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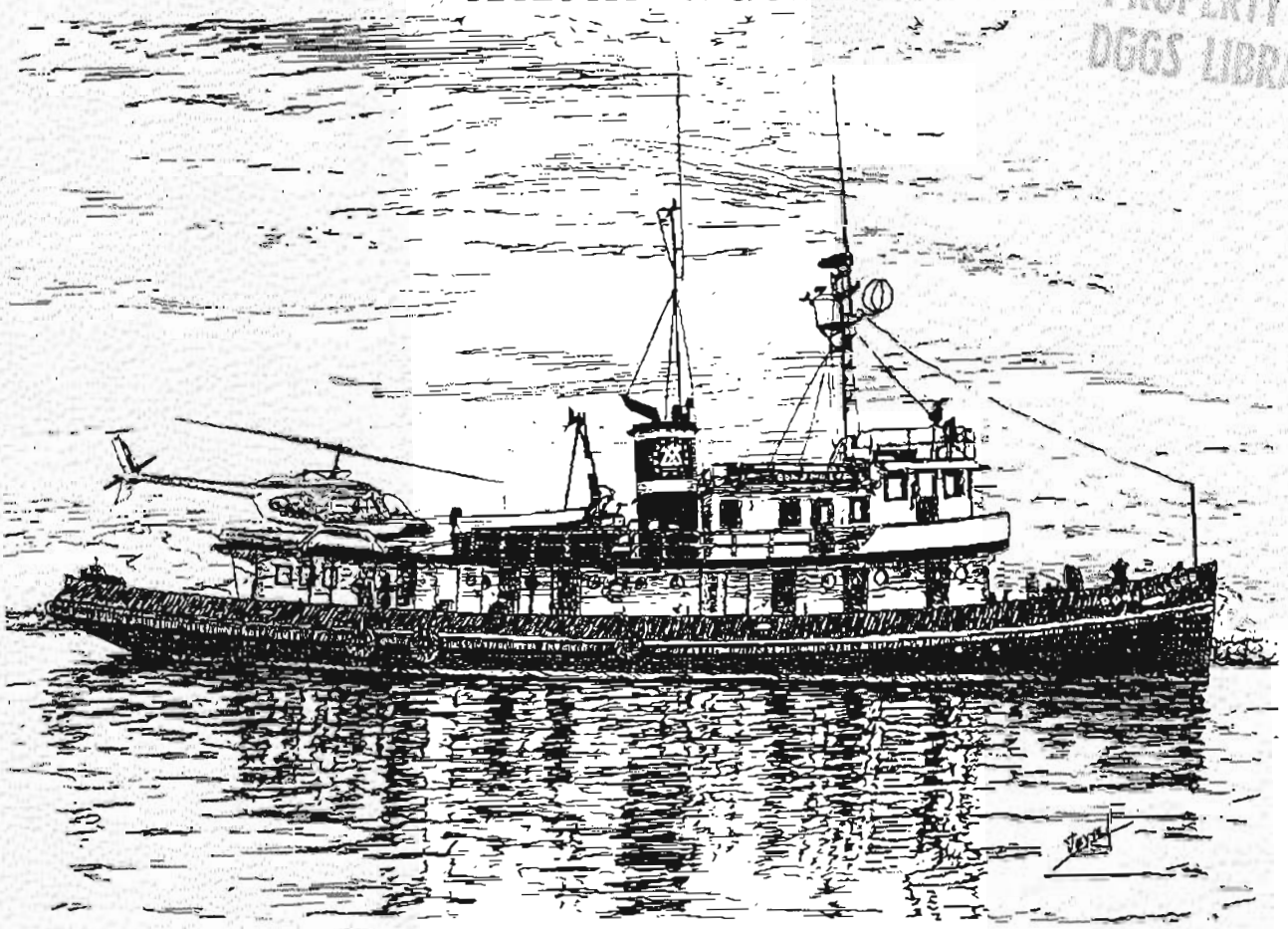

[U.S.G.S. R/V Don J. Miller II]

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

Open-File Report 97-156-G

By David A. Brew

U.S. DEPARTMENT OF THE INTERIOR

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Reconnaissance Geologic Map of the Petersburg B-5 Quadrangle, Southeastern Alaska

By

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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 northwest 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 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)--Includes alluvium, colluvium, and tidal mudflat deposits. In this quadrangle mapped only on northern Prince of Wales Island; 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; four units mapped in this quadrangle, namely:

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

Fresh, locally polygonally jointed, dark greenish gray where fresh, 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 and others, 1985; Brew, 1997j) exposes polymictic glacial till in small lens under dense aphanitic basalt that is mapped with this unit. Whole unit is interpreted to be Pleistocene or younger. Three whole-rock K-Ar ages on basalts in the northern part of the Petersburg B-4 quadrangle to the east, 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). Exposed along south shore of Kupreanof Island from Kah Sheets Bay to Douglas Bay and from west of Totem Bay to beyond Point Barrie in this quadrangle 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.

QTc Volcaniclastic Deposits--

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 beds, 10's of meters thick, to cm-scale well-bedded turbidite-like deposits 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 subordinate to felsic material, quartz subordinate to feldspar, and pyrite is spare but ubiquitous. Deposits lap onto volcanic centers in the vicinity of Tunehean, Lovelace, and Kushneahin Creeks on southwestern Kupreanof Island, and are intercalated with extrusive rocks at several horizons.

QTr Rhyolite, Rhyodacite, and Related Siliceous Extrusive and Intrusive Rocks--

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, 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. Stratigraphic sections include 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 indicated by extreme alteration, brecciation, attitudes of layering, and dikes; isolated massive structureless isolated rhyolite bodies suggest plugs; columnar-jointed cliff exposures in excess of 100 m thick are interpreted as cooling units. Exposed in the northern part of this quadrangle on southern Kupreanof 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, commonly less than 1 m thick. 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; and onto southern Kupreanof Island, in 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.

ALEXANDER BELT

Belt informally named by Brew and others (1984) to denote those rocks that form a coherent stratigraphic section ranging in age from Ordovician up to Cretaceous; including the pre-Cenozoic granitic and other rocks intruded into that section. Occurs in the western part of the map area. Does not correspond exactly to the Alexander terrane of Berg and others (1978) because of reinterpretation and new information.

INTRUSIVE ROCKS OF THE CHILKAT-PRINCE OF WALES PLUTONIC PROVINCE (Cretaceous); Province informally named by Sonnevil (1981); 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,respectively; only 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. 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 northeast of this quadrangle in having ubiquitous hornblende. Exposed in this quadrangle on Prince of Wales Island in two small plutons or stocks in the southeastern corner of quadrangle.

METAMORPHIC ROCKS IN THE CHILKAT-PRINCE OF WALES PLUTONIC PROVINCE (Cretaceous)--Aureoles around plutons of the Chilkat-Prince of Wales plutonic province on Kosciusko and northern Prince of Wales Islands. Age is that of the plutons (about 100 Ma) based on preliminary K-Ar dating (M. A. Lanphere, U.S. Geological Survey, written commun., 1982). As mapped in the southeastern part of this quadrangle, divided into:

Kch Biotite-Quartz-Feldspar Hornfels--

Metapolymictic conglomerate with 1 to 35 cm diameter rounded clasts of syenite(?), granodiorite, feldspar porphyry, chert, intermediate volcanic rock, and mudstone in 1- to 10-m thick beds. Metamorphosed from "Polymictic Conglomerate in Bay of Pillars Formation" mapped elsewhere in the Petersburg-Wrangell area.

Kbh Biotite-Quartz-Feldspar Hornfels--

Fine- to medium-grained, brownish-gray where fresh; original sedimentary structures and bedding of graywacke and mudstone turbidite sequence locally preserved. Includes minor metaconglomerate like that described above (Kch). Metamorphosed from the "Graywacke and Mudstone Turbidite" in "Bay of Pillars Formation" mapped elsewhere in the Petersburg-Wrangell area.

PPsy PORPHYRITIC SYENITE (Inferred Early Permian And Late Pennsylvanian)--

Poorly known porphyritic syenite inferred to be similar to the "Leucosyenite of Klawock And Sukkwan Island" described by Brew (1995, 1996, unit PPsy) and by Churkin and Eberlein (1975, unit Pzsy). That unit consists of biotite- and hornblende-bearing syenite with C.I. 15 exposed near Klawock in the Craig 1:250,000-scale quadrangle to the south; that unit has a K-Ar age on biotite of 276±8 Ma (Churkin and Eberlein, 1975). Exposed in this quadrangle as a small stock near the headwaters of Baker Creek.

PRINCE OF WALES ISLAND SEQUENCE (Devonian to Ordovician)--Informally named by Brew and others (1984) to emphasize the island-arc depositional environment 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, the 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"--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 time-stratigraphic unit. The associated polymictic conglomerates probably represent several separate channels at different horizons carrying material from distant sources. In this quadrangle:

Sch Heceta Limestone--

Massive or thick-bedded, fine-grained limestone; minor limestone breccia, sandstone, mudstone, and pods of polymictic conglomerate. Commonly fractured, locally fossiliferous; light- to medium-dark gray where fresh, weathers buff; 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 analysis 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 northwestern Prince of Wales Island and on islands in Sumner Strait. Locally includes:

Schc Polymictic Conglomerate Intercalated with Heceta Limestone--

Pebble and cobble conglomerate, sedimentary breccia, fine- to coarse-grained graywacke, siltstone, and mudstone. Occurs in discontinuous lenses and large pod-like bodies. Some oligomictic chert pebble or limestone pebble conglomerate, but commonly polymictic, with clasts to 20 cm of porphyritic andesite, gray-green and black chert, limestone, vein quartz, graywacke, granitic and gabbroic composition. Thickness highly variable but must be in excess of 2,000 m in places. Age is inferred from the age of the related "Heceta Limestone". In this quadrangle occurs adjacent to Sumner Strait on northwestern Prince of Wales Island.

Scp Polymictic Conglomerate--

Pebble and cobble conglomerate and other clastic rocks like those described above (Schc), but which occur instead 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" and the "Descon Formation" in this quadrangle and 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 are not at a consistent stratigraphic level. In this quadrangle two main units are present, the "Bay of Pillars Formation on Kuiu and Western Prince of Wales Islands" (Karl and Giffen, 1992) and the "Descon Formation", as well as the "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, with calcareous turbidites occupying interchannel areas. The "Bay of Pillars Formation" was named and defined by Muffler (1967) from exposures on Kuiu Island. Stratigraphic intercalation as well as incorporation of large angular boulders of limestone similar to the "Heceta Limestone" 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. 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 exceeds a few thousand meters. Graptolite collections (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 as units and as individual clastic grains. It also is mostly younger than the "Descon Formation". 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 rare grains of microcrystalline quartz, epidote, volcanic shards, and felsite are found. No white mica or metamorphic rock fragments present. Calcareous graywackes are ubiquitous, and 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 northwestern prince of Wales Island.

Stbc Polymictic Conglomerate--

Polymictic conglomerate; typically massive or thick-bedded and channelized; occasionally cross-bedded. Clast populations vary as do the graywacke compositions, but generally include, in order of decreasing abundance: graywacke, mudstone, volcanic rock, limestone, and syenitic to dioritic intrusive rock. Well-rounded syenite cobbles are distinctively pink and K-feldspar porphyritic. Graywacke and mudstone clasts vary in degree of roundness. Volcanic and carbonate clasts are generally large and angular relative to other clasts. Conglomerates tend to map as NNW-SSE trending belts, such as from the head of the Bay of Pillars to Alvin Bay on Kuiu Island, suggesting paleochannels. The single exposure in this quadrangle, on northwestern Prince of Wales island, is probably is not part of that large system.

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,:

Stpc Conglomerate, Agglomerate, and Volcanic Breccia--

Predominantly volcaniclastic polymictic conglomerate, and volcanic breccia and agglomerate of intermediate to mafic, feldspar and clinopyroxene porphyritic composition. Inferred to underlie part of Sumner Strait in the northeastern corner of this quadrangle.

Descon Formation (Lower Silurian to Lower Ordovician)--Massive graywacke, graywacke, and argillite turbidites--

Also siliceous graptolitic shale, polymictic conglomerate, bedded limestone and limestone breccia, and mafic volcanic sills, flows, and tuffs. Sandstone and conglomerates range from predominantly volcaniclastic to polymictic, including graywacke, shale, chert, limestone, and felsic to gabbroic lithic fragments together with the volcanic grains. The "Descon Formation" crops out on northeastern and northwestern Prince of Wales Island and in the vicinity of Davidson Inlet, Kosciusko Island. These rocks are locally metamorphosed to greenschist facies. Thickness exceeds 3,000 m. Graptolites from the "Descon Formation" yield ages ranging from Tremadocian (Early Ordovician) to Llandoverian (late Early Silurian) (Claire Carter, U.S. Geological Survey, written commun., 1980; Eberlein and others, 1983). This unit is more siliceous and contains more volcanic material than the "Bay of Pillars Formation". Named by Eberlein and Churkin (1970). In the southwestern part of this quadrangle:

SOtdg Graywacke--

Grayish green where fresh, weathers buff; volcaniclastic graywacke and siliceous shale. Association of massive amalgamated beds, graded beds, full Bouma sequences, thin rhythmic beds, slump deposits, sedimentary breccia and conglomerate suggest a proximal depositional environment. Sandstones and conglomerates consist mainly of mafic volcanic rock fragments, with subordinate feldspar, quartz, graywacke, mudstone, chert, limestone, and plutonic rock fragments in a chloritic matrix. Graptolites are found on partings in siliceous argillite beds. Some greenschist facies sandstones are pyritic.

SOtdl Limestone--

Intraformational calcareous breccia and conglomerate, including fossil hash. Occurs stratigraphically above polymictic conglomerate at Port Protection on northwestern Prince of Wales Island in this quadrangle.

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