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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MARL DEPOSITS IN THE WASILLA AREA, ALASKA

by

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1952

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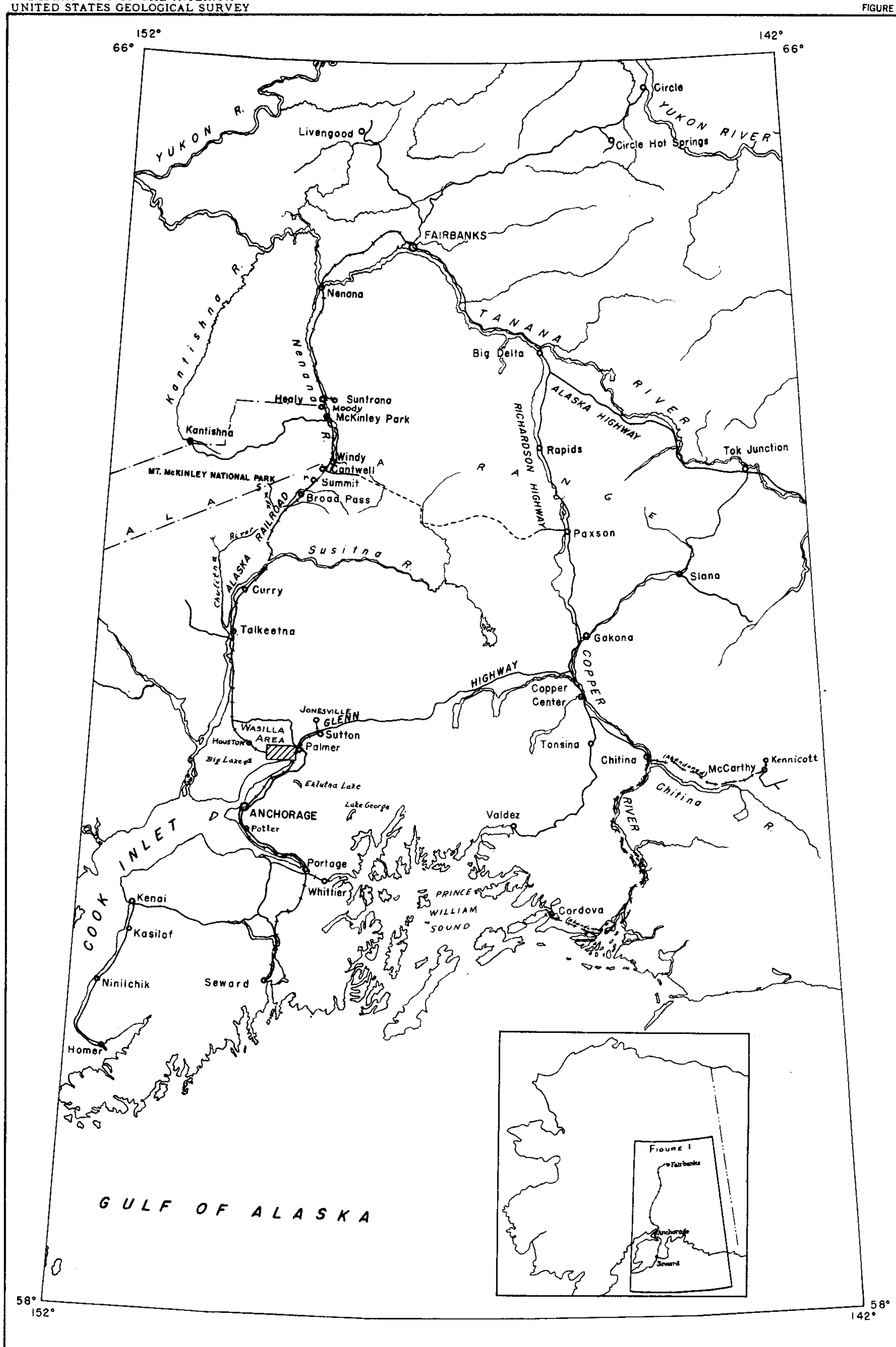
ILLUSTRATIONS

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

FIGURE 1



From U.S.G.S. Alaska Map B, 1950

INDEX MAP OF
SOUTH-CENTRAL ALASKA

25 0 25 50 75 100 Miles
Scale

ABSTRACT

Marl occurs in several localities in the Cook Inlet area in south-central Alaska. The most significant known deposits are found in the Wasilla area, about 30 miles north of the city of Anchorage.

In this area marl has been deposited in three fresh water lakes--Wasilla Lake, Finger Lake and Lucile Lake. The accumulation of the high-lime material (which is still in progress) has taken place in sheltered embayments and shallow marginal areas of the lakes with algae probably acting as precipitating agents. In some instances the embayments have been completely filled with marl and subsequently overlain by a layer of muskeg, effectively sealing off the deposits from the lake proper.

The marl in and adjacent to Wasilla and Finger Lakes attains a maximum thickness of about 21 feet, while the deposits in Lucile Lake are generally thinner and discontinuous, but relatively widely distributed.

Some of the material probably would be of suitable composition for the manufacture of portland cement, but the amount of such material discovered to date is insufficient for this purpose.

INTRODUCTION

The occurrence of marl in several localities in south-central Alaska has been known for many years. In 1916, Daniel M. Lynch discovered a deposit of the lime-rich material on the margin of Otter Lake, on what is now the Fort Richardson Military Reservation, near the city of Anchorage (see Figure 1). A few tons of the marl was calcined to produce lime for agricultural purposes (Martin, 1919). At about this same time, or possibly a few years prior, Chris Stearns found marl on his homestead on the south shore of Wasilla Lake about 30 miles north of Anchorage. The material has not been utilized to date, but plans for the development of the deposit are presently under way by Lime Products, Inc., a Wasilla firm.

Another deposit of marl near the east shore of Big Lake, about 40 miles north of Anchorage is reported to have been used locally for agricultural purposes for many years.

The present report is concerned with the deposits in the Wasilla area which appear to be the most extensive and accessible of those mentioned above.

Previous investigations

The Wasilla area is included in the compilation of the geology of the Alaska Railroad belt (Capps, 1940) in which the region is shown on a reconnaissance map.

A detailed study of the area was made by Trainer (report in preparation) in 1949-1951, in connection with an investigation of the geology and ground water resources of the Matanuska Valley agricultural area.

Present investigation

The purpose of the present investigation was to determine the distribution and chemical composition of the marl on the Edlund property of Lime Products, Inc., (formerly the Stearns homestead, mentioned above) on the south shore of Wasilla Lake, and to determine whether other deposits existed elsewhere in the Wasilla area.

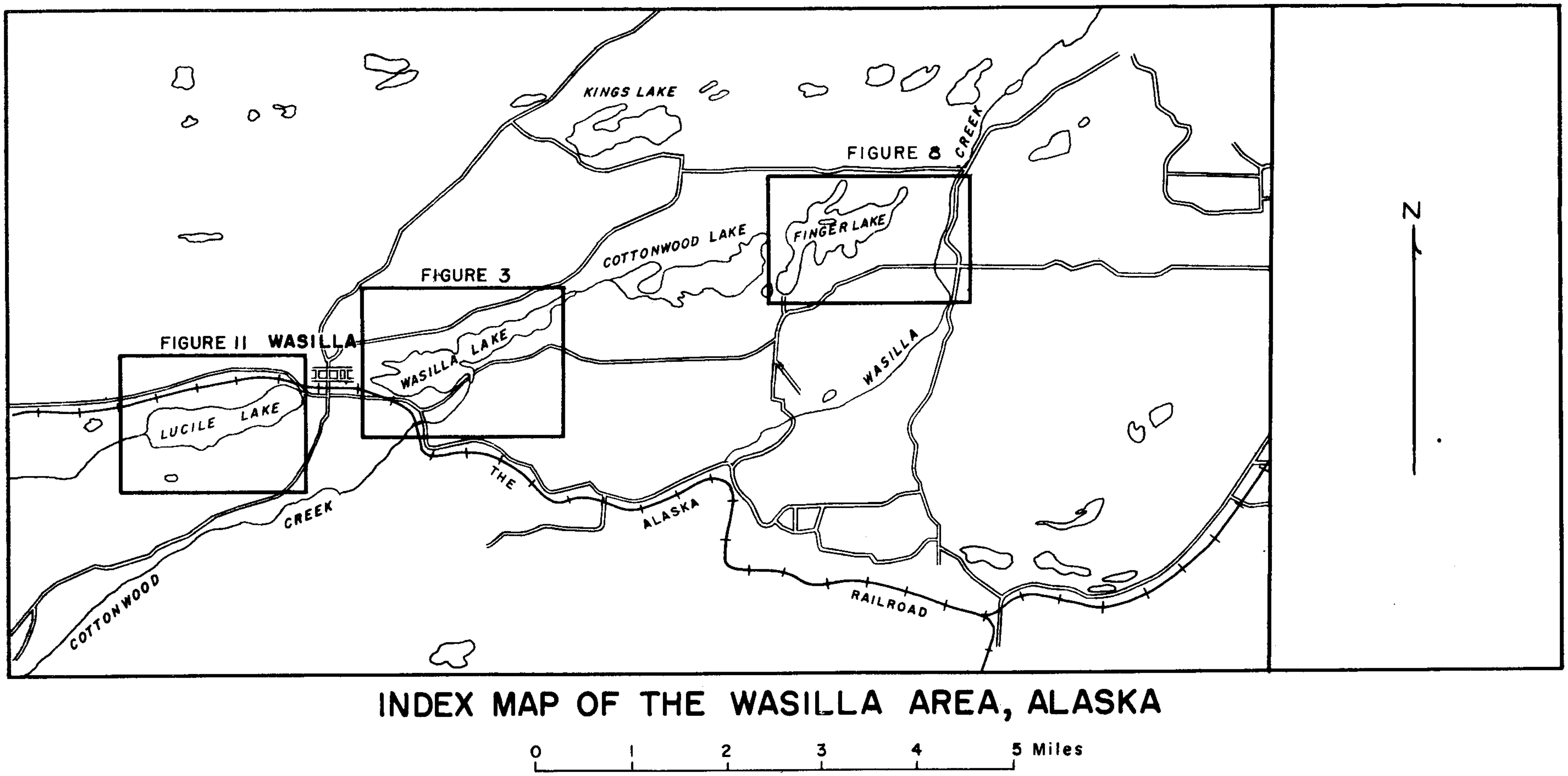
A preliminary examination of the deposit on the Edlund property indicated that the marl had accumulated in a now extinct, muskeg-covered embayment of Wasilla Lake. The present lake bottom immediately adjacent to the filled-in area appeared to be covered with marl and is thought to represent the lakeward growth of the Edlund deposit. It seemed likely therefore that the presence of modern deposits on the present lake bottoms, in addition to being of possible economic significance in themselves, might indicate the presence of additional lake margin deposits, now buried and concealed by muskeg.

The lakes in the Wasilla area are relatively shallow for the most part and the water is quite clear. As the marl is generally light in color, it seemed likely that an aerial reconnaissance of the area would reveal at least the more extensive areas of lake bottom deposition. This proved to be true. The principal areas of deposition in the lakes were determined from the air and subsequently tested from a boat with a soil auger.

The present investigations were carried out during July, 1951, by R. M. Moxham and R. A. Eckhart, geologists, and R. A. Wilkens and Winton Bakke, field assistants.

The authors gratefully acknowledge the help and cooperation of Mr. D. L. Irwin, Director, Alaska Agricultural Experiment Station, and the Green Flying Service of Palmer. Particular thanks are due Mr. William Edlund who generously gave his time and assistance to the authors and who made available a map of his property as well as the results of test drilling and chemical analyses.

FIGURE 2



INDEX MAP OF THE WASILLA AREA, ALASKA

GEOGRAPHY

The geographic limits of the Wasilla area, as referred to in this report, are shown on Figure 2. Wasilla Lake, which is about centrally located in the area, lies about 9 miles west of the town of Palmer, and 30 miles airline north of Anchorage (see Figure 1). The only town within the limits of the area is Wasilla, situated between Lucile and Wasilla Lakes.

The area is located in the western portion of Alaska's agriculturally important Matanuska Valley. The area is easily accessible the year around by road, rail and air. Wasilla is a station on the Alaska Railroad, which crosses the central and southeastern parts of the area. The town is also connected to Alaska's main highway system by several gravelled roads.

The climate in comparison to that of the interior of Alaska is relatively mild, the temperature during the summer months averaging about 50°, while in the winter an average of 15° might be expected. Snow can be expected by late October and as late as May. The average total precipitation is about 17 inches, with a total annual snowfall of about 120 inches (Climatological Data, 1950).

GENERAL GEOLOGY

The Wasilla area is underlain by thick, unconsolidated deposits of glacial outwash which are nearly everywhere mantled by 1 to 3 feet of loess. The glacial debris ranges in size from rock flour to boulders more than a foot diameter, and is composed of rocks of a great variety, derived primarily from the drainage basin of the Matanuska and/or Knik Rivers and perhaps as far east as the Copper River basin.

The four principal lakes in the area, Wasilla, Finger, Lucile and Cottenwood, are elongate in outline, with their long axes roughly aligned and oriented in a northeast-southwest direction. Apparently the lakes occur in depressions in the glacial outwash formed by ice block remnants of a glacier which moved across the area in a southwesterly direction.

During the development of the lakes in the Wasilla area in the post-glacial period, physical, chemical, and organic conditions in certain of the lakes became conducive to the precipitation of lime, particularly in sheltered embayments and shallow, near-shore areas. In some instances the lake-pond-muskeg sequence has now progressed to such an extent that the embayments are completely filled with lime-rich deposits and overlain by muskeg, effectively sealing off these areas from the lakes proper.

The marl ranges in color (while wet) from white through light gray to tan. In general the lighter color reflects a relatively high lime content while the darker shades show a decrease in lime and an increase in organic material.

While wet the marl is quite soft, very sticky and usually plastic. It dries in coherent masses of finely granular material which may be crushed to a fine powder between the fingers.

The calcareous deposits, from a genetic standpoint, are hybrid in character in that they represent accumulations of chemical precipitates mixed with varying amounts of clastic sediments and organic matter. The $CaCO_3$ content of the calcareous deposits in the Wasilla area ranges from 12 to 77 percent, so that the more impure materials are calcareous clays rather than marl; 25 percent $CaCO_3$ is commonly used as an arbitrary lower limit for marl (Pettijohn, 1949, p. 286).

The deposition of marl is a fairly common occurrence in hard water lakes in many of those parts of the world which are blanketed by glacial drift. The physiographic setting of the marl deposits in the Wasilla area is quite similar in many respects to that which has proven favorable for the accumulation of marl in the Great Lakes region, particularly Michigan (Hale, 1903) and Ohio (Stout, 1940) where the calcareous deposits have formed in lake-filled (Occasionally extinct lake) basins within areas mantled by glacial drift. The lakes in most instances are the remaining manifestations of a glacial drainage system.

Several conditions must generally be fulfilled in order for marl to accumulate. The relatively high ratio of chemical sediments to terrigenous and organic debris necessitates 1) a terrain having very low topographic relief, 2) a source of carbonate compounds, 3) a precipitating agency, and 4) physical and chemical conditions such that the rate of precipitation of the carbonates exceeds the rate of dissolution.

As far as is known, there are no quantitative data available regarding the ratio of limestone to other rock types which constitute the unconsolidated deposits in the area within the drainage system of the marl lakes. However, limestone comprises a notably minor portion of the bedrock within the central Copper, Matanuska and Knik River drainage systems and adjacent areas which were presumably the source of the glacial deposits. Despite this fact, the unconsolidated glacial deposits are undeniably furnishing an ample supply of $CaCO_3$. Table 1 lists some chemical analyses of 1) water in the marl lakes and 2) water from Eklutna Lake and Lake George (see Figure 1) which lie beyond the limits of the glacial drift and outwash. The dissolved solids and $CaCO_3$ content is relatively low in the two non-marl lakes.

Table 1. Analyses of water from the Wasilla and adjacent areas.

Location	Lab. No.	Coll. Date	SiO_2	Total hardness as $CaCO_3$	Non-carbonate hardness	PH	Fe	Ca	Mg	Na K	CO_3	HCO_3	SO_4	Dissolved Solids
Cottonwood Creek														
1 m. below Wasilla Lake	SLC 2057	10/19/48	9.2	86.	0	--		28.	4.0	5.1	0	110.	6.	108.
"	64	5/19/49	9.0	72.	0	7.7		23.	3.4	3.9	0	90.	5.4	90.
"	523	10/31/50	8.7	100.	0	7.5	0.02	33.	4.4	3.9	0	126.	3.8	117.
"	672	3/21/51	12.	111.	0	8.0	0.01	37.	4.6	5.1	0	136.	8.0	139.
"	691	5/24/51	7.0	100.	13.	8.0	0.03	33.	4.4	2.8	0	121.	5.4	115.
Finger Lake														
Depth 8 feet	794	8/1/51	2.5	81.	0	8.3	0.02	26.	4.0	1.4	0	100.	1.2	85.
Surface	795	8/1/51	4.5	73.	0	--	0.02	22.	4.5	2.4	0	93.	0.2	81.
Lucile Lake														
Depth 4 feet	796	8/1/51	8.6	53.	0		0.04	16.	3.1	2.4	0	68.	1.3	66.
Surface	797	8/1/51	8.6	55.	2.		0.02	15.	4.3	0.2	0	65.	0.8	62.
Lake George														
Gorge near Palmer	843	July, 1951	2.9	34.	7.	7.1	0.02	11.	1.5	1.3	0	32.	7.1	42.
Palmer-Anchorage Hwy.														
Ditch at mile 44,	653	4/19/51	7.4	125.	34.	7.9	0.01	43.	4.4	8.3	0	112.	43.	167.
Eklutna Lake														
	SCL2051	10/18/48	3.8	55.	11.	--		18.	2.4	2.8	0	54.	15.	70.

The precipitation of the $CaCO_3$ as fresh water marl is usually attributable to some form of organic action. Probably the most common type of deposit results from the lime encrustations produced by Chara (stonewart), a shallow water, bottom-rotted alga. Other limy deposits have been attributed to Myxophyceae (an alga of the blue-green type) higher aquatic plants, plankton, bacteria and mollusks (Welch, 1935, pp. 176-182).

There is little evidence to indicate the agency responsible for the precipitation of the lime in the lakes in the Wasilla area. In the region immediately to the south, a small lake near the Agricultural Experimental Farm contains numerous Chara which are heavily encrusted with $CaCO_3$ (D. L. Irwin, personal communication, 1952). An examination of the lake bottom vegetation in the Wasilla area was not made by the authors, but Mr. Irwin reports finding no Chara in either Wasilla, Finger or Lucile Lakes.

A microscopic examination of the marl from the Edlund property showed the presence of a few fragments of organic remains (stems and oöspores of charophytes) but none of the marl fragments are identifiable as being the remains of Chara encrustation. It is possible however that the original characteristic surficial configuration of the Chara may have been destroyed through abrasion or merely through comminution.

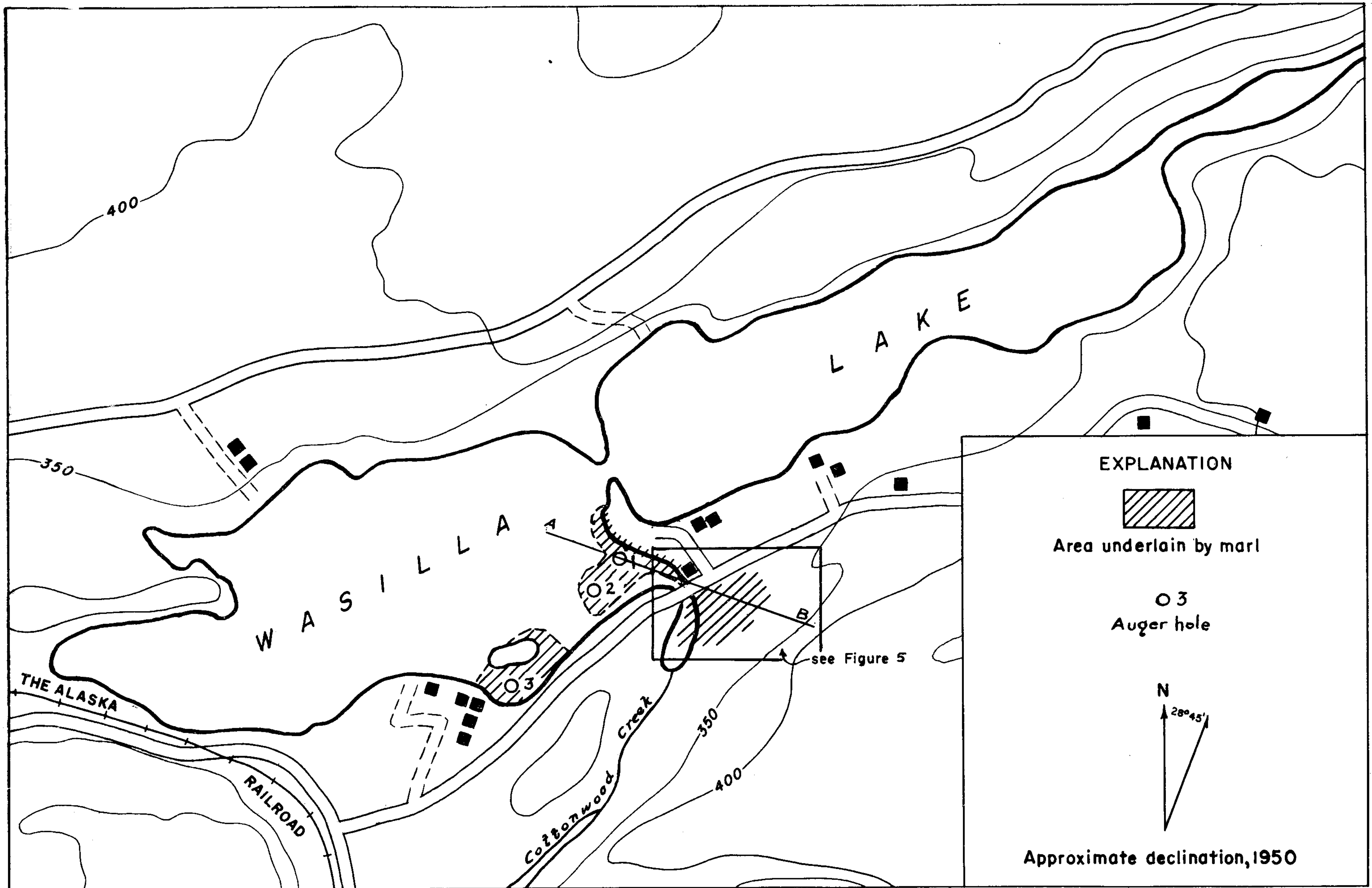
Finally, the accumulation of marl depends upon the interrelation of the carbonate supply and free carbon dioxide in the lake water. If the monocarbonate formed or introduced into the lake water is in excess of the amount which can be converted to soluble bicarbonate by free carbon dioxide, the excess will accumulate as a bottom deposit. If the converse should be true such an accumulation would not form.

ECONOMIC GEOLOGY

The desirable features of local sources of supply of cement and other lime products for the Alaskan construction industry has long been recognized.

Easily accessible deposits of chemically suitable high-lime raw materials are not plentiful and economic problems relating to the development of the more inaccessible deposits have proven to be major obstacles.

The Wasilla area offers access the year around by rail and road, has fuel available at Houston and Jonesville and has access to labor and supplies. Relatively low cost hydroelectric power presumably will be available upon completion of the Eklutna Hydroelectric Project.



Base from Corps of Engineers Matanuska quadrangle, 1950

Geology by R.M. Moxham and R.A. Eckhart, 1951

MAP SHOWING THE INFERRED DISTRIBUTION OF MARL AT WASILLA LAKE, WASILLA AREA, ALASKA

0 1000 2000 3000 4000 5000 Feet

CONTOUR INTERVAL 50 FEET

Marl deposits

The aerial reconnaissance and investigations on the ground showed that marl depositions occurs in or near the margin of Wasilla, Finger and Lucile Lakes. Cottonwood Lake appears to contain little marl.

It is quite probable that other lakes in the Wasilla area contain limy deposits and as mentioned in the introduction, marl beds are known to exist in adjacent regions. Since this investigation was intended primarily as an economic geologic study, the work was limited chiefly to the larger, more accessible deposits of the Wasilla area.

Drill-holes were put down by means of 1½, 3 or 6 inch diameter soil augers. The 1½ inch auger consisted of an 18 inch length of 1-inch cold-rolled steel which had been twisted and chisel pointed to form a bit. Extension rods for the bit were made from 1-inch diameter aluminum pipe, in 2-foot lengths, threaded at both ends. The larger augers consisted of a 9-inch cutting head. The extension rods were 5-foot lengths of iron pipe, threaded on both ends. The upper few feet of the submerged holes drilled in the lake bottoms were cased with 6-inch stove pipe to prevent caving.

Wasilla Lake

The inferred distribution of marl in and adjacent to Wasilla Lake is shown in figure 3.

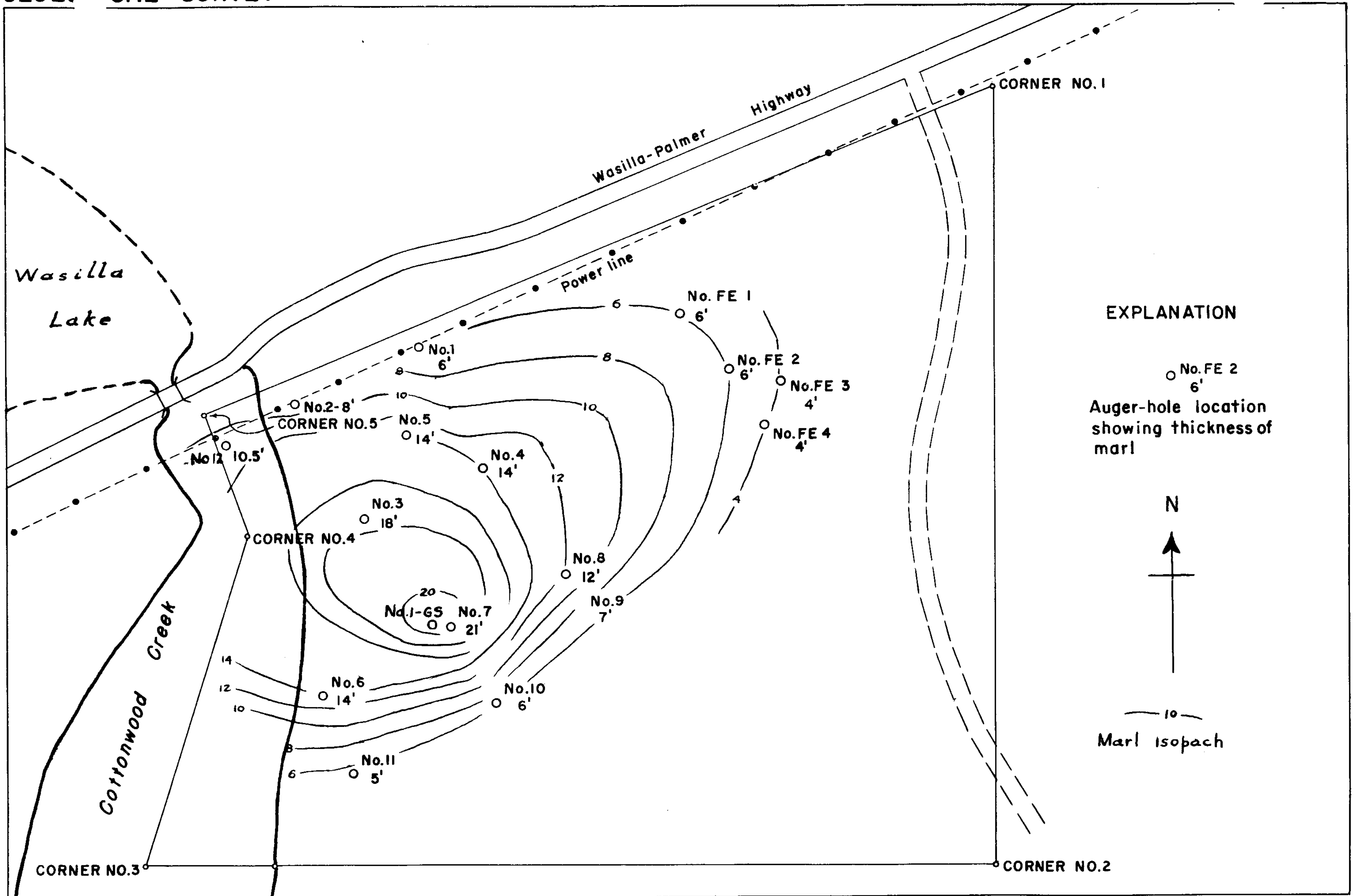
The portion of the Edlund tract underlain by marl is relatively level and poorly drained. A three to four foot layer of water logged muskeg which overlies the marl supports a sparse growth of scrubby spruce and brush, in sharp contrast to the moderately to heavily timbered area immediately adjacent (see Figure 4).

A detailed examination of the muskeg overlying the marl on the Edlund property was made by Dachnowski-Stokes in 1939 (1941, pp. 56-58). Cross-sections of the organic material and the marl were recorded as follows:

> "0-42 inches; the upper 6 inches consist of light reddish-brown sphagnum moss peat, spongy fibrous in texture, acid and relatively free from woody material; it grades into a mixture of brown moss and sedge peat which contains roots and rhizomes of the growing vegetation from the 10- to 18-inch level; the material rests on a thin seam of volcanic ash; below it, is reddish-brown sphagnum moss peat to a depth of 38 inches below the surface, which contains the matted network of roots and rhizomes from tussocky sedges; near the fourth foot level is a layer of dark brown woody sedge peat with stumps of spruce and birch on marl.
>
> 42-108 inches; gray Chara marl; yellow-tinted to pink in color at lower levels; at the base it merges into brown organic sediments, about 2 to 3 inches thick and derived from aquatic plants and plankton organism.
>
> 108-110 inches; sandy gravel."

Figure 4. Aerial view of Wasilla Lake from the south showing the muskeg covered embayment on the Edlund tract.

GEOLOGICAL SURVEY FIGURE 5



From surveys by the Territorial Dept. of Mines and J.C. Baldwin, 1950

Geology by R.M. Moxham, 1951

MAP OF THE EDLUND PROPERTY, WASILLA AREA, ALASKA

0 100 200 300 400 Feet

He has interpreted the succession of materials comprising the muskeg to indicate

> "...the presence of an early lake and a primary free-floating aquatic vegetation which was soon replaced by species of Chara and probably certain blue-green algae; they are the chief agents responsible for the great precipitation of lime over the floor of the lake. Thereafter, trees of spruce and birch with their associates appeared over the surface of the marl, indicating a change to drier conditions. This was followed by a cool moist period associated with the active growth and spreading of sphagnum mosses and sedges."

Numerous auger holes have been drilled by the owner to determine the thickness and extent of the deposit on his property (see Figure 5). He obtained chemical analyses of the core material from private assayers and from the Territorial Department of Mines. The latter agency also surveyed the property and determined the locations of the various test holes. Results of the chemical tests (Table 2) and a map of the property (Figure 5) have been made available by Mr. Edlund. One auger hole (No. 1-GS) was put down by the authors near the center of the deposit. Chemical analyses from core recoveries at the 10, 15 and 20 foot levels are given in Table 2.

The marl is quite fine-grained in texture and is mostly light buff to cream colored, when wet, and is white when dried. Occasional layers tinged with traces of red and green and two thin bands of dark gray silt were encountered in drilling, but in general the material appears to be quite uniform in composition.

The deposit on the Edlund tract is roughly circular in outline and apparently occupies a basin-like depression. The upper surface is quite level. The deposit is thickest (about 21 feet) near the center and thins rapidly toward the periphery. Isopachs which have been sketched on Figure 5 indicate the general geometric configuration.

It is estimated the deposit on the Edlund property contains about 65,000 tons of marl, on the assumption that the dry weight of the material is 54 pounds per cubic foot.

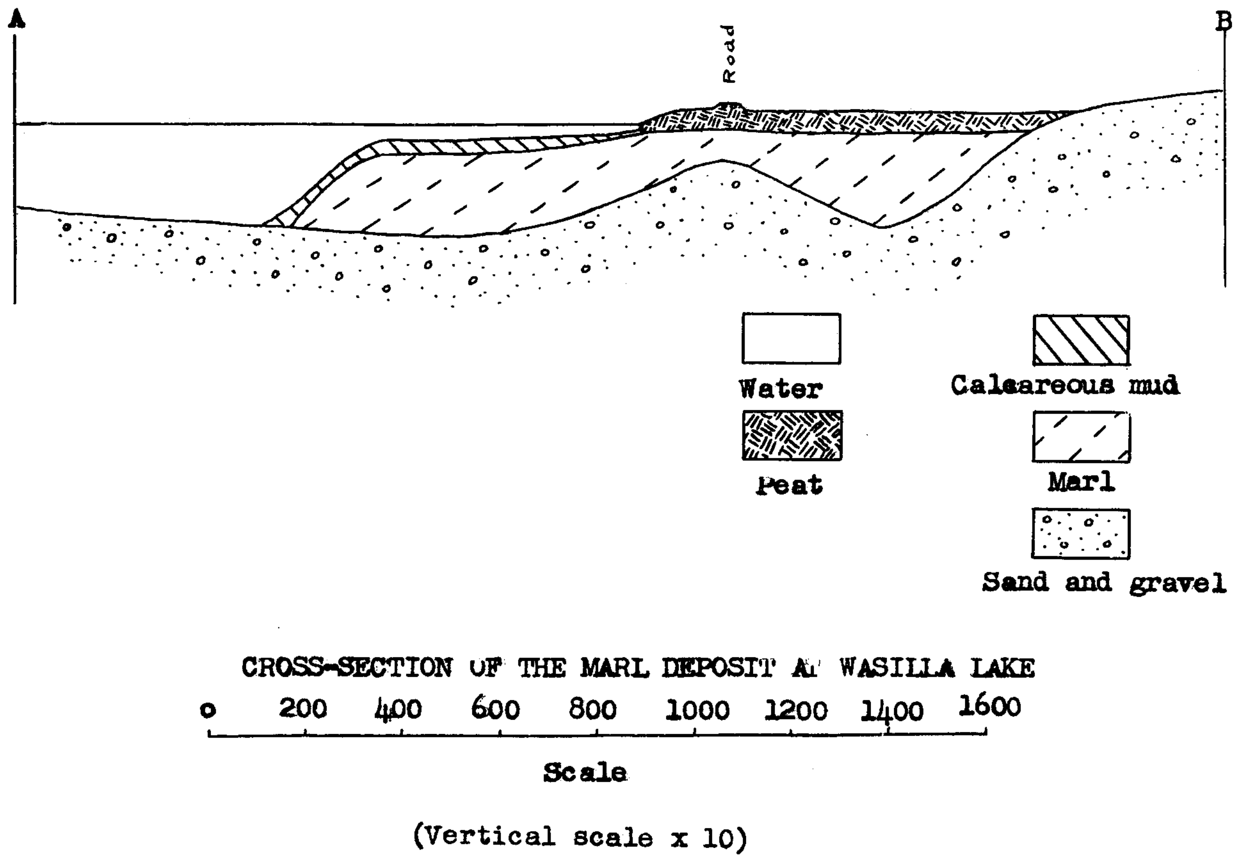
In Wasilla Lake, immediately adjacent to the Edlund property, marl is being deposited on the lake bottom. In all probability this accumulation represents the lakeward growth of the deposit underlying the muskeg covered deposit described above.(see cross-section of the marl at Wasilla Lake, Figure 6). A layer of marl was also found in the extreme southwest corner of the lake. The marl in both areas is white to very light gray in color, plastic and very sticky. It contains abundant mollusk fragments and a relatively small amount of well preserved plant remains.

Table No. 2 Results of chemical analyses of auger-hole samples of marl from the Edlund property.

Hole No.	Sample description	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	Ign. Loss	Insol.	R_2O_3
1/ 1-GS	10 foot level	8.4	.12	.57	.54	45.0	.34	.20	43.2*		
1/ 1-GS	15 foot level	3.4	.00	.26	.41	50.0	.22	.13	45.6*		
1/ 1-GS	20 foot level	18.6	.24	1.4	1.1	37.8	.67	.37	35.8*		
1	composite, total thickness	20.97			0.81	33.65				27.82	4.17
2	" " "	10.40			0.84	42.46				13.75	2.29
3	" " "	14.29			1.27	38.37				17.71	3.09
4	" " "	20.28			0.73	34.97				26.85	3.33
5	center of deposit	15.19			0.49	38.29				20.26	2.69
6	composite, total thickness	13.66			0.91	40.57				18.11	2.69
7	" " "	11.84			0.68	39.34				18.09	2.81
8	" " "	12.10			0.97	40.28				17.87	3.00
9	" " "	19.89			1.08	34.59				26.50	3.71
10	" " "	19.77			0.98	33.46				26.00	3.79
11	" " "	48.04			1.42	14.31				63.97	6.67
12	" " "	12.85			0.87	40.95				16.55	2.43
FE1	" " "	7.26			1.10	44.18				9.56	1.65
FE2	" " "	13.56			1.25	39.95				17.70	3.19
FE3	" " "	41.89			1.27	19.24				54.03	5.77
FE4	" " "	1.24			0.96	50.52				1.51	0.43

*Includes gain due to oxidation of FeO

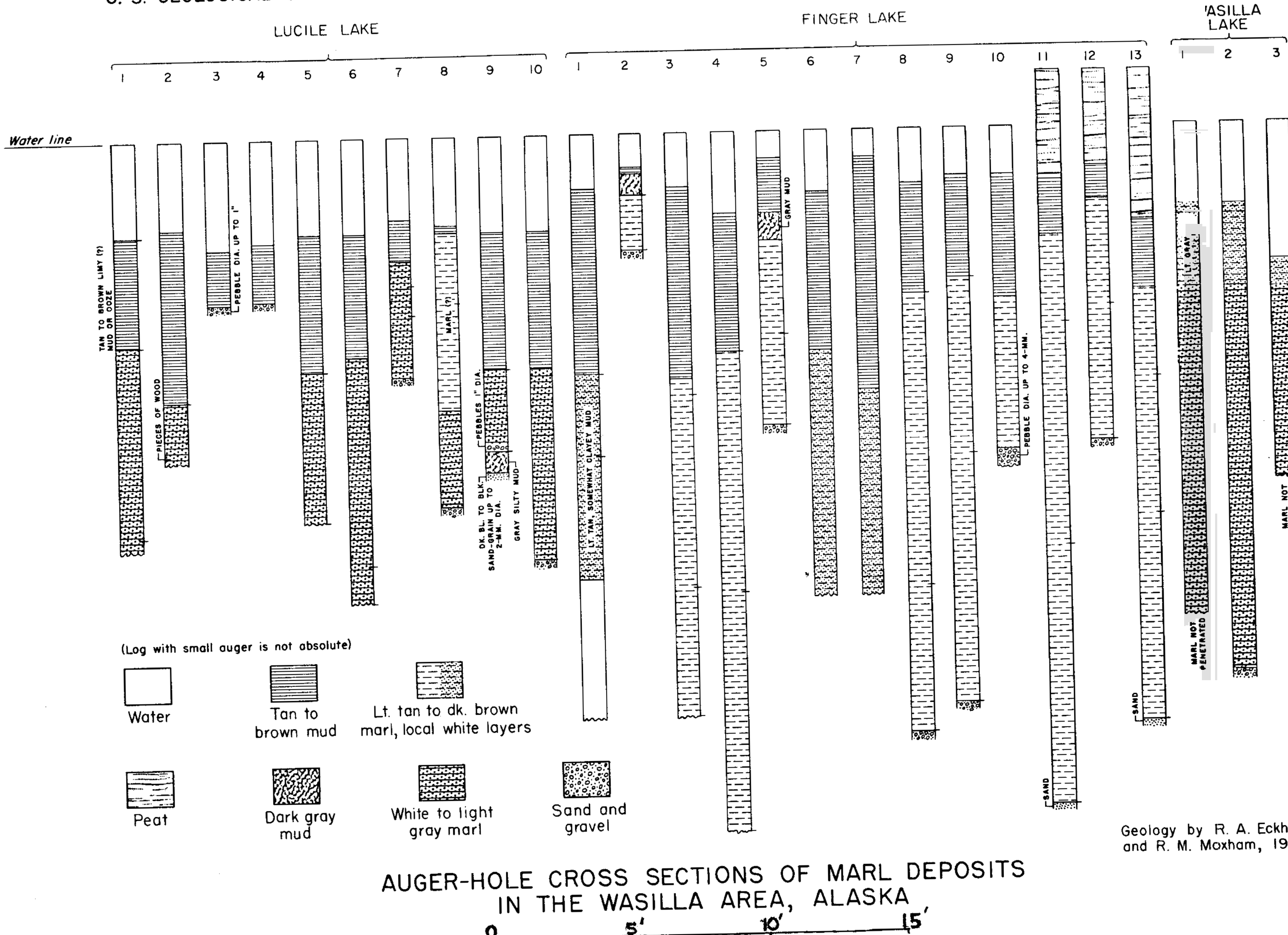
1/ Analysis by Leonard Shapiro and S. M. Berthold, U. S. Geological Survey. All other analyses on Table 2 are by the Territorial Dept. of Mines.



CROSS-SECTION OF THE MARL DEPOSIT AT WASILLA LAKE

U. S. GEOLOGICAL SURVEY

FIGURE 7



Geology by R. A. Eckhart and R. M. Moxham, 1951

AUGER-HOLE CROSS SECTIONS OF MARL DEPOSITS IN THE WASILLA AREA, ALASKA

Marl from drill hole 3 (sample 51 AEt-69) at the southwest corner of Wasilla Lake has yielded 44 varieties and species of fresh water diatoms which are listed below. The identifications were made by K. E. Lohman.

Achnathes flexella (Kützing) Brun	F1/
Amphora ovalis Kützing	F
Caloneis bacillum (Grunow) Nitzsch	R
obtusa (Wm. Smith) Cleve	F
cf. C. silicula (Ehrenberg) Cleve	F
Cocconeis placentula Ehrenberg	R
Cyclotella antiqua Wm. Smith	R
operculata (Agardh) Brebisson	R
cf. C. temperi Brun	R
Cymbella cf. C. cistula (Hemprich) Grunow	F
cuspidata Kützing	F
cf. C. cymbiformis (Ehrenberg) Van Heurck	F
ehrenbergii Kützing	C
cf. C. heteropleura (Ehrenberg) Kützing	R
mexicana (Ehrenberg) Schmidt	R
ventricosa Kützing	F
sp.	F
Epithemia turgida Gregory	F
turgida var. granulata (Ehrenberg) Grunow	F
zebra var. porcellus (Kützing) Grunow	F
Gomphonema boehmicum Reichelt and Fricke	R
intricatum Kützing	F
Mastogloia sp.	F
Navicula cuspidata Kützing	R
oblonga Kützing	F
cf. N. peregrina (Ehrenberg) Kützing	C
pupula var. capitata Hustedt	R
radiosa Kützing	F
scutelloides Wm. Smith	R
tuscula (Ehrenberg) Van Heurck	F
Neidium amphirhynchus (Ehrenberg) Boyer	F
bisculatum (Lagerstedt) Cleve	F
Iridis (Ehrenberg) Cleve	F
sp.	R
Nitzschia cf. N. frustulum (Kützing) Grunow	R
cf. N. haufleriana Grunow	R
Pinnularia dactylus var. demararae Cleve	R
major (Kützing) Wm. Smith	F
microstauron (Ehrenberg) Cleve	F
viridis (Nitzsch) Ehrenberg	F
sp.	F
Rhopalodia gibba (Kützing) O. Muller	R
Stauroneis sp.	C
Surirella linearis var. constricta (Ehrenberg) Grunow	R

1/ The letters refer to the abundance in which the forms occur in the sample. C equals Common, F equals frequent, R equals rare.

Lohman states further,

> "This diatom assemblage is made up almost entirely of species and varieties now living in cool to cold fresh-water lakes in northern United States and Canada. Many of them also occur in Pleistocene deposits such as the Provo formation of central Utah, which contains 40% of the species found in the Cook Inlet samples. The Provo formation is dominantly a calcareous silt containing what appears to be chemically precipitated lime, fresh water molluscs and diatoms.
>
> Inasmuch as the two samples came from material being deposited on lake bottoms at the present time, a Quaternary age is indicated, ranging from Recent to late Pleistocene (Wisconsin)."

The semi-consolidated marl is overlain by 1 to 3 feet of light gray to light tan calcareous mud. The lakeward margin of the marl deposits is generally quite abrupt with the marl surface dropping steeply to a sandy or gravel bottom in a lakeward direction.

Three auger holes were sunk in the Wasilla Lake deposits. Cross-sections of the material penetrated are shown on Figure 7.

Results of chemical analyses of the marl penetrated in holes 2 and 3 are given in Table 3.

It is estimated that the two principal areas of deposition in Wasilla Lake, indicated on Figure 3, aggregate on the order of 135,000 tons on the assumption that the average thickness is at least 10 feet and that the dry weight of the marl is 54 pounds per cubic foot.

Finger Lake

Marl was found in several embayments in Finger Lake, and in two muskeg-covered areas near the southern and eastern shores of the lake (see Figure 8). Ten auger holes were drilled into deposits on the present lake bottom and three into the adjacent shoreline deposits. The marl is generally light tan in color when wet and locally contains streaks of white marl. It is very light-tan to grayish white when dry. The present lake bottom deposits are overlain by a tan to light brown mud which ranges from 2 to 8 feet in thickness, while the adjacent shoreline deposits are overlain by a thin layer of brown mud capped by 3 to 5 feet of peat.

Table 2 gives the results of a chemical analysis of marl penetrated in hole 3 in an embayment on the north side of the lake. Insofar as its megascopic appearance is concerned the material from hole 3 appears to be representative of the marl found in Finger Lake area.

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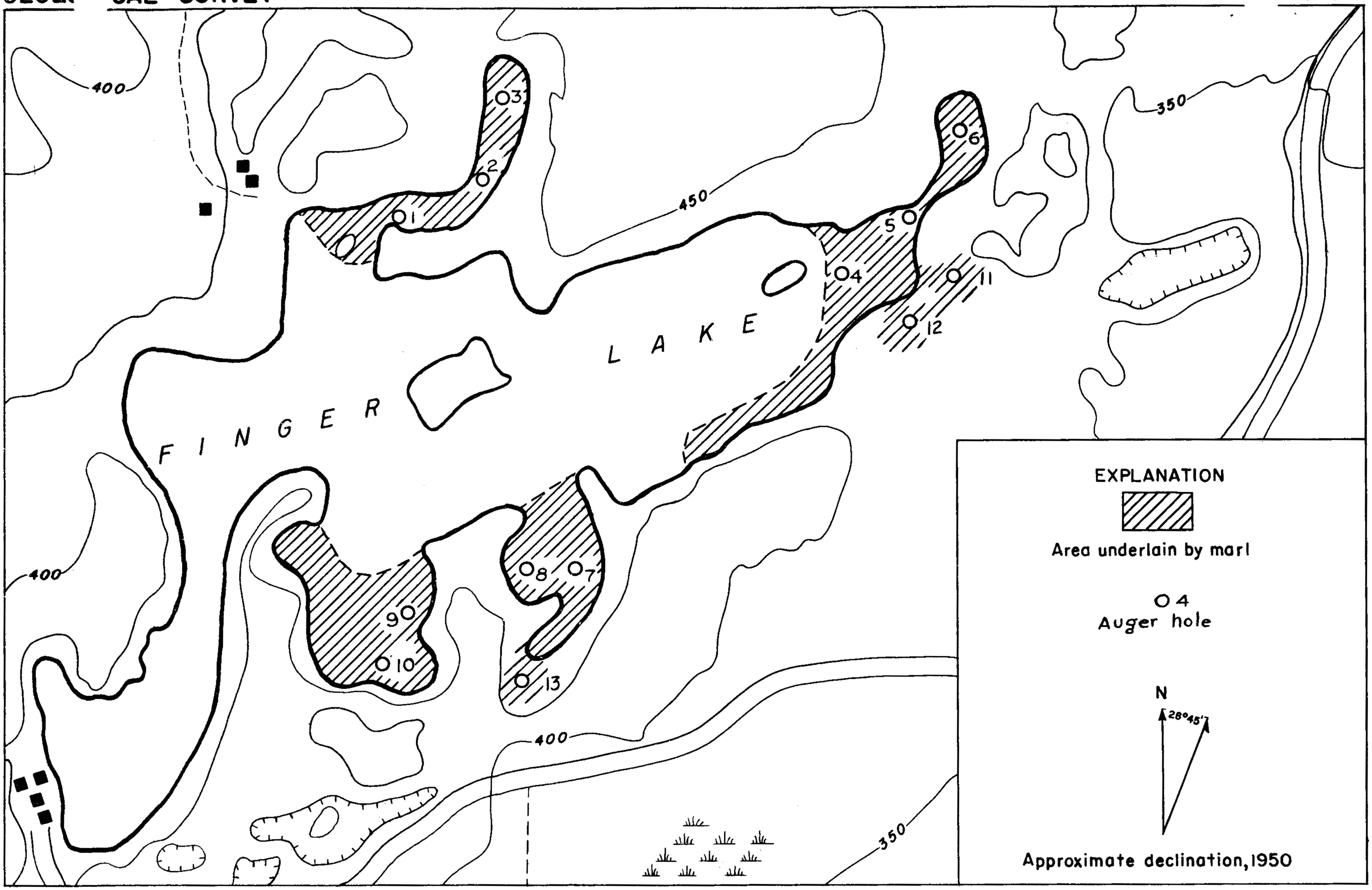
FIGURE 8



Base from Corps of Engineers Matanuska quadrangle, 1950

Geology by R.M. Moxham and R.A. Eckhart, 1951

MAP SHOWING THE INFERRED DISTRIBUTION OF MARL AT FINGER LAKE, WASILLA AREA, ALASKA

0 1000 2000 3000 4000 5000 Feet

CONTOUR INTERVAL 50 FEET

Table 3. Results of chemical analyses of auger-hole samples of marl from Wasilla, Finger and Lucile Lakes 1/

Hole No.	Sample description	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	Ign. Loss*
				Wasilla Lake					
2	composite	18.0	1.8	1.0	.97	37.0	.48	.28	39.3
3	"	16.3	.95	1.1	.59	37.8	.48	.34	40.0
				Finger Lake					
3	composite	32.8	3.2	1.6	.62	21.9	.82	.39	36.8
				Lucile Lake					
1	6 foot level	40.4	9.4	3.0	1.1	8.2	1.6	.94	36.6
1	15 foot level	10.2	1.3	1.2	.56	40.6	.48	.27	43.6

* Includes gain due to oxidation of FeO

1/ Analyses by Leonard Shapiro and S. M. Berthold, U. S. Geological Survey

Cross-sections of deposits as indicated by the drill cores are shown on Figure 7.

The marl attains a thickness of at least 18 feet in one locality (hole 4) at the east end of the lake; the hole did not reach the bottom of the marl. On the east margin of the lake about 209 feet east of the shoreline, drill holes 11 and 12 (Figure 9) show the marl has a minimum thickness of 21 feet. Another muskeg covered embayment on the south shore of the lake (drill hole 13) contains 20 feet of marl (Figure 10).

It is estimated that the marl in Finger Lake may aggregate on the order of 300,000 tons, based on a dry weight of 54 pounds per cubic foot. An insufficient number of test holes have been put down in the shoreline area to determine the thickness and distribution of the buried marl.

Lucile Lake

Marl deposits were found in the west, southwest and east ends of Lucile Lake (see Figure 11). The material is white to light gray in color, plastic to sticky in consistency, and is overlain by light tan to brown mud ranging from 1 to 6 feet in thickness. Test holes were drilled in shoreline areas to the west and south of the lake, but no buried marl was encountered, several test holes were abandoned on encountering permafrost. Cross-sections of the material penetrated in the lake are shown on Figure 7. Chemical analyses of two samples from drill hole 1 located at the northwest end of Lucile Lake are given in Table 3.

The marl deposits in Lucile Lake seemed to be generally thinner and less persistent laterally than those in the other two lakes studied. The deposit at the east end of the lake, although tested in only 2 localities had a maximum thickness of about 4 feet. In the northwest portion of the lake bottom, a thickness of 7 feet was found (hole 15) and an embayment near the center of the south shore contains at least 9 feet of white marl; the bottom of this deposit was not reached.

It is not possible with the present data to give any tonnage figure which would represent other than order of magnitude. A total of 500,000 tons might be represented by the two principal areas of deposition indicated on Figure 11.

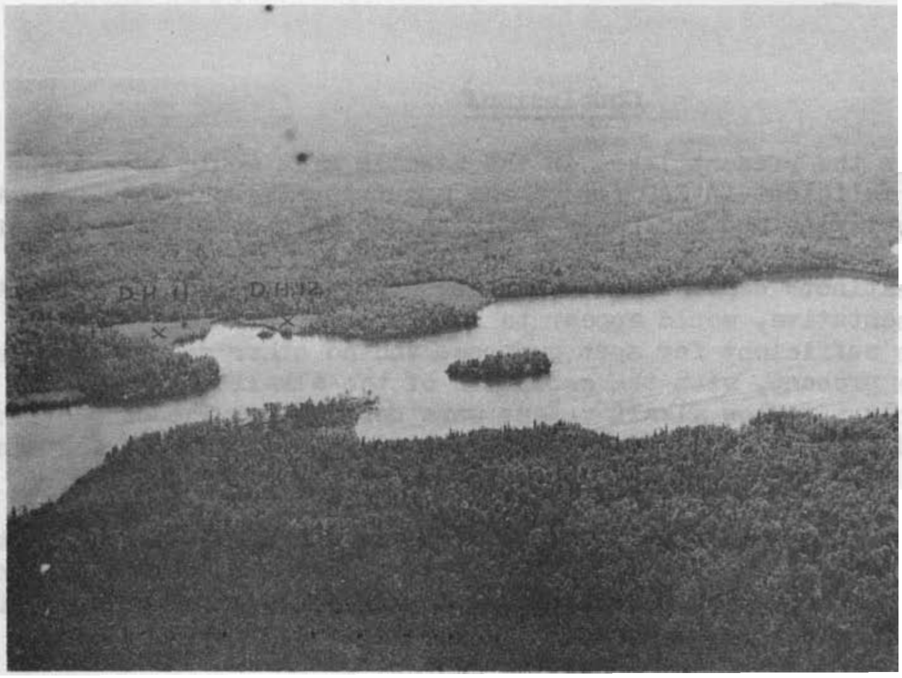


Figure 9. Southward aerial view of the east end of Finger Lake showing muskeg cover over marl at drill-hole locations 11 and 12.

Figure 10. Southward aerial view of Finger Lake showing muskeg cover over marl at drill-hole location 13.

Conclusions

Marl in the present lakes in the Wasilla area would have to be considered deficient in CaO for cement manufacturing purposes. Furthermore the overlying mud and water would undoubtedly complicate its excavation.

The "extinct" deposits on the other hand, if the Edlund deposit is a fair representative, would appear to hold greater promise. The CaO content probably is sufficient for most purposes and no other deleterious substances are present, with the exception of the alkalies which might be objectionable if a low alkali cement were desirable. The peat overburden which would have to be removed probably averages less than 5 feet in thickness.

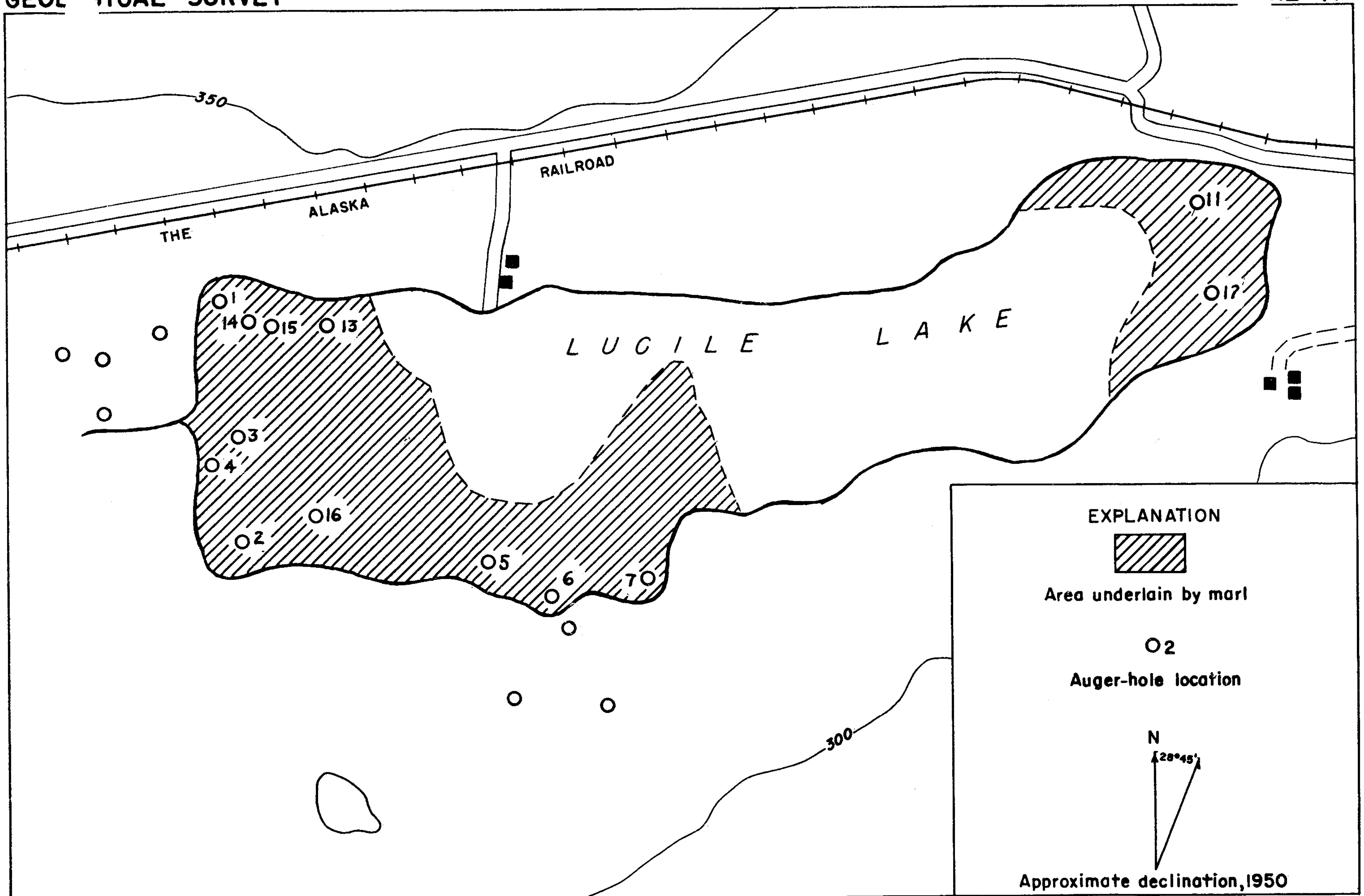
The amount of material present on the Edlund tract is inadequate in itself. However, the test holes at the east and south shores of Finger Lake indicate the presence of additional marl of considerable thickness in that locality which would warrant further investigation.

If some of the present lake marl should prove feasible for exploitation, it might be feasible to make use of other high-lime material to supplement the CaO content of the marl. One possible source of such a supplemental component would be the limestone which crops out immediately east of the Alaska Railroad near Potter (see Figure 1). The limestone occurs as a lens in highly metamorphosed slate and graywacke of Cretaceous age, and appears to be unusually pure, in view of its geologic setting. No tonnage estimates have been made, but the amount of material available appears to be relatively small. One sample of the limestone deposit was collected by Waring in 1937 (1947, p. 5) and results of the chemical analysis are given below.

	Percent
SiO_2	0.40
Fe_2O_3 plus Al_2O_3	0.40
MgO	0.14
CaO	54.70
Ign. Loss	44.36
Total	100.00

The marl from several of the deposits in the Cook Inlet area has been used sporadically for agricultural purposes, but it appears doubtful if an appreciable quantity could be marketed for this purpose, as the soil in the Matanuska Valley area generally does not require lime treatment (D. L. Irwin, personal communication, 1952).

Lime products, Inc., plans to utilize the material on the Edlund property for the manufacture of rock dust for the local coal mining industry. A 5 percent maximum limit on silica is usually required for this purpose. Most of the marl exceeds this limit so some means of benefication will probably be required to remove the silica.



Base from Corps of Engineers, Houston and Matanuska quadrangles, 1950

Geology by R. M. Maxham and R. A. Eckhart, 1951

MAP SHOWING THE INFERRED DISTRIBUTION OF MARL IN LUCILE LAKE, WASILLA AREA, ALASKA

0 1000 2000 3000 4000 5000 Feet

CONTOUR INTERVAL 50 FEET

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