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DEPARTMENT OF THE INTERIOR

INFORMATION SERVICE

GEOLOGICAL SURVEY

For Release OCTOBER 29, 1956

ENGINEERING GEOLOGY OF THE KATALLA AREA, ALASKA

A report discussing the engineering geology along a proposed highway route near Katalla, Alaska, has been released to open file by the Geological Survey today.

The investigation covers an area including the route of the proposed highway from mile 39 on the Copper River Highway, to Katalla. Both the geological properties and the engineering characteristics of earth materials in the area are discussed in this report.

Much of the area is underlain by sedimentary rocks of Tertiary age or metamorphic and igneous rocks of pre-Tertiary age, any of which are suitable for road foundations. Unconsolidated deposits include glacial moraines and outwash, and terrace, beach, fan, meadow, swamp, and landslide deposits. The meadows, landslides, and swamps, are unsuitable for road foundations; most of the other unconsolidated deposits vary in their suitability for highway foundations, although most of them are good foundations materials except where they are poorly drained. Borrow material may be obtained from glacial outwash, beach, and fan deposits.

The report, entitled "Engineering geology of the Katalla area, Alaska" by Reuben Kachadoorian, has been placed on open file at the following Geological Survey offices: Library, Room 1033, General Services Administration Bldg., Washington, D. C.; Brooks Memorial Mines Bldg., College, Alaska; Room 117, Federal Bldg., Juneau, Alaska; 210 E. F. Glover Bldg., Anchorage, Alaska; Library, 4 Homewood Place, Menlo Park, Calif.; 468 New Customhouse, and Library, Denver Federal Center, Denver, Colo.; 1031 Bartlett Bldg., Los Angeles, Calif.; 724 Appraisers Bldg., San Francisco, Calif.; 504 Federal Bldg., Salt Lake City, Utah; South 157 Howard Street, Spokane, Wash.; and also at the Territorial Department of Mines, Territorial Bldg., Juneau, Alaska. Copies from which reproductions of text and illustrations can be made at private expense are available at 4 Homewood Place, Menlo Park, Calif.

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UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

ENGINEERING GEOLOGY OF THE KATALLA AREA, ALASKA

By

Reuben Kachadoorian

1956

The field work on which this report is based was made possible by the cooperation of the Alaska Road Commission.

This report is preliminary and has not been edited or reviewed for conformity with U. S. Geological Survey standards and nomenclature.

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By

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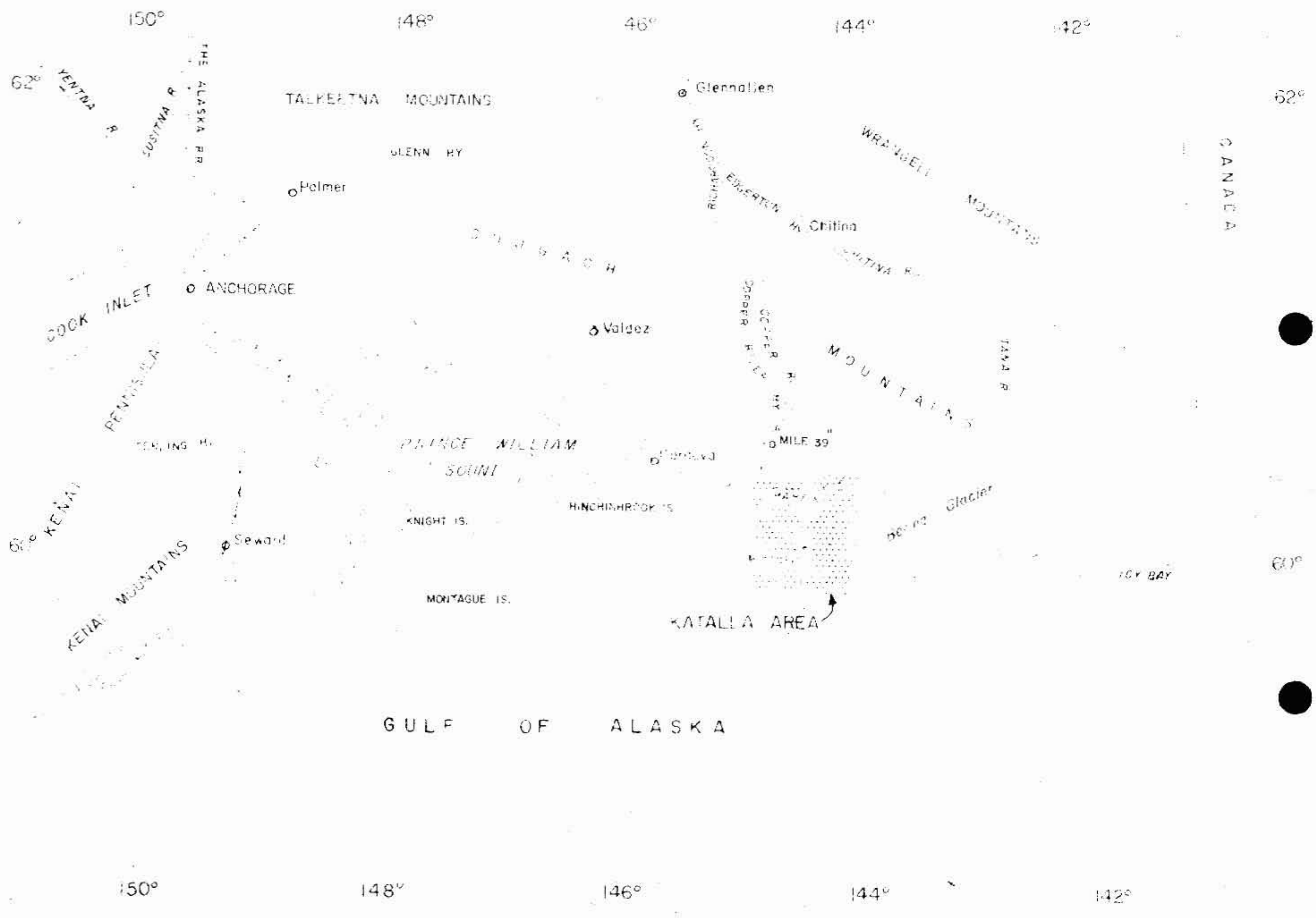
INTRODUCTION

A geological examination of the Katalla area, Alaska, was made during the summer of 1955 at the request of and in cooperation with the Alaska Road Commission. The Katalla area herein defined lies in the Cordova A-1, A-2, B-1, and B-2 quadrangles (fig. 1), and encompasses most of the area considered as the Katalla district by previous investigators. This report describes the engineering geology of the Katalla segment of a proposed highway from Mile 39 on the Copper River Highway to Icy Bay, approximately 110 miles east of the town of Katalla. The completion of this highway and the Copper River Highway from Mile 39 to Chitina will tie the Katalla and Cordova areas into the Alaska Highway net and the Alaska Railroad.

Previous investigations

Previous geologic work in the Katalla district was directed primarily at investigations of oil and coal resources. The Katalla district as defined by Miller (1951) "...extends from the valley of the Copper River eastward about 40 miles to the western margin of Bering Glacier, and from Kayak Island northward about 55 miles to the southern front of the Chugach Mountains". A systematic investigation of this district was begun in 1903 by G. C. Martin and carried out through 1906, and in 1915 by Martin and other geologists of the Geological Survey. The most recent investigation of the Katalla


150°
148°
46°
144°
42°
62°
YENTNA R.
SUSITNA R.
THE ALASKA RR
TALKEETNA MOUNTAINS
GLENN HY
Palmer
Glennallen
WRANGELL MOUNTAINS
RICHARDSON HY
EDGERTON HY
Chitina
CANADA
CHUGACH
ANCHORAGE
COOK INLET
Valdez
COPPER R.
COPPER RIVER RY
MOUNTAINS
TANA R.
PENINSULA
MILE 39
PRINCE WILLIAM SOUND
Cordova
HINCHINBROOK IS.
KNIGHT IS.
Seward
KENAI
KENAI MOUNTAINS
Bering Glacier
ICY BAY
60°
MONTAGUE IS.
KATALLA AREA
GULF OF ALASKA
146°

district was done by D. J. Miller, D. L. Rossman, and C. A. Hickcox in 1944, and by Miller in 1945 and 1951. The primary objective of this investigation was to obtain geologic information useful in appraising the oil possibilities of the Katalla district.

Present investigation

The present geological examination of the Katalla area was made by a Geological Survey party consisting of Reuben Kachadoorian and David D. Smith, geologists; A. Peter Haupert, field assistant; and Nelson C. Fellows, bulldozer operator, who was assigned to the party by the Alaska Road Commission. This examination concerned itself chiefly with an engineering geology investigation of the area. Field mapping by the party consisted of a series of boat and foot traverses during which geological information was gathered and plotted on vertical aerial photographs of 1:40,000 scale, and transferred later to a topographic map of 1:40,000 scale. Areas not visited on the ground were mapped by reconnaissance from a light airplane and photointerpretation. The geology in areas mapped by this method is less accurate than those mapped by ground traverses.

Areas east of the Bering River, north of the Martin River, northwest of Ragged Mountain, and Fox, Kanak, Kayak, and Wingham Islands were not visited on the ground. They were, however, visited by Martin and Miller and information on such areas was obtained from Miller (1951 and oral communication). In addition, information and criteria established in the areas traversed on foot and by boat were used to extend the lithologic units into the above areas by photointerpretation.

Acknowledgments

Field work and logistic support were greatly facilitated by the cooperation of numerous Alaska Road Commission employees. Of particular value was the cooperation of Lawrence C. Hough and James W. Kassen, Alaska Road Commission engineers.

The results of mechanical analyses shown in this report are based upon tests made by the Valdez District of the Alaska Road Commission and the Geological Survey in Menlo Park, California.

GEOGRAPHIC SETTING

Topography

The Katalla area lies on the south flank of the Chugach Mountains and is bounded on the west by the Copper River Delta, on the east by the Bering Glacier, and on the south by the Gulf of Alaska. Major topographic features include roughly northward-trending mountains and ridges interspersed with lakes, glaciers, valleys, swamps, and broad lowland areas. About one-fourth of the map area consists of mountains, one-fourth of sea, one-fourth of tidal lowlands, and the remaining one-fourth is comprised of approximately equal proportions of lakes, valleys, and glaciers.

The mountains rise abruptly from the lowland areas to a maximum elevation of about 3,300 feet in the western part of the area (pl. 2), to 4,000 feet north of the Martin River (pl. 3), and to 2,700 feet in the eastern part of the area (pl. 3).

Vegetation

Two major floral zones are represented in the Katalla area. The coastal forest zone extends from sea level to an approximate elevation of 1,700 feet. Areas above this elevation have alpine tundra vegetation. Variation of vegetation within each zone is controlled by topography, exposure, drainage, and underlying soil and rock types.

Within the coastal forest zone swamps (Qs) and meadows (Qm) are covered with grasses, sedges, and small colonies of shrubs. Willow, alder, and limited patches of Sitka spruce or western hemlock are restricted to higher ground bordering the water courses of the swamps and meadows. Vegetation on the alluvial fans consists of willow, alder, Sitka spruce, and western hemlock. On the fans in the east and west sides of Katalla valley, vegetation is chiefly alder and willow with an occasional small stand of spruce and hemlock. The spruce and hemlock occur in the better-drained upslope part of the fans. The undergrowth on these fans consist chiefly of devils club and salmonberry. Spruce and hemlock, as much as 3 feet in diameter, are the dominant trees on the fan that divides the Katalla Valley and Bering Lake. Devils club, salmonberry, and scattered patches of alder and willow form the undergrowth on this fan. Sitka spruce and western hemlock predominate in the denser forests. They grow on the better-drained lowlands and on the slopes up to an elevation of 1,700 feet. The largest stands of spruce and hemlock occur on (1) moraines (Qmo) and outwash (Qo) south of Kushtaka Glacier, west of Martin River Glacier, and south of Charlotte Lake, (2) on bedrock along the Trout Creek, and (3) along the shore between Redwood Bay and the mouth of Bering River. Trees in these areas are as much as 5 feet across and average 3 feet in diameter. The forest floor is mantled by a thick growth of devils club, salmonberry, and blueberry.

In the alpine tundra zone, above timberline, the upper slopes and summits of the hills and mountains are covered by a thick mat of moss, sedges, and herbs. Shrubs and stunted Sitka spruce and mountain hemlock occur in sheltered localities along the lower margin of the alpine zone. Vegetation-free bedrock is common in areas of very steep slopes and on the higher summits.

GEOLOGY

The geology of the Katalla area is shown on plates 1, 2, 3, and 4. The rocks exposed in the area consist of (1) metamorphic rocks and associated intrusive rocks of pre-Tertiary age, (2) sedimentary rocks of Tertiary age, and (3) unconsolidated sediments of glacial and nonglacial origin of Quaternary age.

Bedrock

Metamorphic rocks and intrusive igneous rocks

The sedimentary and volcanic rocks of pre-Tertiary age are slightly to moderately metamorphosed, and are exposed on (1) Ragged Mountain, (2) all of Wingham Island except the extreme southeastern part, (3) bluffs of Fox and Whale Islands, and (4) in the Chugach Mountains north of the Martin River. The rocks consist of metamorphosed silty and sandy sediments with greenstone, graywacke, and minor amounts of chert, limestone, and intrusive igneous rocks (Martin, 1908, Miller, 1951). The rocks are complexly faulted, folded, and intensely jointed. The sandstone and graywacke are massive and generally fracture into blocks 2 to 5 feet across. Locally, however, they fracture into blocks less than 1 foot across. The greenstone is massive and fractures into blocks 5 to 8 feet across. The shales and slates have well-developed cleavage and break into thin slabs.

Areas underlain by the metamorphic rocks of pre-Tertiary age will offer excellent road foundations. Because the rocks are intensely jointed and have well-developed cleavage over-breakage may result in shales and slates if blasting is necessary for excavation.

Sedimentary rocks

Sedimentary rocks of Tertiary age underlie most of the Katalla area. They extend from the base of Ragged Mountain to the eastern boundary of the mapped area and from the Martin River and Martin River Glacier south to the Gulf of Alaska. They also crop out on the west side of Ragged Mountain. The sedimentary rocks consist chiefly of sandstone, shale, argillite, arkose, siltstone, and conglomerate (Miller, 1951). Miller has subdivided the rocks into several mappable units. Since the engineering characteristics of most of the various units are essentially similar, however, the sedimentary rocks are considered as one unit in this report.

The rocks of Tertiary age are locally metamorphosed in areas of contact with the metamorphosed sediments of pre-Tertiary age. West of Ragged Mountain (pl. 2) the sandstone is massive, hard, fine- to medium-grained and interbedded with argillite, siltstone, and conglomerate containing cobbles and boulders. In the area between Martin Lake and Bering Lake (pls. 3 and 4) the rocks are shale with minor amounts of mudstone, siltstone, and claystone and fine-grained calcareous sandstone interbedded with shale and siltstone. The rocks exposed on the northeast shore of Bering Lake are chiefly coarse arkose. Massive, thick-bedded medium- to coarse-grained sandstone interbedded with fine-grained thin-bedded sandstone is exposed at Split Creek south of Bering Lake. On Burls Creek (pl. 1), east of Katalla, the rocks are chiefly massive gray shale and associated dense, massive glauconitic sandstone, tuff, and volcanic breccia.

The thick- and thin-bedded sandy and shaly sediments locally have joints 4 to 8 inches apart. More commonly the joints in these rocks are spaced 2 to 4 feet apart.

Surfaces underlain by sedimentary rocks are well drained and will offer excellent road foundations. Locally, over-breakage during blasting will occur in the thin-bedded units of this formation.

Unconsolidated deposits

With the exception of glacial outwash (Qo) and glacial moraine (Qmo), the unconsolidated deposits in the Katalla area are of nonglacial origin. Outwash and morainal complexes are restricted to areas within $5\frac{1}{2}$ miles of present glaciers. The nonglacial sediments, however, vary widely in composition and are scattered throughout the Katalla area.

End, lateral, and ground moraines

End, lateral, and ground moraines (Qmo) are common in the Kushtaka Lake, Charlotte Lake, and the Martin River areas (pls. 3 and 4). Kushtaka Lake is dammed by a large, well-developed end moraine approximately 100 feet high. Another well-developed end moraine restricts the Martin River channel approximately 2 miles west of the

Martin River Glacier. Numerous smaller lateral moraines occur on the high slopes of the mountains between Kushtaka and Charlotte Lakes.

The morainal complexes are areas of rough topography consisting of ridges 20 to 100 feet high, separated by swales and undrained depressions. Kettle holes ranging from shallow pan-like depressions 10 feet deep and 100 feet wide to steep-walled pits 50 feet deep and 100 to 500 feet across are common. Lakes are common in the kettle holes and in depressions dammed by till that was plastered at the base of moving ice, or dumped without reworking by meltwater at the point where ice finally melted.

End and lateral moraine complexes were formed at the fronts and sides of glaciers. The larger ridges may represent (1) material plowed up during periods when the glaciers were expanding, (2) material dumped without much reworking by meltwater, and (3) material dumped during periods when the glaciers were receding. Smaller sand and gravel hillocks consist of material washed into tunnels and crevasses along the margins of the ice. The kettle holes represent the sites of isolated ice blocks that melted away within the moraines or melted away after being buried in gravel by meltwater streams.

Sandy till is generally the predominant material comprising moraine complexes, and consists of 35 to 70 percent gravel, 25 to 50 percent sand, and less than 6 percent silt and clay (fig. 2, curves D and E). It is present everywhere in the moraines at depth, and crops out at the surface in long, smooth ridges that are the dominant element in the morainal topography. The dominant exposed material of the moraine that dams the southern part of Kushtaka Lake, however, is not sandy till but

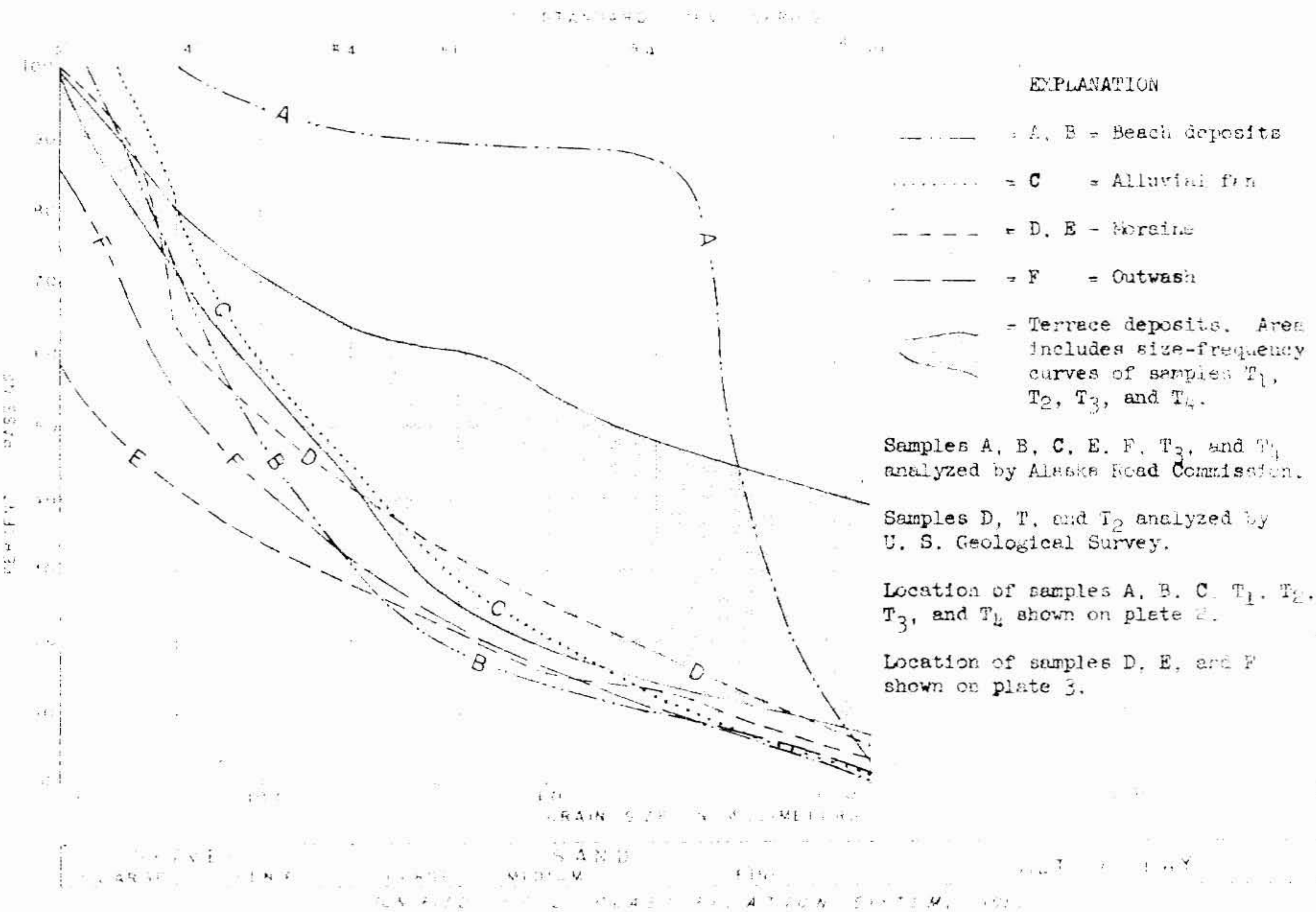


Figure 2. **Cumulative size-frequency curves of deposits in the Katalla area, Alaska**

consisting of cobbles and boulders. Boulders up to 10 feet across are common and a boulder 25 feet across was noted. Sandy till may be present at depth.

Rocks in the morainal complexes consist chiefly of sub-angular to angular cobbles and boulders of granite, sandstone, metamorphic rocks, and volcanic rocks. Most of the larger boulders are granite.

The outer margins of the end and lateral moraines are generally well drained and are relatively favorable areas for road building, where considerations of grades and alignments permit.

Outwash

Outwash (Qo) is glacial debris that has been reworked and deposited by meltwater streams. It consists of well-sorted sands and gravels, commonly stratified. Areas of outwash large enough to be mapped separately are found west of the Martin River and Bering River Glaciers, north and south of Kushtaka Lake, and south of Charlotte Lake. The surficial swamp (Qs) and alluvial sand (Qas) deposits east of the Bering River may be underlain by outwash deposits.

Topography underlain by outwash is characterized by nearly flat surfaces with local relief of 3 to 15 feet consisting of low escarpments, bars, and swales marking the courses of ancient stream channels.

The outwash deposits are similar to, but coarser than, the modern alluvium (Qas) in nearby streams. They consist principally of about 65 percent well-rounded pebble-cobble gravel, 30 percent clean washed sand, and less than 5 percent silt and clay (fig. 2, curve F).

Drainage conditions vary widely in outwash areas. The outwash is coarse and permeable and thus generally has good drainage. Many of the outwash areas, however, have low gradients and are indented below the surrounding terrain, thereby collecting drainage from large areas. The margins of the outwash plains are generally marshy or swampy.

Areas of well-drained outwash offer good road foundations for highways and will yield small quantities of borrow material. The marshy, poorly drained margins of outwash plains will offer good road foundations if adequately drained.

Terrace deposits

Terrace deposits (Qt) are confined to the western portion of the Katalla area. They occur (1) west of the town of Katalla (pl. 2), (2) along the south and west flanks of Ragged Mountain, (3) west of Martin Lake (pl. 4), (4) on Fox and Whale Islands, and (5) in a small area north of the Martin River on the west flank of the Chugach Mountains. The terraces on Fox and Whale Islands, west of Katalla, and along the southern and western margin of Ragged Mountain were formed by wave action. Terraces north of the Martin River and west of Martin Lake may have formed either by wave action or may be terrace-like surfaces developed by glacial scouring.

The terraces are in large part mantled by swamp and meadow deposits 3 to 10 feet thick. The terrace west of Martin Lake is completely covered by meadow deposits 3 to 6 feet thick. Measured thicknesses of terrace deposits range from 3 feet west of Katalla to 46 feet on Whale Island.

Sediments comprising terrace deposits consist of about 35 to 55 percent angular to rounded gravel, 20 to 54 percent sand, and 7 to 40 percent silt or clay (fig. 2, curve T-T').

Terrace deposits at most places are well drained and will offer good road foundations. West of Martin Lake, however, the mantle of meadow deposits, consisting of grasses, sedges, mosses, fine sand, and silt, should be removed and the terrace deposits exposed before construction of the highway.

Beach deposits

All constructional shoreline deposits, built principally by the work of waves and long shore currents, and consisting of sand, pebbles, and boulders, are considered as beach deposits (Qbd) in this report. Under beach deposits are discussed barrier beaches, spits, bay-mouth bars, and cuspate forelands.

Kanak Island, a barrier beach, was formed by waves breaking some distance offshore on the gently shelved offshore area. The waves churned up the bottom sand and built the island. Barrier beaches and sand bars consist principally of coarse- to fine-grained sand with minor amounts of pebbles.

Okalee Spit, Softuk Bar, and the spit at Katalla Bay, are being formed by currents flowing in a northwesterly direction around bedrock headlands (Cave Point, Point Martin, and the Suckling Hills, respectively) and tail-off into deep water.

As the spits and barrier beaches continued to grow they nearly or completely closed the entrance to Katalla Bay, thereby forming a bay-mouth bar. Several distinct former bay-mouth bars were noted in Katalla Valley. The oldest bay-mouth bar in the valley is approximately 4 miles north of the spit now developing at the mouth of the valley. Therefore, the bay at one time extended into Katalla Valley at least 4 miles and the development of a series of spits into bay-mouth bars has forced the bay to its present location. Bay-mouth bars in Katalla Valley vary in composition from about 68 percent gravel, 30 percent sand, and less than 2 percent silt and clay at the head of the valley to about 10 percent gravel, 85 percent sand, and less than 5 percent silt or clay at the mouth of the valley (fig. 2, curves A and B).

Palm Point, south of the town of Katalla, is a cuspate foreland formed by currents from Katalla Bay and from the direction of Martin Islands. The point was built at a time when Katalla Bay extended farther into the Katalla Valley. At the present time the point is being eroded by the current that is building the spit across Katalla Bay.

Beach deposits are generally well-drained and will offer excellent road foundations. The coarser deposits generally lack binder material. Locally, however, excellent borrow material may be obtained. From Palm Point northward to a point approximately three-eighths of a mile south of Katalla the beach is being eroded. Locally, the beach has been cut back an estimated 100 feet in this area within the past 50 years. More commonly, however, the beach has retreated between 25 and 35 feet in this span of 50 years. Elsewhere in the Katalla area erosion of the coastline is of much smaller magnitude.

Alluvial fan deposits

Numerous alluvial fans (Qaf) occur in the Katalla area. Extensive areas of fans occur (1) on the east, south, and west slopes of the mountains bounding Katalla Valley, (2) between Katalla Valley and Bering Lake, and (3) south of Martin Lake. Smaller fans have developed along Redwood, Burls, Mary, Puffy, Dick, Stillwater, and Shepherd Creeks.

The fans have relatively little relief and stand only a few inches higher than their stream channels. Trenches a few feet deep represent old abandoned stream channels and channels occupied only during floods. The heads of the fans are generally well drained and the water table lies 10 to 15 feet below the surface. At the toes, however, numerous seepages occur and meadows and swamps are common.

Alluvial fans consist of interfingering lenses of clean washed gravel and sand, with occasional cobbles. The average grain size of the deposit decreases with increasing distance from the slopes or sources of the material. The average grain size of fan deposits consists of approximately 55 percent gravel, 43 percent sand, and 2 percent silt or clay (fig. 2, curve C).

Alluvial fan areas will offer generally good foundation for highways. Marshy and swampy areas occur at the toes of the fans, where the water table intersects the surface. Such areas should be avoided and the road alignment placed further upslope on the fan. Occasional radical channel changes should be anticipated on alluvial fans during and following floods.

Selective borrowing on alluvial fans will yield sufficient usable sand and gravel for fills. The depth of borrow pits will be controlled by the water table and limited to a few inches at the toe of the fans to 10 or 15 feet at the head of the fans.

Meadow deposits

Extensive areas of meadows (muskegs) occur (1) in the Katalla Valley, (2) west and southeast of Martin Lake, and (3) along the southern margin of Ragged Mountain. Small scattered meadows occur locally on the upper slopes of the mountains.

Meadows are underlain by 1 to 8 feet of spongy material made up of grasses, sedges, mosses, fine sand, and silt. Although they are very absorbent and generally dry on the surface, local swampy areas are abundant in the low-lying meadows. Deep, steep-sided small pools are characteristic of the meadow areas. With the exception of those on the mountain slopes, the meadows are generally underlain by 3 to 12 feet of sand and gravel. The meadows on the high mountain slopes are underlain by bedrock.

Meadows are formed in poorly drained areas and occur (1) behind bay-mouth bars in Katalla Valley, (2) on beach terraces along the southern margin of Ragged Mountain and west of Martin Lake, (3) on an alluvial fan southeast of Martin Lake, and (4) overlying bedrock, on high mountain slopes.

Areas of meadows are unsuitable as road foundation. If road construction across such areas is unavoidable, the grass, sedge, moss, fine sand, and silt should be removed before construction of the highway. The meadow deposit west of Martin Lake ranges from 2 to 5 feet in thickness and should be prospected thoroughly if the highway alignment is to cross this area. Although the abandoned railroad grade crosses extensive areas of meadows in Katalla Valley, the highway alignment should not be placed in this area. Here the average depth of the meadow deposits is at least 8 feet.

Swamp deposits

Large swamps (Qs) are scattered throughout the Katalla area and are especially abundant (1) south of Kushtaka Lake, (2) south of Bering River, and (3) west of the Martin River Glacier. The swamps chiefly overlie areas of outwash and meadow deposits and rarely occur in poorly drained areas of alluvial fan deposits (Qaf) and alluvial sand (Qas).

The features, considered and mapped as swamps in this report consist of large areas in which drainage is impeded so that the soils are saturated throughout the year, and low-lying coastal areas occasionally inundated by the highest tide. Standing water a few inches deep covers much of the surface. Many areas mapped as swamps do not generally contain any standing water. They do, however, become marshy and contain water 2 to 3 inches deep after a few days of rain. Therefore, such areas are considered and mapped as swamps in this report.

Swamp deposits consist of peat, muck, and silt generally as much as 3 feet thick. West of the Martin River and Bering Glaciers, swamps are underlain by outwash sand and gravel. Elsewhere they are underlain by meadow deposits, alluvial sand, and alluvial fan deposits.

Swampy areas fall into three categories as road foundation: (1) swamps underlain by outwash sand and gravel will generally offer fair road foundation, if adequate drainage can be provided, (2) those underlain by alluvial sand will offer poor to fair foundation, and (3) swamps that overlie meadow deposits will offer poor foundations.

Intensive prospecting should be conducted to determine the thickness of the peat, muck, and silt and to establish the underlying material if swampy areas are to be crossed by the highway alignment.

Alluvial sand

Extensive areas of alluvial sand (Qas) underlie the flood plains of (1) the Gandil, Nichawak, and Bering Rivers west of the Bering Glacier, (2) the Martin River west of the Martin River Glacier, (3) the Copper River Delta, (4) the Katalla River, and (5) Shepherd Creek that flows into Bering Lake. Smaller areas of alluvial sand deposits occur along the numerous tributaries of these rivers. The flood plains underlain by alluvial sand are nearly flat, marshy surfaces, crossed by a few winding sloughs and minor streams. Lakes, meadows, and swamps are common.

The alluvial sand flood plains of the large glacier rivers (the Gandil, Nichawak, Bering, Copper, and Martin Rivers) and Shepherd Creek are 1 to 10 feet thick and consist of clean washed fine- to coarse-grained sand interspersed with gravel bars. The fine- to coarse-grained sand is underlain by an unknown thickness of sandy gravel. During construction of a segment of the Copper River Highway in similar deposits west of the Copper River, the Alaska Road Commission engineers state that as much as 30 feet of gravel was encountered beneath the alluvial sand. It is reasonable to assume, therefore, that the thickness of sandy gravel underlying the alluvial sand flood plains of the Gandil River, Nichawak River, Bering River, Copper River, Martin River, and Shepherd Creek is of the same order of magnitude.

The alluvial sand flood plains of the Katalla River and minor streams are 3 to 10 feet thick and consist chiefly of fine- to coarse-grained sand with minor amounts of silt. Gravel was not observed in the sand and silt. These flood plains are generally underlain by fine sand and silt of unknown thickness.

Areas underlain by alluvial sand deposits vary in drainage from poor to fair and also vary from poor to fair as road foundations. The flood plains of the Gandil, Nichawak, Bering, Copper, and Martin Rivers, and of Shepherd Creek will generally offer fair road foundations because they are underlain by sandy gravel. The flood plains of the Katalla River and the minor tributary streams, will offer generally poor, with locally fair areas for road foundations. Therefore, if areas of alluvial sand deposits are to be crossed by the highway, intensive prospecting of this deposit should be undertaken.

Talus

Talus deposits (Qta) are found along the front of the mountains and in the steep-walled valleys within the mountains. Large talus deposits occur on the east flank of Ragged Mountain.

The talus consists of loose rock pried from bedrock cliffs by frost action and other weathering processes, and deposited as aprons and cones on the gentler slopes below. The angular unsorted blocks range from a few inches to 10 feet or more in diameter. Some of the talus deposits reach thicknesses of as much as 50 feet. More commonly, however, they are 25 to 30 feet thick.

Talus deposits are generally unfavorable areas for highway construction because of their steep surface gradients. Furthermore, talus deposits may be in a state of delicate equilibrium and may develop large-scale slumps and slides if disturbed. The talus deposit along the east shore of Martin Lake is completely stabilized and is mantled by a thick growth of vegetation. The thickness of this talus is unknown but is believed to be only 5 to 10 feet thick and locally as much as 15 feet thick. Large blocks of talus debris were not noted. Further examination of this area for possible road location should be made.

Talus deposits commonly contain abundant coarse material suitable for use as riprap. Talus may have to be crushed, however, if used for fill in constructing subgrades.

Landslides

Large landslides (Qls) have developed (1) along the east flank of Ragged Mountain, (2) north of the Martin River on the south flank of the Chugach Mountains, and (3) on the east flank of Charlotte Ridge. Numerous smaller slides are scattered throughout the Katalla area.

With the exception of the large slide on the east flank of Charlotte Ridge, all the large landslides are in the metamorphosed sediments of pre-Tertiary age. The smaller slides are as common in the sandstones and shales of Tertiary age as in the rocks of pre-Tertiary age.

Areas of landslides are subject to additional sliding and thus are unsuitable as road foundation and should be avoided.

Snowslides

During the 1955 summer field season numerous snowslides were heard in the Katalla area. Neis Larson, a resident of Katalla, reported (personal communication) that snowslides are abundant in the area and occur most frequently during the late spring and early summer. He stated that the largest slides occur on the east slope of Ragged Mountain and on the west slope of the mountains forming the eastern boundary of Katalla Valley.

Areas that are subject to snowslides are distinguished by slopes containing chute-like scars, vegetation-free slopes, and slopes supporting relatively young vegetation. Such areas should be considered and evaluated in the location of the highway alignment.

Seismic activity

The Katalla area lies in a seismic zone of major activity. Moderate and severe earthquakes have been reported in Katalla, in Cordova, west of Katalla, and at Yakataga, east of Katalla (Tarr and Martin, 1912). On May 14, 1908 an earthquake with an intensity of VII on the Rossi-Forel scale was reported with its epicenter at Katalla. Tarr and Martin report the description of the earthquake taken from the Katalla Herald (May 16, 1908) as follows: "Two earthquake shocks, occurring in quick succession at 11:07 o'clock Thursday night, set every building in town rocking, moved furniture about rooms, knocked dishes from shelves, and caused many of the people in town, many of whom had retired, to take to the streets.

According to the statements of a number of people, the shocks, of which there were two in almost instantaneous succession, lasted from 10 to 17 seconds. No damage was done. The shocks were accompanied by a vibratory motion pretty nearly north and south. In the Herald office the machinery and fixtures swayed perceptibly, while the building rocked as if it had been struck by a cyclone."

Recent earth movement in the area is indicated by 30 feet displacement of the talus deposits along the fault on the eastern flank of Ragged Mountain (pls. 2 and 4).

Recurrence of earthquakes of intensities as great as that of the 1908 earthquake is probable in the Katalla area. Therefore, man-made structures in the area should be made earthquake resistant.

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