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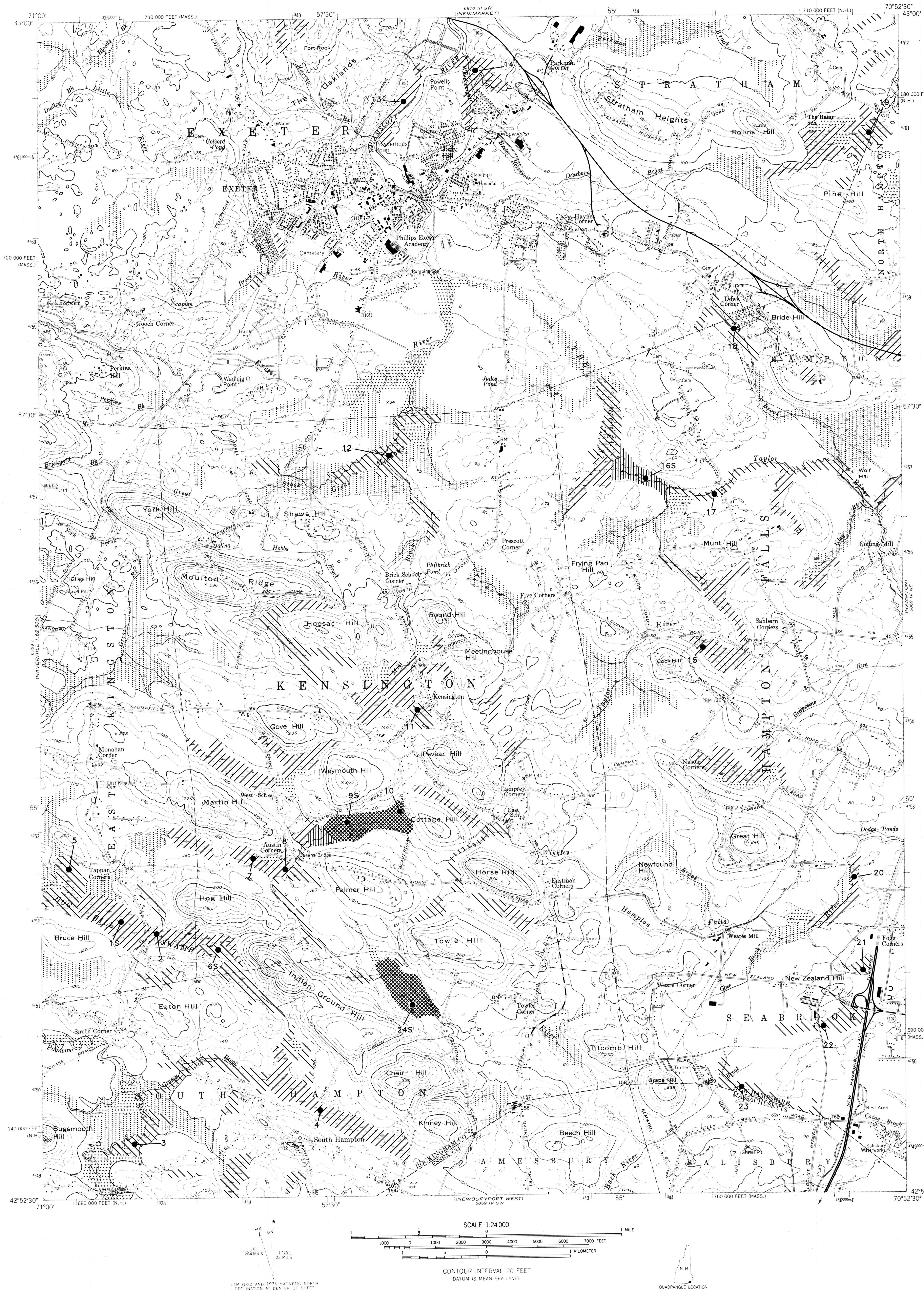

EXPLANATION

WETLANDS ON PEAT, CLAYEY PEAT, AND PEATY CLAY

MAP UNIT	DESCRIPTION
(diagonal lines, right-leaning)	Clayey peat and peaty clay generally less than 3ft. thick but may reach depths of 10ft..
(diagonal lines, left-leaning)	Commercial quality peat absent or generally less than 5ft. thick; clayey peat and peaty clay generally less than 10ft. thick, but may reach depths of more than 20ft..
(vertical lines)	Commercial quality peat averages between 5ft. and 10ft. thick, generally over clayey peat and peaty clay.
(crosshatch)	Commercial quality peat averages more than 10ft. thick, generally over clayey peat and peaty clay.

WETLANDS NOT ON PEATY MATERIAL

Silt and clay with minor sand.

Sand with minor silt.

MAP SYMBOLS

● 9S Location and number of core (Fig. 1). An S denotes that a chemistry sample was taken from this locality. If there is not an S present, then a chemistry sample was not taken from this locality.

Introduction

Wetlands within the study area were visited by the authors during the spring of 1989 as part of an ongoing collaborative effort between the U.S. Geological Survey and the State of New Hampshire to study wetlands and associated peat resources within the State of New Hampshire. The intent of this study was to identify the potential for peat resources, and to provide interpretations of the areal and vertical extent of the various organic and inorganic materials present within these wetlands. Cores were taken and samples were collected in order to further the understanding of relationships between organic and inorganic components within the wetlands to adjacent surficial materials and bedrock.

The wetlands delineated on this map are areas of ground saturated long enough during each year for organic material to accumulate or for chemical changes resulting from wetness to occur in the mineral soil. The presence of these organic accumulations and chemical alteration occurrences identify the soil as hydric. In addition, the wetlands support a vegetation cover composed of swamp, marsh or bog heath plants identified as hydrophytic. These soil and vegetation criteria have been accepted by the U.S. Army Corps of Engineers (Federal Manual, 1989) as the basis for delineating wetlands. Wetlands delineated on the National Wetland Maps prepared by the U.S. Fish and Wildlife Service include the hydrologic, hydrophytic plant and hydric soil criteria, and also identify and classify water bodies and areas of ground flooded by man-made construction as wetlands. Such man-made wetlands are not included on this map. All but two wetlands delineated within the study area are fresh-water wetlands; the wetlands shown on the Squamscott river in the north-central part of the study area are tidal marshes (cores 13 and 14).

Geologic Setting

The surficial geology within the study area and nearby regions, as described by Koteff and Moore (1994), is made up largely of the glacial products of the late Wisconsinan Laurentide ice sheet. These include glaciomarine, glaciolacustrine, and glaciofluvial deposits consisting of poorly to well sorted and stratified clay, silt, sand, and gravel. The most widespread surficial deposit is till consisting of poorly sorted mixtures of clay, silt, sand, pebbles, cobbles, and boulders. There are few bedrock exposures within the study area.

Sampling and analytical methods

Core samples were taken at 24 different sites within the study area to determine the thickness of the various materials comprising the wetland. A Davis sampler, an instrument that collects a 2cm-diameter by 25cm-long core of sample from specified depths, was used. The core samples were described to construct stratigraphic profiles (figure 1), and 9 samples were taken from 5 of the cores for geochemical and quality analyses (tables 1 and 2). Instrumental neutron activation analysis (INAA) was done on whole dry samples to determine elemental composition (table 1). Moisture was determined as received, pH was determined by dispersal in water, and ash, total sulfur, and Hg were determined on dry samples (table 2).

Peat Resources

Peat is a light- to dark-brown or black residuum formed by the partial decay and disintegration of marsh, fen, swamp, or bog plants. The texture of peat may be (1) fibrous-matted material composed of mosses, ferns, grasses, rushes, reeds, sedges, and woody material from trees and shrubs, (2) finely-divided plant material so decomposed that their biological identity is lost, or (3) non-fibrous, plastic, colloidal, and macerated material deposited at the bottom of lakes or other bodies of water.

Commercial quality peat is defined by The American Society for Testing Materials (ASTM) as containing an ash content of not more than 25 percent on an air-dried basis. Peat should be at least 5 feet thick to be considered as a possible resource.

Because peat is derived from different types of vegetation and may contain different amounts and types of mineral matter, the properties and composition of peat can vary considerably in different deposits and even among different parts of the same deposit. The principal factors that determine the commercial value of peat are water-holding capacity, organic and ash contents, fiber content, sulfur content, and acidity.

The Exeter 7.5' quadrangle contains a total estimated resource potential of 364,200 tons of air-dried peat (table 3). The wetland from which cores 9 and 10 were taken is included in this estimate even though sample 9-8 contains 26.3% ash; however, sample 9-4 contains only 4.8% ash indicating that the overall ash content for this peat interval is probably below the threshhold for commercial quality peat. Cores 9 and 10 both show peat to be 12 feet thick; this thickness was multiplied by the size of the wetland from which they were taken (78 acres). The resulting volume was multiplied by 200 tons (of air-dried peat per acre-foot) to arrive at the estimate of 187,200 short tons of air-dried peat for that wetland. The same method was used to calculate the peat resources within the other two wetlands shown in table 3. It should be noted that these estimates are based upon a minimal number of cores taken, and may be overstated.

Other units described on the map delineating organic materials include clayey peat and peaty clay. Clayey peat refers to a sample which generally contains more peat than inorganic material by weight on a dry basis, whereas peaty clay refers to a sample which generally contains more inorganic material than peat by weight on a dry basis. The clayey peat and peaty clay units contain significantly higher levels of ash than the peat units.

Discussion

The stratigraphic development of the organic and inorganic materials below the wetland surface is controlled by a variety of factors making up the overall setting of the wetland. The shape of the basin may influence the thickness of the materials in the wetland, and the type and structure of the adjacent rock materials may influence the ash and elemental content of the organic materials below the wetland surface. Ground and surface water regimes will also influence ash and elemental content.

Wetlands within the Exeter 7.5' quadrangle are within basins in which topography and geomorphology are controlled largely by glacial materials. Overall, more wetlands containing peat and peaty materials are found in the southwest part of the study area, where glacial till is predominant and the basins slope more steeply.

Trace element concentrations generally increase with increasing ash content; however, there appear to be no systematic geochemical anomalies for the elements analyzed (table 1). Two samples (16-4 and 24-12) do contain detectable gold (table 1), one of which (16-4) represents a peat deposit adjacent to a hill underlain by granitic bedrock that contains quartz veins.

Cores 9, 16, and 24 indicate that ash content generally increases with depth, and the pH generally decreases with the increase in ash content (table 2). For all samples, the total sulfur content ranges from 0.26% to 2.2% (table 2).

References

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Cowardin, L.M., Carter, V., Golet, F.C., and LaRoe, E.T., 1979, Classification of wetlands and deepwater habitats of the United States: U.S. Fish and Wildlife Service Report FWS/OBS-79/31, p.1-103.

Federal manual for identifying and delineating jurisdictional wetlands, 1989, Federal Interagency Committee for Wetland Delineation, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S.D.A. Soil Conservation Service, Washington, D.C., Cooperative Technical Publication, 76pp.

Koteff, Carl, and Moore, R.B., 1994, Surficial geologic map of the Kingston quadrangle, Rockingham County, New Hampshire: U.S. Geological Survey Geologic Quadrangle Map GQ-1740. Scale 1:24,000.

Figure 1.-Stratigraphy of cores taken from wetlands in the Exeter 7.5-minute quadrangle, showing depths of individual samples.

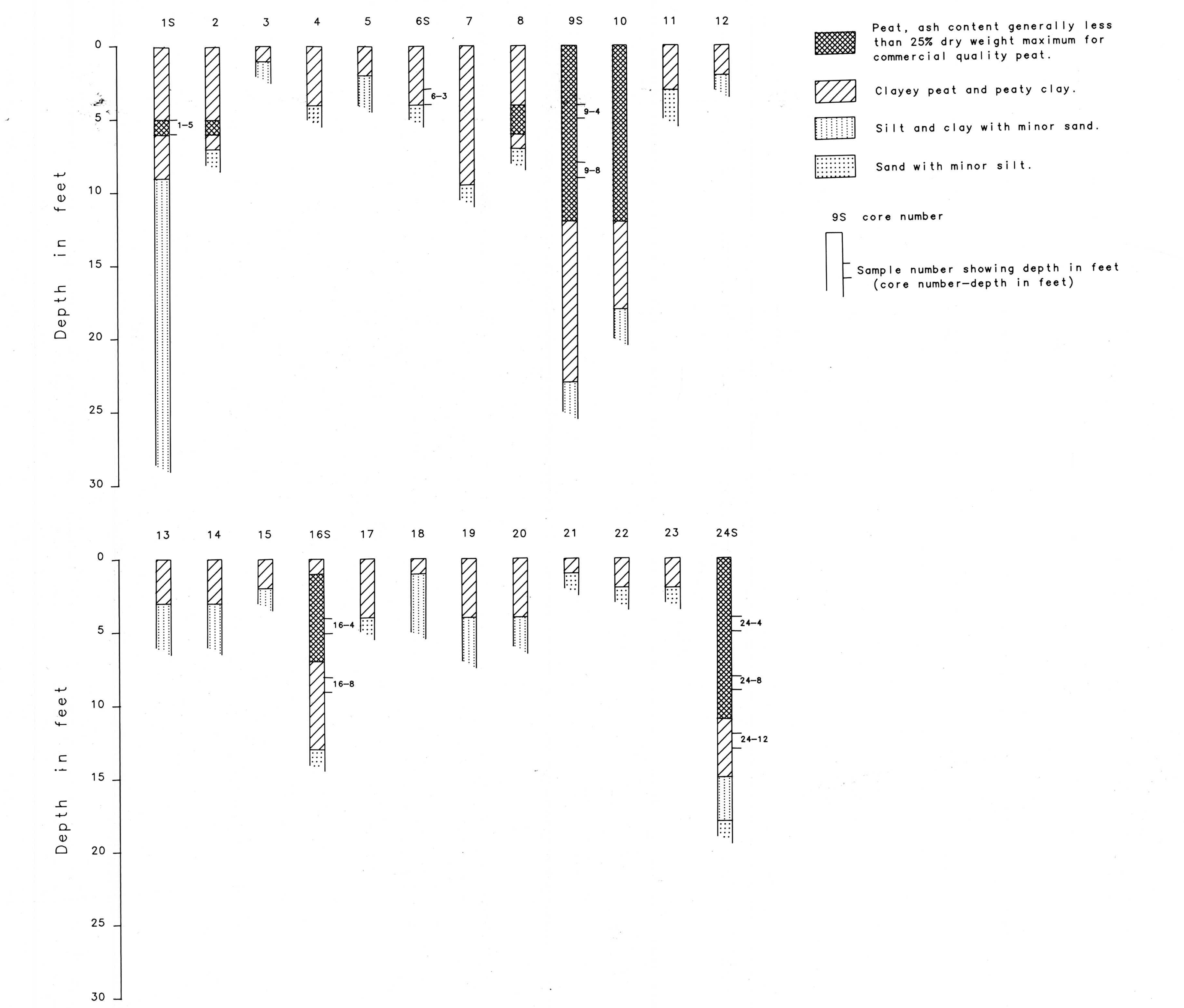

Table 1.-Elemental analyses of core samples by instrumental neutron activation analysis, all values are in parts per million except where noted.

SAMPLE NUMBER	Na(%)	K(%)	Sc	Cr	Fe(%)	Co	Ni	Zn	As	Se	Br	Rb	Sr	Sb	Cs	Ba
1-5	0.06	0.08	0.39	3.01	0.64	7.32	28.00	28.90	53.60	1.15	32.30	<3	48.00	0.10	0.12	<80
6-3	0.13	<1	11.30	51.00	1.36	4.29	35.00	48.00	14.20	5.40	14.40	43.90	163.00	0.12	5.30	810.00
9-4	0.02	<0.02	0.11	2.70	0.04	0.27	3.60	16.30	4.14	<0.4	38.00	<2	48.00	<0.07	<0.02	<50
9-8	0.14	0.20	2.05	14.80	1.34	14.10	28.00	60.40	46.10	1.82	88.00	10.20	70.00	0.16	0.60	120.00
16-4	0.19	0.28	1.23	8.00	1.31	5.81	7.90	46.40	50.60	1.14	43.40	9.20	82.00	0.14	0.57	140.00
16-8	1.23	1.90	7.51	37.10	1.73	13.90	17.00	64.60	42.40	<1	15.70	80.00	160.00	0.15	3.67	363.00
24-4	0.02	0.02	0.64	4.50	0.18	0.99	16.30	14.60	12.80	2.79	50.00	<2	88.00	0.23	0.10	<50
24-8	0.02	0.02	0.21	2.22	0.07	1.04	7.10	17.80	19.30	0.80	42.40	<3	43.00	0.10	0.05	<50
24-12	0.50	0.47	4.99	35.10	1.90	12.40	33.00	79.00	39.80	1.95	53.00	28.30	113.00	0.20	1.87	148.00

SAMPLE NUMBER	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Hf	Ta	W	Au(ppb)	Th	U
1-5	2.93	3.52	<11	0.46	0.09	0.04	0.34	0.03	0.29	0.04	<0.2	<3	0.43	1.29
6-3	271.00	229.00	<110	36.60	4.90	2.47	7.40	1.17	1.03	0.63	3.80	<5	11.80	152.00
9-4	0.82	0.87	<8	0.11	0.02	0.02	<0.1	<0.02	0.20	<0.02	<0.2	<2	0.11	0.27
9-8	11.20	11.90	<14	2.03	0.36	0.20	0.73	0.11	0.71	0.17	0.86	<3	1.96	5.50
16-4	6.03	8.70	<10	1.02	0.18	0.10	0.47	<0.05	0.54	0.15	0.82	4.00	1.40	4.60
16-8	38.60	65.00	<17	6.56	1.08	0.72	2.81	0.38	5.47	1.06	2.00	<2	9.10	5.23
24-4	4.78	3.27	<7	0.85	0.14	0.08	0.39	<0.03	0.13	0.02	<0.2	<2	0.57	3.33
24-8	1.37	0.87	<8	0.20	0.04	0.02	<0.4	<0.03	0.06	0.03	<0.2	<2	0.19	1.03
24-12	25.20	31.30	<12	4.42	0.76	0.43	1.62	0.23	2.61	0.43	1.18	4.20	4.86	12.40

Table 2.-Moisture, pH, ash, sulfur, and Hg content of core samples; d.b. refers to analyses done on a dry basis.

SAMPLE NUMBER	moisture (as received%)	pH	ash% (d.b.)	total sulfur% (d.b.)	Hg-ppm (d.b.)
1-5	89.70	3.90	9.10	2.20	0.02
6-3	76.10	5.10	56.40	0.39	0.04
9-4	90.10	5.20	4.80	0.30	<0.005
9-8	90.00	4.00	26.30	1.90	<0.005
16-4	86.30	3.50	22.50	0.83	<0.005
16-8	68.40		76.90	0.26	<0.005
24-4	89.60	6.00	9.90	1.00	0.03
24-8	92.30	6.10	5.30	1.30	0.02
24-12	87.10	4.20	49.20	1.90	0.01

Table 3.-Peat resources estimated on the basis of a minimum thickness of 5 feet, and assuming a 1-acre-foot yield of 200 tons air-dried peat.

Wetland as designated by core number(s)	Acres	Peat thickness in core (ft.)	Air-dried weight (short tons)
9,10	78	12	187,200
16	32	6	38,400
24	63	11	138,600
			364,200 total

WETLAND AND PEAT RESOURCE MAP OF THE EXETER 7.5-MINUTE QUADRANGLE, NEW HAMPSHIRE AND MASSACHUSETTS

By

John C. Jackson and Cornelia C. Cameron

1995