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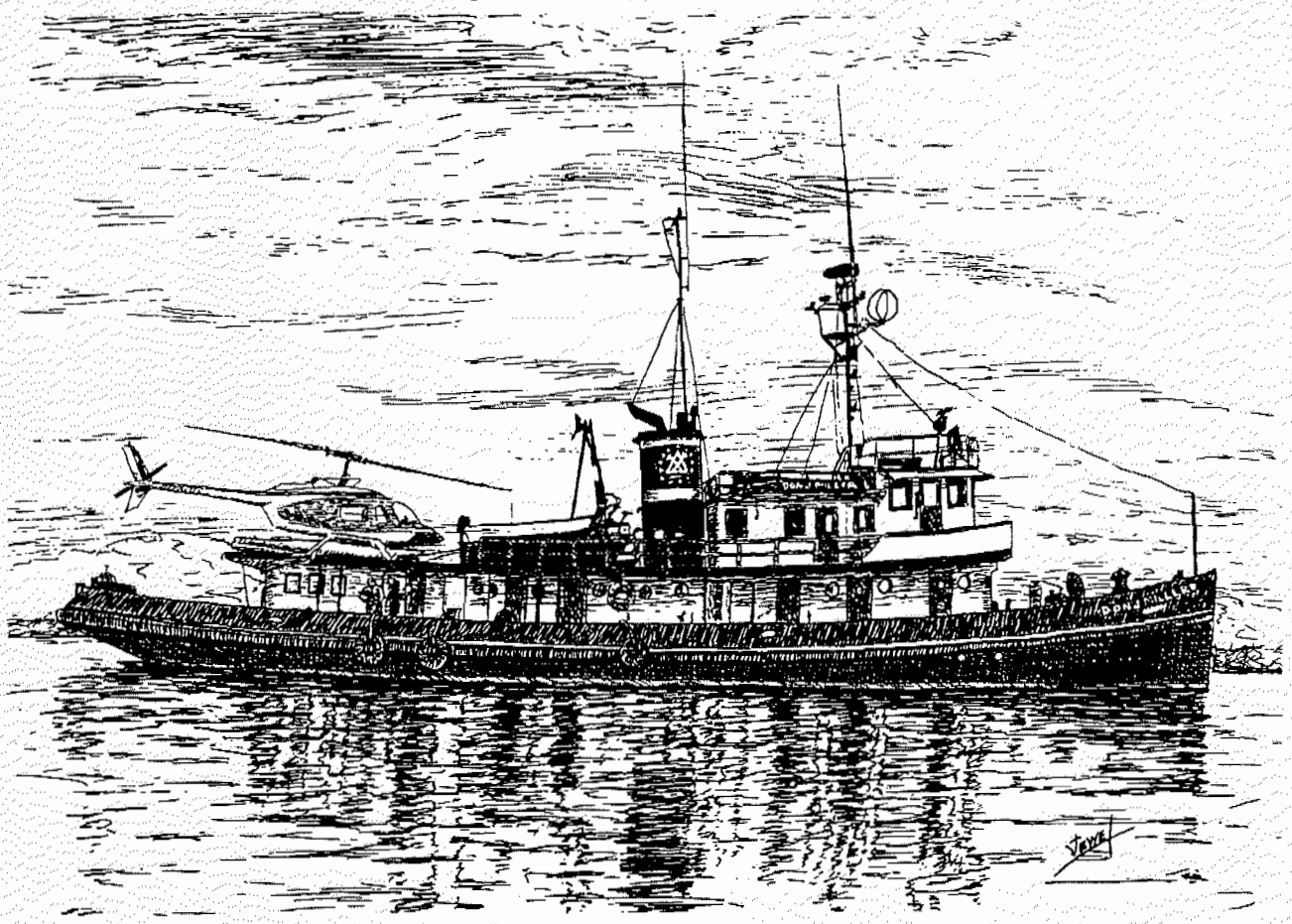

[U.S.G.S. R/V Don J. Miller II]

RECONNAISSANCE GEOLOGIC MAP OF THE PETERSBURG B-4 QUADRANGLE, SOUTHEASTERN ALASKA

Open-File Report 97-156-F

By David A. Brew

U.S. DEPARTMENT OF THE INTERIOR

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Reconnaissance Geologic Map of the Petersburg B-4 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. Those studies are a direct follow-up to geological, geochemical, and geophysical studies (cited below) done in the region by the Alaskan Branch of the U.S. Geological Survey in the 1970's and 1980's.

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 lies to the north 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) Alexander belt, (2) Duncan Canal-Zarembo Island-Screen Islands sub-belt of the Gravina belt, and (3) 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)--Includes alluvium, colluvium, and tidal mudflat deposits. In this quadrangle mapped only on northeastern Prince of Wales Island, and many small areas elsewhere are not shown.

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; one unit mapped in this quadrangle:

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 Petersburg C-4 quadrangle (Brew, 1997j), to the north of this one, exposes polymictic glacial till in a small lens under dense aphanitic basalt that is mapped with this unit; whole unit is interpreted to be Pleistocene or younger (Brew and others, 1985). Three whole-rock K-Ar ages on basalts in the northern part of this quadrangle on southern Kupreanof Island gave ages of 0.272±0.085, 0.262±087, and 4.04±6.95 Ma (M. A. Lanphere, U.S. Geological Survey, written commun., 1972). Unit is exposed 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.

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 where fresh; buff, white, green lavendar, maroon, or pink where altered; generally rusty weathering. Disseminated pyrite and zeolites common. Many exposures are texturally complicated mixtures of discontinuous mm-scale flow-layered, brecciated, spherulitic, and phenocrystic rocks. Varied stratigraphy 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 indicated by extreme alteration, brecciation, attitudes of layering, and dikes; isolated massive structureless rhyolite bodies suggest plugs; columnar-jointed cliff exposures in excess of 100 m thick are interpreted as cooling units. Exposed in the northern and eastern parts of this quadrangle on southern Kupreanof Island and western Zarembo Island, respectively.

QTa Andesite and Other Intermediate Extrusive Rocks--
Dark gray where fresh, green to maroon where altered, blocky weathering, pyroxene- and feldspar-porphyritic, massive to vesicular and amygdaloidal flows 10-50 cm thick. Apparently intercalated with basalts in southern Rocky Pass area between Kulu and Kupreanof Islands, also occurs in south central Kupreanof Island, and near exposures of "Rhyolite, Rhyodacite, etc." (QTr) near Kah Sheets Lake. In this quadrangle, exposed on western Zarembo Island.

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 mafic tuff and flow breccia of irregular thickness, but generally less than 1 m thick. Mafic dikes and small localized flows occur higher in the section. 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; in this quadrangle exposed on northwestern Zarembo Island. Most extensive volcanic unit in the Kuiu-Etolin belt; may also underlie much of exposed extrusive volcanic section on Kuiu, Kupreanof and Zarembo Islands.

QTx Breccia and Agglomerate--

Poorly exposed, enigmatic light- and dark-gray, interlayered volcanic graywacke and mafic tuff breccia of basaltic(?) composition. Crops out in this quadrangle on isolated reefs in Kashevarof Passage off northeast Prince of Wales Island.

Tk KOOTZNAHOO FORMATION(?) (Paleogene)--Nonmarine arkosic sandstone, sandstone, shale, and conglomerate.

Medium- to very thick-bedded, locally cross-bedded Dominant rock type is medium- to very coarse-grained, lithic feldspathic quartz arenite. Conglomerates contains clasts up to 10 cm of granitic rock, slate, schist, chert, felsic volcanics. Minor shale is locally carbonaceous and contains plant fossils; rare thin coal beds; greater than 300 m thick near Dakaneek Bay on Kupreanof Island (K. A. Dickinson, U.S. Geological Survey, oral commun., 1980). Available fossil evidence suggests that all of this unit in the northern part of the Petersburg-Wrangell map area near Keku Strait is Paleocene in age and that in the southern part on Zarembo Island (which includes the area in this quadrangle) is early Eocene, whereas the type Kootznahoo Formation on Admiralty Island (Lathram and others, 1965) is now considered latest Eocene through early Miocene age (Wolfe, 1966; J.A. Wolfe, U.S. Geological Survey, written communs., 1979, 1983). The similarities in depositional environment, stratigraphic position, and lithology suggest that the name Kootznahoo Formation is appropriate although the depositional basins may not have been connected. Unit is inferred to underlie most, if not all, of the "Extrusive and Intrusive Volcanic Rocks of Kuiu-Etolin Volcanic-Plutonic Belt" units in the Petersburg-Wrangell map area and locally intertongues with at least the lower part of those units. The largest outcrop of the unit is south and southeast of Hamilton Bay on Kupreanof Island; another large area is on the southwest side of Zarembo Island and Bushy Island; small outcrops occur in this quadrangle at California Bay on Prince of Wales Island, on the north end of the Bushy Islands, and east of Point Nesbitt on Zarembo Island; other outcrop areas in the general Petersburg-Wrangell area are in the divide between Port Camden and Threemile Arm on Kuiu Island, at Kadake Bay on Kuiu Island, and in the upper drainage of Hamilton Creek on Kupreanof Island; Buddington and Chapin (1929) report an occurrence at Kah Sheets Bay on Kupreanof Island which Brew and others (1984) did not find. See Muffler (1967), Dickinson (1979), Dickinson and Campbell (1982), Wright and Wright (1908), and Loney (1964) for further information.

ALEXANDER BELT

Belt informally named by Brew and others (1984) to denote those rocks that form a coherent stratigraphic section, together with the pre-Cenozoic granitic and other rocks intrusive into that section in the western part of the map area. The stratigraphic sequence ranges in age from Ordovician up to Cretaceous. The belt does not correspond exactly to the Alexander terrane of Berg and others (1978).

INTRUSIVE ROCKS OF THE CHILKAT-PRINCE OF WALES PLUTONIC PROVINCE (Cretaceous); Province informally named by Sonnevil (1981); preliminary K-Ar determinations on hornblende from the "Hornblende Quartz Monzodiorite, etc." on Kosciusko and Prince of Wales Islands (M. A. Lanphere, U.S. Geological Survey, written communs., 1981, 1982) give 98.7 and 100.0 Ma. One unit mapped in this quadrangle:

Kwqo Hornblende Quartz Monzodiorite with Minor Tonalite, Granodiorite, Quartz Diorite, Diorite, Quartz Monzonite, and Monzodiorite--

Massive to foliated, equigranular to locally porphyritic; medium-grained; C.I. 2 to 48 (approx.). Most pyroxene altering to hornblende and biotite to chlorite; accessories are apatite and sphene. Unit differs in general from the Upper Cretaceous plutons of the Admiralty-Revillagigedo plutonic belt in the Gravina and Mainland Belts to the east by lack of epidote and garnet, lower color index, and by lack of local plagioclase-porphyry phase. Unit differs from the "Biotite-Pyroxene-(Hornblende-)Monzodiorite, etc." (Kqo) mapped on northeastern Kupreanof Island north of this quadrangle in having ubiquitous hornblende. Exposed on Prince of Wales Island in southwestern corner of quadrangle.

ULTRAMAFIC COMPLEX AT BLASHKE ISLANDS AND RELATED ROCKS (Cretaceous)--K-Ar dating (Lanphere and Eberlein, 1966) suggests an age of 110 Ma for this complex (Kennedy and Walton, 1946; Walton, 1951ab), which is considered to be a westward outlier of the Klukwan-Duke plutonic belt informally named by Brew and Morrell (1983). Recently reported on by Himmelberg and others (1986). Only one of the complex's units is mapped in this quadrangle:

Kbgb **Clino**pyroxene-Hornblende Gabbro--

Massive to locally cm-scale flow banded; medium-grained; C.I. 65-75; hypidiomorphic granular. Medium gray where fresh; weathers dark gray. Locally 5 percent mafic inclusions 2 to 3 cm maximum dimension; fine grained mafic dikes common. Exposed on small islands and rocks between the north end of Kashevarof Passage and Clarence Strait.

PRINCE OF WALES ISLAND SEQUENCE (Devonian to Ordovician)--Informally named by Brew and others (1984) to emphasize the island-arc depositional situation that persisted from Ordovician through Early Devonian time; consists of two dominant lithologic associations, "Carbonate Rocks and Associated Conglomerates" and "Turbidites and associated rocks". In this quadrangle Silurian and Silurian and Ordovician parts of those two associations are mapped, as follows:

Carbonate Rocks and Associated Conglomerates (Upper to Lower Silurian): Extensive carbonate units--the Kuiu Limestone and the Heceta Limestone, which is mapped in this quadrangle--are interpreted to have formed as fringing reefs or carbonate banks in an island-arc environment dominated by volcanic turbidites. They probably range in age and are not a single stratigraphic horizon. The associated polymictic conglomerates probably represent several separate channels at different horizons carrying material from distant sources. Two units exposed in this quadrangle:

Sch Heceta Limestone--

Massive or thick-bedded, fine-grained limestone, minor limestone breccia, sandstone, mudstone, and pods of polymictic conglomerate. Commonly highly fractured, locally fossiliferous. Light- to medium-dark gray where fresh, buff where weathered; forms rough pockety surfaces in tidal zone and karst topography inland. Thickness probably greater than 4,000 m in some exposures. Age is Middle and Late Silurian according to Eberlein and Churkin (1970) based on discussion of several collections. Eberlein and others (1983) extended the lower age limit to include late Early Silurian; several new collections confirm this assignment. Named by Eberlein and Churkin (1970) for exposures on Heceta Island in the Craig map-area to the south; other exposures discussed in detail by Ovenshine and Webster (1970). Exposed in this quadrangle on northeastern Prince of Wales Island and in the Clarence Strait area.

Scp Polymictic Conglomerate--

Pebble and cobble conglomerate and other clastic rocks like those described elsewhere (Brew and others, 1984) as the "Polymictic Conglomerate Intercalated with Heceta Limestone" (Schc) , but which occur instead stratigraphically between the "Heceta Limestone" (Sch) and the "Graywacke Mudstone, Turbidites, and Limestone" (DStbg) of the "Bay of Pillars Formation". Thickness probably greater than several thousand m locally. Age is not known directly, but is inferred from the age of the adjacent units noted above. Mapped in the southwestern part of this quadrangle on Prince of Wales Island.

Turbidites and associated rocks (Upper Silurian to Lower Ordovician): These very extensive turbidite, conglomerate, and volcanic units--the "Bay of Pillars Formation" in this quadrangle and the "Descon Formation" elsewhere on Prince of Wales Island--are interpreted to be the dominant feature of a long-lived island-arc environment. The two formations probably grade into one another. The limestones, conglomerates, and volcanic units that are mapped separately probably vary in age and do not represent persistent stratigraphic horizons. Karl and Giffen (1992) described some aspects of the sedimentology. In this quadrangle two main units are present, the "Bay of Pillars Formation on Kuiu and western Prince of Wales Islands" and "Bay of Pillars Formation on Northeastern Prince of Wales Island ":

Bay of Pillars Formation on Kuiu and western Prince of Wales Islands (Upper to Lower Silurian)--

Dominantly graywacke, mudstone, and calcareous mudstone turbidites, with subordinate conglomerate, limestone, and intermediate to mafic volcanic flows, breccia, and tuff. Sedimentary features in sandstone turbidites include massive amalgamated beds, channelized beds, graded beds with Bouma sequences, and chaotically deformed slump deposits. Associated polymictic conglomerates are massive to channelized and cross-bedded. Ubiquitous limestone turbidites are rhythmically bedded with carbonaceous partings. Isolated exposures of volcanic rocks are massive and generally brecciated. Sandstones are extremely variable in composition. Three dominant varieties include calcareous graywacke, volcaniclastic graywacke, and quartzofeldspathic graywacke. Sediment immaturity and rapid local changes in sandstone composition suggest local sources. Proximal turbidite facies and cross-bedding in conglomerates suggest shallow to moderate water depths; map pattern suggests local volcanic centers with associated carbonate reefs, and a dominant regime of graywacke turbidite deposition, with calcareous turbidites occupying interchannel areas. The Bay of Pillars Formation was named and defined by Muffler (1967) from exposures on Kuiu Island. It is mapped on Kuiu, Kosciusko, and northern Prince of Wales Islands. Stratigraphic intercalation as well as incorporation of large angular boulders of limestone similar to the Heceta suggests a facies relationship with that unit. Well rounded syenite porphyry cobbles indicate a distinctive source terrane for the conglomerates found elsewhere in the Petersburg-Wrangell area. Preliminary structural and paleocurrent data suggests deposition of Bay of Pillars sediments in basins between a syenite-bearing landmass to the west and volcanic/carbonate centers to the east. Unit thickness probably greater than a few thousand meters. Bay of Pillars rocks are locally hornfelsed by Mesozoic and Tertiary plutons. Graptolite collections made during the study of Brew and others (1984) range in age from middle Llandoverian to early Ludlovian (Claire Carter, U.S. Geological Survey, written commun., 1980). Differs from the "Descon Formation" (Brew and others, 1984) because it has significantly less volcanic debris, both in stratigraphic horizons and as individual clastic grains. It also is mostly younger than the Descon. As mapped in this quadrangle, divided into:

Stbg Graywacke, Mudstone, Turbidites, and Limestone--

Buff, green, or gray, tan to maroon weathering graywacke, mudstone and calcareous mudstone. Graywackes typically medium- to thick-bedded or massive, with amalgamated beds as well as full Bouma sequences. Mutti and Ricchi-Lucci turbidite facies represented are dominantly B and C "inner fan" channel facies, with associated A conglomerates and E overbank deposits. Soft sediment deformation is common. The graywackes are immature, consisting of poorly sorted angular clasts with extreme compositional variability over short distances laterally and vertically. The three dominant varieties are: 1) calcareous graywacke with carbonate clasts, fossil fragments, subordinate feldspar, quartz, and volcanic rock fragments; and patchy recrystallized carbonate matrix; 2) volcaniclastic graywacke consisting mainly of felted intermediate to mafic volcanic rock fragments, with subordinate grains of feldspar, monocrystalline, embayed quartz, occasional fossil fragments, and chloritic or clayey matrix; and 3) quartzofeldspathic graywacke with detrital biotite and potassium feldspar, and with locally calcareous or clayey matrix. In all three types three rock types, rare grains of microcrystalline quartz, epidote, volcanic shards, and felsite may be found. No white mica or metamorphic rock fragments were seen. Calcareous graywackes are ubiquitous, and often grade to limestone interbeds. The volcaniclastic graywackes are most characteristic around northernmost Affleck Canal, Port Malmesbury, Bay of Pillars, and Security Bay on Kuiu Island. Quartzofeldspathic graywackes occur in the vicinity of Table Bay and Explorer Basin on the west side of Kuiu Island. In this quadrangle, exposed on northeastern Prince of Wales Island.

Stbo Olistostrome Blocks of Heceta Limestone in Turbidite Matrix--Disrupted blocks of Heceta(?) limestone in massive calcareous sandstone matrix, and intraformational limestone conglomerate, interpreted as olistostromes (Ovenshine and Webster, 1970). Best exposed south of Alvin Bay on Kuiu Island and on islands in Sumner Strait; exposed on the northern shore of Prince of Wales Island in this quadrangle.

Bay of Pillars Formation on Northeastern Prince of Wales Island (Upper(?) to Lower Silurian)--

Graywacke and siliceous mudstone turbidites. Amalgamated beds, full Bouma sequences, and high sand/shale ratios suggest a proximal turbidite facies association. Rhythmically bedded limestones, polymictic conglomerate, and volcanic agglomerate and breccia are intercalated with the graywackes. Sandstones and conglomerates are volcaniclastic, immature, and probably reflect local sources . All graptolite collections to date are of Early Silurian age (Claire Carter, U.S. Geological Survey, written commun., 1980). The unit is distinguished from "Bay of Pillars rocks on Kuiu and western Prince of Wales Islands" by a more volcaniclastic and less calcareous composition. As mapped in this quadrangle on northeastern Prince of Wales Island, divided into:

Stpg Graywacke, Slate, and Limestone--

Greenish-gray where fresh, buff weathering, volcaniclastic graywacke and argillite turbidites. Massive to amalgamated, graded, and rhythmic beds corresponding to Mutti and Ricchi-Lucci A, B, C, and E turbidite facies, suggest a proximal depositional environment in moderate water depths. Graptolites locally on argillaceous bed-parting surfaces. Local soft sediment deformation is typically associated with calcareous layers or lenses. Exposed on northeastern Prince of Wales Island in this quadrangle.

Stpc Conglomerate, Agglomerate, and Volcanic Breccia--

Predominantly volcaniclastic, polymictic conglomerate, and volcanic breccia and agglomerate of intermediate to mafic composition, feldspar and clinopyroxene porphyritic composition. Exposed at two outcrop areas on the north shore of Prince of Wales Island in this quadrangle.

GRAVINA BELT

The term Gravina belt is used here to denote sedimentary and volcanic rocks of Late Jurassic and Early Cretaceous age (and the pre-Cenozoic granitic and other rocks intruded 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 does not correspond exactly because of newer information and differing interpretations. In this quadrangle, only some of the Duncan Canal-Zarembo Island-Screen Island sub-belt rocks are present

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. As mapped in this quadrangle, consists of one unit:

Mzv Greenschist And Greenstone Metamorphosed From Intermediate To Mafic Volcanic Rocks--Greenschist, greenstone, phyllite, and 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. Inferred to underlie part of Sumner Strait in the northeastern part of this quadrangle.

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