DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN FILE REPORT 81-720

ISOPACH MAP OF HOLOCENE SEDIMENTARY UNITS

The three Holocene sedimentary units were mapped because they are seismically distinct and because their geotechnical properties probably differ from those of the underlying sediment. The data used in this interpretation consist of 5,320 line kilometers of 3.5-kHz echograms. The lithologic composition of these units is determined from visual core descriptions of approximately 64 samples in the survey area. These were collected from the U.S. Geological Survey's R V Sea Sounder in 1976, 1977, and 1978, and the R V Karluk in 1978 (Nelson and Larsen, written communications, 1981). Time measurements were converted to sediment thickness by using a velocity of 1,600 m/s. Cross sections were constructed directly from seismic lines 123 and 164 using an assumed velocity of 1,500 m/s for the water column. Estimated error in hand digitizing depths from seismic sections is 0.4 m for the sediment and 0.35 m for the water column.

DESCRIPTION OF MAP UNITS

Qs_1 UPPER HOLOCENE UNIT

Seismic reflection characteristics--This unit is acoustically transparent and is bounded by the sea-floor reflection along its top and a distinctly coherent, smooth reflector along its base.

Sample characteristics--A light-colored, well-sorted, moderately well-rounded, fine sand near shore grades into an olive-gray, fine-sandy silt offshore. Organic carbon occurs in various amounts throughout the unit as lenses of peat or as thin, organic-rich silt layers.

Distribution--The unit forms a prograding wedge that extends seaward from the Yukon Delta. The thickness of the unit ranges from 0 at its seaward edge to 2 m near the delta and averages 1.5 m. Because the unit is relatively thin, only its areal distribution (not its thickness) was mapped.

This deposit conformably overlies the middle Holocene unit (Qs_2) and unconformably overlies the lower Holocene unit (Qs_3) where the middle Holocene unit is not present. Holocene sedimentation rates in the area have been estimated at 52 to 58 cm per 1,000 years (Knebel and Creager, 1973; Nelson and Creager, 1977). Based on these rates and the distribution and thickness of this unit, it was determined that the accumulation began when the Yukon Delta became established in its present location about 2,500 years ago (McDougall, 1980; Nelson, 1980). The limited amount of geotechnical data indicates that the unit is competent; however, local accumulations of organic material tend to reduce its shear strength (Olsen and others, 1980).

Qs_2 MIDDLE HOLOCENE UNIT

Seismic reflection characteristics--This unit is acoustically transparent except for local areas to the east that appear acoustically diffuse. It is bounded along its top by the sea-floor reflection or by the overlying Qs_1 unit, where present, and by a discontinuous reflector that defines its base. The basal reflector appears choppy or hummocky in the west and sharp or slightly fuzzy in the east.

Sample characteristics--Dark-gray, clayey silt with mica and sand laminations in the west grades into an olive-gray, silty sand with mica and clay lenses at the extreme eastern extent of the unit. Traces of organic matter are found throughout the unit.

Distribution--The unit forms a sheet which extends northward from the Yukon Delta. The observed thickness of the unit ranges from 5.6 m near the delta to 1.2 m at its northern extent and averages 3 m.

This deposit conformably overlies the lower Holocene unit (Qs_3). The basal reflector of the unit is interpreted as corresponding to the top of a regional, organic-rich (peat) layer within the lower Holocene unit. Core descriptions indicate that the unit is generally competent.

Qs_3 LOWER HOLOCENE UNIT

Seismic reflection characteristics--This unit is predominantly acoustically transparent in the eastern third of the survey area and becomes intermittently diffuse over the rest of the area. Internal reflectors are incoherent, discontinuous, and subparallel in the northeast corner. The unit is bounded along its top by the sea-floor reflection or by one of the overlying units, where present, and along its base by a discontinuous reflector. The basal reflector appears choppy or hummocky in the center of the area and sharp or slightly fuzzy in the northeast, northwest, and southwest corners.

Sample characteristics--Olive-gray, clayey silt with sandy horizons near the center of the survey area grades into an olive-gray, very fine sandy silt to fine sand in the northeast, northwest, and southwest corners of the area. The sand content generally increases with depth. A regional, organic-rich (peat) layer occurs at the top of the unit.

Distribution--The maximum thickness of this wedge-shaped unit is 10.5 m near the delta. This unit underlies portions of unit Qs_2; however, in order to display isopachs of both units on the same map while maintaining the most information, a change of horizon boundary was chosen to separate the units.

This unit is the oldest and the most extensive Holocene deposit mapped. The regional, organic-rich (peat) layer at the top of the unit is believed to have formed during a stillstand of the Holocene sea transgression. This stillstand occurred 10 to 12 meters below present sea level. Others have recognized a stillstand at similar depths in the immediate area (Nelson, 1980). Reflection characteristics, stratigraphic position, and limited core data (Olsen and others, 1980) suggest that the basal reflector of Qs_3 is a second, regional, organic-rich (peat) layer. This lower organic-rich (peat) layer may have formed before the Holocene sea transgression, or during an earlier stillstand of the transgression.

The limited amount of geotechnical data indicates that the unit is competent; however, accumulations of organic material tend to reduce its shear strength (Olsen and others, 1980).

REFERENCES

Knebel, H. J., and Creager, J. S., 1973, Yukon River--evidence for extensive migration during the Holocene transgression: Science, v. 179, p. 1230-1232.

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Olsen, H. W., Clukey, E. C., and Nelson, C. H., 1980, Geochemical characteristics of bottom sediments in the northern Bering Sea, 32 p., in Larsen, M. C., Nelson, C. H., and Thor, D. R., eds., Geological, geochemical and geotechnical observations on the Bering Shelf, Alaska: U.S. Geological Survey Open-file report 80-979, 32 p.

OPEN-FILE REPORT SERIES ON NORTON SOUND, ALASKA, 1981

The U.S. Department of the Interior has scheduled for late 1982 Norton Sound, Outer Continental Shelf (OCS) Oil and Gas Lease Sale 57. This map is one of a series of five U.S. Geological Survey maps prepared as part of the prelease investigation of the surface and near-surface geologic environment of Norton Sound. The maps in this series are:

Bathymetric map of Norton Sound, Alaska, by D. A. Steffy, B. W. Turner, and L. D. Lybeck. Open-File Report 81-719, 1 oversized sheet, scale 1:250,000.

Isopach map of Holocene sedimentary units, Norton Sound, Alaska, by D. A. Steffy, B. W. Turner, L. D. Lybeck, and J. T. Roe. Open-File Report 81-720, 1 oversized sheet, scale 1:250,000.

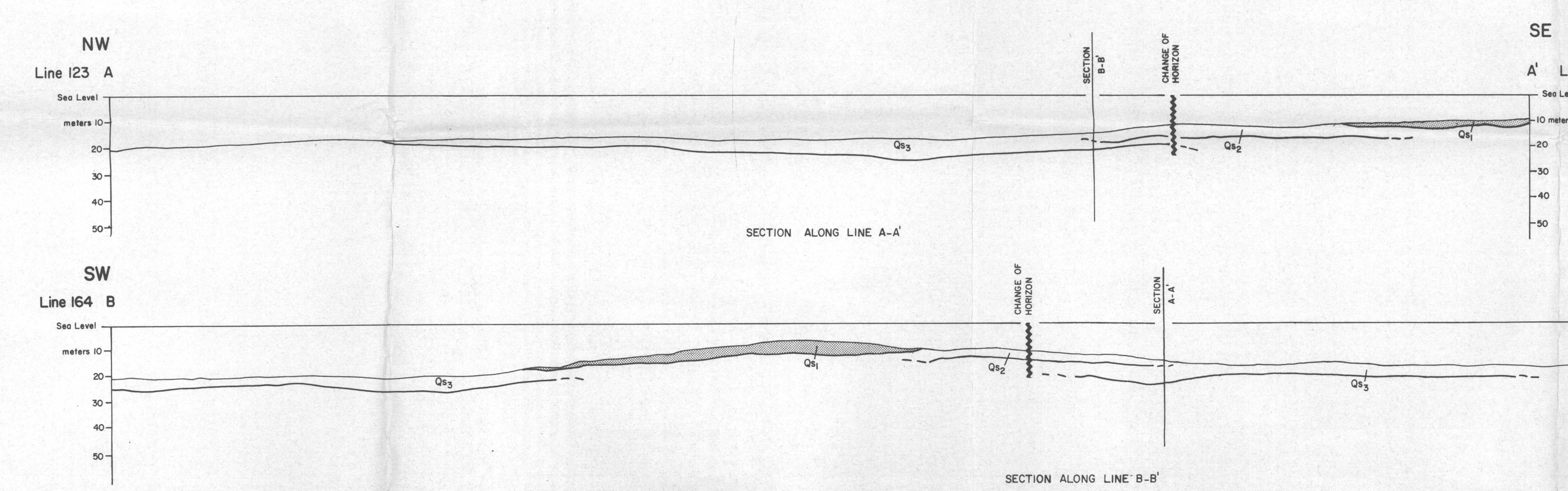
Map showing selected geologic features, Norton Sound, Alaska, by D. A. Steffy and L. D. Lybeck. Open-File Report 81-721, 1 oversized sheet, scale 1:250,000.

Map showing acoustic anomalies and near-surface faulting, Norton Sound, Alaska, by D. A. Steffy and P. J. Hoose. Open-File Report 81-722, 1 oversized sheet, scale 1:250,000.

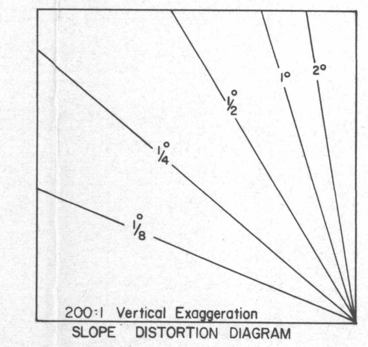
Isopach map of Quaternary and upper Tertiary strata, Norton Sound, Alaska, by P. J. Hoose, D. A. Steffy, and L. D. Lybeck. Open-File Report 81-723, 1 oversized sheet, scale 1:250,000.

The data used to construct these maps were collected in 1980 by Nekton, Inc., under contract to the U.S. Geological Survey. These data include 5,320 line kilometers of multisensored, high-resolution seismic records. The acoustic systems used included a minisleeve exploder or a 15-cubic-inch watergun with both common-depth-point (CDP) processing and analog format, a 4.5-kilojoule (kJ) or an 800-joule minisparker, a 3.5-kHz piezoelectric profiler, a fathometer, and side-scan sonar. The tracklines along which data were collected are shown on each map. Navigation along preplotted survey lines was accomplished using a Cubic Western DM-54 Automatic Ranging Grid Overlay (ARGO) system with an accuracy of 30 meters and a precision of 8 meters. A Motorola Mini-Ranger III system was used to calibrate the ARGO system and as a backup.

A 4.8-km X 4.8-km grid representing the tract boundaries from the Bureau of Land Management Protraction Diagram is superimposed on each map. The tracts to be offered for lease are entirely within the area shown on these maps. For lease purposes the official protraction diagram should be used. Copies of the data, base maps, and digital navigation tapes can be obtained from the National Geophysical and Solar-Terrestrial Data Center (address: NOAA/NGSDC, Code D-621, Boulder, Colorado 80303). Inquiries should refer to OCS Sale 57, data set identifier AK 19184.



Datum is Sea Level
Depth in Meters
Vertical Scale = 1:1,250
Horizontal Scale = 1:250,000
Vertical Exaggeration = 200:1



SOURCE OF SHORELINE FROM BLM PROTRACTION DIAGRAMS NQ3-7, NQ3-8, NP3-1 AND NP3-2. PUBLISHED IN 1976.

SCALE 1:250,000
5 0 5 10 15 20 25 STATUTE MILES
5 0 5 10 15 20 25 KILOMETERS
5 0 5 10 15 NAUTICAL MILES
CONTOUR INTERVAL 1 METER

MAP PROJECTION UTM CLARKE 1866 SPHEROID, ZONE 3.

ISOPACH MAP OF HOLOCENE SEDIMENTARY UNITS, NORTON SOUND, ALASKA

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1981