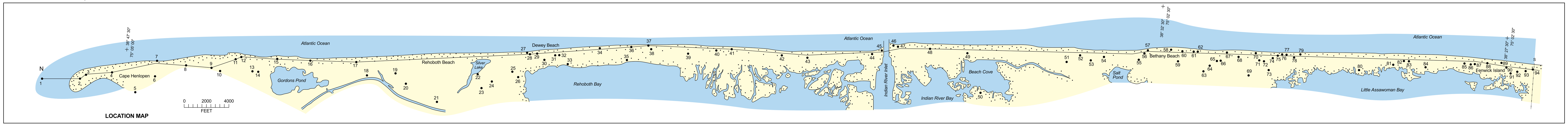

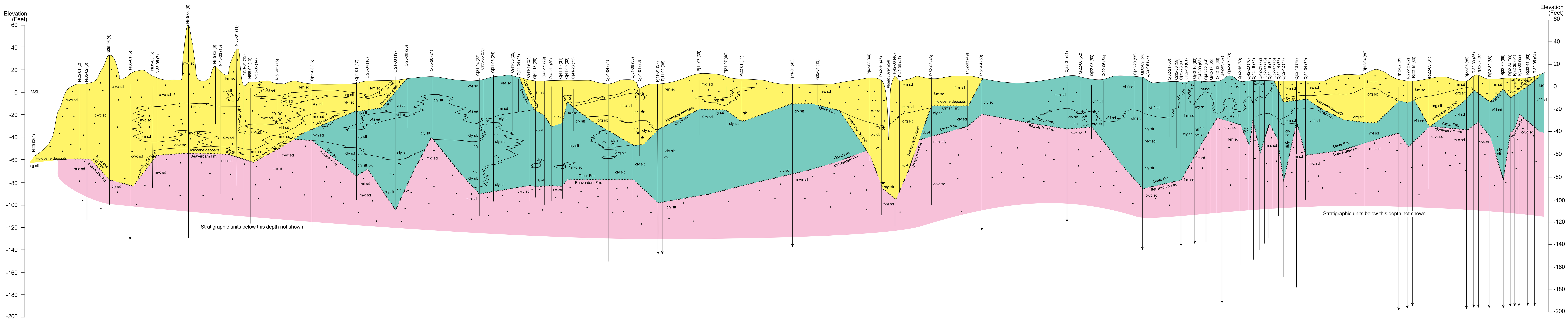

CROSS SECTION OF PLIOCENE AND QUATERNARY DEPOSITS ALONG THE ATLANTIC COAST OF DELAWARE

By
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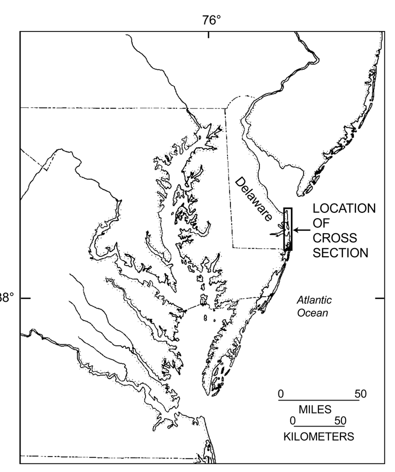
1999



EXPLANATION

Ni25-02 (1) Delaware Geological Survey borehole identifier. Number in parenthesis refers to location of borehole on map above cross section.

• 5 Location of borehole

* Radiocarbon date (Ramsey and Baxter, 1996).

DGSID	Lab ID	Calib R.C. Date	Sample Elev.	Sample Type
		(Years BP)	(ft)	
Ni35-03	R-4103	7860	-60	peat
Nj51-02	R-4104	174	-0.167	peat
Nj51-02	R-4104	1915	-20	shell
Nj51-02	R-4104	3168	-23	shell
Nj51-02	R-4104	28400	-48.5	plant
Oj51-01	R-4101	272	-0.7	peat
Oj51-01	R-4101	2761	-19.3	shell
Oj51-01	R-4101	6282	-36.6	wood
Oj51-01	R-4101	7016	-42.3	peat
Pj22-01	R-4111	3063	-19.4	peat
Pj22-01	R-4111	3116	-19.4	peat
Pj42-11	R-4115	3736	-35.3	shell
Pj42-11	R-4115	12561	-84.3	basal peat
Qj22-06	TEM-204	45000	-24.6	shell hash
Qj22-08	I-5207	39900	-25	wood
Qj42-09	Beta 18-32	31750	-37.7	organic silt

AA Amino acid racemization analysis (Groot and others, 1990).

Shell

Unconformity

vf-f sd Very fine to fine sand (may contain varying amounts of silt and some organic material).

f-m sd Fine to medium sand.

m-c sd Medium to coarse sand (may contain pebbles and gravel beds).

c-vc sd Coarse to very coarse sand (may contain pebbles and gravel beds).

org slt Organic-rich silt (contains plant fragments and disseminated organic material; may in places be a peat).

cly slt Clayey silt (commonly identified in well logs as clay or mud).

cly sd Clayey sand (contains varying amounts of silt; may be identified in well logs as mud).

Sand suitable for beach nourishment.

Lithologic contact

Holocene Deposits

Omar Formation

Beaverdam Formation

DISCUSSION

Introduction

Exploration for sand resources for beach nourishment has led to an increase in the amount of geologic data available from areas offshore Delaware's Atlantic Coast. These data are in the form of cores, core logs, and seismic reflection profiles. In order to provide a geologic context for these offshore data, this cross section has been constructed from well and borehole data along Delaware's Atlantic coastline from Cape Henlopen to Fenwick Island. Placing the offshore data in geologic context is important for developing stratigraphic and geographic models for predicting the location of stratigraphic units found offshore that may yield sand suitable for beach nourishment. The units recognized onshore likely extend offshore to where they are truncated by younger units or by the present seafloor.

This cross section emphasizes lithology. The distribution of lithologies onshore indicates their potential distribution offshore where they crop out at the seafloor or are overlain by thin marine deposits of Holocene age. Because of the scale represented on the cross section, lithology is necessarily generalized, and all the details of lithology from a particular borehole are not shown. The continuity of lithology between boreholes allows for the recognition of lithologic trends within stratigraphic units.

Previous Work

Cross sections of the Holocene portion of the Atlantic Coast include those of John (1977) and Kraft et al. (1987). They show detail only in the Holocene-age sediments; everything beneath is shown only as pre-Holocene without any detail of stratigraphic unit or lithology. Miller (1971) included a cross section from Cape Henlopen to Fenwick Island that showed the geology in terms of stratigraphic units, aquifers, and aquicludes. No detailed lithology was shown. More recent stratigraphic studies in southern Delaware (Andres, 1986; Ramsey and Schenck, 1990; Ramsey, 1993; Andres and Ramsey, 1995) have identified the major stratigraphic units underlying coastal Delaware and have provided information regarding their ages and stratigraphic relationships.

Stratigraphy

Beaverdam Formation

The oldest unit shown on the cross section is the Beaverdam Formation of latest Miocene to Late Pliocene in age on the bases of palynomorphs examined from fine-grained sediments within the unit (Groot et al.,1990). The formation is composed primarily of fine to coarse sand with interbeds of fine silty sand to sandy and clayey silt (Benson, 1990) deposited in fluvial to estuarine environments. Gravel and pebbly sand beds are common. In the coastal areas of Delaware, the Beaverdam has a characteristic fining-upward signature on gamma logs (Andres, 1986; Benson, 1990).

Omar Formation

The Omar Formation is the principal unit of Pleistocene age in coastal Delaware (Jordan, 1974). On the bases of studies of palynomorphs and aminostratigraphy of shell material from the Omar, the unit is considered to range in age from late Pliocene to late Pleistocene (Groot et al., 1990) and to have been deposited during several distinct transgressive events associated with rising sea level and high sea stands. For this cross section, the Omar is mapped as one lithologic unit rather than separate depositional units associated with different sea level events. The dominant lithology within the Omar in coastal Delaware is a gray clayey sand to sandy silt that contains scattered shell and organic-rich beds containing plant fragments. Scattered beds of fine sand and silty fine sand are common. Less common are thin beds of medium to coarse sand (Benson, 1990). The Omar was deposited in lagoonal, tidal delta, marsh, and spit environments, much like that of the present coastal system.

Holocene deposits

The Holocene deposits consist of fine to coarse sand, sandy to clayey silt, silty clay, and organic rich clayey silt beds with abundant plant fragments. These sediments were deposited over the last 10,000 years during the rise of sea level in a transgressive barrier-lagoon system (John, 1977; Kraft and John, 1979; Chrzastowski, 1986; Kraft et al., 1987). Radiocarbon dates from organic remains from these deposits are listed in Ramsey and Baxter (1996).

Unconformities

The stratigraphic boundaries between the units are unconformities generated by subaerial exposure during low stands of sea level during the Pliocene and Pleistocene and by ravinement surfaces associated with transgressive systems during sea level rise. The unconformities are recognized on the bases of contrasting lithogies, age relationships, weathering horizons, and differences in compaction and fossil content.

Sand Resources

Analysis of distribution of lithologies within the Quaternary units of coastal Delaware indicates that they are not particularly good sources of sand for beach nourishment material. The units are composed primarily of fine-grained sediments deposited in marsh and lagoonal environments. The largest body of sand is the Cape Henlopen spit, formed by the path of movement of sand along the shoreline and out into the mouth of the Delaware Bay during the Holocene (Kraft et al., 1978). Another area of abundant sand is adjacent to the Indian River Inlet. This area is composed of sand deposited in the flood and ebb tidal shoals associated with the past lagoonal inlets of Rehoboth and Indian River bays. Seismic reflection profiles and cores offshore of the inlet indicate that sandy units do underlie the seafloor in this area.

The Omar Formation appears to be less promising as a source of sand. Much of the unit is composed of relatively fine sand and silt. Where sand in the Omar is common, it is in most places close to present sea level. Sand is less common at depths greater than 20 ft below sea level. These sandy deposits have been removed by shoreface and nearshore erosion within a few hundred feet offshore of the present shoreline where water depths are greater than 20 ft.

The Beaverdam Formation is the unit most likely to be a source of sand offshore. The unit is dominated by sand, especially in the interval between 40 and 100 ft below sea level. The formation extended offshore crops out on the sea floor over a distance of several miles offshore. Colors and textures of these sands are similar to those sands dredged in 1988 from about 2.5 miles off Fenwick Island for beach nourishment.

Acknowledgments

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