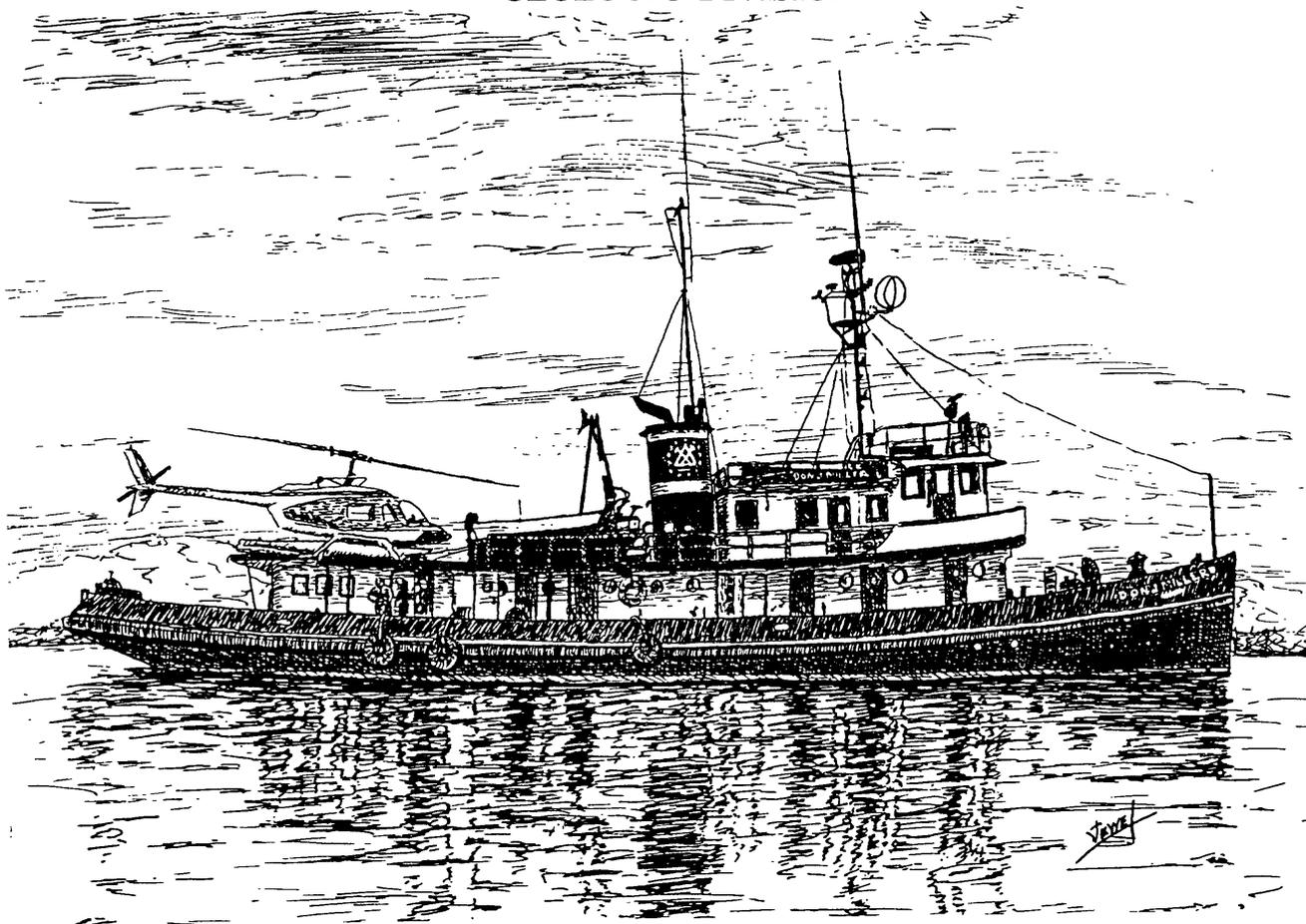


**U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
GEOLOGIC DIVISION**



[U.S.G.S. R/V Don J. Miller II]

**RECONNAISSANCE GEOLOGIC MAP OF THE PETERSBURG C-5 QUADRANGLE,
SOUTHEASTERN ALASKA**

Open-File Report 97-156-K

By David A. Brew



This report has not been reviewed for conformity with U.S. Geological Survey editorial standards or with the North American Stratigraphic Code. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government



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Southeastern Alaska**

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RECONNAISSANCE GEOLOGIC MAP OF THE PETERSBURG C-5 QUADRANGLE, SOUTHEASTERN ALASKA

By David A. Brew

INTRODUCTION

This map and its accompanying information were prepared specifically as part of the State of Alaska Division of Geological and Geophysical Surveys and the U.S. Department of Interior Bureau of Land Management Alaska Minerals Section (Juneau, Alaska) mineral-resource studies of part of the Petersburg, Alaska 1:250,000-scale quadrangle. These studies are a direct follow-up to the U.S. Geological Survey studies in the area in the 1980's, which are cited below.

The geologic information presented here has been released previously in generalized form (Brew and others, 1984); the information is based on reconnaissance field mapping and thus does not have the density of field-station control, samples, or field observations that are expected in published U.S. Geological Survey 1:63,360-scale geologic maps. This map is one of a series that share the same format and general information (Brew, 1997a-m; Brew and Koch, 1997). There are both a combined description and a combined correlation of the map units for this whole series of maps (Brew and Grybeck, 1997).

The available information on known mineral deposits in the whole Petersburg-Wrangell area was released previously (Grybeck and others, 1984) and Brew and others (1989, 1991). Bedrock, stream-sediment, and other geochemical data were released and interpreted by Karl and others (1985), Karl and Koch (1990), Cathrall and others (1983a-w), and Tripp and Cathrall (1984). Aeromagnetic and aeroradioactivity surveys information was released by the U.S. Geological Survey (1978, 1979) and Bouguer gravity information by Barnes and others (1989). Remotely-sensed features were described by LeCompte (1981). Burrell and others (1982) released a preliminary bibliography of Petersburg and Port Alexander quadrangles-related items.

Assessments of the undiscovered mineral resources for the whole Petersburg-Wrangell area are also available (Brew and others, 1989, 1991; Brew and Drinkwater, 1991). Some of the mineral-resource-assessment tract information in neighboring areas was revised by Brew and others (1996). Brew (1993) presented a generalized view of metallogenic belts that includes this area.

Detailed information on the Late Cretaceous plutonic rocks in the Petersburg 1:250,000-scale quadrangle is found in Burrell (1984abc); major-element chemical and other data for the area were reported by Douglass and others (1989), and relatively young volcanic features were described by Brew and others (1984) and by Brew (1990). McClelland and Gehrels (1990) reinterpreted some of the geology in and around the Duncan Canal area, which lies to the east of this quadrangle.

The index map on the over-size sheet shows the major geological elements of the Petersburg-Wrangell area. They are, from west to east, (1) the Alexander belt, consisting of generally unmetamorphosed Lower Paleozoic through Upper Triassic rocks intruded by scattered mid-Cretaceous plutons, (2) the Gravina belt, consisting of unmetamorphosed to highly metamorphosed, variably deformed Upper Jurassic(?) through mid-Cretaceous flysch and volcanic rocks intruded by both mid- and Upper Cretaceous plutons, and (3) the Mainland belt, consisting of metamorphic rocks intruded by Upper Cretaceous, lower Tertiary, and mid-Tertiary plutons. Younger than almost all parts of all of these belts, and extending from the Alexander belt across the Gravina belt and onto the mainland belt, is the lower to middle Tertiary Kuiu-Etolin belt of varied volcanic rocks, associated plutons, and minor sedimentary rocks. The Alexander belt corresponds more or less to the Alexander terrane of Berg and others (1978), the Gravina belt is a refined interpretation of their Gravina belt. This quadrangle includes rocks of the (1) Duncan Canal-Zarembo Island-Screen Islands sub-belt of the Gravina belt, and (2) Kuiu-Etolin belt (see Correlation of Map Units diagram on the oversize sheet).

DESCRIPTION OF MAP UNITS

[Note: All formational and descriptive map-unit names in the text of the following descriptions are set off with quotation marks to make them easier to identify.]

Qs SURFICIAL DEPOSITS (Holocene and(or) Pleistocene)--None mapped in this quadrangle, although many small areas of alluvium, colluvium, tidal mudflat deposits, and some glaciofluvial deposits are present.

KUIU-ETOLIN BELT

Belt informally named by Brew and others (1979), redefined by Brew and Morrell (1983), and the age revised by Brew and others (1985).

EXTRUSIVE AND INTRUSIVE VOLCANIC ROCKS OF KUIU-ETOLIN VOLCANIC-PLUTONIC BELT (Quaternary and Tertiary)--Diverse volcanic rocks exposed in a broad area extending from northeastern Kuiu southeastward through Kupreanof and Zarembo Islands. Divided into:

Qb Extrusive Basaltic Rocks and Underlying Sediments (Holocene and(or) Pleistocene)--

Fresh, locally polygonally jointed, dark greenish gray, dense, very fine-grained to aphanitic magnetite-bearing olivine basalt and minor pyroxene basalt. Individual flows are as much as 10 m thick and are columnar jointed; most flows are less than 1 m thick. Underlain locally by aa flows and mafic volcanic breccia in layers up to 0.5 m thick and by locally derived, poorly sorted, well-bedded brown- to gray-weathering conglomerate, pebbly sandstone, sandstone and minor siltstone deposited in fluvial or beach environment. Quarry on peninsula in Kah Sheets Bay in the Petersburg C-4 quadrangle to the east exposes a small lens of polymictic glacial till under dense aphanitic basalt that is mapped with this unit; the whole unit is interpreted to be Pleistocene or younger. Three whole-rock K-Ar ages on basalts from a few miles south of Kah Sheets Bay gave ages of 0.272 ± 0.085 , 0.262 ± 0.087 , and 4.04 ± 6.95 Ma (M. A. Lanphere, U.S. Geological Survey, written commun., 1972). Exposed in the southern part of this quadrangle and elsewhere along south shore of Kupreanof Island from Kah Sheets Bay to Douglas Bay and from west of Totem Bay to beyond Point Barrie and at Indian Point and on High Castle Island in Duncan Canal. Equivalent rocks may be included with "Basalt and Other Mafic Extrusive Rocks" (QTb), particularly along Rocky Pass and near the mouth of Irish Creek.

Extrusive and Intrusive Volcanics and Volcaniclastic Rocks (Quaternary(?) and Tertiary)--

Complicated intrusive and extrusive volcanic pile best exposed on southwestern Kupreanof Island and on Zarembo Island, may include rocks that should be assigned to "Extrusive Basaltic Rocks and Underlying Sediments" (Qb) but which cannot be distinguished in the field from older basalts. Originally considered to be the southeastern, and more varied extension of "Admiralty Island Volcanics" named by Loney (1964) and assigned a late Eocene to Oligocene age on Admiralty Island; that age revised to Eocene to Miocene(?) by Lathram and others (1965); however, K-Ar dating (G. Plafker, U.S. Geological Survey, oral commun., 1982) of volcanic rocks there indicates a Miocene age. The "Admiralty Volcanics" are now considered to be a different but possibly time-equivalent unit. Time- and litho-stratigraphic relations are uncertain, but dominant rhyolites and basalts appear to have erupted at undetermined times and in no obvious or simple sequence from Paleocene (as indicated by the age of the locally underlying "Kootznahoo Formation") to Holocene (as inferred from the possible inclusion of Quaternary volcanic rocks in the unit). The unit may include rocks erupted throughout the Tertiary and Quaternary, but it is likely that there is a significant Oligocene break. Stratigraphically varied, with major lithologic types occurring repeatedly throughout the section. Some suggestion that "Altered Dellenite, etc." (QTf), and "Gabbro and Microgabbro" (Tmgb) exposed elsewhere in the Petersburg-Wrangell area occur only low in the section. "Siliceous Volcaniclastic Rocks" (QTc) occurs in and around "Rhyolite, Rhyodacite, etc." (QTr); see also Muffler (1967). Divided into:

- QTc **Volcaniclastic Deposits--**
Includes unsorted and sorted pyroclastic deposits, felsic to mafic tuff, lapilli tuff, tuff breccia, and block and ash deposits. Also includes felsic to mafic lahars and oligomictic conglomerates. Deposits range from matrix-supported massive units 10's of meters thick, to units that are well-bedded at cm scale, with graded beds, and thinning and fining upwards cycles. Tuffaceous deposits are generally altered to pale green clay; ashy horizons are locally silicified. Coaly plant material is rare, but present where bedding is well-developed. Mafic material is subordinate to felsic material, quartz subordinate to feldspar, and pyrite is sparse but ubiquitous. Exposed in a north-to-south belt through this quadrangle. Deposits lap onto inferred volcanic centers in the vicinity of Tunehean, Lovelace, and Kushneahin Creeks, and are intercalated with extrusive rocks at several horizons.
- QTr **Rhyolite, Rhyodacite, and Related Siliceous Extrusive and Intrusive Rocks--**
In general, aphanitic to finely crystalline, generally quartz and feldspar porphyritic; C.I. less than 1. Locally layered, spherulitic, and(or) miarolitic. Light gray on fresh surfaces; buff, white, green lavender, maroon, or pink where altered; generally rusty weathering. Pyrite and zeolites common. Many exposures are complicated mixtures of discontinuous mm-scale flow layered, brecciated, spherulitic, and phenocrystic rocks. Unit is heterogeneous and includes lava flows, obsidian flows, lahars, welded and nonwelded ash, tuff, and lapilli, all cut locally by porphyritic rhyolite and rhyodacite dikes. Vents and domes are suggested by extreme alteration, brecciation, attitudes of layering, and dikes. Massive structureless isolated rhyolite bodies suggest plugs. Columnar-jointed cliff exposures in excess of 100 m thick are interpreted as cooling units. Exposed throughout the quadrangle on southern Kupreanof Island.
- QTa **Andesite and Other Intermediate Extrusive Rocks--**
Massive to vesicular and amygdaloidal flows 10-50 cm thick; pyroxene and feldspar porphyritic. Dark gray on fresh surfaces, green to maroon where altered, blocky weathering. Apparently intercalated with basalts in southern Rocky Pass area between Kuiu and Kupreanof Islands. Occurs in the central and northeastern part of this quadrangle, especially near exposures of "Rhyolite, Rhyodacite, etc." (QTr).

QTb Basalt and Other Mafic Extrusive Rocks--
Dark gray where fresh, rusty weathering; platy, blocky, or columnar jointed flows 50 cm to several meters thick. Commonly vesicular and amygdaloidal; amygdule fillings include calcite, epidote, chalcedony, chlorite, and zeolites, in order of decreasing abundance. Platy flows are pyroxene microporphyritic; massive flows may contain magnetite, pyroxene, and olivine. Intercalated with mafic tuff and flow breccia of uneven thickness. Section of gently east-dipping flows greater than 500-m thick extends from Port Camden on Kuiu Island, across Rocky Pass to western Kupreanof Island; exposed throughout this quadrangle. Most extensive volcanic unit in the Kuiu-Etolin belt; may also underlie much of exposed extrusive volcanic section on Kuiu, Kupreanof and Zarembo Islands. Mafic dikes and small localized flows occur higher in the section.

QTd Dikes, Sills, and Extrusive Rocks--
Cross cutting network of dikes, flows, sills, and breccias ranging in composition from basalt to rhyolite. Extremely complicated, heterogeneous, outcrops; that may include xenoliths of metamorphic country rock. Exposed in the central part of this quadrangle. Best exposures are associated with granitic intrusion west of Threemile Arm on Kuiu Island, and on Conclusion and Zarembo Islands. Interpreted to be local feeder systems for adjacent extrusive rocks.

INTRUSIVE GRANITIC AND OTHER ROCKS OF KUIU-ETOLIN VOLCANIC PLUTONIC BELT (Miocene and(or) Oligocene--K-Ar determinations of about 20-22 Ma obtained on rocks from the "Granite of Central and Northern Etolin Island" (Tmge) (M. A. Lanphere, U.S. Geological Survey, written communs., 1981, 1982). Descriptions of the rocks of this belt given by Hunt (1984). In this quadrangle there are two units:

- Tmqk Heterogeneous Granitic Rocks of Central Kupreanof and Northeastern Kuiu Islands--
 Biotite-hornblende granite, quartz syenite, quartz monzonite, and quartz monzodiorite. Poorly exposed, nonfoliated; hypidiomorphic, inequigranular to porphyritic. Fine- to medium-grained; C.I. 02 to 20. Mirolitic cavities common and locally abundant, as are fine-grained mafic inclusions. Feldspar mineralogy consists of microperthitic alkali feldspar which commonly rims plagioclase grains; common and locally pervasive micrographic intergrowths; and some potassic alteration of plagioclase. Mafic mineralogy consists of brown biotite (often partially replaced by chlorite), green-brown to blue-green hornblende (commonly associated with a pale-green fibrous secondary amphibole), and rare pale pyroxene. Accessory minerals include locally abundant sphene, magnetite, and rare allanite; epidote occurs as mirolitic cavity fillings. Includes minor amounts of pyroxene-rich coarse- to medium-grained quartz monzodiorite (C.I. 25-35), and of medium-grained, subophitic, pyroxene-biotite diorite (C.I. 40-50) similar to "Diorites Associated with the Granitic Rocks on Northwestern Kuiu and Zarembo Islands" (Tmaz and Tmdk). Unit is exposed in a small pluton in this quadrangle in central Kupreanof Island south of Castle River, and also on northwestern Kuiu Island southwest of Threemile Arm (where it also forms dikes which invade the adjacent country rocks), and as small plugs on Horseshoe and Monte Carlo Islands in Keku Strait. Various phases of these plutons have counterparts among all of the other coeval plutons in the quadrangle; they differ from various granitic units on Etolin Island in generally lower quartz and greater plagioclase content, finer grain size, and generally higher C.I.
- Tmdk Heterogeneous Dioritic Rocks of Northern Kuiu Island--
 Biotite-hornblende-pyroxene diorite, quartz diorite, quartz monzodiorite, and gabbro. Massive, nonfoliated; allotriomorphic to hypidiomorphic. Seriate; medium- to coarse-medium-grained; C.I. 17 to 50. Extensively diked and locally migmatitic with granitic to dioritic neosomes invading dioritic paleosomes. Feldspar mineralogy includes zoned plagioclase with local potassic alteration; locally abundant "clots" of interstitial potassium-feldspar; rare micrographic intergrowths; and abundant subophitic mafics. Mafic minerals are generally intergrown and consist of pale clinopyroxene, some orthopyroxene, green-brown hornblende (associated with a pale-green, fibrous secondary amphibole), minor brown biotite, and rare olivine. Accessory minerals include sphene, apatite, magnetite, and rare allanite. Unit exposed in a stock at the northern edge of this quadrangle; elsewhere in the outer portion of the pluton at Washington Bay on northwestern Kuiu Island and as a small plug at the head of Threemile Arm on northeastern Kuiu. Resembles the more dioritic phases of the "Migmatitic Granitic Rocks of Central and Northern Etolin Island " (Tmme).

GRAVINA BELT

The term Gravina belt is used here to denote sedimentary and volcanic rocks of Late Jurassic and Early Cretaceous age, including the pre-Cenozoic granitic and other rocks intruded into them in the east-central part of the Petersburg-Wrangell map area. As used here, the term also includes rocks of indeterminate Mesozoic age in a broad zone to the west of and adjoining the Jurassic and Cretaceous rocks. This zone is called the Duncan Canal-Zarembo Island-Screen Island sub-belt and it has within it blocks of Paleozoic and Mesozoic rocks unlike any elsewhere in the Gravina belt, but similar to some in the Alexander belt. The Gravina belt as used here more or less corresponds to the Gravina belt as defined by Berg and others (1978), but the map distribution does not correspond because of newer information and differing interpretations.

STEPHENS PASSAGE GROUP (Upper Cretaceous (Cenomanian) to Upper Jurassic(?))--Name proposed by Lathram and others (1965) for the "...sequence of slate, graywacke, conglomerate, and augite-bearing volcanic flow breccia, Late Jurassic and Early Cretaceous in age, which forms a well-defined northwest-trending belt of rocks exposed along the eastern slopes and shores of Admiralty Island...". This sequence also occurs south and east of Admiralty Island (Souther and others, 1979) and extends southward into this area. Information presented by Brew and others (1984) showed that the Group is as young as Albian or Cenomanian, i.e., late Early and early Late Cretaceous, in this area. The "Brother's Volcanics"/"Douglas Island" unit probably intertongues with the "Seymour Canal Formation", probably near the top of the latter (Loney, 1964). Cohen and Lundberg (1993) reported on details of the "Seymour Canal Formation" north of this quadrangle. Not mapped in this quadrangle, but see below:

DUNCAN CANAL-ZAREMBO ISLAND-SCREEN ISLAND SUB-BELT OF THE GRAVINA BELT

See "Gravina belt" heading (above) for background information.

METAMORPHOSED STEPHENS PASSAGE GROUP AND OTHER ROCKS (Upper(?) Mesozoic)-- Interpreted to be mostly metamorphic equivalents of the "Stephens Passage Group", but some may be derived from "Cannery Formation" (Muffler, 1967; Brew and others, 1984), some from a different facies of the "Stephens Passage Group", and some from a previously unrecognized facies of Triassic rocks. One unit mapped in this quadrangle:

- Mzv Greenschist and Greenstone Metamorphosed from Intermediate to Mafic Volcanic Rocks--
Greenschist, greenstone, phyllite, minor semischist. Weathers light to dark green, locally brownish. Derived from pillow breccia, agglomerate flows, and possible tuffs. Appears less deformed and less metamorphosed than other nearby rock units. Probably several thousand meters thick. Locally abundant relict pyroxene phenocrysts suggest a close link to the "Douglas Island Volcanics" (KJsv). Inferred upper Mesozoic age based on association with other units. Unit contrasts with the "Phyllite and Slate Metamorphosed from Mudstone and Minor Graywacke" (Mzp) mapped elsewhere in the Petersburg-Wrangell area in its apparent lesser metatuff and its higher proportion of rocks of volcanic origin. Exposed in the northeasternmost corner of this quadrangle and along and near Duncan Canal and Woewodski Island, and elsewhere on Zarembo Island and on Key Reef in Clarence Strait.
- Mzp Phyllite and Slate Metamorphosed from Tuff, Mudstone and Minor Graywacke--
Chlorite phyllite, slate and semischist, minor conglomerate, limestone and quartzite. Fine- to very fine-grained. Highly folded, especially in northern Kupreanof Island. Some phyllite is light green on fresh surfaces and medium green weathered and is inferred to have been derived from intermediate composition tuffaceous rocks; other phyllite is dark gray on fresh and weathered surfaces and is inferred to have been derived from fine-grained clastic sediments, as are dark gray fresh and weathered slates. These dark gray rocks are locally graphitic. Locally polymictic conglomerate layers less than 1 m thick occur on northwestern Kupreanof Island only. Thickness unknown, but probably great. One collection of conodonts from the limestone layers in west-central Kupreanof Island indicates that the unit is at least in part Upper Triassic (B. R. Wardlaw and A. G. Harris, U.S. Geological Survey, written commun., 1983). Unit contrasts with the "Cannery Formation" (MDc) elsewhere in the Petersburg-Wrangell area because the unit contains less chert and is more deformed and contrasts with the "Greenschist, Chert, Limestone, and Argillite" (Mzm) because the unit is of lower metamorphic grade and contains little limestone. Unit probably grades into the "Phyllite" (Ksp) to the east. Muffler (1967) mapped the exposures of this unit on northwestern Kupreanof Island as "Seymour Canal Formation" (KJss in this series of maps) on the basis of lithologic correlation with that unit on Admiralty Island to the north. Those rocks have been assigned to this unit because of difficulty in mapping them southward as a separate unit. Unit is exposed in the northeast part of this quadrangle and also very widely elsewhere. It is the most common unit in the northern part of the Duncan Canal-Zarembo Island-Screen Island sub-belt.

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