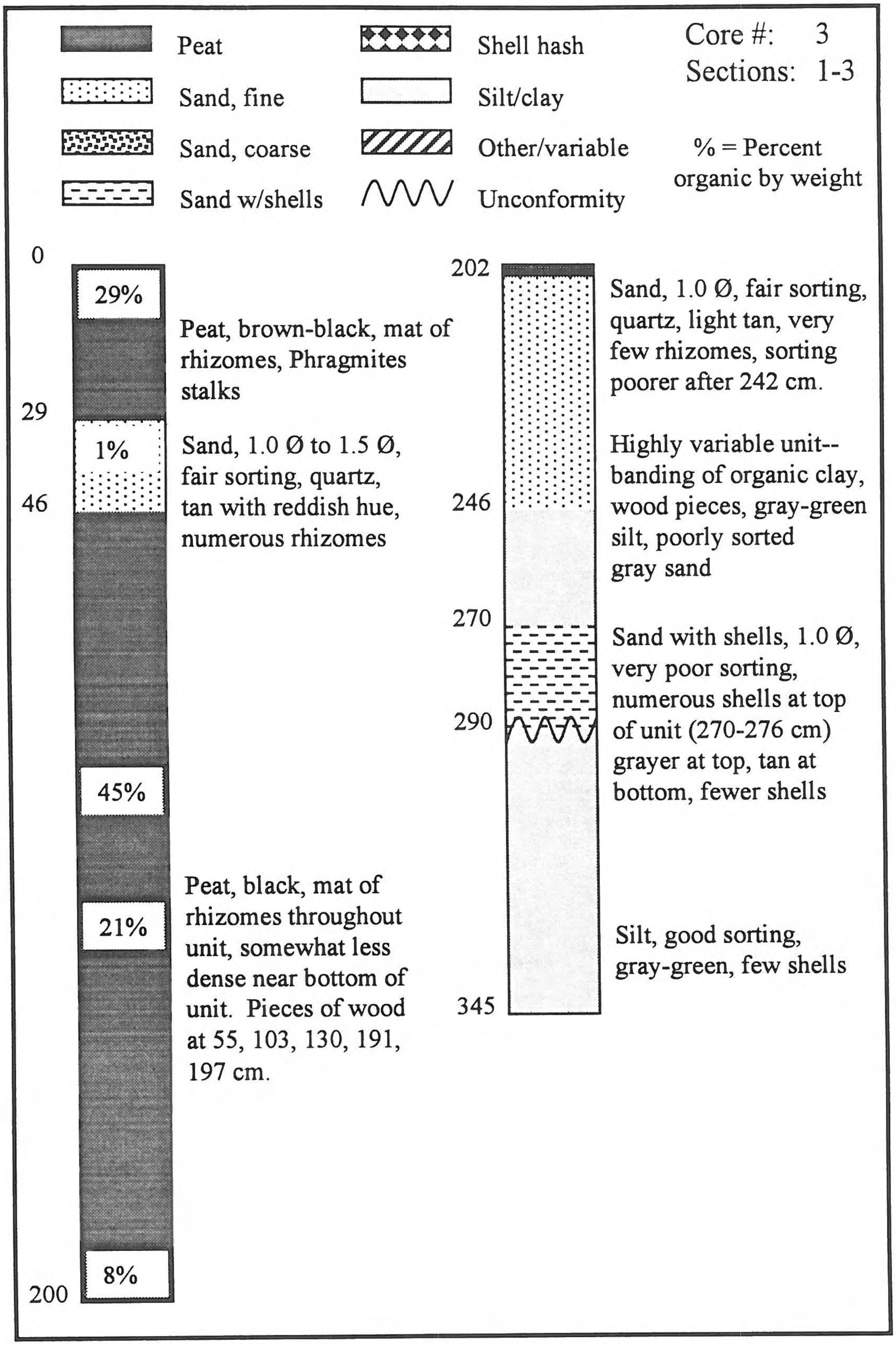
Appendix A

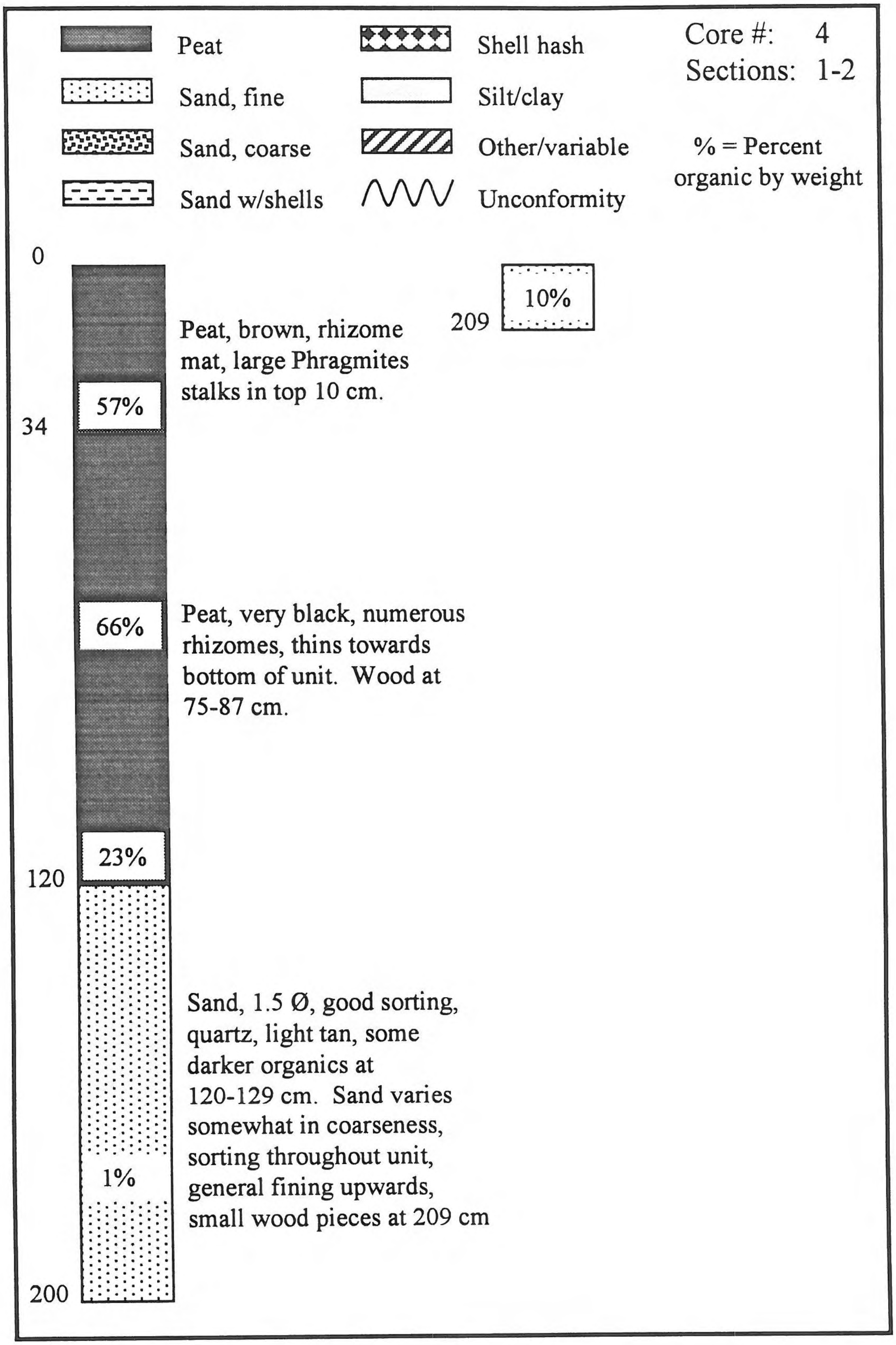
Vibracore Logs

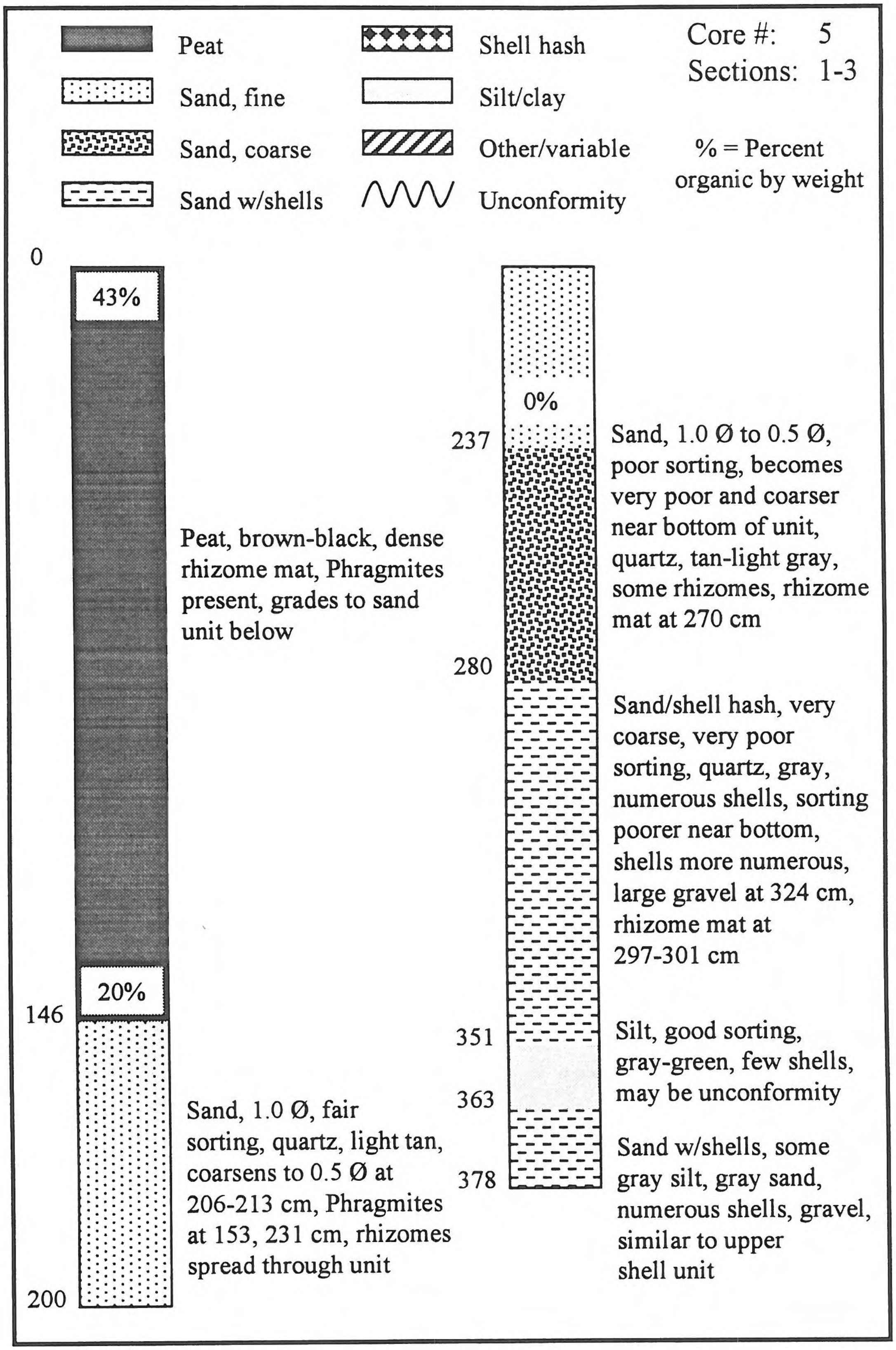
These logs are records of the vibracores taken at Cove Point in the summer of 1996. They have been corrected for compaction; as such, depths do not match the depths observed in the core photographs (Appendix B). Logs are arranged with the topmost part of the core starting in the top left corner of the page. At the end of two meters, the core log starts again on the right side of the page. Because all the cores were uniform after 4 meters (they all sampled the St. Mary's formation if they reached that far) it was decided that only the first 4 meters would be shown. Each unit is described; carbon content test results are noted in the middle of the graphic core display. The legend for the cores requires a few notes of explanation: The division between fine and coarse grained sands is 1.0 phi (∅). Those sediments which were classified as sand with shells were typically coarse grained; thus it was not necessary to have a fine grained sand with shells category. The clay and silt category was used almost exclusively for the Miocene deposits which appeared in many of the cores. This was the only type of clay/silt observed in the stratigraphic logs. Variable is classified only where the mixing of layers is too dense to permit detailed explanations. Grain sizes are given in phi (∅) and millimeters as follows: 2.0 = 0.25 mm; 1.5 = 0.357 mm; 1.0 = 0.500 mm; 0.5 = 0.707 mm; 0.0 = 1.000 mm; -0.5 = 1.414 mm; -1.0 = 2.000 mm.

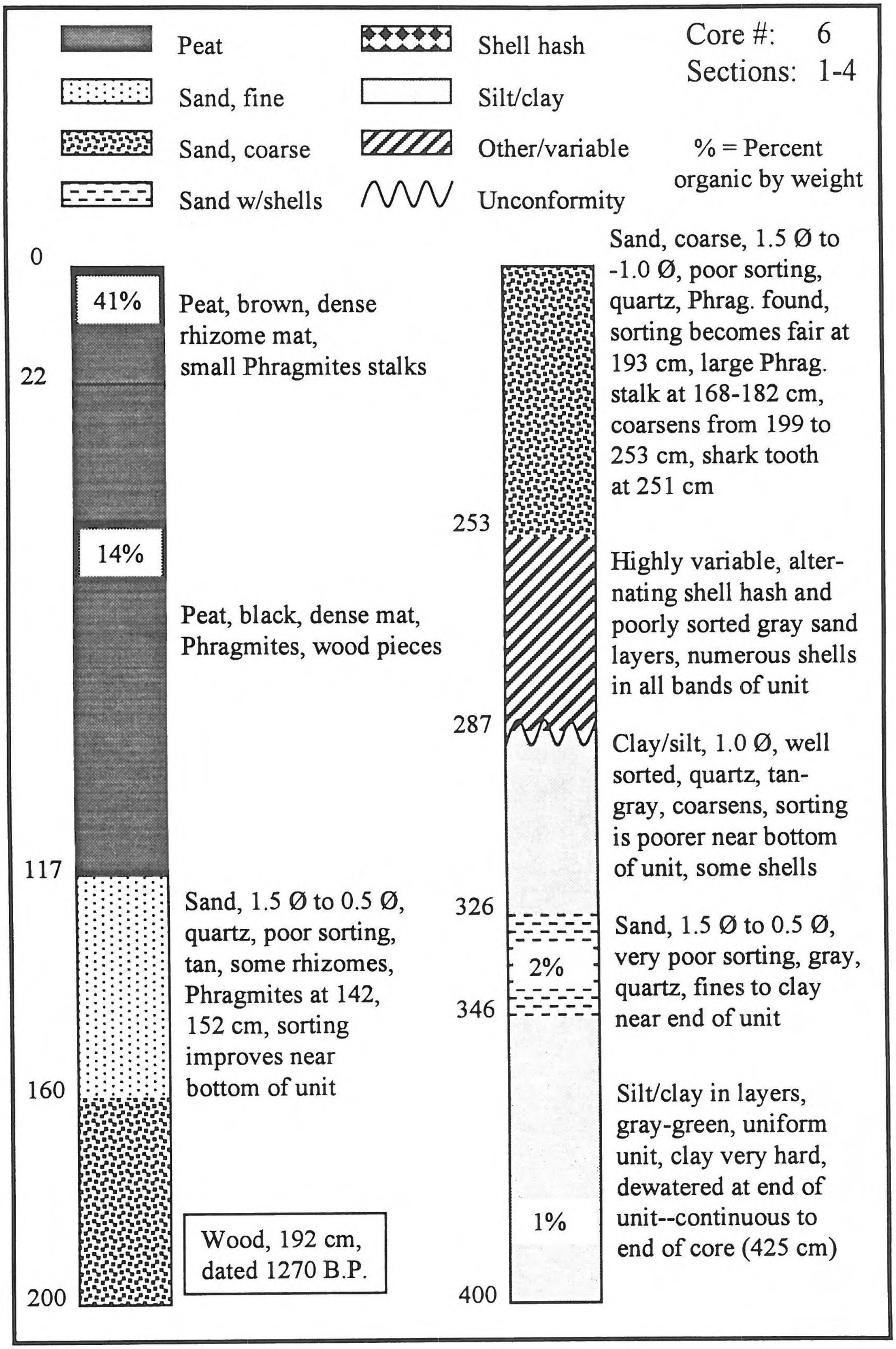

Peat
Sand, fine
Sand, coarse
Sand w/shells
Shell hash
Silt/clay
Other/variable
Unconformity
Core #: 1
Sections: 1-4
% = Percent organic by weight
0
120
148
200
37%
32%
1%
Peat, brown, water drained when core was opened.
Peat, brown, mat of rhizomes, numerous Phragmites stalks. Shades to blacker near bottom of unit
Sand, 1.0 Ø, well-sorted, quartz, light tan-orange, some black organics. Phragmites stalks at 189 cm.
2%
248
299
386
Sand with shells, poorly sorted, quartz, gray, (almost shell hash), quartz sand, few rhizomes.
Silt/clay, well sorted, gray-green, few shells, some interbedding with layers of higher clay content


Peat
Sand, fine
Sand, coarse
Sand w/shells
Shell hash
Silt/clay
Other/variable
Unconformity
Core #: 2
Sections: 1-2
% = Percent organic by weight
0
54%
16%
43%
21%
10%
154
200
Peat, black, dense mat of rhizomes, Phragmites apparent in several parts of unit.
Sand, 1.5 Ø to 1.0 Ø, quartz, poor sorting, tan, slight reddish cast, some black organics, some smaller shells. Dense rhizome cluster at 192 cm.
221
226
241
21%
15%
Charcoal, 223 cm, dated 1710 B.P.
Silt/clay, well sorted, gray-green, banded with denser clay layers, wood and sand also layered in unit.

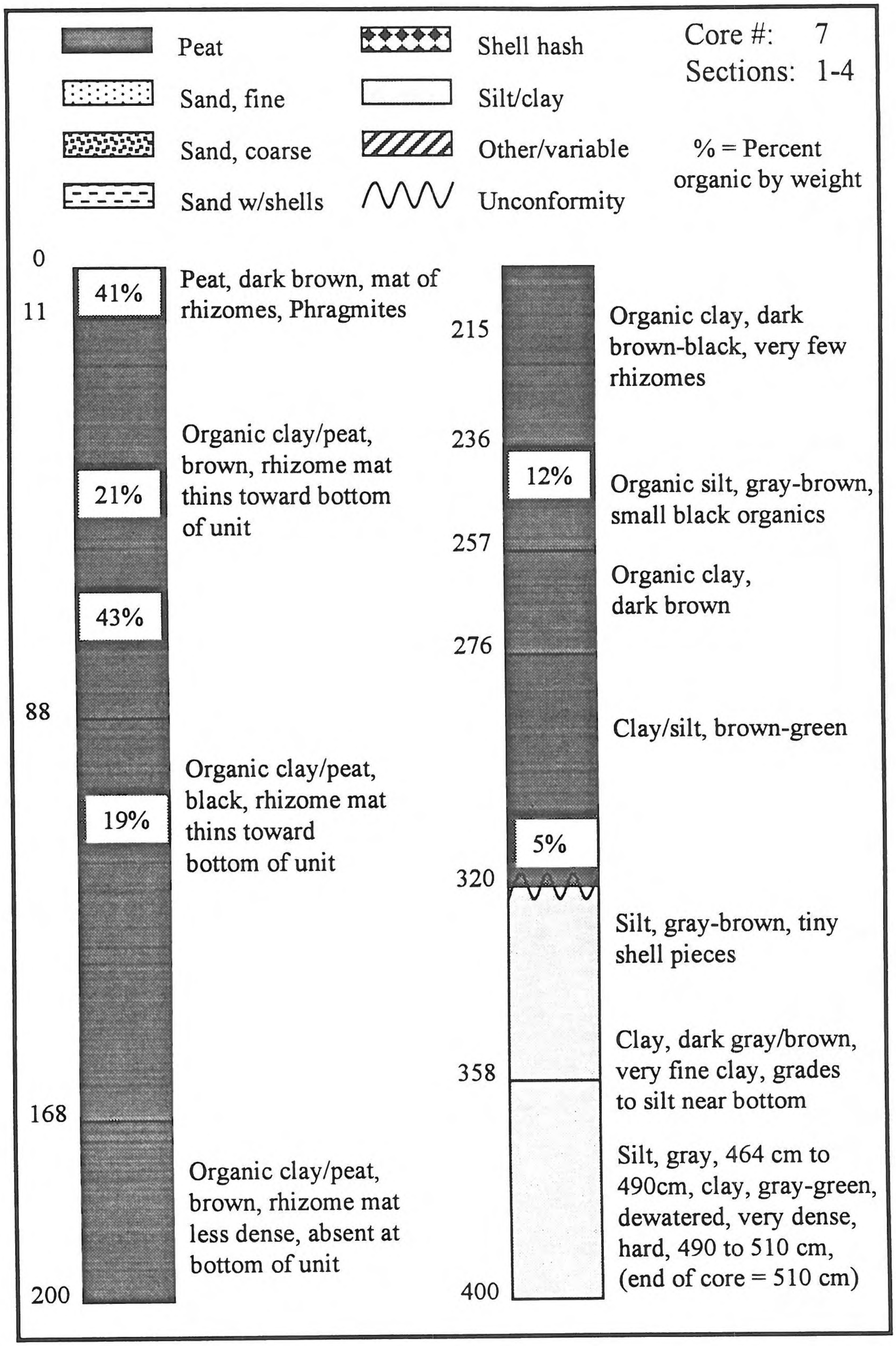

Peat
Shell hash
Core #: 3
Sections: 1-3
Sand, fine
Silt/clay
Sand, coarse
Other/variable
% = Percent organic by weight
Sand w/shells
Unconformity
0
29%
Peat, brown-black, mat of rhizomes, Phragmites stalks
29
1%
Sand, 1.0 Ø to 1.5 Ø, fair sorting, quartz, tan with reddish hue, numerous rhizomes
46
45%
21%
Peat, black, mat of rhizomes throughout unit, somewhat less dense near bottom of unit. Pieces of wood at 55, 103, 130, 191, 197 cm.
8%
200
202
Sand, 1.0 Ø, fair sorting, quartz, light tan, very few rhizomes, sorting poorer after 242 cm.
246
Highly variable unit--banding of organic clay, wood pieces, gray-green silt, poorly sorted gray sand
270
Sand with shells, 1.0 Ø, very poor sorting, numerous shells at top of unit (270-276 cm) grayer at top, tan at bottom, fewer shells
290
Silt, good sorting, gray-green, few shells
345

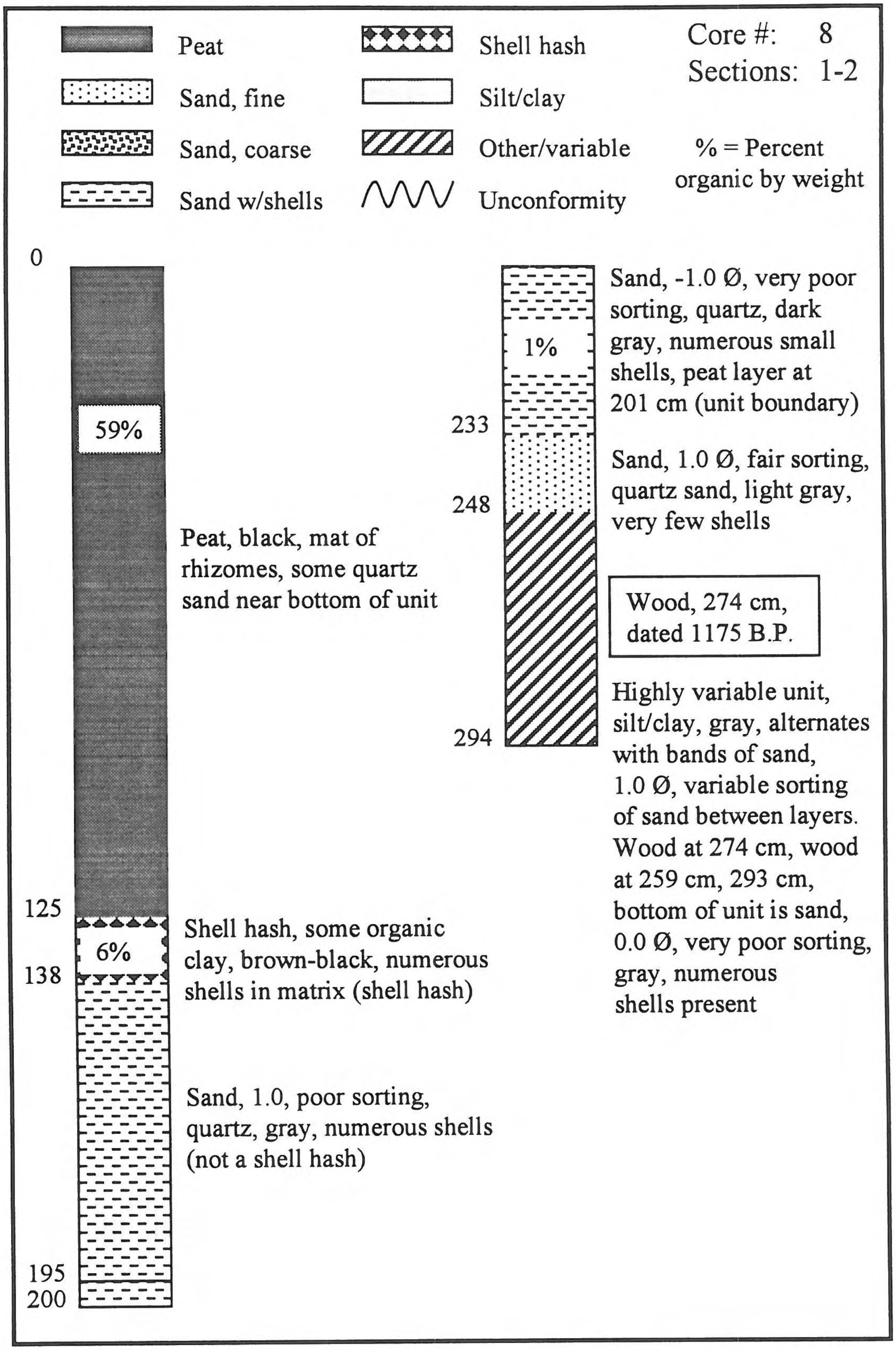

Peat
Sand, fine
Sand, coarse
Sand w/shells
Shell hash
Silt/clay
Other/variable
Unconformity
Core #: 4
Sections: 1-2
% = Percent organic by weight
0
34
120
200
57%
66%
23%
1%
209
10%
Peat, brown, rhizome mat, large Phragmites stalks in top 10 cm.
Peat, very black, numerous rhizomes, thins towards bottom of unit. Wood at 75-87 cm.
Sand, 1.5 Ø, good sorting, quartz, light tan, some darker organics at 120-129 cm. Sand varies somewhat in coarseness, sorting throughout unit, general fining upwards, small wood pieces at 209 cm

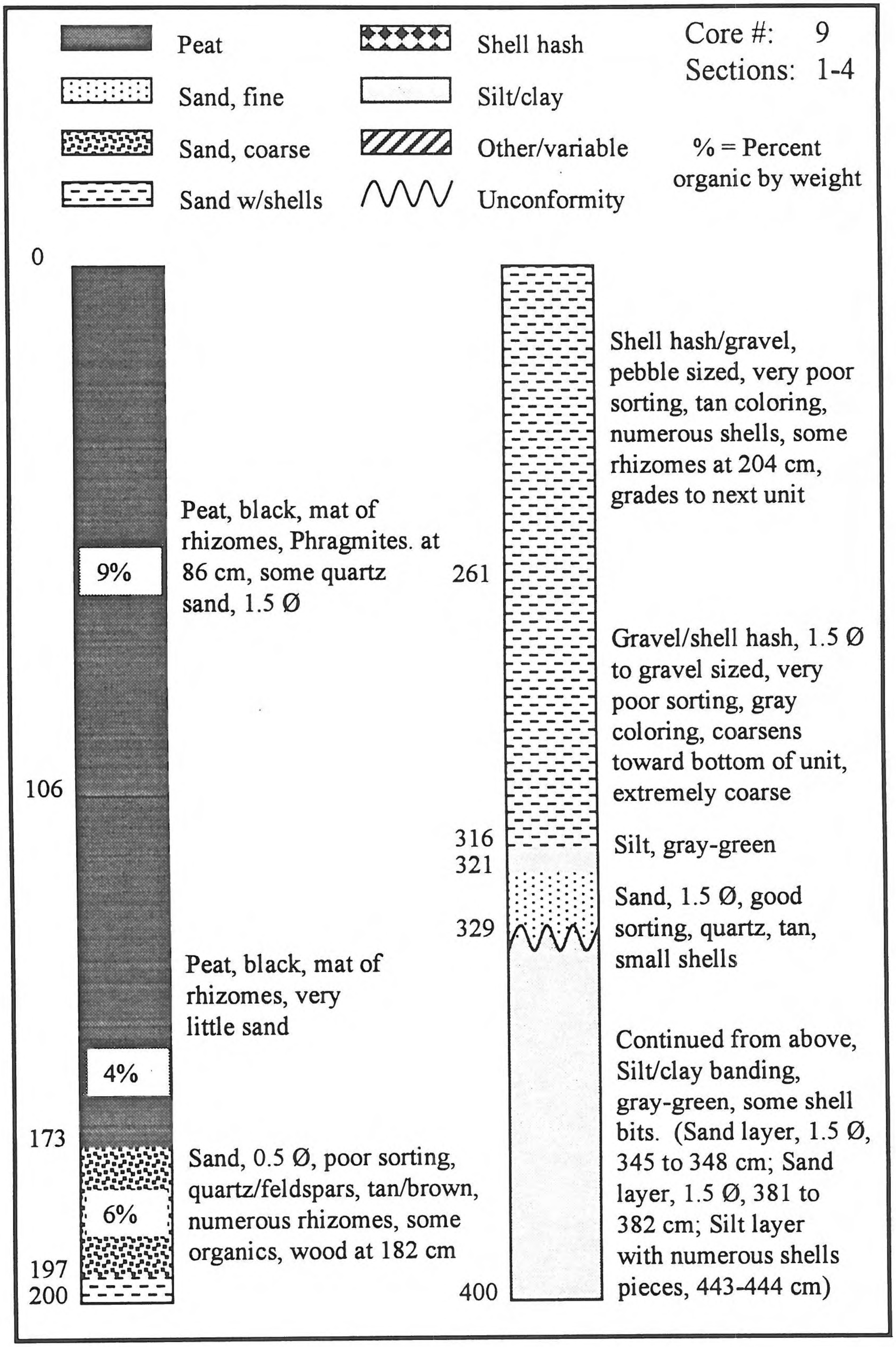

Peat
Sand, fine
Sand, coarse
Sand w/shells
Shell hash
Silt/clay
Other/variable
Unconformity
Core #: 5
Sections: 1-3
% = Percent organic by weight
0
43%
Peat, brown-black, dense rhizome mat, Phragmites present, grades to sand unit below
20%
146
Sand, 1.0 Ø, fair sorting, quartz, light tan, coarsens to 0.5 Ø at 206-213 cm, Phragmites at 153, 231 cm, rhizomes spread through unit
200
0%
237
Sand, 1.0 Ø to 0.5 Ø, poor sorting, becomes very poor and coarser near bottom of unit, quartz, tan-light gray, some rhizomes, rhizome mat at 270 cm
280
Sand/shell hash, very coarse, very poor sorting, quartz, gray, numerous shells, sorting poorer near bottom, shells more numerous, large gravel at 324 cm, rhizome mat at 297-301 cm
351
Silt, good sorting, gray-green, few shells, may be unconformity
363
Sand w/shells, some gray silt, gray sand, numerous shells, gravel, similar to upper shell unit
378

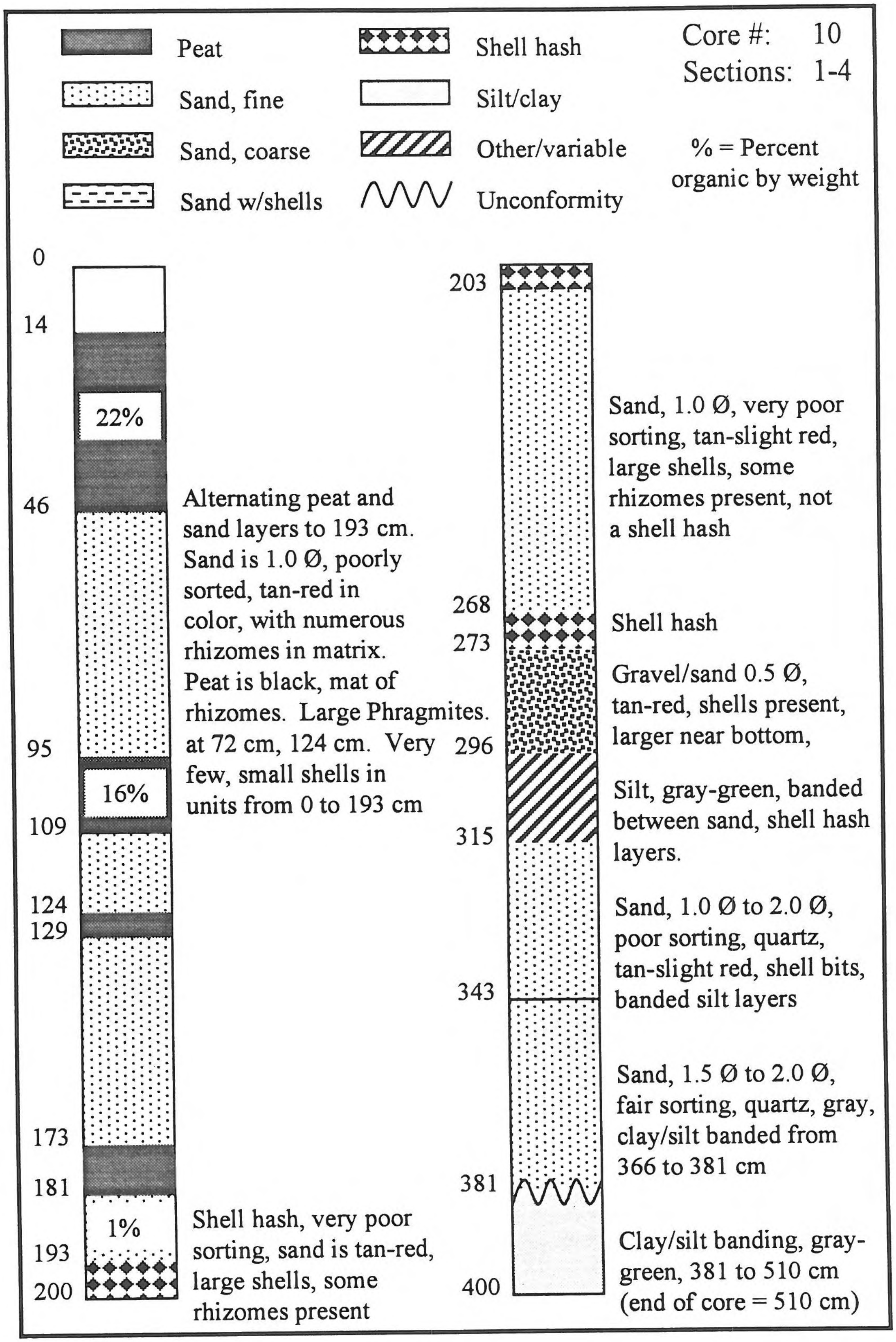


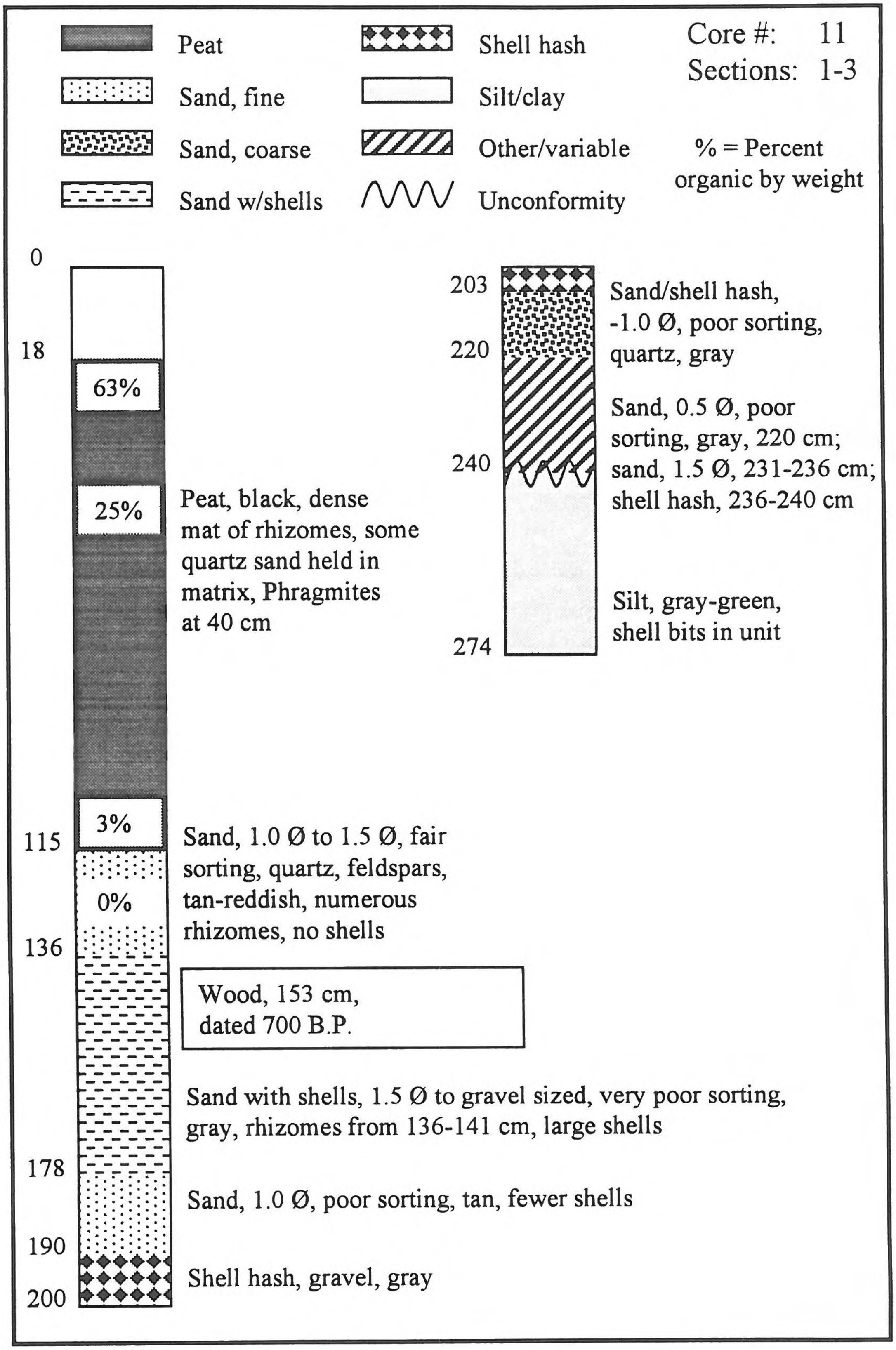
Peat
Sand, fine
Sand, coarse
Sand w/shells
Shell hash
Silt/clay
Other/variable
Unconformity
Core #: 6
Sections: 1-4
% = Percent organic by weight
0
22
117
160
200
41%
14%
Peat, brown, dense rhizome mat, small Phragmites stalks
Peat, black, dense mat, Phragmites, wood pieces
Sand, 1.5 Ø to 0.5 Ø, quartz, poor sorting, tan, some rhizomes, Phragmites at 142, 152 cm, sorting improves near bottom of unit
Wood, 192 cm, dated 1270 B.P.
253
287
326
346
400
2%
1%
Sand, coarse, 1.5 Ø to -1.0 Ø, poor sorting, quartz, Phrag. found, sorting becomes fair at 193 cm, large Phrag. stalk at 168-182 cm, coarsens from 199 to 253 cm, shark tooth at 251 cm
Highly variable, alternating shell hash and poorly sorted gray sand layers, numerous shells in all bands of unit
Clay/silt, 1.0 Ø, well sorted, quartz, tan-gray, coarsens, sorting is poorer near bottom of unit, some shells
Sand, 1.5 Ø to 0.5 Ø, very poor sorting, gray, quartz, fines to clay near end of unit
Silt/clay in layers, gray-green, uniform unit, clay very hard, dewatered at end of unit--continuous to end of core (425 cm)


Peat
Sand, fine
Sand, coarse
Sand w/shells
Shell hash
Silt/clay
Other/variable
Unconformity
Core #: 7
Sections: 1-4
% = Percent organic by weight
0
11
88
168
200
41%
21%
43%
19%
Peat, dark brown, mat of rhizomes, Phragmites
Organic clay/peat, brown, rhizome mat thins toward bottom of unit
Organic clay/peat, black, rhizome mat thins toward bottom of unit
Organic clay/peat, brown, rhizome mat less dense, absent at bottom of unit
215
236
257
276
320
358
400
12%
5%
Organic clay, dark brown-black, very few rhizomes
Organic silt, gray-brown, small black organics
Organic clay, dark brown
Clay/silt, brown-green
Silt, gray-brown, tiny shell pieces
Clay, dark gray/brown, very fine clay, grades to silt near bottom
Silt, gray, 464 cm to 490cm, clay, gray-green, dewatered, very dense, hard, 490 to 510 cm, (end of core = 510 cm)

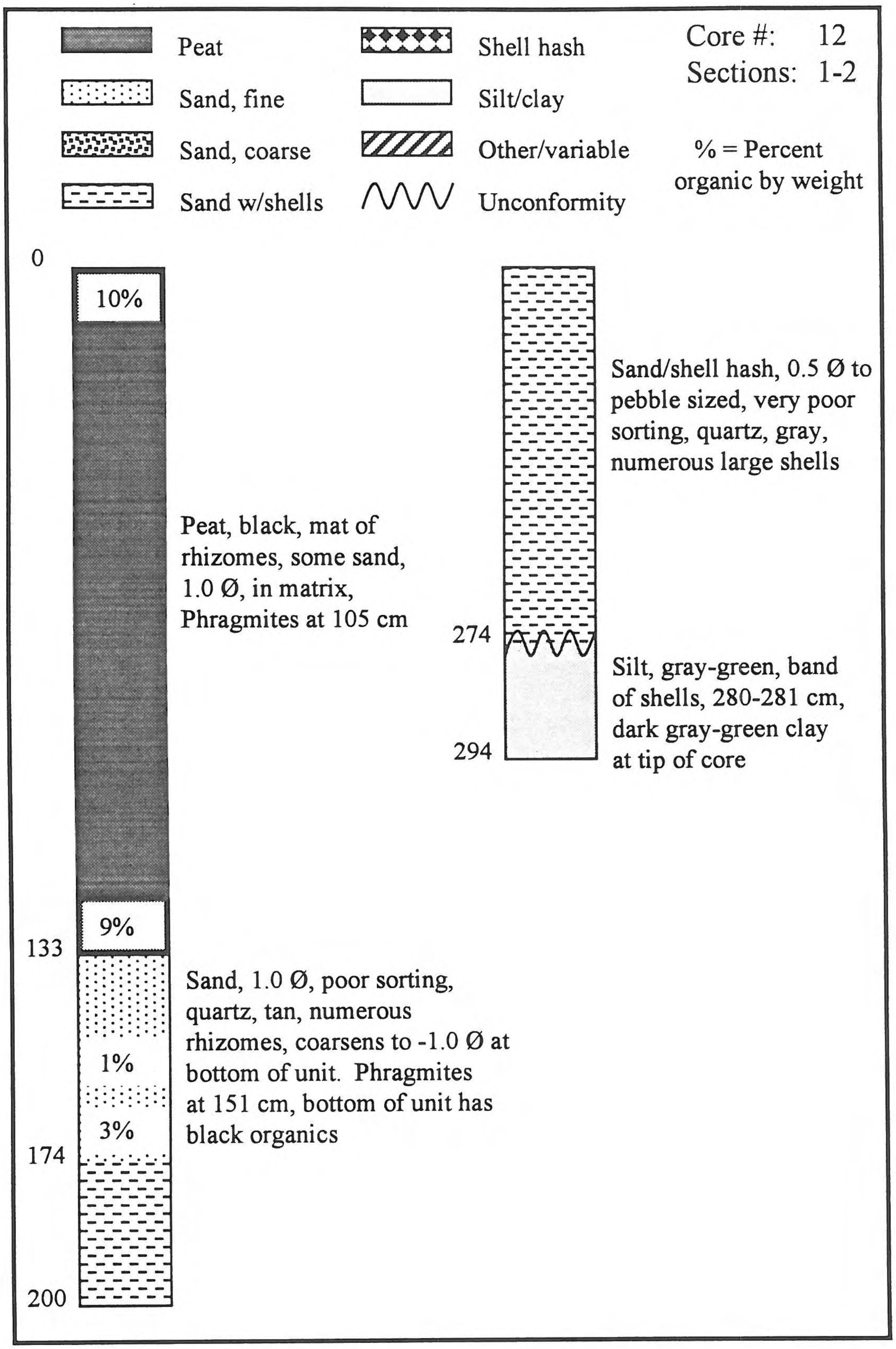

Peat
Sand, fine
Sand, coarse
Sand w/shells
Shell hash
Silt/clay
Other/variable
Unconformity
Core #: 8
Sections: 1-2
% = Percent organic by weight
0
59%
Peat, black, mat of rhizomes, some quartz sand near bottom of unit
125
6%
138
Shell hash, some organic clay, brown-black, numerous shells in matrix (shell hash)
Sand, 1.0, poor sorting, quartz, gray, numerous shells (not a shell hash)
195
200
1%
Sand, -1.0 Ø, very poor sorting, quartz, dark gray, numerous small shells, peat layer at 201 cm (unit boundary)
233
248
Sand, 1.0 Ø, fair sorting, quartz sand, light gray, very few shells
Wood, 274 cm, dated 1175 B.P.
294
Highly variable unit, silt/clay, gray, alternates with bands of sand, 1.0 Ø, variable sorting of sand between layers. Wood at 274 cm, wood at 259 cm, 293 cm, bottom of unit is sand, 0.0 Ø, very poor sorting, gray, numerous shells present

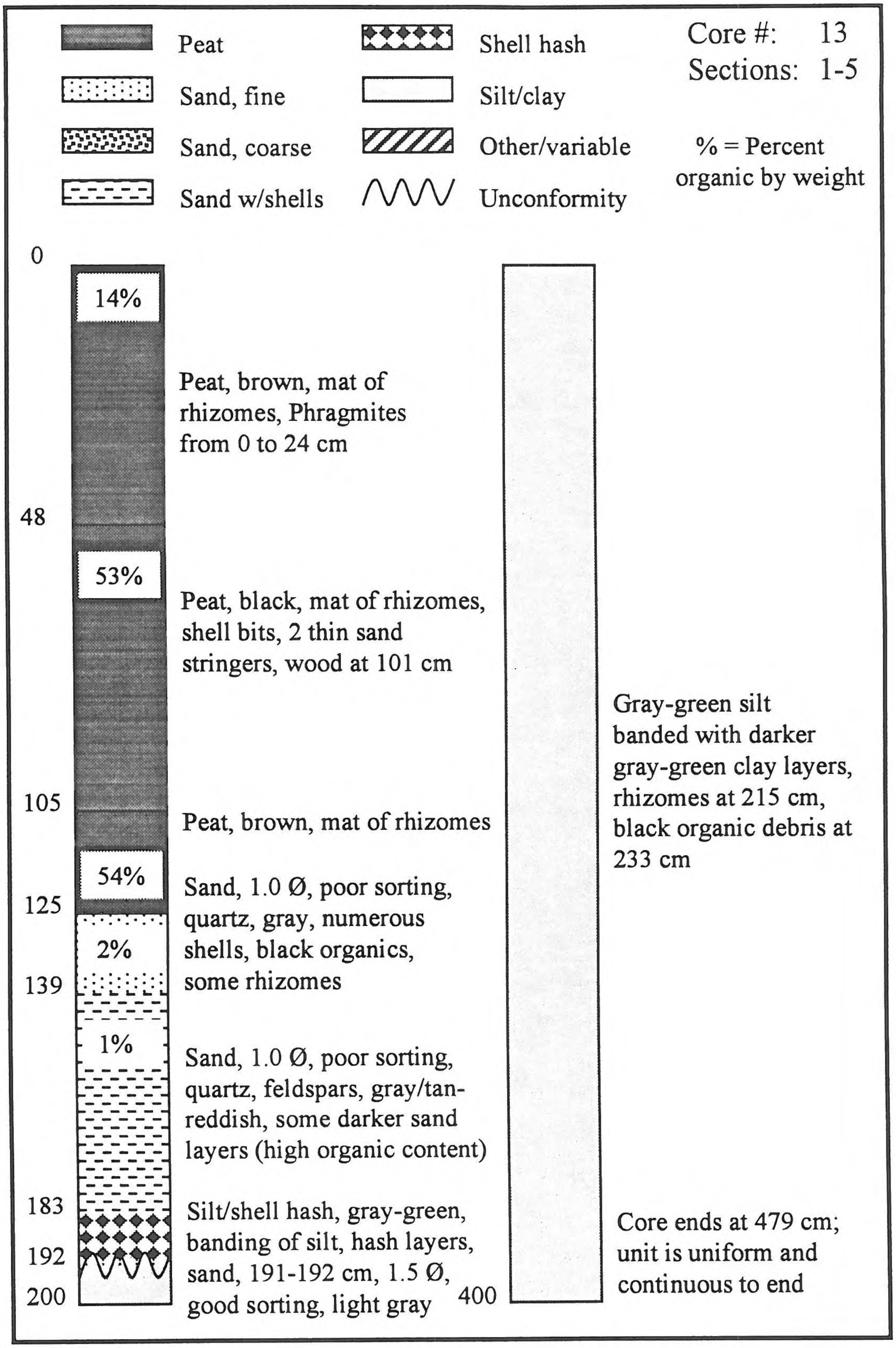

Peat
Sand, fine
Sand, coarse
Sand w/shells
Shell hash
Silt/clay
Other/variable
Unconformity
Core #: 9
Sections: 1-4
% = Percent organic by weight
0
106
173
197
200
9%
4%
6%
Peat, black, mat of rhizomes, Phragmites. at 86 cm, some quartz sand, 1.5 Ø
Peat, black, mat of rhizomes, very little sand
Sand, 0.5 Ø, poor sorting, quartz/feldspars, tan/brown, numerous rhizomes, some organics, wood at 182 cm
261
316
321
329
400
Shell hash/gravel, pebble sized, very poor sorting, tan coloring, numerous shells, some rhizomes at 204 cm, grades to next unit
Gravel/shell hash, 1.5 Ø to gravel sized, very poor sorting, gray coloring, coarsens toward bottom of unit, extremely coarse
Silt, gray-green
Sand, 1.5 Ø, good sorting, quartz, tan, small shells
Continued from above, Silt/clay banding, gray-green, some shell bits. (Sand layer, 1.5 Ø, 345 to 348 cm; Sand layer, 1.5 Ø, 381 to 382 cm; Silt layer with numerous shells pieces, 443-444 cm)

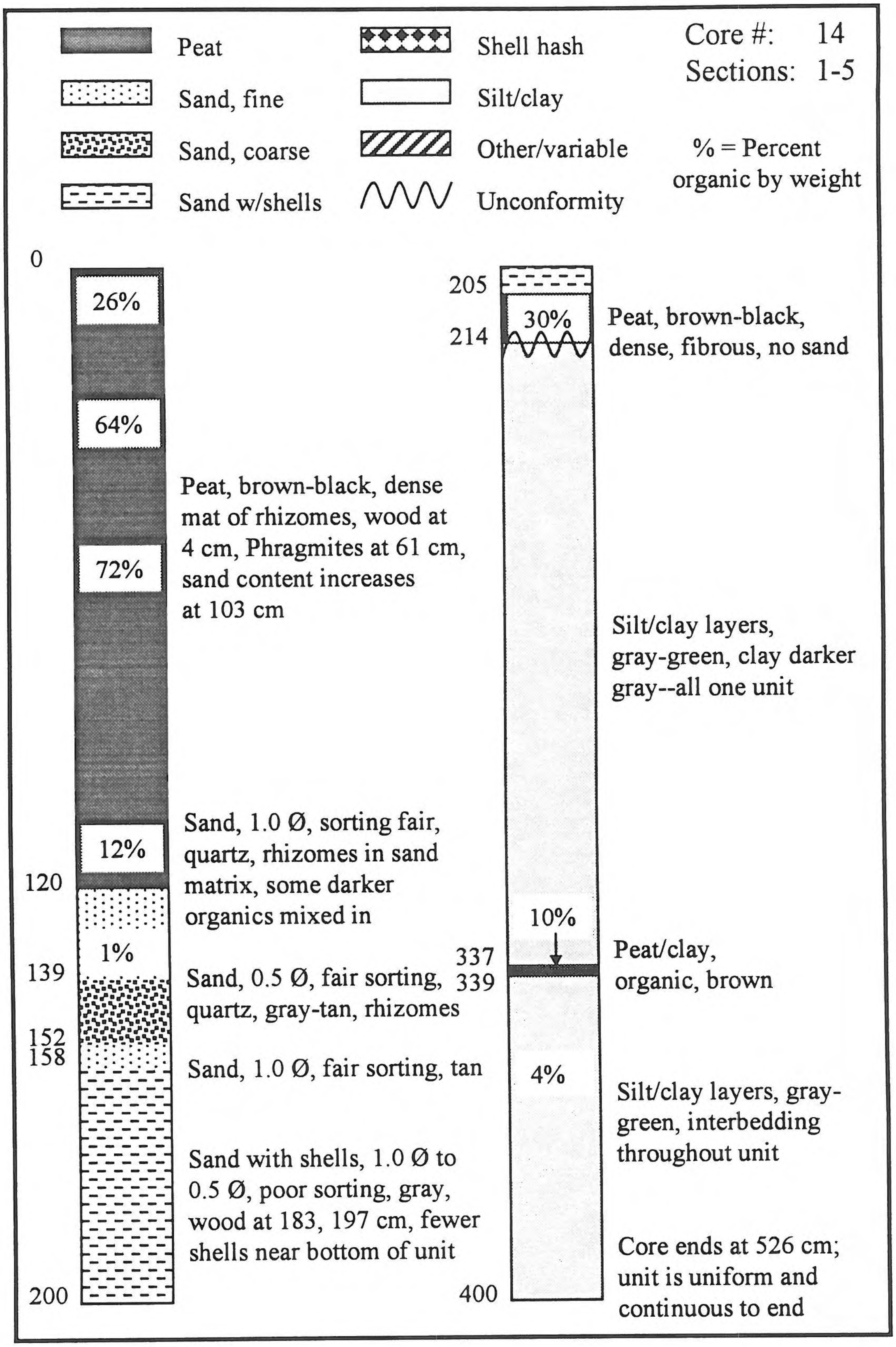

Peat
Sand, fine
Sand, coarse
Sand w/shells
Shell hash
Silt/clay
Other/variable
Unconformity
Core #: 10
Sections: 1-4
% = Percent organic by weight
0
14
22%
46
Alternating peat and sand layers to 193 cm. Sand is 1.0 Ø, poorly sorted, tan-red in color, with numerous rhizomes in matrix. Peat is black, mat of rhizomes. Large Phragmites. at 72 cm, 124 cm. Very few, small shells in units from 0 to 193 cm
95
16%
109
124
129
173
181
1%
193
200
Shell hash, very poor sorting, sand is tan-red, large shells, some rhizomes present
203
Sand, 1.0 Ø, very poor sorting, tan-slight red, large shells, some rhizomes present, not a shell hash
268
Shell hash
273
Gravel/sand 0.5 Ø, tan-red, shells present, larger near bottom,
296
Silt, gray-green, banded between sand, shell hash layers.
315
Sand, 1.0 Ø to 2.0 Ø, poor sorting, quartz, tan-slight red, shell bits, banded silt layers
343
Sand, 1.5 Ø to 2.0 Ø, fair sorting, quartz, gray, clay/silt banded from 366 to 381 cm
381
Clay/silt banding, gray-green, 381 to 510 cm (end of core = 510 cm)
400



Peat
Sand, fine
Sand, coarse
Sand w/shells
Shell hash
Silt/clay
Other/variable
Unconformity
Core #: 11
Sections: 1-3
% = Percent organic by weight
0
18
63%
25%
3%
115
0%
136
178
190
200
Peat, black, dense mat of rhizomes, some quartz sand held in matrix, Phragmites at 40 cm
Sand, 1.0 Ø to 1.5 Ø, fair sorting, quartz, feldspars, tan-reddish, numerous rhizomes, no shells
Wood, 153 cm, dated 700 B.P.
Sand with shells, 1.5 Ø to gravel sized, very poor sorting, gray, rhizomes from 136-141 cm, large shells
Sand, 1.0 Ø, poor sorting, tan, fewer shells
Shell hash, gravel, gray
203
220
240
274
Sand/shell hash, -1.0 Ø, poor sorting, quartz, gray
Sand, 0.5 Ø, poor sorting, gray, 220 cm; sand, 1.5 Ø, 231-236 cm; shell hash, 236-240 cm
Silt, gray-green, shell bits in unit


Peat
Sand, fine
Sand, coarse
Sand w/shells
Shell hash
Silt/clay
Other/variable
Unconformity
Core #: 12
Sections: 1-2
% = Percent organic by weight
0
10%
Peat, black, mat of rhizomes, some sand, 1.0 Ø, in matrix, Phragmites at 105 cm
9%
133
Sand, 1.0 Ø, poor sorting, quartz, tan, numerous rhizomes, coarsens to -1.0 Ø at bottom of unit. Phragmites at 151 cm, bottom of unit has black organics
1%
3%
174
200
Sand/shell hash, 0.5 Ø to pebble sized, very poor sorting, quartz, gray, numerous large shells
274
Silt, gray-green, band of shells, 280-281 cm, dark gray-green clay at tip of core
294


Peat
Sand, fine
Sand, coarse
Sand w/shells
Shell hash
Silt/clay
Other/variable
Unconformity
Core #: 13
Sections: 1-5
% = Percent organic by weight
0
48
105
125
139
183
192
200
14%
53%
54%
2%
1%
Peat, brown, mat of rhizomes, Phragmites from 0 to 24 cm
Peat, black, mat of rhizomes, shell bits, 2 thin sand stringers, wood at 101 cm
Peat, brown, mat of rhizomes
Sand, 1.0 Ø, poor sorting, quartz, gray, numerous shells, black organics, some rhizomes
Sand, 1.0 Ø, poor sorting, quartz, feldspars, gray/tan-reddish, some darker sand layers (high organic content)
Silt/shell hash, gray-green, banding of silt, hash layers, sand, 191-192 cm, 1.5 Ø, good sorting, light gray
400
Gray-green silt banded with darker gray-green clay layers, rhizomes at 215 cm, black organic debris at 233 cm
Core ends at 479 cm; unit is uniform and continuous to end


Peat
Sand, fine
Sand, coarse
Sand w/shells
Shell hash
Silt/clay
Other/variable
Unconformity
Core #: 14
Sections: 1-5
% = Percent organic by weight
0
26%
64%
72%
12%
120
1%
139
152
158
200
Peat, brown-black, dense mat of rhizomes, wood at 4 cm, Phragmites at 61 cm, sand content increases at 103 cm
Sand, 1.0 Ø, sorting fair, quartz, rhizomes in sand matrix, some darker organics mixed in
Sand, 0.5 Ø, fair sorting, quartz, gray-tan, rhizomes
Sand, 1.0 Ø, fair sorting, tan
Sand with shells, 1.0 Ø to 0.5 Ø, poor sorting, gray, wood at 183, 197 cm, fewer shells near bottom of unit
205
214
30%
10%
337
339
4%
400
Peat, brown-black, dense, fibrous, no sand
Silt/clay layers, gray-green, clay darker gray--all one unit
Peat/clay, organic, brown
Silt/clay layers, gray-green, interbedding throughout unit
Core ends at 526 cm; unit is uniform and continuous to end