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THE ULTRABASIC ROCKS OF THE BLASHKE ISLANDS, KANE PEAK, AND MT. BURNETT, SOUTHEASTERN ALASKA

by

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INTRODUCTION

The authors, in connection with a Geological Survey project to investigate the occurrence of nickel, chromium, and platinum, examined several ultrabasic rock bodies in southeastern Alaska during the summer of 1943. Among these were the bodies of the Blashke Islands, Kane peak, and Mt. Burnett which appear to be genetically similar.

BLASHKE ISLANDS

The Blashke Islands are in Clarence Strait (see fig. 1), about 8 miles south of the most southerly point on Zarembo Island, and are separated from Prince of Wales Island by Kashevarof Passage.

The islands were briefly examined by Buddington 1/ in 1923 who described the major relations of the ultrabasic rocks. The authors spent the first two weeks of June 1943 examining the Blashke Islands.

The Blashke Island group consists of sixteen islands ranging in length from one-eighth mile to 1½ miles and numerous much smaller islands. The islands have a total land area of approximately 3 square miles. The islands are low and heavily wooded. The highest point is 414 feet and most of the area is less than 100 feet above sea level. The rocks that comprise the islands are very well exposed along the many miles of shoreline.

A large portion of the central ultrabasic mass has been eroded to form a basin, now occupied by a salt lagoon. The lagoon is connected to tidewater by three narrow passages, known as salt chucks, through which the tide rushes with great velocity.

1/ Buddington, A. F., Geology and mineral deposits of southeastern Alaska: U. S. Geol. Survey Bull. 800, pp. 190-191, 1929.

General geology

The Blashke Islands are underlain by deformed sediments, intruded by an ultrabasic body of roughly circular outcrop.

Bedded rocks

The sediments consist largely of graywacke and pyroclastic material, with some interbedded conglomerate, black slate, and limestone. The rocks are part of a belt of Silurian 2/ rocks that are present throughout much of norther Prince of Wales Island.

The sediments in general dip from 45 degrees to vertical and appear to change in trend around the ultrabasic intrusive and to conform generally with the outline of the intrusive. The sediments in a zone of varying width around the intrusive have been recrystallized to a dense, fine-grained hornfels.

Intrusive rocks

The southeastern portion of the Blashke Islands is underlain by a roughly circular body of ultrabasic rocks about 1½ miles in diameter (see fig. 2). Buddington 3/ states:

> "A cursory examination seems to indicate that the essential features are a core of dunite about a mile in diameter with an encircling ring of pyroxenite and an outer border of hornblende gabbro-diorite. The two rings of pyroxenite and hornblende gabbro-diorite are together roughly about three-eighths of a mile wide, though accompanied by outlying masses of diorite in the adjacent sediments."

The core of the ultrabasic intrusive is an oval dunite mass about 6,000 feet by 8,000 feet in outcrop dimensions. Encircling the dunite core is a 500-foot to 2,000-foot ring of pyroxenite and wehrlite. The wehrlite tends to be concentrated in irregular patches within the pyroxenite ring near the contact between the pyroxenite and the dunite.

Surrounding the pyroxenite-wehrlite ring is an irregular ring of varying width of gabbro with local variants of hornblendite, diorite, augitite and anorthosite. The gabbro phase is gradational with the surrounding sediments.

The contacts between the different ultrabasic rock types generally are intrusive contacts, although many of the contacts between wehrlite and pyroxenite

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2/ Buddington, A. F., op. cit., p. 191.

3/ Buddington, A. F., op. cit., pp. 190-191, 1929.

are gradational. The core of dunite solidified prior to the bordering ring of pyroxenite as is proven by the fact that dikes of pyroxenite cut the dunite. The pyroxenite, in turn, is cut by apophyses of the outer ring of gabbro.

In general, the contacts between the various units of the ultrabasic body are approximately vertical. Thus the dunite core may be likened to a solid cylinder surrounded by concentric cylinders of proxenite-wehrlite and gabbroic rock. Questionable data from a few magnetometer observations suggest that the contacts may dip steeply inward.

The following rock descriptions are based on field identification and on microscopic examination of rock powders.

Dunite: The dunite core is composed of about equal proportions of olivine and serpentine. The olivine, with a mean index of refraction of 1.667, is close to forsterite in composition and contains about 93 percent of the Mg_2SiO_4 molecule and about 7 percent of the Fe_2SiO_4 molecule.

Wehrlite: The wehrlite is made up of approximately equal proportions of olivine of medium grain size and coarsely-crystalline diopside. Index of refraction measurements indicate that the olivine in the wehrlite is much richer in iron (Fe_2SiO_4) 27 percent, Mg_2Si_4, 63 percent than is the olivine of the dunite core. The diopside has a mean index of refraction of 1.680 and corresponds to a member of the diopside-hedenbergite series with 88 percent of diopside molecule. ($CaMgSi_2O_6$) and 12 percent of hedenbergite molecule ($CaFeSi_2O_6$).

Pyroxenite: The pyroxenite is composed principally of medium-grained diopside of about the same composition as that in the wehrlite. Textural variations in the pyroxenite are great. The average grain size of different specimens ranges from less than a millimeter to several centimeters. The coarsely-crystalline diopside is in irregular segregations of pegmatitic texture, and in more or less well defined pyroxene-anorthite pegmatite dikes. Feldspar, much of which is as calcic as anorthite, 96 percent, is locally present in the pegmatitic segregations interstitial with the diopside, and may comprise as much as 50 percent of the pegmatite dikes.

Gabbro: The gabbro of the outer ring is made up largely of feldspar, pyroxene, and their alteration products. The feldspar is extremely calcic, typically bytownite or anorthite, ranging in composition from An 80 to An 93. The pyroxene is augite. It contains considerably more aluminum and iron than does the diopside of the pyroxenite adjacent to the gabbro. Locally diorite cuts the gabbro and is probably a late differentiate of the gabbro. The feldspar of this rock ranges from andesine to labradorite.

The relations within each solid-solution series of minerals indicates that each ring outward was formed at somewhat lower temperatures than that of the preceding inward ring. The dunite core contains the magnesium-rich olivine which presumably formed at higher temperatures than that of the more iron-rich olivine of the wehrlite. The calcium-magnesium pyroxene of the pyroxenite presumably formed at higher temperatures than did the more aluminous and more iron-rich pyroxene of the gabbro zone. Likewise, the feldspar associated with the more coarsely-crystalline phase of the pyroxenite, though present in distinctly subordinate amounts, is richer in calcium than that of the gabbro.

Summing up the chemical relations within this complex: From the center of the intrusive outward, the proportion of magnesium decreases abruptly and the proportions of calcium, iron, silica and aluminum increase regularly.

Mineral deposits

No chrome spinel was identified in the dunite. The dunite is remarkably free of any spinel group minerals.

Sulfide minerals, principally pyrrhotite and chalcopyrite, are locally present in the marginal phases of the pyroxenite and of the gabbro. At no place were more than a few percent of sulfide minerals noted, though tonnages of material containing between 1 percent and 2 percent of sulfide minerals are large. Two analyses of the typical sulfide-bearing marginal gabbro were made for nickel, copper and platinum by Cyrus Feldman of the Chemical Laboratory, Geological Survey. He reports:

Specimen	Cu	Ni	Percent Pt. Metals
43 A Ke 295	0.0086	0.03	less than 0.0003
43 A Ke 306	0.016	0.05	0.0003

Assuming that the platinum metal present is platinum, 0.0003 percent is equivalent to about $3.50 of platinum per ton of rock, (based on the present price of approximately $35.00 per ounce of platinum).

The ultrabasic body in the Blashke Islands is very similar in structure and mineralogy to the ultrabasic bodies from which the platinum deposits of the Ural Mountains were derived. However, the possibility of placer accumulations of platinum in the Blashke Islands is believed slight, because of recent glaciation and because suitable places of accumulation of placer materials are lacking.

KANE PEAK, KUPREANOF ISLAND

A few days in the middle of August 1943, were spent in mapping the ultrabasic rocks in the vicinity of Kane Peak, Kupreanof Island (see fig. 1). These rocks were briefly examined by Buddington 5/ in 1923.

The ultrabasic rocks crop out over an area about 1¼ miles in diameter and extend from near the summit of Kane Peak to Frederick Sound in the vicinity of Cape Straight (see fig. 3). This region, is, for the most part, covered with muskeg, brush and timber, and outcrops are sparse except along the beach and on Kane Peak.

5/ Buddington, A. F., op. cit., p. 192.

The ultrabasic intrusive is in contact with thin-bedded Cretaceous graywacke, biotite-quartz gneiss, and a mass of monzodiorite, which intrudes the graywacke. The graywacke crops out around the northern and southern margins of the ultrabasic body. It strikes, in general, northwesterly and dips about 60° NE. However, near the contact of the ultrabasic mass with the surrounding sediments, the dip and strike of the foliation and bedding of the sediments is approximately parallel to the contact of the intrusive. Dips are, for the most part, inward toward the ultrabasic intrusive. Near the monzodiorite intrusive the graywacke has been converted to biotite-quartz schist.

The ultrabasic rocks range in composition from gabbro to dunite. Wehrlite, pyroxenite, hornblendite, and mica-rich variants of these rocks are locally abundant. Because of the short time available for work in the Kane Peak area, and because of inadequate exposures, the exact relations between these various rock types are not known.

In general the northern and southern margins of the intrusive appear to be bordered by a band, as much as 1,000 feet thick, of hornblendite with some hornblende gabbro. Hornblendite was not found near the western limit of the ultrabasic body, for here a portion of the original ultrabasic intrusive is believed to have been cut away by the presumably younger monzodiorite intrusive.

The central part of the body is made up of dunite, wehrlite and diopside pyroxenite. These rocks locally are extremely fresh, as on Kane Peak, but at some places are so highly serpentinized that the original character of the rock has been completely destroyed. Locally parts of these rocks have been altered to coarse phlogopite mica.

The ultrabasic rocks that crop out on Kane Peak proper are largely pyroxenite, dunite and wehrlite. The main shoulder of Kane Peak is pyroxenite containing about 10 percent to 20 percent of olivine. Contacts between the pyroxenite mass and surrounding dunite and wehrlite are gradational, with irregular areas of dunite in the pyroxenite and some extremely coarse diopside crystals in the dunite. Several dike-like masses of dunite cut the pyroxenite, and what appear to be schlieren of pyroxene are strung out in the dunite.

Mineral deposits

No chrome spinel was noted in the dunite. Locally the pyroxenite contains a few percent of sulfide minerals and the weathered rock is stained a brick-red. However, the sulfide minerals nowhere constitute an appreciable amount of the rock, and therefore, the material was not sampled.

MT. BURNETT AND VICINITY, CLEVELAND PENINSULA

The authors spent most of September 1943, in a detailed examination of parts of the ultrabasic rocks of Mt. Burnett and vicinity, Cleveland Peninsula.

Mt. Burnett lies on the northwest side of Cleveland Peninsula, about 35 miles northwest of Ketchikan (see fig. 1). The ultrabasic area is accessible from either Vixen Inlet or Union Bay. The ultrabasic rocks crop out in a mass about 7 miles long and 1 mile to 2 miles wide. (see fig. 4) These rocks for the most part have been relatively resistant to weathering and stand out as prominent rust-colored bare ridges with an average altitude of about 2,000 feet. Soils develop with difficulty on the ultrabasic rocks.

Bedded rocks

The ultrabasic rocks have intruded phyllite and schist of the Wrangell-Revillagegedo belt of metamorphic rocks 6/. The metamorphic rocks are, for the most part, thin bedded and range in composition from sericite schist to biotite-quartz schist. The schists strike northwest and are isoclinally folded. Steep to intermediate dips in both directions were recorded.

Tertiary conglomerate, unconformably overlying pyroxenite and phyllite, crops out for several thousand feet along the beach of Union Bay south of Union Point. The conglomerate is made up of unsorted boulders and angular fragments of rock as much as 4 feet in diameter, consisting of pyroxenite, gabbro and schist or phyllite. The boulders are cemented by mud and sandy material. Fossils of wood are included in the matrix. Locally the conglomerate grades into poorly sorted sandstone containing numerous pebbles and some boulders several feet in diameter. These rocks have been correlated by Buddington 7/ with the Port Camden Eocene rocks.

Intrusive rocks

The ultrabasic rocks form a large composite stock, which is made up of diorite, gabbro, hornblendite, pyroxenite, wehrlite and dunite.

The diorite crops out as a body, the limits of which have not been mapped, which bounds the ultrabasic mass to the south. Whether this diorite is a part of the ultrabasic complex or is part of a younger stock that cuts the ultrabasic rocks is not known.

A crude banding was noted within the ultrabasic mass. The central part of the body is made up largely of dunite, wehrlite and pyroxenite. In general the eastern portion of the body appears to be largely dunite, whereas the western part is largely pyroxenite. These distinctions are not sharp because the dunite contains many irregular patches of pyroxenite and wehrlite, and the pyroxenite contains many areas largely of dunite. The central mass of pyroxenite and dunite is separated from the surrounding schists by bordering facies of pyroxenite, hornblendite and gabbro. The marginal hornblendite and gabbro is particularly well exposed along the beach in the vicinity of the cannery on Union Bay, where the hornblende zone is probably several thousand feet thick.

6/ Buddington, A. F., op. cit., pl. 1.

7/ Buddington, A. F., op. cit. p. 263.

At every place where contact relations were observed pyroxenite of the marginal zone was bordered outward by hornblendite. At no point was dunite noted in contact with hornblendite nor was dunite or pyroxenite in contact with the surrounding schists of the Wrangell-Revillagegedo series.

Dunite: The dunite was examined in considerable detail in the eastern portion of the ultrabasic area. Within this area the dunite is made up almost solely of olivine with a mean index of refraction of 1.667, which indicates that the olivine consists of about 92 percent of forsterite (Mg_2SiO_4) and 8 percent of fayalite (Fe_2SiO_4). Serpentinization of the dunite is extremely variable. Much of the dunite is completely altered to serpentine, whereas some is very fresh.

The dunite, it is believed, was deformed after it consolidated. Parallel shear cracks are conspicuous on surfaces of weathered dunite, and dikes of dunite, which are much sheared, have been squeezed into the pyroxenite.

Pyroxenite: Two varieties of pyroxenite are present. A variety of pyroxenite which lies near the outer limits of the ultrabasic body, between the dunite and the marginal hornblendite, is composed largely of diallage, but contains a small amount of olivine and amphibole. The diallage has a mean index of refraction of 1.687 and therefore presumably contains a considerable amount of alumina and iron. The olivine present in minor quantities in the pyroxenite is considerably richer in iron than that of the central zone. Its mean index of refraction is 1.688 which indicates a Fe_2SiO_4 (fayalite) content of about 20 percent. The pyroxenite of the border zone is typically extremely variable in grain size; locally veins and irregular segregations of pyroxene, of pegmatitic texture, with crystals several inches in length are surrounded by pyroxenite of finer grain size.

Considerable magnetite, probably titaniferous, is associated with the pyroxenite of the border zone. Most of the magnetite is interstitial to the pyroxenite and appears to have been one of the last components of the rock to crystallize. Some vein-like magnetite masses, 1 inch or more in width cut the pyroxenite. The marginal pyroxenite is also cut by dikes of the nearby hornblendite and hornblende gabbro.

A second type of pyroxenite occurs in irregular masses within the central dunite, and numerous dikes of this pyroxenite cut the dunite. This pyroxenite is made up almost exclusively of diopside with an index refraction of about 1.678, indicating that it contains about 92 percent of diopside ($CaMgSi_2O_6$) molecule and 8 percent of hedenbergite ($CaFeSi_2O_6$) molecule.

Wehrlite: Irregular areas of wehrlite, gradational with dunite and with pyroxenite, are present within the dunite and pyroxenite masses of the central zone. The wehrlite is made up of diopside crystals, which are as much as 2 inches across, in an olivine matrix. In general, however, the intermediate rock type, wehrlite, is much less common than either pyroxenite or dunite. For the most part the rock minerals seem to have aggregated into rocks of essentially mono-mineralic composition.

Hornblendite: The hornblendite is a massive dark rock composed almost entirely of long interlocking crystals of hornblende. Hornblendite of medium grain size, with individual crystals as much as an inch in length, is cut by numerous dikes of pegmatitic hornblendite. Pegmatitic hornblendite typically is present in dikes 1 to 2 feet in width and 20 feet or more in length. The dikes are made up of hornblende and subordinate amounts of feldspar. The hornblende is in the form of elongate crystals as much as 10 inches in length, oriented with the long axis of the crystal at right angles to the walls of the dike. Feldspar, where present, is generally extremely calcic though feldspar of intermediate composition and even albite was collected from the dikes. At numerous localities minor amounts of sulfide minerals are associated with hornblendite.

Gabbro: Outward, toward the schists, the hornblendite grades into a hornblende rich gabbro. This gabbro is extremely variable in percentage of dark minerals and in texture. It is in turn, gradational with the surrounding schists.

Mineral deposits

Numerous small pods of chromite are scattered at random through the dunite. Most of the pods are only an inch wide and a few inches long. Locally they are sufficiently concentrated to constitute an appreciable amount of the total rock. At point A (see fig. 4) about 5,000 square feet of outcrop are estimated to contain about 5 percent of irregular chromite segregations. Much of the chromite is present in fractures that cut the dunite. This chromite is definitely later than the dunite.

At point B (see fig. 4) a single body of massive chromite was found that is estimated to contain about 25 tons of chromite. The body in outcrop dimensions is about 13 feet long by 1½ feet wide. The body is massive, black, slightly magnetic chromite, surrounded by dunite. Movement along minor fractures has offset part of the body a few inches. Analyses of specimens of chromite from these two localities have been made by John E. Husted, of the Chemical laboratory, of the Geological Survey. The analyses are given below:

Locality	Cr (percent)	Fe (percent)	Cr_2O_3 (percent)	Cr/Fe ratio
A	22.62	17.91	33.03	1.26
B	18.50	37.37	27.01	0.50

Because of the low grade and the poor chrome-iron ratio this chromite is essentially of no value.

May, 1944.

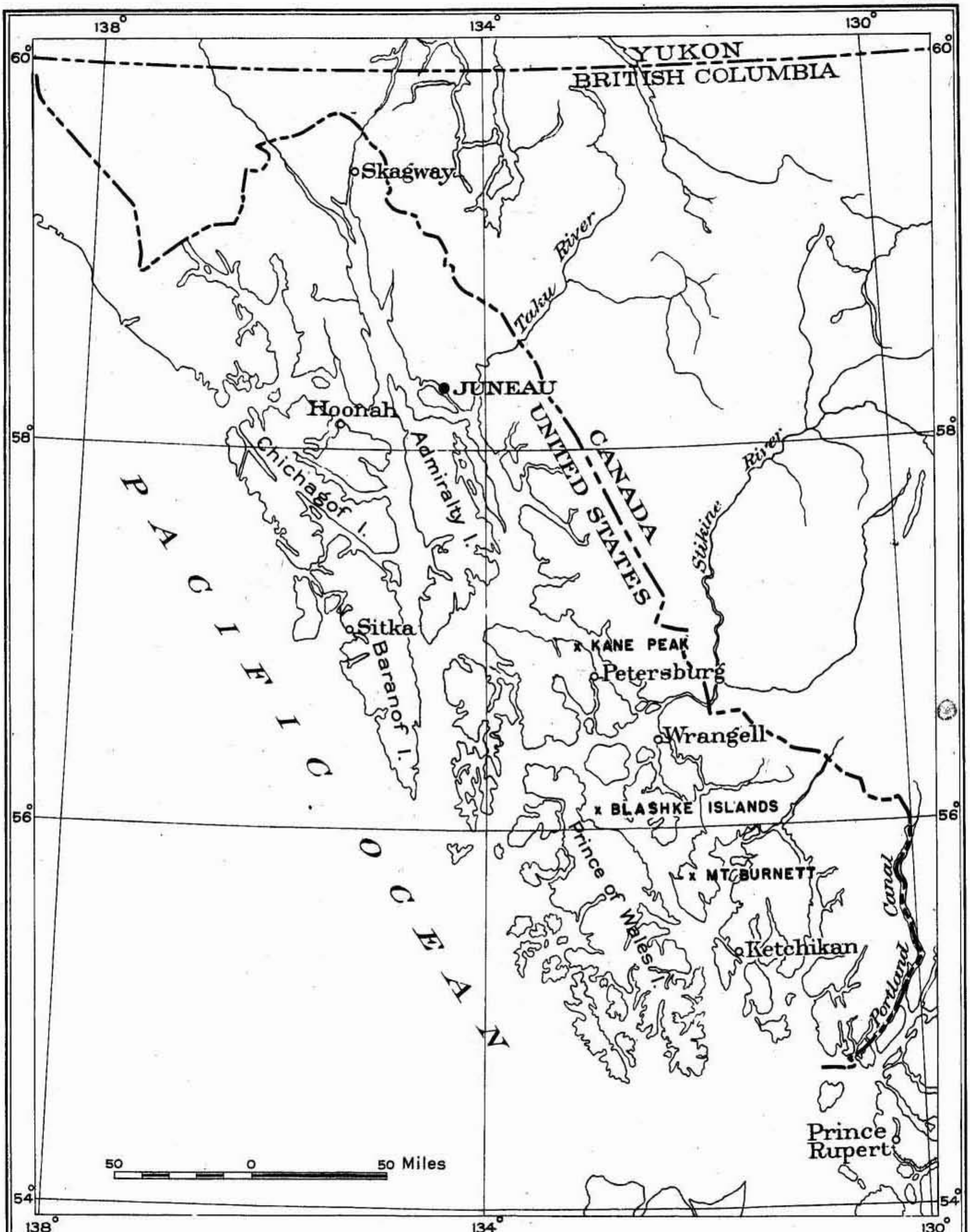

FIGURE I.- INDEX MAP SHOWING LOCATION OF BLASHKE ISLANDS, KANE PEAK AND MT. BURNETT DIFFERENTIATED ULTRABASIC BODIES, SOUTHEASTERN ALASKA

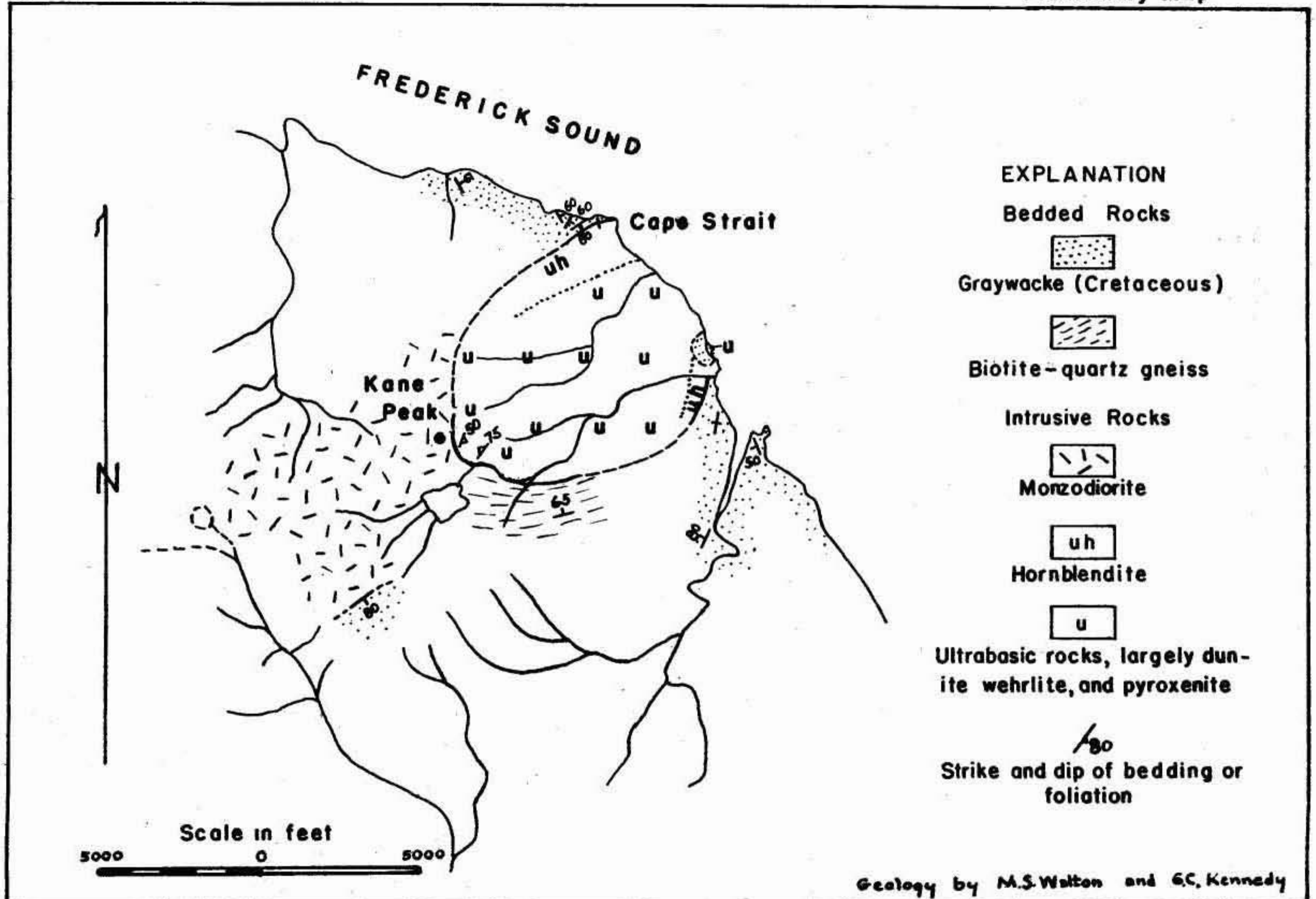

FIGURE 3. – GENERALIZED GEOLOGIC MAP OF KANE PEAK AND VICINITY, KUPREANOF ISLAND, SOUTHEASTERN ALASKA

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