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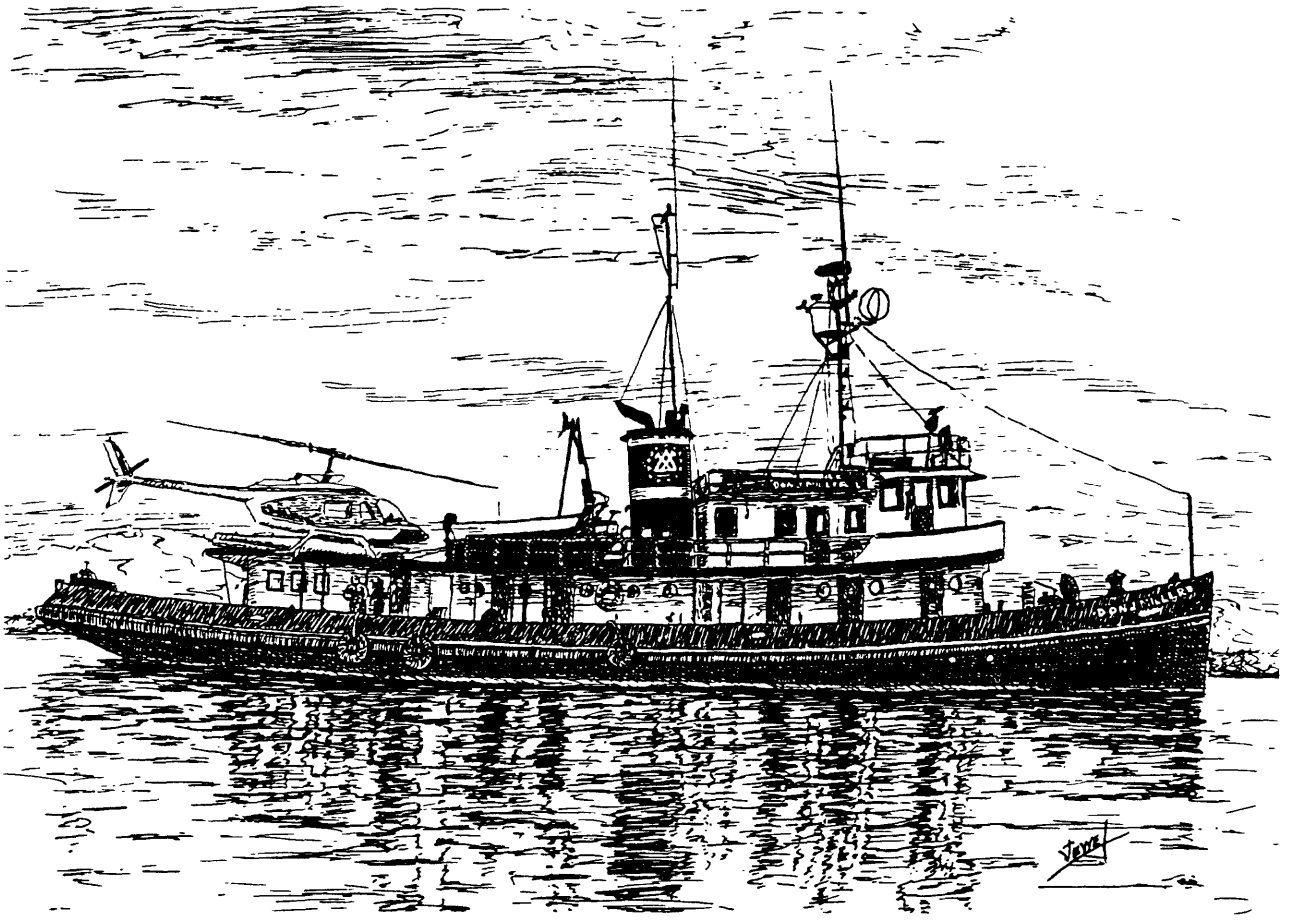

[U.S.G.S. R/V Don J. Miller II]

RECONNAISSANCE GEOLOGIC MAP OF THE PETERSBURG C-3 QUADRANGLE, SOUTHEASTERN ALASKA

Open-File Report 97-156-I

By David A. Brew

U.S. DEPARTMENT OF THE INTERIOR

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Reconnaissance Geologic Map of the Petersburg C-3 Quadrangle, Southeastern Alaska

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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 most 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 is to the west 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 and onto the mainland belt, is the lower to middle Tertiary Kuiu-Etolin belt that consists largely 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) Gravina belt itself (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)--Includes alluvium, colluvium, tidal mudflat deposits, and some glaciofluvial deposits. The distribution of the large area of surficial deposits in the Blind Slough area was mapped in the field, but the deposits have not been studied in detail and many small areas elsewhere are not shown.

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 intrusive into that section, 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.

INTRUSIVE ROCKS OF ADMIRALTY-REVILLAGIGEDO PLUTONIC BELT AND ASSOCIATED MIGMATITE (Upper Cretaceous)--Belt informally named by Brew and Morrell (1983) and described by Burrell (1984abc); K-Ar determinations (M. A. Lanphere, U.S. Geological Survey, written communs., 1981, 1982) interpreted to be applicable to the whole suite, including the rocks in this quadrangle, are as follows:

Map unit	General location	Biotite age	Hornblende age
Ktif unit	Wrangell Is.	83.2 Ma	91.6 Ma
" "	Mitkof Is.	-	89.1 Ma
Ktef unit	Zarembo Is.	90.4 Ma	93.0 Ma

Somewhat similarly dated rocks occur in lithically correlative units to the east in the Bradfield Canal quadrangle (R. L. Elliott and R. D. Koch, oral commun., 1982; Koch and Berg, 1978). As mapped in this quadrangle, divided into:

Ktif Hornblende-Biotite Tonalite, Granodiorite, Quartz Monzodiorite, and Quartz Diorite--
Equigranular to sparsely porphyritic, massive to weakly foliated; medium-grained; C.I. 14 to 52;. Light gray on fresh surfaces, weathers yellowish-gray. Rounded, elongate, very fine-grained dioritic and local ultramafic inclusions. Mineralogic features include oscillatory zoned seriate plagioclase grains; both discrete and small clumps of biotite and hornblende; mutually exclusive subhedral epidote and clinozoisite; rare garnet; and accessory sphene, allanite, and apatite. Alteration includes plagioclase to sericite and mafic minerals to epidote. Unit differs from "Hornblende-Biotite Tonalite and Granodiorite, etc." (Ktef) by lack of pyroxene and garnet and better development of seriate plagioclase. "Hornblende-Biotite Tonalite" (Ktop) is a porphyritic variation of this unit. Exposed in this quadrangle on Mitkof Island, and elsewhere on Zarembo, and Woronkofski Islands (Burrell, 1984ab).

Ktop Hornblende-Biotite Tonalite--
Porphyritic, locally foliated. Medium- to coarse-grained; C.I. 15 to 40. Medium to dark gray on fresh surfaces, brownish-gray where weathered. Local alignment of plagioclase laths defines foliation; rare hornfels inclusions; aplitic granite dikes, pegmatite veins, and tonalite dikes into country rock at margins produce interfingering contacts. Plagioclase porphyritic with local reddish-brown garnet phenocrysts; garnet-rich and -poor zones locally define layers. Mineralogy includes zoned seriate plagioclase with minor alteration to sericite; mafic minerals mostly in clumps; epidote and zoned garnet present; accessory sphene, apatite, and allanite; some biotite altered to chlorite. Body on southwestern Mitkof in this quadrangle is quartz monzodiorite. Unit is gradational with "Hornblende-Biotite Tonalite, Granodiorite, etc." (Ktif), but differs in its porphyritic texture and ubiquitous garnet. Unit differs from "Biotite-Epidote-Hornblende Quartz Monzodiorite Unit" (Kqop) by the dominance of biotite over hornblende; larger hornblendes with poorer crystal form and (locally) abundant inclusions; presence of garnet; and clumps of mafics as opposed to discrete mafics. Unit differs from "Biotite Tonalite, Quartz Diorite and Granodiorite" (Ktgp) in abundance of hornblende and a higher color index. Exposed in this quadrangle on southern Mitkof Island and elsewhere on Lindenberg Peninsula; and on Rynda, Kadin, Woronkofski, and Wrangell Islands (Burrell, 1984b); and in Ernest Sound.

Ktoc Garnet-Biotite Tonalite and Minor Granodiorite--

Nonfoliated crowded plagioclase rock; inequigranular to porphyritic. Very fine- to medium-grained; C.I. 14 to 29. Medium gray on fresh surfaces; weathers light gray. Forms small elongate bodies less than 3 square km in area; also makes up one larger body on northern Wrangell Island. Mineralogy includes reddish-brown garnet, clinozoisite (or rarely epidote) and local muscovite. Biotite and quartz commonly interstitial to closely spaced plagioclase laths. Unit is similar to "Biotite Tonalite, Quartz Diorite, and Granodiorite" (Ktgp) mineralogically, but differs texturally by its finer grain size and lack of large phenocrysts. Exposed in this quadrangle on southern Mitkof Island and elsewhere on northern Wrangell, Woronkofski and Etolin Islands (Burrell, 1984b).

Kqop Biotite-Epidote-Hornblende Quartz Monzodiorite--

Locally foliated; plagioclase porphyritic with medium- and coarse-grained phenocrysts (to 12 mm), and a fine- to medium-grained groundmass. The C.I. range is 17 to 48. Weathers brownish-gray, gray and white on fresh surfaces. Body margins are commonly more mafic and have a very fine- to fine-grained groundmass. Also common are muscovite-biotite garnet-epidote aplite dikes of granitic and granodioritic composition. Mineralogy includes oscillatory zoned plagioclase with sericite alteration of the cores; interstitial quartz and K-feldspar; euhedral fine-grained hornblende; minor biotite; and primary (occasionally twinned and zoned) and secondary epidote. Unit is exposed in the western part of this quadrangle on Kupreanof Island and elsewhere on the Lindenberg Peninsula, Woewodski Island, and on Woronofski and northern Zarembo Islands.

Kqo Pyroxene-Biotite-Hornblende-Quartz Monzodiorite, Quartz Diorite, Monzodiorite, and Diorite--

Locally foliated, equigranular. Medium-grained, fine- to medium-grained near margins; C.I. 20 to 61. Black and white to medium gray on fresh surfaces, weathers brownish-gray to orangish-gray. Mafic inclusions, quartz and pegmatite veins and diabase dikes present. Mineralogy includes include anhedral, commonly poikilitic, hornblende with pyroxene; biotite and plagioclase inclusions; anhedral biotite; and pyroxene. Plagioclase is twinned, zoned,and grains are very closely packed. Plagioclase, K-feldspar, and quartz form the groundmass. To the northwest, on the northern Lindenberg Peninsula, biotite, opaques and clinopyroxene are common in the Missionary Range body. Hornblende appears and increases in abundance as pyroxene and opaque minerals decrease in abundance to the south. Hornblende, when present, is usually the dominant mafic mineral. Unit is exposed on northern Lindenberg Peninsula and, in this quadrangle, on central Mitkof Island (Burrell, 1984a).

Kdi Hornblende Diorite--

Hornblende diorite, quartz diorite, and minor tonalite. Medium- to very-coarse-grained; C.I. 15 to 50. Equigranular, except for local crowded plagioclase porphyry like the "Hornblende-Biotite Tonalite" (Ktop). Weathers light to dark green; highly altered to epidote- and chlorite-rich rock. Crops out in the southwestern part of this quadrangle and on Woewodski Island to the west. Differs from other Cretaceous granitic rocks in the relatively high degree of alteration.

METAMORPHOSED STEPHENS PASSAGE GROUP ROCKS (Upper Cretaceous)--In general, these units are associated with the Upper Cretaceous and Tertiary plutons (of the Kuiu-Etolin Belt) and plutons of the Admiralty-Revillagigedo plutonic belt in the Gravina Belt. The rocks have been rather arbitrarily assigned a Late Cretaceous age and are described here or assigned a Tertiary age and described elsewhere as "Hornfelsed Seymour Canal Formation Rocks" (Tsh) based on the known or inferred age of the pluton(s) nearby. This results in a potentially misleading map pattern, however, because the metamorphic rocks adjacent to Tertiary plutons may have undergone Upper Cretaceous metamorphism as well; and the units that are based on Tertiary metamorphic effects alone are poorly defined. The Cretaceous age assignment used here is also not entirely satisfactory from either a field mapping or petrographic study viewpoint; this is due to both the complexity of spatial overlapping metamorphic effects and the apparent lack of an unmetamorphosed protolithic unit for one of the metamorphic units mapped outside of this quadrangle. Two units mapped in this quadrangle:

Kss Schist and Hornfels--

Greenschist and albite-epidote to hornblende-hornfels facies metamorphic rocks derived from "Seymour Canal Formation" (KJss). Original textures and structures generally preserved. Dominantly fine- to medium-grained, grayish-brown on fresh surfaces and reddish-brown weathered. Locally foliated; commonly compositionally layered chlorite-biotite-quartz-feldspar schist and semischist; minor phyllite; some strongly hornfelsed rocks close to plutons. Clear-cut aureoles around Upper Cretaceous plutons are (garnet-andalusite-staurolite-)biotite-quartz-feldspar hornfels and schistose hornfels; some calc-silicate and intermediate composition layers and lenses locally. Age of metamorphism varies as described in headnote above; age of protolith is Late Jurassic to middle Cretaceous based on derivation of this unit from the "Seymour Canal Formation".

Ksp Phyllite--

Subgreenschist and greenschist facies metamorphic rocks inferred to be derived from fine-grained sediments associated with the turbidites of the "Seymour Canal Formation" (KJss) mapped elsewhere in the Petersburg-Wrangell area. Original textures and structures generally obscure. Dominantly very-fine-grained, dark-gray weathering, carbonaceous chlorite-quartz-feldspar phyllite; some interlayered graywacke and graywacke semischist. Locally extensive layers and lenses of very-fine-grained, light to dark-green weathering chlorite-rich phyllite are interpreted to have been metamorphosed from fine-grained volcanic sediments such as tuffs or from highly transposed and tectonized coarser grained intermediate composition rocks. Age interpretation is the same as that given above for the "Schist and Hornfels" (Kss).

INTRUSIVE ROCKS OF KLUKWAN-DUKE PLUTONIC BELT (Cretaceous): Belt informally named by Brew and Morrell (1983); rocks interpreted to be 100-110 Ma on the basis of their similarity to dated rocks elsewhere (Lanphere and Eberlein, 1966) and on a K-Ar age of 107 Ma from the pluton at Turn Mountain on Kupreanof Island (M. A. Lanphere, U.S. Geological Survey, oral commun., 1983). See also Taylor and Noble (1960) and Taylor (1967). One unit mapped in this quadrangle:

Khb Hornblendite--

Hornblendite and hornblende gabbro. Locally compositionally layered, fine- to medium-grained. Weathers dark grayish-green to black; C.I. 70 to 100. Locally cut by granitic rocks like those of nearby Upper Cretaceous plutons, but on Sukoi Islets in the Petersburg C-2 quadrangle appears to cut some granitic bodies. Exposed in this quadrangle on the northeast shore of Mitkof Island; elsewhere on the southeast side Woronkofski Island, on islets in Zimovia Strait, and in a large body on northwestern Kupreanof Island at Turn Mountain that is interpreted to be the outer envelope of an Alaska-type mafic/ultramafic pluton (Taylor, 1967).

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)--Currently 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. In this quadrangle:

Mzs Semischist and Phyllite Metamorphosed From Graywacke and Siltstone--
Low grade (probably sub-greenschist facies) metamorphic rocks. Locally highly folded; generally poorly foliated but finer-grained phases have good cleavage. Brownish-gray where fresh, gray to brown where weathered. Relict textures and sedimentary structures indicate derivation from a graywacke and siltstone or mudstone turbidite sequence. Unit in othe quadrangles encloses several large lenses of "Fossiliferous Limestone" (Dls) of Devonian age, but there is no direct indication of the age. Proximity to "Seymour Canal Formation" (KJss) outcrops in other quadrangles and compatibility of the protoliths with that formation suggest that this unit is a metamorphic and deformed equivalent of that formation. Unit contrasts with the "Phyllite and Slate Metamorphosed From Mudstone and Minor Graywacke" (Mzp) in the proportion of originally coarse-grained sediments, and in the general absence of volcanic(?) protolith phyllite in this unit, and the two units probably intertongue much more complexly than is shown on the map. Exposed in this quadrangle in Duncan Canal, and on Woewodski, Zarembo, and Etolin Islands.

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 this quadrangle along and near Wrangell Narrows and Woewodski Island and elsewhere on Zarembo Island and on Key Reef in Clarence Strait.

Mzr Schist and Semischist Metamorphosed From Felsic Volcanic Rocks--
Quartz-feldspar schist and semischist, minor phyllite and greenstone; fine-grained. Light grayish green on fresh surfaces, orangish-brown where weathered. Thickness unknown; relations to adjacent units uncertain. Age not known directly, but inferred from spatial association with other units. Exposed on Woewodski Island in the southwestern part of this quadrangle and nearby in Duncan Canal.

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 where weathered and is inferred to have been derived from intermediate composition tuffaceous rocks. Other phyllite is dark gray both on fresh and weathered surfaces and is inferred to have been derived from fine-grained clastic sediments, as are the dark gray fresh and weathered slates. 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 ; it contrasts with the "Greenschist, Chert, Limestone, and Argillite" (Mzm) mapped elsewhere because that unit is of lower metamorphic grade and contains no 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 very widely as the most common unit in the northern part of the Duncan Canal-Zarembo Island-Screen Island sub-belt, and in the southwestern part of this quadrangle.

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 the map-area described here. 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 Volcanics" 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. In this quadrangle:

KJsv Brothers Volcanics/Douglas Island Volcanics--

Augite-bearing flows, volcanic breccia, and intercalated tuff, volcanic graywacke, phyllite and slate. Andesitic to probably basaltic composition. Weathers dark greenish-gray, gray, and green; generally lighter colored on fresh surfaces. Relict augite phenocrysts conspicuous in most outcrops. Probably a few thousand meters thick; individual flow or breccia units as much as a few hundred meters thick and graywacke, tuff, and slate lenses may also be that thick. No fossils have been found in this unit in this map area; its age is based on its close association with the locally fossiliferous "Seymour Canal Formation". The "Brothers Volcanics" were named by Loney (1964) from exposures just north of this map area; and the "Douglas Island Volcanics" were named by Lathram and others(1965) on Admiralty Island from exposures on Douglas Island to the north. Exposed in this quadrangle on southwestern Mitkof Island and elsewhere on Kupreanof, Zarembo, and Etolin Islands. The best and least deformed or metamorphosed outcrops are those here on southwestern Mitkof Island and near Steamer Bay on Etolin Island. See also Berg and others (1972); Ford and Brew (1977, 1978) and Page and others (1977).

HYD GROUP(?) (Upper Triassic)--One unit mapped in this quadrangle, namely:

Trhv Felsic and Intermediate Volcanic Flows and Breccia, Limestone, and Argillite--

Dominantly very-fine to fine-grained, chlorite-quartz-muscovite-feldspar phyllite. Light to dark green on fresh surfaces, rusty and green where weathered; locally chertlike. Interpreted by Berg and Grybeck (1980) and Berg (1981) to be felsic metatuff. Includes thinly layered to laminated quartz-feldspar phyllite or semischist interpreted by the same workers to be metarhyolite. Associated with dark gray thin bedded carbonaceous mudstone, siltstone, and limestone. Thickness unknown, but probably several hundred meters at least. Age Late Triassic-early Karnian for the unit inferred from one collection of halobiid pelecypods from exposures on the west side of Duncan Canal (N. J. Silberling, U.S. Geological Survey, written commun., 1980). Host unit for massive sulfide deposits. Exposed along and near Duncan Canal, on the Castle Islands and, in this quadrangle, on Woewodski Island . The exposures on Rookery Island in Duncan Canal and on the northeast side of East Island in the Kashevarof Islands in the quadrangle to the south are well-bedded silty limestone of different and more uniform aspect.

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