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NONMETALLIFEROUS DEPOSITS IN THE ALASKA RAILROAD BELT

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INTRODUCTION

In recent years the need for building materials in the Alaska Railroad belt has increased to many times the prewar demand, largely as a result of military and related construction. It is expected that this need not only will continue but will increase in the postwar period as a result of new construction.

Deposits of several types of nonmetallic minerals used in construction are known in the Railroad belt (see fig. 1), but none has been developed on a commercial scale. This report is based largely on an investigation in 1931 by G. A. Waring, who spent seven weeks examining nonmetalliferous deposits, other than coal, along the Railroad. Since that time the activities of the Geological Survey in this area have been confined almost entirely to studies of metalliferous deposits and coal, and only a few brief examinations of nonmetalliferous deposits, incidental to other studies, have been made.

GRANITE

Occurrence in Alaska

Granitic rocks underlie large areas in many parts of the mountain ranges of Alaska. On the islands and adjacent mainland of southeastern Alaska a considerable part of the land area consists of granitic rocks. Similar rocks are present in the northeastern part of the Alaskan Peninsula, in various parts of the Alaska Range, in the mountains of the Seward Peninsula, and in the Yukon River basin. In the Kuskokwim River basin there are areas of granitic rocks, occurring chiefly as stocks and dikes. The central mass of the Talkeetna Mountains, in south-central Alaska, is largely granitic rock.

In spite of the abundance and widespread occurrence of granitic rocks in Alaska, the lack of local demand for building stone has prevented the development of a quarrying industry in most parts of the Territory.

Granite near Eklutna

Near Eklutna, about 9 miles south of Matanuska, a small mass of medium-grained quartz diorite forms a group of low hills that are about a quarter of a mile in diameter and 100 feet in maximum height and lie about 1,000 feet west of the railroad, on the shore of Knik Arm. The southern half of the deposit is owned by the Office of Indian Affairs and has been developed by the Alaska Railroad as a source of coarse riprap. The northern half of the deposit is on private land. The rock at this locality is generally massive, without gneissic structure or jointing, and is exceptionally fresh as a result of glacial scouring that removed all weathered rock.

Granite near Curry

A large body of granitic rock is exposed beside the Alaska Railroad in the canyon of the Susitna River about 1½ miles south of Curry. The railroad bed was blasted out along the bluffs at the river's edge, and the granitic material is exposed along the railroad for about 200 yards. The granitic mass was intruded into black slate and schist. The intrusive is light gray medium-coarse grained, and even textured. The rock consists of quartz, plagioclase feldspar, white mica, and a small portion of dark minerals and is therefore a quartz diorite. A small amount of molybdenite is found along minor quartz veins and aplite dikes that traverse the mass. The quartz diorite has a slightly gneissic structure and cleaves readily into blocks. Although somewhat weathered superficially the rock is

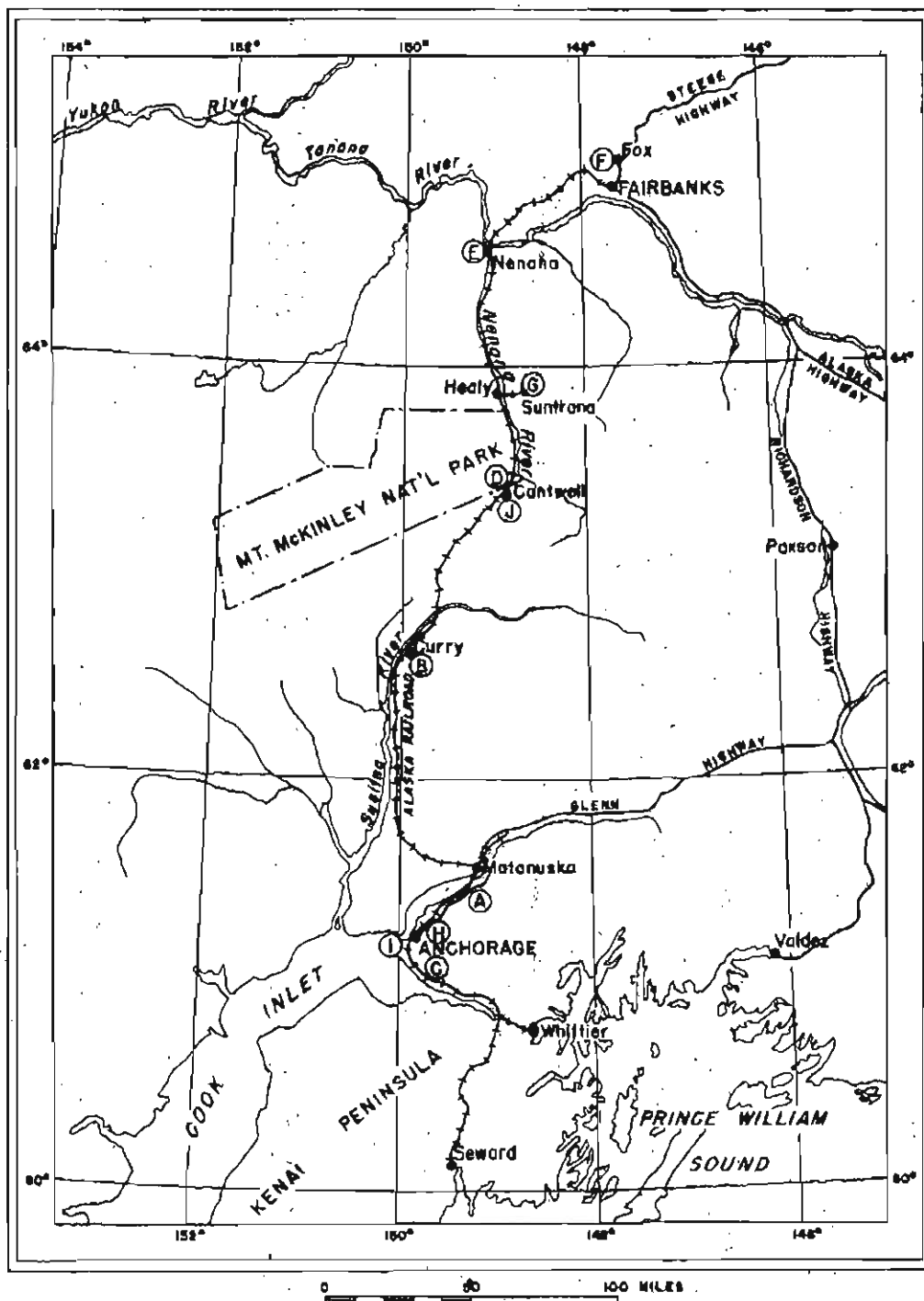


FIG. 1.— Index map showing location of nonmetalliferous deposits in Alaska Railroad belt. A, Eklutna (granite); B, Curry (granite); C, Potter (limestone); D, Windy (limestone); E, Nenana (limestone); F, Fox (limestone); G, Healy and Lignite Creeks (clay); H, Government Hill at Anchorage (clay); I, Point Woronzof (clay); J, Cantwell (clay).

fresh and unaltered a few inches below the surface. The quartz diorite is exposed in the canyon wall to an elevation of more than 600 feet above the railroad and for at least a half mile from the tracks.

For several years this quartz diorite was quarried by the Alaska Railroad for use as riprap. A siding was installed and the rock was quarried as needed. As quarrying progressed, however, the quarry face became too high for safe operations, the workings were abandoned, and riprap for the Alaska Railroad was obtained from the Eklutna deposit.

LIMESTONE

Occurrence in Alaska

Deposits of limestone and marble are known in many parts of the Territory, the most extensive being in the islands of southeastern Alaska and the adjacent mainland. In 1912 and 1913 Burchard ^{1/} examined 58 localities, 8 of which had been opened as quarries. Since 1928, with the exception of the war years, the quarry of the Pacific Coast Cement Co. was operated on Dall Island. During 1946 the Alcoa Mining Co. carried on extensive development operations at Edna Bay on Kosciusko Island.

Large deposits of limestone are known in the Alaska Range and at several places in the interior of Alaska, but within the writer's knowledge they are too remote from transportation facilities to be of commercial interest.

Limestone near Potter

A prominent ledge of limestone lies half a mile northeast of the railroad, near Potter, 14 miles south of Anchorage, at the landward edge of the marsh land bordering Turnagain Arm. The deposit consists of a lens in slate and schist. The limestone is about 20 feet thick, rises 25 feet above the marsh land, and juts out 50 feet from the hillside. It dips about 60° NW. Another lens, 6 to 8 feet thick, lies northwest of the first lens. The limestone may extend for several hundred feet into the hillside, and perhaps also for some distance in depth; ground water, however, would interfere with quarrying below the marsh level.

The property was patented as a mineral claim in July 1927, by C. R. and S. F. Rhodes, of Anchorage. A few tons of the rock was quarried and burned to lime in a kiln at the site. This plant is now in ruins. The lime was used in plaster work in a few buildings in Anchorage. The analyses given in table 1 show the limestone to be unusually pure.

Such lenses of pure limestone are apparently not common in the altered sedimentary rocks of the district. Half a mile northwest of the quarry a broken mass of calcareous slate apparently forms another limy lens in the country rock. In the railroad cuts farther southeast along the shore of Turnagain Arm, a few lenses of limestone 1 to 2 inches thick were noticed. In the higher areas north and northeast of Potter, C. F. Park of the Geological Survey found small lenses and masses of limy shale.

Limestone near Windy

Limestone is present in a belt of highly metamorphosed rocks that crosses the Alaska Railroad in the vicinity of Windy, about 213 miles by

^{1/} Burchard, Ernest F., Marble resources of southeastern Alaska; with a section on the geography and geology, by Theodore Chapin: U. S. Geol. Survey Bull. 682, 1920.

rail north of Anchorage. Several ledges of limestone are exposed on the ridge extending $1\frac{1}{2}$ to $2\frac{1}{2}$ miles southwest of the station. The five most prominent ledges are shown in figure 2. Ledge A is at an elevation from 800 to 900 feet higher than the railroad and half a mile north of it. The beds are nearly vertical in the enclosing slate and form a lens about 300 feet long and 30 feet wide. The limestone is massive or thick-bedded, dark gray, and intricately fractured and traversed by a network of thin calcite veins. Ledge B, apparently a separate lens from Ledge A, is at an elevation 600 feet higher than the railroad and forms an outcrop only a few square yards. Halfway between Ledge B and the railroad is a terrace of travertine or calcareous tufa, 100 yards wide. Between the terrace and the railroad the slope is covered by blocks of the tufa; tufa is still being deposited by the seepage water. Ledge C forms a prominent cliff on the crest of the ridge at an elevation 1,300 feet higher than the railroad. The limestone here is more massive, lighter in color, and less highly veined by calcite than the limestone in the lower ledges. Bedding is not evident, but presumably the limestone forms a lens in the nearly vertical slate. The limestone extends for a quarter of a mile along the strike of the slate and has a maximum width of 150 feet. Ledge D is at the eastern end of the higher part of the ridge where a thickness of about 100 feet of limestone at the base of a steep slope is exposed in three small cliffs. This limestone is similar to that of Ledges A and B but even more veined by calcite. Ledge E extends for a quarter of a mile along the south bank of Bain Creek, a small stream that empties into the Nenana River near Windy. The stream has cut against the ledge and formed cliffs in which is exposed a thickness of about 100 feet of limestone. The limestone at this locality is dark gray and intricately veined by calcite. Analyses of samples from the four principal ledges are given in table 1. One sample from Ledge A contains considerable magnesia, but the other sample from Ledge A, and that from Ledge C are usually pure limestones. The other two samples contain considerable silica.

The ledges described above apparently mark the eastern limit of limestone in this area. Abundant exposures to the east reveal only chert and greenstone. It is believed, however, that a more or less continuous belt of limestone may extend westward for at least 2 miles from these outcrops. The abundance of calcareous tufa on the slopes below the ledges suggests that limestone may underlie a larger area than the few outcrops indicate.

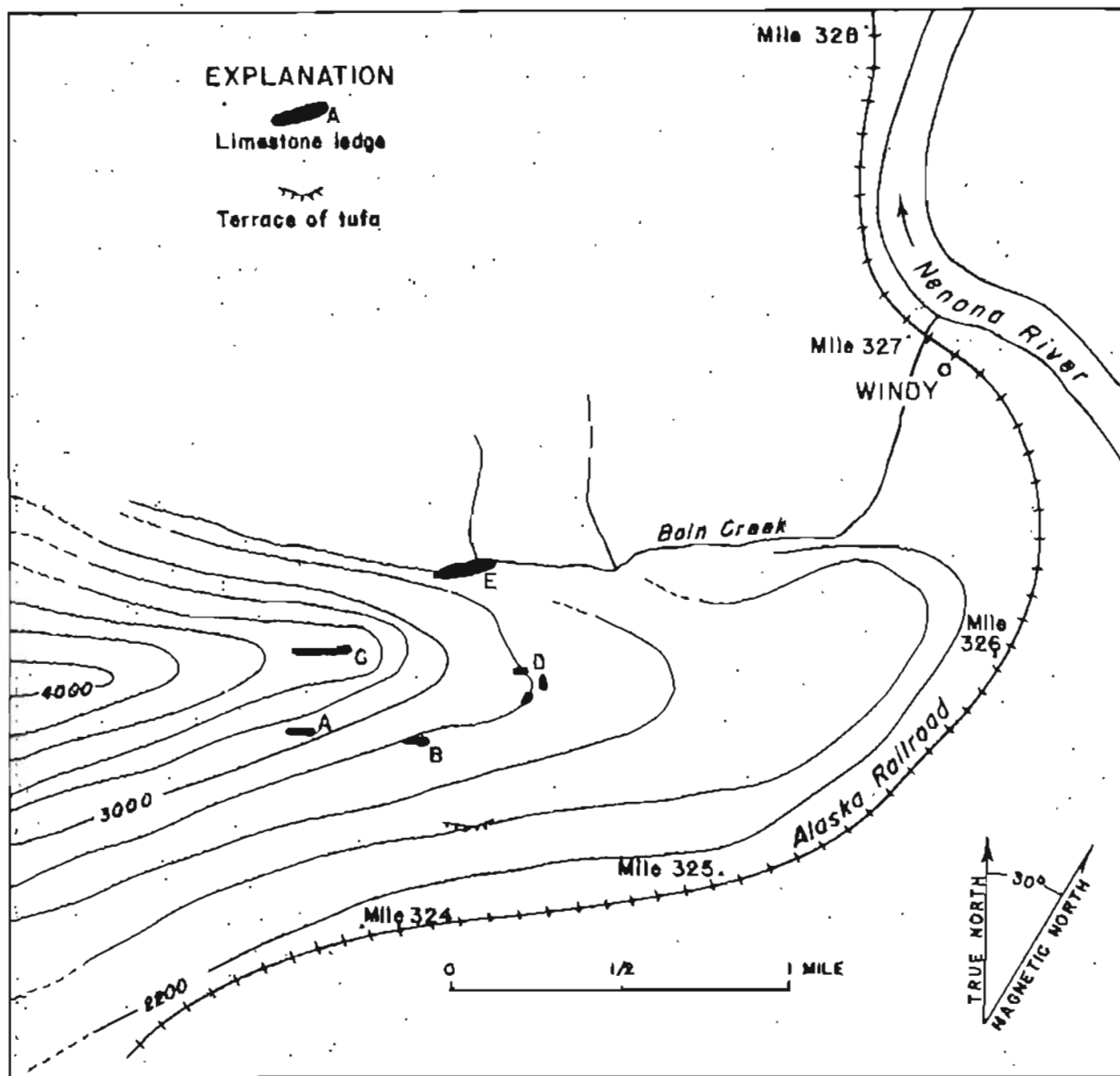
Limestone near Nenana

A lens of blue-gray limestone, about 400 feet long and 1 to 4 feet thick, enclosed in the Birch Creek schist, is exposed at mile 414.5 in a railroad cut on the north side of the Tanana River, opposite the Nenana depot. The limestone grades laterally into more siliceous schist. An analysis of the limestone (table 1) shows 2.1 percent of insoluble matter, probably silica, and a very low magnesia content.

Small lenses of white calcareous rock in the schist were observed at miles 416.6 and 416.9 and at other places, but none of these bodies is large enough to be of commercial importance.

Limestone near Fox

Fox is about 8 airline miles north-northeast of Fairbanks, at the junction of the Circle and Livengood Highways. At the base of a hillside about three-fourths of a mile southwest of Fox, and just north of the roadbed of the abandoned Tanana Valley Railroad, a lens of white fine-grained limestone, with a maximum thickness of about 15 feet, is exposed for 200 feet. Tests were made several years ago to determine the suitability of this stone for burning for lime. It was found to contain too



By G. A. Waring,
1931

FIG. 2.- SKETCH MAP SHOWING LOCATION OF LIMESTONE LEDGES NEAR WINDY, ALASKA

Contour interval 200 feet

Analyses of limestone from the Alaska Railroad belt

(Maurice L. Sharp, U. S. Bureau of Mines, analyst)

	Analysis number								
	1	2	3	4	5	6	7	8	9
Insoluble.....	---	---	---	0.9	0.5	10.6	16.2	2.1	---
Silica (SiO ₂).....	.40	.76	.49	---	---	---	---	---	2.06
Iron and alumina (Fe ₂ O ₃ + Al ₂ O ₃).....	.40	.72	.42	.9	.7	1.0	5.2	1.1	.50
Magnesia (MgO).....	.14	1.01	4.72	tr.	tr.	.6	3.2	.7	19.88
Lime (CaO).....	54.70	96.56	49.63	54.4	54.7	49.2	40.9	53.6	31.20
Carbon dioxide (CO ₂), calculated.....	---	---	44.17	---	---	---	---	---	---
Undetermined (carbon dioxide and water).....	44.36	.95	---	---	---	---	---	---	---
Loss on ignition.....	---	---	---	43.8	43.9	38.1	40.4	42.4	---
	100.00	100.00	99.43	100.0	99.8	99.5	99.9	99.9	99.7

1. Limestone near Potter, analyzed in May, 1926.
2. Lime burned from limestone near Potter, analyzed in May, 1926.
3. Limestone from Ledge A near Windy, analyzed in 1926.
4. Limestone from " A " " " 1931.
5. " " " C " " " " "
6. " " " D " " " " "
7. " " " E " " " " "
8. Limestone near Nenana, analyzed in 1931.
9. Limestone near Fox, analyzed in 1931.

much magnesia to be of value for this purpose. An analysis of the rock is given in table 1.

Although the stone is considerably fractured at the surface, blocks 1 to 2 feet in diameter probably could be obtained for use as building or monumental stone.

CLAY

Clay on Healy and Lignite Creeks

The coal-bearing formation of Tertiary age in the Wenana coal field includes numerous beds of clay and shale. Some of the clay and shale is suitable for the manufacture of brick and tile according to preliminary tests. One such bed, more than 100 feet thick, is exposed at the Suntrana coal mine on Healy Creek, 4 miles east of Healy, where it forms a prominent dark-brown band in the bluff, about 500 feet above the base of the formation. Similar brown shale has been traced for several miles along the upper course of Lignite Creek, about 4 miles north of Suntrana.

Samples of the thick bed of clay shale at Suntrana were collected in 1923 by John A. Davis, engineer in charge of the station of the U. S. Bureau of Mines at Fairbanks, and sent to the Ceramic Experiment Station of the Bureau at Columbus, Ohio. The following data are from the report of the tests made there by E. E. Pressler:

Clay from the upper 85 feet of the deposit proves to be the best. The lower part is too sandy to dry and burn satisfactorily. The clay works well in dies, and the drying behavior is satisfactory. It burns to a good body in the customary range of firing temperature for heavy clay wares. The total shrinkage is less than usual in a surface clay and only slightly above the average for shale. The clay is nearly free of lime, organic matter, and sulfur, which are objectionable in clays for heavy ware. The color of the ware when fired to high temperature is good. Some clays that burn to a less pleasing color are used in the manufacture of face brick.

Clay at Government Hill, Anchorage

Interbedded in the unconsolidated sands and gravels that underlie Government Hill, north of the mouth of Ship Creek in Anchorage, is a bed of clay 10 feet or more thick. In 1928 the Alaska Railroad had this clay tested to determine its suitability for brickmaking. Several thousand bricks were made and used in local construction, but apparently they had not been burned sufficiently to withstand crumbling. Laboratory tests on small samples of the clay showed it to have small shrinkage, to burn well, and to have all the other qualities of a good brick clay.

Clay at Point Woronzof

A bed of dark-gray clay, very cohesive and plastic when wet, is exposed in low bluffs on the shore of Cook Inlet near Point Woronzof, 4 miles west of Anchorage. The bed is at least 30 feet thick and is almost or completely free of sand grains. This clay and that at Government Hill probably were deposited in the tidal estuary, as they are similar to deposits of clay now forming on the wide mudflats that are exposed at low tide along Knik Arm. A purer clay probably can be obtained from Point Woronzof than from either the Government Hill or Suntrana localities, but all three places offer abundant material for local brickmaking.

Clay near Cantwell

In the railroad cut half a mile northeast of Cantwell Station (mile 319.5), there is a small amount of white clay which is very plastic when wet. It is on the eastern border of a light-colored, felspathic porphyry dike 300 feet wide. This dike rock is highly decomposed and locally has weathered into white clay. Only a few cubic feet of the clay was seen when the area was visited by the writer in July 1931, and it is very doubtful whether a deposit of commercial size is present. Analyses of the rock and the clay by Maurice L. Sharp, analyst of the U. S. Bureau of Mines, are as follows:

ANALYSES OF PORPHYRY DIKE AND CLAY NEAR CANTWELL

	Dike rock	Clay derived from dike rock
Loss on ignition	10.2	7.3
Insoluble	76.9	88.4
Iron oxide and alumina ($\text{Fe}_2\text{O}_3 + \text{Al}_2\text{O}_3$)	8.4	3.2
Lime (CaO)	3.4	0.7
Magnesia (MgO)	1.1	tr.
	<hr/> 100.0	<hr/> 99.6