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GEOLOGY OF THE CRAIG QUADRANGLE, ALASKA

By

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Introduction

This report consists of the following:

1) Geologic map (1:250,000) (Fig. 1); includes Figs. 2-4, index maps

2) Description of map units

3) Map showing key fossil and geochronology localities (Fig. 5)

4) Table listing key fossil collections

5) Correlation diagram showing Silurian and Lower Devonian facies changes in the northwestern part of the quadrangle (Fig. 6)

6) Sequence of Paleozoic restored cross sections within the Alexander terrane showing a history of upward shoaling volcanic-arc activity (Fig. 7).

The Craig quadrangle contains parts of three northwest-trending tectonostratigraphic terranes (Berg and others, 1972, 1978). From southwest to northeast they are the Alexander terrane, the Gravina-Nutzotin belt, and the Taku terrane. The Alexander terrane of Paleozoic sedimentary and volcanic rocks, and Paleozoic and Mesozoic plutonic rocks, underlies the Prince of Wales Island region southwest of Clarence Strait. Supracrustal rocks of the Alexander terrane range in age from Early Ordovician into the Pennsylvanian, are unmetamorphosed and richly fossiliferous, and appear to stratigraphically overlie pre-Middle Ordovician metamorphic rocks of the Wales Group (Eberlein and Churkin, 1970).

Rocks northeast of Clarence Strait have been assigned to the Gravina-Nutzotin belt and Taku terrane (Berg and others, 1978). The Gravina-Nutzotin belt underlies the southern part of the Cleveland Peninsula and Eagle and Onslow Islands, and includes marine flysch-like argillite and graywacke, interbedded andesitic to basaltic volcanic and volcaniclastic rocks, and subvolcanic plutons that range in composition from quartz diorite to dunite and peridotite. Rocks assigned to the belt in neighboring parts of southeastern Alaska have been faunally dated as Late Jurassic to mid-Cretaceous (Berg and others, 1972). In the Craig quadrangle, fossils have not been found in any of the rocks northeast of Clarence Strait, their stratigraphic relations are obscured by complex structure and metamorphism, and unrecognized strata as old as late Paleozoic may be mixed with beds as young as late Mesozoic (Berg, 1982, p. 12-14). Because of these uncertainties, rocks in the Craig quadrangle, interpreted by Berg and others as part of the Gravina-Nutzotin belt, herein are assigned an age of Mesozoic or late Paleozoic. In the Craig quadrangle the contact between the Gravina-Nutzotin belt and the Alexander terrane is the Clarence Strait fault.

The Taku terrane includes bedded rocks that underlie the extreme northeastern part of the quadrangle on Etolin and Bronson Islands and the Cleveland Peninsula bordering Ernest Sound. In the Craig quadrangle, the terrane comprises complexly deformed and metamorphosed pelitic sedimentary rocks and subordinate felsic to mafic volcanic rocks. Fossils have not been found in these rocks and their Mesozoic or Late Paleozoic age assignment is based on lithologic correlation with faunally dated similar strata near Ketchikan (Silberling and others, 1982). The bedded rocks in the Taku terrane are intruded by intermediate and felsic plutons of Mesozoic and Cenozoic age.

The distribution and relations of Gravina-Nutzotin belt and Taku terrane rocks in the Craig quadrangle are uncertain owing to absence of well-defined stratigraphic markers and to the effects of metamorphic masking. In the Craig quadrangle, bedded rocks on southern Cleveland Peninsula and on Eagle and Onslow Islands are characterized by abundant andesitic metatuff and agglomerate rich in relict augite phenocrysts, and which were assigned by Berg and others (1972) to the Gravina-Nutzotin belt. To the northeast, the bedded rocks are mainly metapelite and subordinate diverse metavolcanic rocks without relict phenocrysts that they assigned to the Taku terrane. Based on regional structural and stratigraphic relations of Gravina-Nutzotin belt and Taku terrane rocks in other parts of southeastern Alaska, Berg and others interpreted their contact as a northeast-dipping thrust zone. In the Craig quadrangle, however, the aforementioned uncertainties prevented us from mapping the specific location of this fault zone and it is not shown on the map.

Regional structures in the Craig quadrangle include northwest-trending high-angle faults and numerous thrust faults, including folded thrusts. Many of the thrusts dip eastward and many of the stratified rocks are isoclinally folded with development of slaty cleavage together with often more than one set of penetrative folds and lineations. Regional metamorphism generally ranges from only slight recrystallization to greenschist facies, but in places reaches the intensity of the amphibolite facies, particularly in the southern and northeastern parts of the quadrangle.

Paleomagnetic data indicate that the Alexander terrane had an original paleoposition at about 40° N., 120° W. (western Nevada and northeastern California) and that it subsequently drifted northward and rotated 25° clockwise in situ (Van der Voo and others, 1980).

Potentially important, and in most cases formerly productive, deposits of Cu, Fe, Ti, Au, Ag, Pb, Zn, Mo, Pt group metals and high calcium limestone and barite occur in the Craig quadrangle and vicinity.

DESCRIPTION OF MAP UNITS

UNCONSOLIDATED DEPOSITS

Diverse Quaternary surficial deposits are widely distributed throughout the quadrangle but have not been separately studied or mapped. Only major areas of distribution are shown and their delineation has been inferred mainly from the examination of aerial photographs.

Qag UNDIFFERENTIATED SURFICIAL DEPOSITS--Includes mainly alluvium, tidal mudflat, and glaciofluvial deposits

BEDROCKS

Ts CONGLOMERATE, SANDSTONE, AND CONGLOMERATIC SANDSTONE (Eocene?)--At Coal Bay, located on the south shore of Kasaan Bay, rocks consist of light-gray to buff graywacke-type sandstone that contains carbonized logs with branches still attached. Two kilometers to the northeast, at the head of Little Coal Bay, conglomerate and conglomeratic sandstone containing cobbles and boulders of diorite and subordinate black argillite of local derivation are interbedded with graywacke that contains a few discontinuous flat-lying seams of lignitic coal a few inches thick. In the valley of Lava Creek, at head of Thorne Bay, deltaic conglomerate contains abundant pebbles and cobbles of locally derived argillite, gneiss, trachyte and amygdaloidal lava, biotite granite, schist and chert in a lithified matrix that contains rounded clasts of quartz, orthoclase, and microcline in addition to small fragments of the lithologies of the rocks listed. The conglomerate is cut by pitchstone dikes. Northeast of Clarence Strait, similarly constituted and probably correlative conglomerate, sandstone, siltstone, and shale, with minor lignite occur on northeastern Eagle Island and south of Union Point, the northeast headland of Union Bay. Field relations suggest deposition as alluvial fans, piedmont gravels and deltas at the mouths of steep gradient streams that drained terranes of considerable relief (Buddington and Chapin, 1929, p. 267; Sainsbury, 1961, p. 328). Tentative Eocene age assignment based on (1) the presence of igneous and metamorphic detritus in the Prince of Wales Island conglomerates believed to have been derived from a provenance of Middle Cretaceous age, and (2) the possible correlation between the pitchstone dikes that cut the Ts unit in the valley of Lava Creek with rhyolitic detritus abundant in Eocene rocks north of the Craig quadrangle (Sainsbury, 1961, p. 328). Probably not more than 30 m thick

NORTHEAST OF CLARENCE STRAIT

SEDIMENTARY ROCKS

MzPzsm METASEDIMENTARY ROCKS (Mesozoic or upper Paleozoic)--Thinly bedded phyllitic mudstone, siltstone, sandstone, grit, conglomerate, and minor limestone. Phyllitic rocks grade transitionally northeastward into schist. Hornfelsed adjacent to gabbro and ultramafic complex (Kgb, Kum) at Union Bay and adjacent to bodies of Tqm and Kq. Probably mainly of Jurassic and Cretaceous age but may include rocks as old as late Paleozoic (Berg and others, 1976)

VOLCANIC ROCKS

Tba BASALT AND ANDESITE (Tertiary)--Chiefly basalt flows and andesite debris flows. Only known occurrences in the area are on Eagle and Muffin Islands

MzPzvm ANDESITIC AND BASALTIC METATUFF AND AGGLOMERATE (Mesozoic or upper Paleozoic)--Chiefly texturally diverse, apple-green to dark-green andesitic or basaltic metatuff and agglomerate. These rocks intertongue locally with subordinate greenish-gray and dark-gray pelitic metasedimentary rocks. Near Meyers Chuck, the metavolcanic rocks apparently are intercalated with light-gray marble. The metavolcanic rocks are characterized nearly everywhere by relict euhedral ferromagnesian phenocrysts up to 2 cm long, and by coarse to fine relict fragmental texture. On southern Cleveland Peninsula, the unit consists of massive, coarse blocky volcanic breccia; elsewhere it ranges from coarse ferromagnesian- (and locally feldspar-) porphyritic breccia to aphanitic green phyllite. Greenschist-facies regional metamorphism has produced a metamorphic mineral assemblage that includes varying proportions of albite, epidote, chlorite, actinolite, quartz, muscovite, biotite, and calcite. Mesozoic or late Paleozoic age assignment is based on lithologic correlation with similar metavolcanic rocks of Jurassic or Cretaceous age and with similar marble of late Paleozoic age on nearby Gravina and Revillagigedo Islands (Berg, 1981, p. 7)

INTRUSIVE ROCKS

Tqm QUARTZ MONZONITE (Tertiary)--Miarolitic, leucocratic quartz monzonite consisting predominantly of medium- and coarse-grained, hypidiomorphic-granular quartz, plagioclase, potassium feldspar, and accessory biotite. Locally brecciated adjacent to fault zone along Canoe Passage. Dated by K-Ar method at about 20 m.y. B.P. (J. G. Smith, unpub. data)

Kq QUARTZ DIORITE AND GRANODIORITE (Cretaceous)--Minor diorite, leucoaplite, and pegmatite. Body southeast of Niblack Point on Cleveland Peninsula is mainly metadiorite and (or) gabbro. Forms sills, dikes, stocks, and diapirs. Stocks commonly are zoned from garnet-bearing porphyritic quartz diorite border to granodiorite core. Foliation, resulting mainly from regional deformation and possibly partly from protoclasis, ranges from intense in many of the smaller plutons to weak or absent in the cores of some of the larger bodies. These plutons probably correlate with a compositionally and texturally similar pluton at Neets Bay (Ketchikan quadrangle), dated by K-Ar method at about 90 m.y. B.P. (Smith and Diggles, 1981)

Kum DUNITE, PYROXENITE AND PERIDOTITE (Cretaceous)--Ultramafic complex. Pipe and lopolith of hornblende pyroxenite, pyroxenite, olivine pyroxenite, peridotite, and dunite. Pipe and lopolith are concentrically zoned, with dunite in center and pyroxenite or hornblende pryoxenite in periphery. Pyroxenite contains significant primary magnetite (after Ruckmick and Noble, 1959). Dated by K-Ar method at about 100 m.y. B.P. (Lanphere and Eberlein, 1966)

Kgb GABBRO (Cretaceous)--Minor saussurite gabbro and diorite. Mainly moderately foliated to massive, medium-grained gabbro containing plagioclase, ortho- and clinopyroxene, and accessory biotite and magnetite. Forms margin and cap of zoned ultramafic complex at Union Bay (after Ruckmick and Noble, 1959). Intruded by ultramafic complex (Kum). Cretaceous age inferred from close spatial relation to ultramafic complex

SOUTHWEST OF CLARENCE STRAIT

NORTHERN PART OF QUADRANGLE (see Fig. 4)

Predominantly Sedimentary Rocks
(Locally subdivided to show major volcanic components)

ℙk KLAWAK FORMATION (Middle and Lower Pennsylvanian)--Occurs in vicinity of Klawock, western Prince of Wales Island. Sandstone and siltstone; minor limestone and chert-pebble conglomerate. Orange weathering, calcareous, and rich in small fusilinids (Douglass, 1971). Also contains abundant productoid brachiopods, corals, bryozoans, and the trace fossil Spirophyton. See locality F1 on map and table of key fossil localities (Fig. 5, Table 1). Thickness 150-300 m

ℙl LADRONES LIMESTONE (Middle and Lower Pennsylvanian)--Occurs in Trocadero Bay and Tlevak Strait areas, western Prince of Wales Island. Limestone, sublithographic and massive, and minor dolomite. Locally contains light-gray chert nodules. Oolites, endothyrid foraminifera, fusulinids, and shelly fossils are common. See locality F10 on Fig. 5 and Table 1. Thickness 300 m+

Mp PERATROVICH FORMATION (Upper and Lower Mississippian)--Limestone containing dark-gray chert nodules and beds that increase downward to a bedded chert member at the base of the formation. Contains abundant shelly fossils, especially rugose corals (Armstrong, 1970), and conodonts in the upper part (Faulhuaber, 1977). See localities F2, F3, F4, F13, and F14 on Fig. 5 and Table 1. Thickness 300 m+

Dp PORT REFUGIO FORMATION (Upper Devonian; Famennian)--Northernmost known exposures occur on San Juan Bautista and Balandra Islands. Interbedded sequence of massive to well-bedded graywacke and banded mudstone, and siltstone with minor polymictic boulder conglomerate, black pyritic siltstone, calcareous siltstone and quartzofeldspathic arenite. On San Juan Bautista Island intruded by MzPzg dioritic stock that contains sparsely disseminated base metal sulfide minerals. For more complete description of formation see discussion under "SOUTHERN PART OF QUADRANGLE" (Suemez, Sukkwan and part of Prince of Wales Islands) where it is more extensively distributed and better paleontologic control exists

Dw WADLEIGH LIMESTONE (Upper and Middle Devonian; Famennian to Late Eifelian)--Limestone, generally thick- to medium-bedded and massive; minor argillaceous limestone and calcareous shale, especially in upper part of formation. Composed of fragmented shelly fossils in a dark, lime-mudstone matrix. Frequently rich in the spaghetti-shaped stromatoporoid Amphipora and corals (Oliver and others, 1975; Tchudinova and others, 1974; Savage, 1977a; Savage and Funai, 1980). Massive stromatoporoids in places form reefs and reef breccia. Brachiopods, gastropods, ostracodes, pelecypods, and crinoids make up substantial quantities of the coarse fossil detritus. Conodonts are described by Savage (1977b) and Savage and Funai (1980). See localities F5, F6, F8, F20, F27, F28, F29, F43, F44, F45, and F46 on Fig. 5 and Table 1. Thickness about 300 m

Dk KARHEEN FORMATION (Lower Devonian)--Sandstone, shale, and conglomerate. Minor well-bedded and penecontemporaneously deformed platy limestone. Characterized by red beds, calcareous cement, and festoon crossbedding, ripple marks, and mud cracks (Eberlein and Churkin, 1970; Ovenshine, 1975). Clasts are mainly mafic volcanic rocks and chert, but pebbles to boulders of sandstone, graywacke, siltstone, quartz, limestone, and felsic to mafic granitoid igneous rocks are also present. Abundant detrital K-feldspar and flakes of bronze-colored biotite in the sandstones distinguish it from the older sandstones in the section. Locally, the limestone contains abundant brachiopods (Kirk and Amsden, 1952) and Early Devonian conodonts (Savage, 1977a). See fossil localities F12 and F16 on Fig. 5 and Table 1. On eastern and northern Heceta Island the Karheen is mainly sandstone and shale and lies conformably on Heceta Limestone. Farther east, on Prince of Wales Island, the Karheen overlies the Staney Creek sequence (DSs) that contains both Heceta-like limestone and Karheen-like clastic rocks, suggesting an interfingering of Karheen lithologies with those of the Staney Creek area. In the southern part of the area (San Christoval Passage) the Karheen consists mainly of polymictic pebble to cobble conglomerate that lies with angular unconformity on the Descon Formation that contains Middle Ordovician (Caradocian) graptolites. See fossil locality G-1 on Fig. 5 and Table 1. To date, the Karheen has yielded only fossils of Early Devonian age. However, at its conformable contact on northern and eastern Heceta Island, the subjacent Heceta Limestone beds contain shelly faunas indicative of a Late Silurian (Ludlovian) age (see fossil loc. F15 on Fig. 5 and Table 1). Also, at Pt. Santa Gertrudis on northern Lulu Island, approximately 15 m of massive to thickly bedded light-brownish-gray limestone rests conformably upon about 600 m of Karheen conglomerate and sandstone that, in turn, unconformably overlies Descon beds that contain Early Silurian graptolites (Buddington and Chapin, 1929). The basal 1 m of the limestone is richly fossiliferous and has yielded conodonts indicative of an earliest Devonian (early Lochkovian) age (see fossil loc. F12 on Fig. 5 and Table 1). These relationships, as well as those between the Karheen and the Staney Creek sequence (i.e., DSs), suggest that deposition of the Karheen may have begun in Late Silurian time. Thickness about 1,800 m

Dsn SEDIMENTARY ROCKS OF THE PORT ST. NICHOLAS AREA (Lower Devonian)--Sandstone overlain by massive limestone (50 m thick) and graptolitic shale (about 50 m thick) (Churkin and others, 1970). Sandstone is calcareous, light gray, crossbedded, contains widely scattered chert pebbles, and is interbedded with mudstone. Limestone is fossil fragmental, fetid and contains abundant corals and stromatoporoids. Also present are conodonts that indicate an early to middle Pragian age (Savage and others, 1977). Shale contains abundant Monograptus yukonensis and M. pacificus. See fossil locality G3 on Fig. 5 and Table I. Near the entrance to Klakas Inlet, about 6.5 km south of the Craig quadrangle boundary, a similar graptolitic shale with M. pacificus fauna and associated chert-pebble conglomerate (Ds) rests unconformably upon an Ordovocian mudstone, shale, graywacke and volcanic section lithologically similar to the Descon Formation (Churkin and others, 1970). Total thickness 400 m+

Dn BRECCIA OF NORTHEASTERN NOYES ISLAND (Lower Devonian)--Graptolite- and plant-bearing shale (Churkin and others, 1969) interbedded with graywacke, sandstone, and conglomerate. Characteristically has breccia beds and blocks of limestone rich in shelly fossils and conodonts. These breccias are olistostrome deposits that contain reworked shallow-water faunas in a deeper water sequence. Rests with major angular unconformity upon Descon Formation and contains reworked(?) block of Lower Silurian shale in a matrix that contains Monograptus yukonensis and other Early Devonian graptolites. See fossil locality G7 on Fig. 5 and Table 1. More than 400 m thick

Dkl LIMESTONE OF KASAAN ISLAND (Lower Devonian)--Limestone associated with rhyolite (Dkr) forming islands in Kasaan Bay. Limestone thick to thin bedded and rich in shelly fossil fragments, particularly corals, stromatoporoids, and crinoids. Locally rich with brachiopods, conodonts (Savage, 1981), and ostracodes (Berdan and Copeland, 1973). See fossil locality F22 on Fig. 5 and Table 1. Time equivalent to parts of Karheen Formation and possibly may range higher to correlate with the Coronados Volcanics farther west. Top and base of limestone not exposed. Exposed thickness about 150 m

Sh HECETA LIMESTONE (Upper, Middle, and uppermost Lower Silurian)--Limestone with thick lenses and pods of polymictic conglomerate, limestone breccia, and sandstone (Shc) in zone near middle in type area. Limestone is massive, sublithographic, and lighter colored than other limestone in section. It is richly fossiliferous with corals, dasycladacean algae, and brachiopods. Stromatoporoids (including Amphipora), gastropods, pelecypods, bryozoans, trilobites, conodonts, and graptolites also occur. See fossil localities F15, F17, F18, F23, F35, F37, F38, and F47 on Fig. 5 and Table 1. Contact with underlying Descon Formation generally conformable, but along west Heceta Island has basal breccia with angular slabs of black graptolitic shale with monograptids of middle Early Silurian age (see fossil locality G25 on Fig. 5 and Table 1). Thickness varies strikingly over short distances in the south, probably due to pre-Karheen erosion, and eastward due to facies change into the Staney Creek sequence (DSs) (see description below). Maximum thickness over 3,000 m on western Heceta Island, thinning rapidly eastward. Locally includes:

Shc LIMESTONE BRECCIA, CONGLOMERATE, AND SANDSTONE OF THE HECETA LIMESTONE (Upper, Middle, and uppermost Lower Silurian)--Limestone breccia and conglomerate consist largely of reworked intraformational lithologies. Polymictic conglomerate contains a variety of plutonic, volcanic, and sedimentary rock clasts, including chert, which is not an abundant lithology among early Paleozoic rocks known to occur in the area. Clastic limestone with minor slate and metachert of the Hazy Islands (L. J. P. Muffler, unpub. data, 1963) is provisionally included in this unit but may actually be correlative with the Bay of Pillars Formation (Late Silurian and Early Devonian) of the Petersburg quadrangle (D. A. Brew, oral commun., 1983)

DSs ROCKS OF THE STANEY CREEK AND TUXEKAN PASSAGE REGION (Lower and Upper Silurian, and possibly as young as Early Devonian)--Interbedded sequence consisting mainly of limestone, sandstone, calcareous mudstone, and polymictic conglomerate. Light-gray, massive to well-bedded, cyclically repeated, fine-grained fossiliferous limestone resembling Heceta Limestone (Sh) and conglomeratic sandstone, limy sandstone and concretionary mudstone with locally well-developed mudcracks and ripple marks resembling certain lithologies of both the Karheen Formation (Dk) and clastics within the Heceta Limestone (Shc). Near Staney Creek these rocks overlie massive andesitic to basaltic tuff and breccia of the Luck Creek region (SObl). Basal limestone and shaly beds contain Catenipora and late Llandoverian graptolites (see fossil locality G11 on Fig. 5 and in Table 1) younger than the highest graptolites known to occur in the Descon Formation (SOd). Limestone beds in the upper part of the sequence are rich in dascyladacean algae, corals, Amphipora and Conchidium.

The available paleontologic and stratigraphic evidence suggest to us that, in large part, the Heceta Limestone, with its interbedded clastic units (Shc) and probably the basal part of the Karheen Formation change facies in an easterly to east-northeasterly direction into the DSs sequence (see Fig. 6). These facies changes suggest that Heceta-like limestone thins eastward and that Karheen or Shc clastic rocks thicken eastward producing a transitional facies that is considerably thinner (about 300 m thick) than coeval rocks on Heceta Island. Qualified by poor inland outcrop control, the inferred intertonguing and transitional relationships suggest a transitional zone that may be as much as 6 km wide, extending generally north-northwestward from the Staney Creek area along Tuxekan Passage and probably into the Cyrus Cove-Marble Passage area of Orr and Marble Islands. Within this transitional belt, which probably includes parts of eastern Tuxekan Island, where only isolated and restricted exposures provide inadequate control for extending the distribution of units Sh, Shc, and Dk as mapped in the field from west to east, the calls are considered highly questionable and therefore may be open to reinterpretation as DSs, especially as better outcrop control becomes available as a result of logging operations and other developments. We interpret the distribution of transitional facies of the rocks of the Staney Creek region as an indication of a northerly or northwesterly depositional strike related to a shoreline. About 300 m thick

SOd DESCON FORMATION (Lower Silurian through Lower Ordovician)--Mainly graywacke and mudstone with interbedded basalt flows and pyroclastic rocks (SOdv), conglomerate, sedimentary breccia, chert, shale, and sandstone. Graywacke composed mainly of basaltic detritus in a chloritic noncalcareous matrix. Graded bedding and other turbidite features common. Rhythmically banded mudstone with graded bedding and penecontemporaneous slump structure is interbedded with graywacke. Conglomerate and sedimentary breccia range in composition from wholly volcaniclastic, crudely layered, augite-phenocryst-rich basaltic andesite breccia resembling the breccia of the Luck Creek region (SObl) to polymictic varieties with chert, felsic volcanic, graywacke, and gabbroic lithic clasts. Black, thin-bedded chert and siliceous shale are minor but very important lithologies because they contain well-preserved graptolites excellent for dating (Churkin, Carter, and Eberlein, 1970). See fossil localities G1, G2, G4, G5, etc., on Fig. 5 and Table 1. Orange-weathering quartzofeldspathic wacke, a minor but distinctive lithologic variant of the Descon, is well exposed along the west shore of Warm Chuck Inlet (Heceta Island) about 5.5 km northeast of Point Desconocida, as well as inland and southeastward along the northeast shore of Lulu Island for a distance of about 6 km from a point 2.25 km southeast of Pt. Santa Gertrudis. Quartzofeldspathic wacke is also interbedded with basaltic volcanics and graywacke in a belt approximately 1 km wide that extends southward and eastward across the entrance to Salt Lake Bay and onto Prince of Wales Island. Locally the Descon Formation has been penetratively deformed and transformed into slate, phyllite, semischist and into schist and amphibolite of the relatively low-grade greenschist metamorphic facies. Examples, as indicated by foliation symbols, may be seen in exposures on the eastern Maurelle Islands in Anguilla Bay, in the Harris River-Hollis area near the entrance to McKenzie Inlet, and in the Skowl Arm-Polk Inlet area. Total thickness at least 3,000 m; base not exposed. Locally includes:

SOdv BASALTIC VOLCANIC ROCKS OF THE DESCON FORMATION (Lower Silurian through Lower Ordovician)--Basaltic volcanic rocks are characterized by stubby phenocrysts of fresh augite and altered andesine plagioclase and form submarine flows (often with pillow structure), breccia, and tuff. Unit is interbedded with sedimentary rocks of the Descon Formation (SOd) and is only delineated separately where permitted by scale.

VOLCANIC AND ASSOCIATED VOLCANICLASTIC ROCKS

QTv VOLCANIC ROCKS (Quaternary or Tertiary)--Poorly consolidated basaltic to rhyolitic breccia and tuff. Abundant phenocrysts of plagioclase and minor phenocrysts of biotite; typically in glassy matrix. Breccia consists of plagioclase porphyry fragments in a crystal lithic lapilli tuff matrix. These fragmental volcanic rocks are closely associated with dikes of similar composition that contain xenoliths of more indurated Descon Formation volcanic conglomerate and granitic rocks. Prominently iron-stained to weather brown and reddish-brown. Small widely separated outcrops suggest isolated eruptive centers

Dsv ST. JOSEPH ISLAND VOLCANICS (Devonian?)--Basalt, submarine flows, breccia, tuff, and volcanic conglomerate. Minor interbedded tuffaceous and calcareous siltstone, mudstone, and sandstone. Flows locally amygdaloidal and with pillow structure. Northwest-trending schistosity developed in Maurelle and Wood Islands area. Nonfossiliferous. Lamprophyre dike 328±10 m.y. B.P. (K/Ar) cuts formation. Thickness about 2,000 to 3,000 m

Dc CORONADOS VOLCANICS (Devonian)--Fragmental basalt interlayered with fossiliferous limestone. Amygdaloidal pillow basalt fragments cemented by calcite (aquagene breccia and tuff). Limestone composed almost entirely of fossil fragments, mainly tabulate corals and massive stromatoporoids with less common horn corals, gastropods, crinoid columnals, brachiopods (Tchudinova, Churkin, and Eberlein, 1974). See fossil localities F7, F34 on Fig. 5 and Table 1. Limestone is interlayered with upper part of volcanic rocks and is similar to the overlying Wadleigh Limestone. Thickness about 150 m

Dkr RHYOLITE OF KASAAN ISLAND (Lower Devonian)--Dikes and sills of rhyolite cut limestone of Kasaan Island (Dkl). Thin layers of welded rhyolite tuff are also interstratified with the limestone. Fragments of rhyolite occur in limestone breccia composed mainly of broken fossil debris

SObl BRECCIA OF LUCK CREEK (Upper Ordovician and Lower Silurian)--Andesitic breccia with angular to subangular andesite porphyry fragments in an indurated matrix of andesite tuff. Breccia texture nearly everywhere accentuated by differential weathering of large clasts of andesite from matrix. Abundant stubby phenocrysts of pyroxene (diopsidic augite), less prominent needlelike phenocrysts of hornblende and lath-shaped plagioclase phenocrysts in a fine groundmass produce a distinctive porphyritic texture. Generally massive and structureless but very thick, crude layering visible above timberline west and east of Thorne River when viewed from a distance. At Staney Cone the breccia contains a lens up to 10 m thick of light-gray aphanitic limestone with Catenipora sp. of Late Ordovician to Early Silurian age (W. A. Oliver, Jr., written commun., 1972). See fossil localities F9, F31 on Fig. 5 and Table 1. Radiometric dating of K/Ar hornblende from the breccia along Big Salt Lake and near Kogish Mtn. gives ages of about 440 m.y. B.P. indicating a Late Ordovician (Ashgillian) age approximately equivalent to the zone of Dicellograptus ornatus within the Descon Formation (Carter, Trexler, and Churkin, 1980). Close association and lithologic similarity of Descon Formation volcanics, both pyroclastics and submarine flows, with this breccia indicate an intertonguing relationship. Thus, minor beds of pyroxene phenocryst-rich breccia and tuff closely resembling the breccia of Luck Creek are mapped as Descon where they are in predominantly finer grained well stratified volcaniclastic sequences.

The breccia of Luck Creek may be the extrusive counterpart of Pzic and represent a proximal facies to a submarine volcanic center (most probably the axis of a volcanic arc). The finer grained, better bedded tuffs and volcanic sandstones and mudstones of the Descon Formation may, in turn, represent more distal facies developed on the margins of the volcanic center, in forearc, back arc, or interarc basins. Up to several thousand meters thick

INTRUSIVE ROCKS

Kpg PYROXENITE AND GABBRO OF SALT CHUCK MINE AREA (Cretaceous?)--Discordant, pipelike intrusive composed mainly of variably textured, olivine-bearing pyroxenite and gabbro, transitional into diorite. Minor hornblendite. Pyroxenite is dark-greenish gray and contains about 75 percent by volume of augite, partly altered to greenish-brown hornblende, with subordinate olivine, brown biotite, minor sericitized plagioclase and locally as much as 10 percent magnetite. Dark-gray gabbro typically contains 50-60 percent calcic plagioclase (labradorite), 20-25 percent augite, and small amounts of biotite and magnetite. Diorite contains up to 75 percent andesine and 25 percent hornblende with ubiquitous accessory sphene and locally small amounts of quartz. Leucocratic variants contain as much as 40 percent K-spar that rims and replaces calcic plagioclase in a manner suggestive of late potash metasomatism. Pyroxenite, gabbro and diorite believed to be differentiates of same magma (Gault, 1945). Intrusive is economically significant because it is the host for deposits of Cu, Au, Ag, and Pt group metals. One mine, Salt Chuck (Goodro), operated intermittently from 1905 to 1941 and produced about 300,000 tons of milling ore estimated to have averaged 0.95 percent Cu, 0.36 oz Au, 0.17 oz Ag, and 0.063 oz Pd per ton (Holt and others, 1948). Cu production thus exceeded 5,000,000 lbs. Mertie (1969), however, points out that the average annual value of Pt-group metals was too high for Pd, rather than Pt, to have been the major constituent of that group produced. Ore bodies were irregularly distributed masses and disseminations consisting mainly of bornite with minor chalcopyrite, secondary chalcocite, covellite, native Cu, plus recoverable Au, Ag, and Pt-group metals. Provisional Cretaceous age of the intrusive is based on Sainsbury's (1961) conclusions and lithologic similarity to certain other magnetite-rich ultramafic and mafic plutons that occur in a belt approximately 560 km long and 50 km wide in southeastern Alaska and were emplaced during the interval 100-110 m.y. B.P. (Lanphere and Eberlein, 1966). However, the possibility exists that this pluton is older than Cretaceous and perhaps is related to and coeval with unit Pzic

Kd DIORITE AND RELATED INTRUSIVE ROCKS (Cretaceous)--Mainly hypidiomorphic granular hornblende and (or) biotite diorite and quartz diorite plutons. Transitional phases through granodiorite and adamellite, and, rarely, to granite locally occur. Includes sodic granite in Kasaan Bay region where alkali metasomatism has resulted in the development of veinlets and overgrowths of orthoclase and albite and, at places, large pink porphyroblasts in the host rocks. Contact zones commonly hornfelsized or schistose and contain veinlets and disseminations of iron and copper sulfide minerals. Local development of skarn. Plutons cut by felsic and mafic dikes, and rare pitchstone (similar to the pitchstone dikes that cut Ts conglomerate at Lava Creek). In vicinity of Kasaan Bay may include some Pzic

MzPzg UNDIVIDED GRANITIC ROCKS (Mesozoic and (or) Paleozoic)--Diorite, quartz diorite, granodiorite and related plutonic rocks of intermediate composition for which definitive evidence of age is mainly lacking. Most are known to be post-Early Silurian, but locally may include some units or belong to Pzic or Kd

IPsy SYENITE (Permian)--See discussion under Intrusive rocks, Suemez, Sukkwan, and Part of Prince of Wales Islands

Pzic ENSIMATIC IGNEOUS COMPLEX (Early Ordovician to Early Devonian, and possibly later Paleozoic)--Metaigneous complex consisting of masses of diorite-basite migmatite, and irregular intrusive bodies of hornblende and (or) quartz diorite chloritic magmatite, leucogabbro, trondhjemite and minor pyroxenite cut by mafic (locally sheeted) and felsic dike swarms (Saleeby and Eberlein, 1981). Combinations of these phases occur on eastern Prince of Wales Island between Kasaan Peninsula and Moira Sound as well as in the Ruth Bay-Klakas Island area (Dixon Entrance quadrangle) on the west coast of the island. The igneous complex intrudes the Wales Group, as exemplified by the relationships exhibited along the northeast shore of Sunny Cove, West Arm, and Cholmondeley Sound, where banded migmatitic diorite gneiss and amphibolite transect fine-grained, well-foliated greenschist. Both units, in turn, are cut by irregular quartz-feldspar (andesine) veins. The igneous complex also intrudes parts of essentially unmetamorphosed eugeosynclinal early Paleozoic sequences coeval with and (or) belonging to the Descon Formation. At least two long-enduring intrusive stages have been recognized. The oldest is represented by trondhjemites that occur at Klakas Island and vicinity (Dixon Entrance quadrangle) about 7 km south of the southern boundary of the Craig quadrangle. U/Pb zircon age patterns, both concordant and discordant, indicate igneous crystallization ages in the 450-500±5 m.y. B.P. range (Saleeby and others, in press). The youngest stage is represented by dikes and pods that occur in leucogabbro and diorite on Kasaan Peninsula and by a complex mixture of gabbro, pyroxenite and metadiorite that is exposed along the east shore of Prince of Wales Island from the vicinity of Island Point southward to Monie Lake. $^{207}Pb/^{206}Pb$ age determinations, in conjunction with discordant arrays of U/Pb ages, suggest crystallization ages in the range 400-450 m.y. B.P. (Saleeby and Eberlein, 1981; Saleeby and others, in press). The igneous complex is cut by two and possibly three episodes of dikes. The oldest is definitely coeval with the complex itself. The others are younger, i.e., post-400 m.y. B.P. Field relationships and the increasing number of radiometric ages being developed in the 400-450 m.y. B.P. range suggests units SObl and SOd may represent extrusive early Paleozoic volcanic arc counterparts of the intrusive complex which was emplaced close to the surface. This would lend support to the hypothesis (Eberlein and Churkin, 1976) that at least some of the mineral deposits that occur in these early Paleozoic volcanogenic host rocks (e.g., the copper-magnetite deposits on Kasaan Peninsula) may owe their origin to volcanic exhalative and (or) sea floor contact metasomatic processes genetically related to the emplacement of the ensimatic igneous complex (Pzic)

SOUTHERN PART OF QUADRANGLE (See Fig. 4)

Dall Island

Predominantly sedimentary rocks
(locally subdivided to reflect volcanic components)

QTb BASALTIC VOLCANIC ROCKS (Quaternary or Tertiary)--See description under Suemez, Sukkwan, and Part of Prince of Wales Islands

Dp PORT REFUGIO FORMATION (Upper Devonian; Famennian)--See discussion and description under Suemez, Sukkwan, and Part of Prince of Wales Islands

Sdl LIMESTONE OF DALL ISLAND AND VICINITY (Middle and Upper(?) Silurian)--Massive to thick-bedded, fine-grained, sublithographic, light-gray limestone that resembles the Heceta Limestone (Sh). Thin-bedded limestone and shale of underlying SOs unit contains graptolites of late Early Silurian (Llandoverian) age (see fossil loc. G9 on Fig. 5 and Table 1). Locally, adjacent to intrusives, has been converted to marble. Over 300 m thick

SOs SEDIMENTARY ROCKS OF DALL ISLAND AND VICINITY (Lower Silurian through Middle Ordovician)--Predominantly turbidite sequence composed mainly of banded mudstone, slaty, cherty, dark-gray to black graptolitic shale, siltstone, argillite with local red and green zones, and graywacke rich in volcanic detritus. Resembles the coeval SOd sequence but lacks significant intervals of basaltic volcanics, conglomerate, and quartzofeldspathic sandstone. Locally penetratively deformed resulting in the development of schist, semischist, and phyllite. Graptolite fossil localities G42, G43 and G44 have yielded faunas that range in age from Middle Ordovician to Early Silurian. Uppermost beds are siliceous and are apparently overlain conformably by massive (Sdl) limestone that resembles the Heceta Limestone (Sh). (See also description of SOs by Suemez, Sukkwan, and Prince of Wales Islands area to east)

PzP€s METAMORPHIC ROCKS OF DALL ISLAND AND VICINITY (Pre-Middle Ordovician; Precambrian?)--Interlayered sequence of crumpled metasedimentary and metavolcanic rocks mainly of the greenschist metamorphic facies (nomenclature after Winkler, 1979). Principal varieties include chlorite-albite-epidote ± carbonate schist, greenstone (locally exhibiting relic pillow structure), actinolite-chlorite-epidote ± plagioclase schist, quartz-bearing chlorite schist, metakeratophyre derived from siliceous tuff, phyllite, and slate, all locally interbedded with impure chloritic and siliceous marble. Some of these rocks contain varietal sillimanite and porphyroblasts of garnet, biotite, and, on foliation planes, large radiating clusters of dark-green hornblende. Protoliths were volcaniclastic graywacke, mudstone, quartzofeldspathic sandstone, lava flows and tuff interbedded with impure limestone. Intensity of penetrative deformation and metamorphic grade generally increases from north to south. Nonfossiliferous. Cut by hornblende pyroxenite intrusive between Grace Harbor and Vesta Bay (Dixon Entrance quadrangle) that has yielded a K-Ar age on hornblende of 408±10 m.y. B.P. (M. L. Lanphere, oral commun., 1981). Assemblage lithologically resembles Wales Group (PzP€w) of southern Prince of Wales Island with which it is provisionally correlated

Intrusive rocks

DIORITIC ROCKS IN VICINITY OF SQUAW MOUNTAIN (Post-Silurian)--Light-gray, medium- and fine-grained, hypidiomorphic-granular quartz diorite or granodiorite containing quartz and plagioclase, and accessory potasium feldspar, biotite, hornblende, and sphene; sporadic veinlets and patches of epidote and possibly other deuteric(?) minerals. Locally contains irregular veinlets up to 2 cm thick of quartz-potassium feldspar aplite, and sporadic quartz veins and lenses up to a meter thick and several meters long. Pluton is jointed and locally sheared but not significantly foliated or otherwise penetratively deformed. Intrudes and thermally metamorphoses strata of Middle and Late(?) Silurian age

GABBROIC ROCK OF THUNDER MOUNTAIN AND VICINITY (Post-Silurian)--Deformed and hydrothermally altered hornblende(?) gabbro. Much or all of this dikelike or stocklike pluton consists of a medium-grained, hypidiomorphic and subidiomorphic granular aggregate of calcic plagioclase and pale-green amphibole that has been cataclastically(?) deformed and largely replaced by secondary minerals. The secondary minerals occur in pervasive veins and patches and consist of epidote-clinozoisite, prehnite, actinolite, chlorite, albite, and leucoxene. Traces of primary ilmenite and sphene remain. The pluton intrudes and thermally metamorphoses strata of Middle and Late(?) Silurian age

Suemez, Sukkwan, and Part of Prince of Wales Islands

Sedimentary and volcanic rocks

QTb BASALTIC VOLCANIC ROCKS (Quaternary or Tertiary)--Olivine basalt and andesitic flows, breccia, lapilli tuff, and dikes. Layered units are fresh, relatively flat-lying and are considered to be subaerial. In vicinity of Tlevak Strait includes the Tlevak Basalt, olivine basalt flow rocks that contain phenocrysts of olivine and labradorite in an intergranular groundmass of labradorite microlites, olivine and subordinate clinopyroxene (Eberlein and Churkin, 1970). The area north of Arena Cove at the south end of Suemez Island is underlain mainly by porphyritic olivine basalt flows and dikes with conspicuous columnar jointing. Flows are interbedded with massive basaltic breccia and lithic lapilli tuff. Breccia consists almost entirely of basalt clasts as much as 2.5 cm across. In part scoriaceous. Reported association of basaltic lava with coal seams in small outcrops along streams heading into Port Refugio (Buddington and Chapin, 1929, p. 271) not confirmed in this investigation but, if correct, would favor a Tertiary age assignment for the basalts

QTrd RHYOLITIC VOLCANIC ROCKS OF SOUTHERN SUEMEZ ISLAND (Quaternary or Tertiary)--Rhyolite and dacite flows and small intrusives with locally well developed columnar jointing, especially in Arena Cove, southern Suemez Island. Typically porphyritic with phenocrysts of quartz and sanidine. Part of rhyolite is obsidian with black glass nodules in yellow glass (sideromelane?) and bands of greenish-black glass. Spatially, closely associated with QTb

Mp PERATROVICH FORMATION (Upper and Lower Mississippian)--See description under NORTHERN PART OF QUADRANGLE

Dp PORT REFUGIO FORMATION (Upper Devonian; Famennian)--(See also description under NORTHERN PART OF QUADRANGLE.) Graywacke rich in volcanic detritus, siltstone, volcanic and polymictic conglomerate, shale, pillow basalt, breccia, aquagene tuff, and very minor limestone rich in brachiopods. Very closely resembles Descon Formation and, where unfossiliferous, may not be separated. In general, however, matrix of Dp sedimentary rocks have enough calcite to effervesce with 10 percent hydrochloric acid and are less indurated than similar lithologies of the Descon Formation. In the Shelikof Island area aquagene tuff and breccia forms the top of the formation which directly underlies basal thin-bedded chert and limestone of the Peratrovich Formation. The tuff there is laminated to thin bedded, bluish gray to dark greenish gray, and is composed mostly of lapilli-sized vesicular and amygdaloidal basalt fragments cemented by white crystalline carbonate. Along the southeast shore of Soda Bay the formation is represented by a structurally complex section that includes amygdaloidal and in part scoriaceous pillow basalt, breccia, aquagene tuff, calcareous siltstone, dolomitic breccia, tuffaceous calcareous sandstone and dark-gray to black silty limestone. Certain of the limestone beds contain abundant brachiopods characterized by spiriferoid athyrid and rhynchonellid species (Savage, Eberlein, and Churkin, 1978). Besides shelly fossils, fish fragments, crinoid columnals, and vascular plants are abundant in some beds. See fossil localities F11 and F33 on Fig. 5 and Table 1. Several thousand meters thick. Locally includes:

Dpv VOLCANIC ROCKS OF THE PORT REFUGIO FORMATION (Upper Devonian)--Volcanic conglomerate, pillot basalt, and aquagene tuff. Delineated separately from Dp unit where permitted by scale

Ds MUDSTONE, SILTSTONE, CONGLOMERATE, AND MINOR LIMESTONE (Lower and Lower Middle? Devonian)--Turbidite sequence comprising medium- to greenish-gray, locally banded and graded mudstone, tuffaceous and calcareous siltstone, and dark-gray to black argillite, with subordinate pebble conglomerate, wacke, silty limestone and andesitic volcanic rocks. Known area of distribution is from head of Kassa Inlet to entrance of Klakas Inlet. Total thickness is over 2,000 m. The youngest beds of the sequence appear to be a predominantly volcanic section about 200 m thick of interbedded andesitic flows, broken pillow breccia and tuff. Their contact with the Port Refugio Formation (Dp) and equivalent or younger units has not been recognized. Basal beds are high energy conglomerate and sedimentary breccias that rest unconformably upon older eugeosynclinal strata of the Klakas Inlet sequence (SOs), the Wales Group (Pzp€w), and lithologic representatives of the ensimatic igneous complex (Pzic). Thickness, coarseness and composition of clasts varies depending upon distance from and the composition of local sources. Lower contact relations are well exposed in islands at mouth of Klakas Inlet (Dixon Entrance quadrangle), where an essentially oligomictic orange-weathering, carbonate-cemented breccia, consisting almost entirely of trondhjemite clasts, rests directly upon a protoclastically deformed ensimatic igneous complex (Pzic) that consists mainly of lithologically identical trondhjemite, sheared mafic and felsic dike material, and possible altered mafic volcanics of the Wales Group (PzPϾw). The breccia is at least 75 m thick and grades upward with a decrease in clast grain size (i.e., coarsely graded) through a calcareous, sandy zone with reworked carbonate-cemented trondhjemite clasts into dark-gray to black argillaceous siltstone and fine-grained sandstone with concretionary horizons (Eberlein, unpub. data., 1949; Eberlein and Saleeby, oral commun., 1981). Interbedded black pyritic slate zones (see locality G12 on Fig. 5 and Table 1) carry a graptolite fauna, including Monograptus pacificus, indicative of an Early, possibly earliest Middle Devonian (Pragian) age (Churkin, Jaeger, and Eberlein, 1970). Additional fossil control includes graptolites and shelly faunas from limestone beds within the sequence in Klakas, Keete and Kassa Inlets. (See fossil locality G12 on Fig. 5 and Table 1). The unit is thus considered to be coeval with at least parts of the Karheen (Dk), Wadleigh (Dw), limestone of Kasaan Island (Dkl), the olistostrome deposits on northeastern Noyes Island (Dn), the Port St. Nicholas sedimentary sequence (Dsn), and perhaps the Coronados Volcanics (Dc). Total known maximum thickness approximately 2,000+ m. Top not exposed

Dvs SEDIMENTARY AND VOLCANIC ROCKS OF INNER POINT-POINT ADAMS AREA BETWEEN PORT JOHNSON AND MOIRA SOUND, EASTERN PRINCE OF WALES ISLAND (Devonian?)--Flyschlike, tuffaceous, gray, greenish-gray and tan to rich-brown-colored, banded mudstone, graywacke, quartzo-feldspathic wacke and subordinate grit. Grit wacke beds 2-3 m thick tend to be most massive and contain chips of mudstone. Flysch section grades upward with increasing carbonate content into tuffaceous marlstone, crudely graded, carbonate-cemented, broken pillow breccia, and volcanic conglomerate in turn overlain by carbonate-cemented lithic lapilli aquagene tuff, with subordinate pillowed basaltic to andesitic flows, volcanic breccia and conglomerate that contains rounded clasts up to 1 m diameter of altered leucogabbro and diorite and altered mafic dike material typical of unit Pzic. Sequence probably deposited below wave base with attendant volcanism along submarine scarp. Lowest exposed beds thrust northward over Wales Group (PzPϾw) to east of Moss Point on south shore of Port Johnson. Sequence to date has proven to be unfossiliferous. Provisional assignment to the Devonian is based on presence of Pzic detritus as in the talus breccia (Dbx) and associated rocks (Dcb) in Clover Bay area, and similarities to other Devonian volcanogenic deposits in the region. Total exposed thickness about 1,900 m. Top not exposed. Predominantly volcanic section at top estimated to be over 55 m thick

Dbx TALUS BRECCIA (Middle and Early? Devonian)--Exotic marine talus slope breccia with minimal matrix composed almost entirely of poorly sized angular up to boulder-scale clasts of plutonic rock types identical to those of the ensimatic igneous complex (Pzic) known to occur to the north and south. Gabbroic and metadioritic lithologies predominate. Also present, however, are clasts of dark hornfels and (or) mafic dike material, mudstone and unmetamorphosed fetid gray limestone with fragments of fossils identical to that at the head of Clover Bay (fossil locality F24). Some of the blocks measure more than 3 m but most are less than 1/3 mm. Locally, a sandy matrix is recognizable and at one place a lens of sandstone composed of the same igneous detritus was observed. Matrix also contains detrital biotite. Contact with underlying(?) sedimentary rocks of Clover Bay (Dcb) is faulted. To north of Doctor Point at outlet of Monie Lake, the breccia appears to have been thermally affected by the adjacent igneous complex (Pzic) suggesting both may be related to the same tectonoplutonic episode. Thickness estimated to be approximately 2,300 m, but is likely to vary greatly over short distances, especially in view of its considered submarine talus origin

Dcb SILTSTONE, SANDSTONE, AND LIMESTONE OF CLOVER BAY (Devonian, possibly Early)--Calcareous well-bedded graywacke, siltstone with subordinate gray argillaceous limestone, banded mudstone with graded bedding and granule to pebble conglomerate that locally exhibits cross laminae. Sets generally range in thickness from a few centimeters to about 1 meter. Conglomerate clasts consist mainly of mafic volcanics, red and green chert, and subordinate granitoid lithologies similar to unit Pzic. The unmetamorphosed sequence includes at least two units, up to 15 m thick, of dark- to medium-gray, fetid, argillaceous limestone that carries abundant fragmented shelly and coralline fossils. See fossil locality F24 on Fig. 5 and Table 1. These faunas favor a Devonian age assignment, and the presence of ostracodes with a sulcus resembling <u>Beyrichia</u> sp. suggests an Early Devonian age. The previously reported presence of probable Triassic fossils from conglomerate and graywacke interbedded with Devonian limestone (Buddington and Chapin, 1929, p. 313) and conclusion that section is overturned are not supported by field evidence obtained during this investigation. Sequence shows no thermal contact effects by the adjacent Pzic unit with which it is considered to be in fault contact to the south. Thickness estimated to be at least 75 m

SOs GRAYWACKE, BANDED MUDSTONE, SILTSTONE, ARGILLITE AND ASSOCIATED BASALTIC FLOW AND FRAGMENTAL ROCKS (Silurian? through Middle Ordovician and probably older)--Essentially a thick unmetamorphosed flyschlike turbidite assemblage of marine, predominantly volcaniclastic, sedimentary rocks comprising medium to fine graywacke, tuffaceous banded mudstone, tuffaceous siltstone locally interbedded with thinly laminated marble, siltstone, argillite, grit, volcanic conglomerate and breccia with abundant intraformational detritus. Subordinate cherty and limy beds, siliceous slate and quartzofeldspathic wacke. Includes local development of flows and fragmental volcanics too restricted to show at map scale. Graywacke beds tend to be massive and contain chips and angular clasts of siltstone and mudstone. Graded bedding and penecontemporaneous slump structures common as are whole and incomplete Bouma sequences. Also present at some places are over 1,000-m-thick sections of marine andesitic to basaltic rocks (SOv).

The SOs (SOv) eugeosynclinal sequence closely resembles the Descon Formation, with which it is wholly or in part coeval, but it tends to be more calcareous and less indurated. Thus, in the absence of fossils, it may be confused lithologically with similar facies of the younger Port Refugio Formation (Dp).

Locally, the above described lithologies have been penetratively deformed and converted to slate, phyllite, semischist and even greenschist. Zones of hornfels have been developed adjacent to the larger intrusives, as in Moira Sound and on Sukkwan and Suemez Islands.

Fossil control for the age of the sequence derives from 10 widely spaced localities from Corlies Islands (loc. G8) at the northwest through Klakas Inlet (loc. G13) to Moira Sound (loc. G14) at the southeasternmost corner of the quadrangle. The most productive fossil localities, G12 and G13, are outside the boundaries of the quadrangle (see localities G12 and G13 on Fig. 5 and Table 1), but occur in rocks coextensive with units of SOs. All have yielded graptolites, and in one case (loc. G13) conodonts indicative of a Middle Ordovician age. The base of the sequence is not known, but beneath the above numbered locality in Klakas Inlet are approximately 3,500 m of unmetamorphosed, well bedded, rhythmically banded mudstone, siltstone, argillite, and grit with graywacke interbeds 1 to 3 m thick that contain floating chips and angular clasts of mudstone. These beds in turn are underlain by what appears to be a comparable thickness of sedimentary breccia and conglomerate that typically contains poorly sized clasts of intraformational porphyritic basaltic to andesitic volcanic rock, grayish-red siltstone and mudstone in a somewhat sheared sandy to argillaceous matrix. Clasts of chert, marble, and chlorite schist similar to that occurring in the subjacent Wales Group are present in minor amounts. Also interbedded with the conglomerate and breccia are units of massive graywacke, grayish-red mudstone, and a few fragmental basaltic volcanics. The existence of such a thick section of unmetamorphosed clastic rocks beneath the horizon represented by latest Early Ordovician graptolites and Middle Ordovician conodonts at locality G13 suggests that the basal beds described probably range downward in age into the Cambrian. The upper part of the sequence in Klakas Inlet includes an additional 300 m of dark-gray banded mudstone, siltstone, and graywacke, overlain by about 600 m of basaltic lava (in part pillowed and spilitized) and fragmental volcanics. The latter has been intruded by a deuterically altered granodiorite that has yielded a K-Ar date of 421 m.y. B.P. (Turner and others, 1977; Herreid and others, 1978), considered to be a minimum age. Herreid and others (1978) also report that the sequence is unconformably overlain by a basal conglomerate of Devonian age. Similarly, in Moira Sound at least seven lithologic units that have an aggregate thickness of about 7,000 m underlie a thin section of black, locally graphitic cherty shale that has yielded Middle Ordovician (Caradocian) graptolites (locality G14). The lowest exposed beds are in fault contact with the Wales Group. Locally includes:

SOv MARINE ANDESITIC TO BASALTIC ROCKS (Silurian? through Middle Ordovician)--Andesitic to basaltic flows (in part pillowed), flow breccia and agglomerate, lithic lapilli tuff and finer grained, more distal volcaniclastic representatives. Locally, especially in the southeast corner of the quadrangle, more siliceous volcanics occur in the section and have the lithologic characteristics of aphanitic, thin-layered quartz-sericite metatuff that resemble chert and have been classified as quartz keratophyre because of the presence of the blue quartz "eyes," and twinned albite phenocrysts. As described below, however, this lithology is especially typical of certain siliceous tuffaceous facies of the Wales Group (PzP€w). Accordingly, at such places (e.g., in Niblack Anchorage, and locally along Moira Sound) where schistosity symbols have been shown in areas believed to be underlain by SOs and SOv, the latter assignment is questioned to direct attention to the possibility that units of the Wales Group (PzP€w) may be present. Volcanic rocks of this unit (SOv) are over 1,000 m thick

PzP€w WALES GROUP (Pre-Middle Ordovician, Precambrian?)--Structurally complex assemblage of predominantly andesitic to basaltic marine fragmental volcanic rocks and flows, graywacke, mudstone and shale with locally interlayered marble regionally deformed and metamorphosed to greenschist and in places to amphibolite facies. The most abundant and widely distributed lithology is greenish-gray, thinly foliated, commonly crenulated chlorite-albite-epidote±quartz±actinolite schist that is compositionally layered parallel to foliation (=schistosity). This greenschist probably was derived from tuffaceous mudstone, siltstone, and graywacke. More siliceous and argillaceous layers also contain abundant sericite, mainly at the expense of chlorite. Transitions to quartz-sericite schist are common. Frequently associated with such more siliceous phases are beds of quartz albite metakeratophyre 1/4 meter to 3 or more meters thick, believed to have been derived mainly from water-laid rhyolitic tuff. In some cases, however, field and petrographic evidence favor derivation from original flows.

The metakeratophyre typically contains scattered rounded blue quartz "eyes" and phenocrysts or glomeroporphyritic clots of twinned albite (An_5 or less) set in a very fine grained chertlike microscopic groundmass of quartz and albite. Chemically, the rock is silica and soda rich, ranging between 67.5-70.0 percent and 4.6-7.5 percent, respectively. Alumina, in the range 10.07-16.4 percent, is present in amounts just sufficient to satisfy the requirement of albite, and K_2O is generally low (0.2-2.0 percent). Thus, the rock has essentially a normative mode.

Beds of metakeratophyre are ubiquitously distributed throughout the region known to be underlain by the Wales Group, but they rarely constitute more than a few percent of any given section. They are perhaps most abundant and best displayed along the west shore of Hetta Inlet, especially in the vicinity of Eek Point where they are in fault contact with meta-SOs. Experience of the senior authors suggests that these metakeratophyre lithologies are diagnostic of and perhaps restricted to the Wales Group. The only presently known possible exception is in the Niblack Anchorage area as noted and qualified in the discussion of the SOv sequence.

Locally, marble (PzP€wm), in part dolomitic, constitutes an important part of the Wales group. Carbonates are believed to be most abundant in the upper part of the Wales Group section, but the stacking of units within the group is uncertain due to structural complexities, poor and discontinuous exposures, and lack of age control (both paleontologic and radiometric).

The Wales Group exhibits the structural characteristics of a regional metamorphic complex. All the units described tend to be foliated, with the development of schistosity and compositional layering that for the most part are parallel and believed to represent original bedding. Minor folds, with wavelengths of 2-20 cm, and crenulations with axes parallel to those of minor folds and amplitudes of 1-15 mm, are visible in many exposures. Other structural features commonly present include (1) kink bands, (2) boudins of quartz and carbonate up to 5 m thick and 20 m long, (3) lineations formed by the intersection of cleavage and foliation, the axial plane traces of minor folds and the preferred linear orientation of elongate minerals (e.g., actinolite) and (or) mineral streaking on planes of schistosity, and (4) segregations of quartz mainly mobilized from the original rocks that both parallel and transect foliation and have become concentrated in the crestal regions of small folds. The geometric relationships among these minor structural features indicate that in general the Wales Group has been subjected to at least two periods of penetrative deformation and, locally, there is evidence for as many as four.

At most places the Wales Group is in fault contact with Ordovician and Devonian strata, but at the head of the South Arm of Cholmondeley Sound and Klakas Inlet, it appears to be overlain by a basal breccia and conglomerate that are essentially unmetamorphosed and are definitely pre-Middle Ordovician. For reasons outlined in the SOs age discussion, these basal beds that overlie the metamorphosed rocks of the Wales Group may well be as old as Cambrian. If so, a Precambrian age assignment for the Wales Group would be in accord with the available stratigraphic and structural evidence. Attempts to obtain isotopic control on the age of the Group have so far proven inconclusive. Preliminary discordant zircon U-Pb ages on a trondhjemitic phase of an ensimatic igneous complex (Pzic) that intrudes the Wales Group and thereby permitted a possible Precambrian age assignment (Churkin and Eberlein, 1977) proved to be an artifact of uranothorite impurities within the zircon populations (Saleeby and Eberlein, 1981). Hopefully, continuing efforts by Jason Saleeby to date the Wales Group isotopically will prove successful and provide more definitive evidence as to the age of this structurally complex, metamorphosed arc assemblage.

The thickness of the Group is not known but it is believed to be at least several thousand meters. Locally it includes:

PzP€wm MARBLE OF THE WALES GROUP (Pre-Middle Ordovician, Precambrian?)--Generally medium- to fine-grained, medium- to light-gray marble, occuring as thin beds interlayered with schistose metavolcanics and greenstone flows of the Wales Group (PzP€w). The relationships are especially well displayed in the Brennan Bay-Babe Island area of Cholmondeley Sound. In places, however, the marble is more massive and occurs in units that range in thickness from 30 to more than 300 m (e.g., at the head of Hetta Inlet and inland south and westward from the head of the West Arm of Chlomondeley Sound)

Intrusive rocks

Kgrd GRANODIORITE AND ASSOCIATED PLUTONIC ROCKS (Cretaceous, mainly Early)--Mainly plutons of small to intermediate size whose cores or central areas are dominated by granodiorite that grades into marginal phases of heterogeneous composition. Common variants include diorite, quartz monzonite, monzonite, and even gabbro (as in the case of the small pluton between Klakas and Keete Inlets). The Copper Mountain pluton is perhaps the most thoroughly mapped because of its formerly productive mineral deposits and famous collecting localities. It shows compositional changes from syenite to gabbro over distances of a few hundred meters or less near the borders (Kennedy, 1953). Contact zones of skarn and hornfels are commonly extensive. The pluton typically contains about 50 percent andesine, 10-15 percent K-feldspar and 15-20 percent quartz, with about 15 percent varietal hornblende and (or) biotite. The intrusive is cut by dikes of essentially inclusion-free leucogranodiorite, aplite and, in some cases, veinlets of K-feldspar. The Copper Mountain and Hetta Lake plutons probably are the same body and have yielded concordant hornblende and biotite K-Ar ages that range from 101 to 105±3 m.y. B.P. (Herreid and others, 1978). Similarly, a smaller intrusive about 3 km north-northeast of the head of Keete Inlet has been dated at 113±3 m.y. B.P. (hornblende) and 96.6±3 m.y. B.P. (biotite). Hornblende separates from the heterogeneous Pin Peak-Bear Lake intrusive have yielded K-Ar dates in the same Early Cretaceous age range

Kd DIORITE AND ASSOCIATED PLUTONIC ROCKS (Cretaceous?)--Mainly hornblende and (or) biotite diorite. Locally contains varietal clinopyroxene. Transitional phases range in composition from quartz diorite through monzodiorite and local monzogabbro. Locally porphyritic and perthitic. Commonly deuterically altered with the development of chlorite, uralite from the pyroboles and saussuritic products that include albite, epidote-clinozoisite and sericitic mica from the breakdown of plagioclase. Sphene and apatite are ubiquitous accessories. Locally may be included in unit Pzic

Kgb GABBRO AND PYROXENITE (Cretaceous, mainly Early?)--Mainly small plutons of several square kilometers in extent and consisting of medium- to coarse-grained gabbro composed of calcic plagioclase and clinopyroxene, and olivine-augite pyroxenite. Cut by fine-grained dikes and veinlets of essentially the same gabbroic composition as well as pegmatoid material. Some may be included in areas shown on map as unit Pzic

MzPzg See discussions of same unit above under Intrusive Rocks, Northern Part of Quadrangle. Includes small gabbroic intrusive southwest of Jumbo Island. Also includes:

MzPzsy SYENITE (Mesozoic and (or) Paleozoic)--Nepheline-eudialyte-bearing syenite and associated pegmatites between Dora Bay and South Arm, Cholmondeley Sound

IPsy SYENITE OF SUKKWAN ISLAND (Permian or Pennsylvanian)--Mainly hypidiomorphic granular leucosyenite consisting of up to 75 percent by volume of alkali feldspar (antiperthite?), ubiquitous golden to dark-brown biotite, and minor amphibole and aegerine augite. Color index is about 15. Accessory minerals include sphene and apatite. Quartz rare to absent. Locally becomes sodic diorite. Underlies much of eastern Sukkwan Island with the abundant development of thick hornfels zone in the SOs host rocks. K-Ar dating of hornblende and biotite from the southernmost shoreline exposure of the pluton has yielded ages of 283 m.y. and 293 m.y. B.P., respectively (new decay constants, M. A. Lanphere, oral commun., 1981). A similar lithology is poorly exposed in the vicinity of the water supply source for Hydaburg and may be related to the Sukkwan Island intrusive. A small syenitic intrusive near Klawak (northern part of quadrangle) has yielded a K-Ar age of 276 m.y. B.P.

Ogb GABBRO AND ASSOCIATED MAFIC ROCKS OF SUKKWAN ISLAND (Ordovician)--Medium- to coarse-grained xenomorphic granular hornblende gabbro, hornblende pyroxenite, and hornblendite of variable composition and texture. For most part altered (saussuritized, uralitized). Potassium-argon dating of two hornblende concentrates gave ages of 440 and 449 m.y. B.P. (new decay constants, M. A. Lanphere, oral commun., 1981). May be cogenetic with unit Pzic

Pzic See discussion of this unit above under Intrusive Rocks, Northern Part of Quadrangle. North of Doctor Pt. includes:

Pzih Heterogeneous body of altered hornblendite

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Explanation of Figure 3, Index Map Showing Principal Sources of Geologic Data

Area 1 George Moerlein, Consulting Geologist (written commun., 1981).
2 Mapping by A. T. Ovenshine and G. D. Webster (1967, 1968).
3 Mapping by A. T. Ovenshine and G. D. Webster (1967); G. Donald Eberlein (1979).
4 Mapping by G. Donald Eberlein, assisted by: S. Oriel and C. D. Reynolds (1947); C. D. Reynolds, D. M. Ford, and R. H. Bixby (1948); C. D. Reynolds, S. L. Moore, and W. L. D'Olier (1949); B. Rogers (1975).
5 Mapping by G. Donald Eberlein, Michael Churkin, Jr., and M. Lanphere (1964); G. Donald Eberlein, Michael Churkin, Jr., and A. Thomas Ovenshine, assisted by Charles Carter (1965); G. Donald Eberlein and Michael Churkin, Jr., assisted by K. Crowther (1966); Nairn Albert and M. J. Rymer (1973); Michael Churkin, Jr., assisted by J. Robar (1974).
6 After Berg, H. C., Elliott, R. L., Koch, R. D., Carten, R. B., and Wahl, F. A., 1976, Preliminary geologic map of the Craig D-1 and parts of the Craig C-1 and D-2 quadrangles, Alaska: U.S. Geol. Survey Open-File Map OF 76-430, 1 sheet.
7 Mapping by Michael Churkin, Jr., assisted by J. Robar (1974); parts of area modified from Sainsbury, C. L., 1961, Geology of part of the Craig C-2 quadrangle and adjoining areas, Prince of Wales Island, southeastern Alaska: U.S. Geol. Survey Bulletin 1058-H, p. 299-362, pl. 33-39.
8 Modified from Sainsbury, C. L., 1961, Geology of part of the Craig C-2 quadrangle and adjoining areas, Prince of Wales Island, southeastern Alaska: U.S. Geol. Survey Bulletin 1058-H, p. 299-362, pl. 33-39; additional mapping by G. Donald Eberlein and Michael Churkin, Jr., assisted by W. Vennum (1972); by Churkin assisted by J. Robar (1974); G. Donald Eberlein and Jason Saleeby (1979).
9 Mapping by G. Donald Eberlein, assisted by Nairn Albert (1974); additional mapping and field checking by G. Donald Eberlein and Jason Saleeby (1979). Information in Dolomi area modified from: Herreid, G., 1967, Geology and mineral deposits of the Dolomi area, Prince of Wales Island, Alaska: Alaska Division of Mines and Minerals Geologic Report 27, 17 p., 10 figs., 2 tables.
10 Mainly after Herreid, G., Bundtzen, T. K., and Turner, D. L., 1978, Geology and geochemistry of the Craig A-2 quadrangle, Prince of Wales Island, southeastern Alaska: Alaska Division of Geological and Geophysical Surveys, Geologic Report 48, 49 p., 2 pl.; shoreline mapping of Klakas Inlet and South Arm, Cholmondeley Sound, by G. Donald Eberlein, assisted by W. D'Olier (1949); field checking and additional mapping by G. Donald Eberlein and Michael Churkin, Jr., assisted by W. Vennum (1971, 1972), and by G. Frantz and B. Rogers (1975).
11 Mapping by H. C. Berg, D. A. Brew, A. L. Clark, D. Grybeck, A. T., Ovenshine, J. G. Smith, and Ray Wehr (1969, 1970, 1971).
12 Mapping by G. Donald Eberlein and Michael Churkin, Jr., assisted by Charles Carter (1965), K. Crowther (1966), W. Vennum (1971, 1972), N. Albert and M. J. Rymer (1973), J. Robar (1974), G. Frantz, and B. Rogers (1975). Information in Niblack

Anchorage area (Craig A-1 quadrangle) revised from Peek, B. C., 1975, Geology and mineral deposits of the Niblack Anchorage area, Prince of Wales Island, Alaska: Unpublished M.S. thesis, University of Alaska.

Table 1.--Key fossil localities of the Craig Quadrangle

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
G-1 Descon (SOd)	C-4	Eberlein, 1965, 65AE17, Cruz Islands, Descon chert & shale unconformably below Karheen Fm.	Graptolites, Zone of *C. baragwanathi* (=upper *D. clingani* zone)*	Middle Ordovician (Caradocian) (Eastonian)	Claire Carter, written commun., 1981
G-2 Descon (SOd)	C-4	Churkin, 1964, 64ACn 1361. Big Salt Lake. The most common graptolite fauna in Descon	Graptolites, Zone of *N. gracilis*	Middle Ordovician (early Caradocian) (Gisbornian)	Claire Carter, written commun., 1981
G-3 Sedimentary rocks of the Port St. Nicholas area (DSn)	B-4	Churkin, 66ACn282; Savage, 1974, 1975. Landslide above Port St. Nicholas. The youngest graptoloid horizon in circumpacific	Graptolites (*Monograptus pacificus*), conodonts, trilobites	Early Devonian (late Emsian)	Churkin, Jaeger, and Eberlein, 1970; Savage, Churkin, and Eberlein, 1977; A. R. Ormiston, written commun., 1975
G-4 Descon (SOd)	C-5	Churkin, 1965, 65ACn 1502, Esquibel Island. Complete graptolite succession from Uppermost Ordovician through Lower Silurian	Graptolites, *Dicellograptus ornatus* through *Monograptus cyphus* Zones	Late Ordovician (Ashgillian) through first half of Early Silurian (Llandoverian)	Churkin, Carter, and Eberlein, 1970

*For correlation of graptolite zones used here, see Webby and others, 1981; Bulman, 1970; Carter and Churkin, 1977

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
G-5 Descon (SOd)	C-5	Churkin, 1965, 65ACn 1141. East shore Steamboat Bay. One of oldest graptolite faunas in Descon	Graptolites, zone undetermined*, approximately late Arenigian	Late Early Ordovicain (Arenigian)	Claire Carter, written commun., 1981; Eberlein and Churkin, 1970 *Two species only: Didymograptus? sp. (rare) Tetragraptus cf. T. amii (r)
G-6 Descon (SOd)	C-5	Churkin, 1964, 64ACn 1562, *Boca de Finas*. One of youngest Ordovician graptolite faunas in Descon	Graptolites, Zone of D. ornatus	Late Ordovician (Ashgillian) (Bolindian)	Eberlein and Churkin, 1970; Claire Carter, written commun., 1981
G-7 Breccia of NE Noyes Island (Dn)	C-5	Churkin, 1965, 65ACn 1181, Steamboat Bay, Noyes Island. Dates argillaceous matrix of olistostrome	Graptolites together with vascular plants	Early Devonian. One of youngest graptoloid faunas in Alaska	Churkin, Eberlein, Hueber, and Mamay, 1969
G-8 Sedimentary rocks of Dall Island and vicinity (SOs)	A-3	Churkin, 1975, 75ACn431, McFarland Islands; Corlies Islands. Fossil age control for SOs in southern part of quadrangle	Graptolites, approximately Zone of Oncograptus	Early Middle Ordovician (Yapeenian)	Claire Carter, written commun., 1981

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
G-9 Sedimentary rocks of Dall Island & vicinity	A-4	Churkin, 73ACn962, Foul and Diver Bays, Dall Island. Highest beds of SOs here are same age as top of Descon. Overlying Sd therefore correlates with Heceta Limestone	Graptolites, Zones of *R. maximus* to *M. crenulata*	Early Silurian (Late Llandoverian)	Claire Carter, written commun., 1980
G-10 Sedimentary rocks of Dall Island and vicinity (SOs)	B-5	Churkin, 73ACn831, 821, 681, Port San Antonio, Baker Island. Dates rocks on Baker Island (and other west coast islands) as Ordovician and Silurian	Graptolites, Zones of *M. convolutus* (831, 681) and *D. clingani* (821)	Early Silurian and Middle Ordovician	Claire Carter, written commun., 1980
G-11 Rocks of the Staney Creek area (DSs)	D-4	Churkin, 1973, 73ACn 1881, Staney Creek area. Thin, graptolitic shale interbedded with ls. and volcaniclastic ss. and cgl. Directly overlies F19. Mainly clastic section here correlates with Heceta Ls.	Graptolites, Zones of *M. crenulata* and *C. centrifugus*	Late Early Silurian (Llandoverian-Wenlockian)	Claire Carter, written commun., 1980

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
G-12 Sedimentary rocks of Dall Island and vicinity (SOs)	Dixon Entrance D-2	Churkin, 1964, 64ACn1171, 1172, 1191; Vennum, 1972, 72AV482. Kassa Inlet and Klakas Inlet. Graptolitic slate and conglomerate	Graptolites, Zone of Monograptus pacificus	Late Early Devonian (Praguian)	Churkin, Jaeger, and Eberlein, 1970
G-13 Sedimentary rocks of Dall Island and vicinity (SOs)	Dixon Entrance D-2	Eberlein, 1972, 72AE221. East shore, Klakas Inlet. Black shale and banded mudstone, sandstone, and conglomerate	Graptolites, Zone of G. teretiusculus. Conodonts	Latest Early Ordovician (Llandeilian; late Darriwilian)	Claire Carter, written commun., 1981
G-14 (SOs)	Craig A-1, Dixon Entrance D-1	Eberlein, 1974, 74AE180, 167, 168, Moira Sound. Black shale in mudstone and graywacke section closely associated with schist	Graptolites, Zone of N. gracilis	Middle Ordovician (Caradocian)	Claire Carter, written commun., 1974
G-15 (SOs)	Ketchikan A-6	Eberlein, 1974, 74AE160, South arm, Chichagof Bay	Graptolites	Middle or Late Ordovician	Claire Carter, written commun., 1974

Table 1.--Key fossil localities for the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
G-16 Descon (SOd)	B-3	Churkin, 1966, 66ACn931, near Dawson Mine	Graptolites, Zone of *Nemagraptus gracilis*	Middle Ordovician	Claire Carter, written commun., 1981
G-17 Descon (SOd)	C-5	Churkin, 1974, 64ACn 1561, 1,500 ft below contact with Heceta Limestone. Boca de Finas	Graptolites, Zones of *Monograptus gregarius* and *M. sedgwickii*	Early Silurian (Llandoverian)	Churkin, M., Jr., in Eberlein and Churkin, 1970; Claire Carter, written commun., 1981
G-18 Descon (SOd)	C-5	Eberlein, 1965, 65AE61; Churkin, 1965, 65ACn961, Twocrack Island, uppermost 50 feet of Descon	Graptolites, Zones of *Monograptus griestoniensis* and *Monoclimcis crenulata*	Early Silurian (Llandoverian)	Churkin, M., Jr. in Eberlein and Churkin, 1970a; Claire Carter, written commun., 1981
G-19 Descon (SOd)	C-5	Churkin, 1965, 65ACn953, Anguilla Island	Graptolites, Zone of *Dicellograptus gravis*	Early Late Ordovician (Eastonian)	Churkin, M., Jr., in Eberlein and Churkin, 1970a; Claire Carter, written commun., 1981

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
G-20 Descon (SOd)	C-5	Eberlein, 1965, 65AE65, Anguilla Island. Slate and metagraywacke, schistose. One of oldest faunas in Descon	Graptolites, Zone indeterminate	Approximately Early Ordovician (Arenigian)	Churkin, M., Jr., in Eberlein and Churkin, 1970a; Claire Carter, written commun., 1981
G-21 Descon (SOd)	C-5	Eberlein, 1964, 64AE58; Churkin, 1964, 64ACn1582, Heceta Island, Warm Chuck Inlet	Graptolites, Zones of Nemagraptus gracilis and Climacograptus bicornis	Middle Ordovician	Claire Carter, written commun., 1981
G-22 Descon (SOd)	C-5	Churkin, 1965, 65ACn1571, Culebra Islands, siliceous siltstone and tuff	Graptolites, Zone indeterminate (very poor, sparse collection)	Middle or Late Ordovician?	Claire Carter, written commun., 1981
G-23 Descon (SOd)	C-5	Churkin, 1965, 65ACn1253 (USGS M1141), eastern Noyes Island	Graptolites, Zone of Akidograptus acuminatus	Early Silurian (Llandoverian)	Churkin and Carter, 1970

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
G-24 Breccia of NE Noyes Island (Dn)	C-5	Churkin, 1965, 65ACn1192. NE Noyes Island, same horizon as G7	*Monograptus pacificus* fauna	Early Devonian	Churkin, Eberlein, Heuber, and Mamay, 1969
G-25 Descon (SOd)	C-5	Buddington, A. F., #1902; Eberlein, 1964, 64AE55; Churkin, 1964, 64ACn1551. Graptolitic slate fragments in conglomerate 200 ft below Heceta Limestone	Graptolites, about Zone of *M. gregarius*	Early? Silurian (Llandoverian)	Ruedemann, Rudolph, in Buddington and Chapin, 1929; M. Churkin, Jr., field determination, 1964
G-26 Descon (SOd)	B-5	Churkin, 1973, 73ACn642, San Fernando Island	Graptolites, Zone of *C. bicornis*	Middle Ordovician (Caradocian)	Claire Carter, written commun., 1981
G-27 Descon (SOd)	B-5	Buddington, A. F., #2146; Churkin, 1965, 65ACn1361, SW San Fernando Island	Graptolites, Zone of *N. gracilis*	Middle Ordovician (Caradocian)	Ruedemann, Rudolph, in Buddington and Chapin, 1929; Claire Carter, written commun., 1981

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
G-28 Descon (SOd)	B-5	Churkin, 1973, 73ACn661; Churkin, 1965, 65ACn1371, San Fernando Island near Sword Point	Graptolites, Zone of *Monograptus convolutus*	Early Silurian (Llandoverian)	Claire Carter, written commun., 1981
G-29 Descon (SOd)	B-5	Eberlein, 1973, 73AE44, south shore Lulu Island	Graptolites, Zone of *N. gracilis*	Middle Ordovician (Caradocian)	Claire Carter, written commun., 1981
G-30 Descon (SOd)	B-5	Churkin, 1973, 73ACn262, south shore of Lulu Island	Graptolites, Zone of *Adelograptus antiquus*	Early Ordovician (Tremadocian)	Claire Carter, written commun., 1981
G-31 Descon (SOd)	B-5	Churkin, 1965, 65ACn1263, (M1142 in Churkin and Carter, 1970), Noyes Island, St. Nicholas Channel	Graptolites, Zone of *Monograptus gregarius*	Early Silurian (Llandoverian)	Claire Carter, written commun., 1981; Churkin and Carter, 1970
G-32 Descon (SOd)	B-5	Eberlein, 1973, 73AE66, northwestern Baker Island	Graptolites, Zone of *Dicellograptus ornatus*	Late Ordovician (Ashgillian)	Claire Carter, written commun., 1981

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
G-33 Descon (SOd)	C-4	Churkin, 1965, 65ACn591, south entrance to Big Salt Lake	Graptolites, approximately the Zones of Glyptograptus teretiusculus and Paraglosso-graptus tenta-culatus	Middle Ordovician	Claire Carter, written commun., 1981
G-34 Descon (SOd)	C-4	Churkin, 1966, 66ACn193, head of Shinaku Inlet	Graptolites, Zone of Dicrano-graptus clingani	Middle Ordovician	Claire Carter, written commun., 1981
G-35 Descon (SOd)	B-4	Eberlein, 1966, 66AE20, Port St. Nicholas	Graptolites, approximately the Zone of D. clingani	Middle Ordovician	Claire Carter, written commun., 1981
G-36 Descon (SOd)	B-4	Churkin, 1966, 66ACn381, Pt. Miraballes	Graptolites, Zone of C. bicornis	Middle Ordovician	Claire Carter, written commun., 1981

Table 1.--*Key fossil localities of the Craig Quadrangle* (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
G-37 Descon (SOd)	C-3	Churkin, 1966, 66ACn1002, Maybeso Creek area	Graptolites, Zones of *N. gracilis* and *C. bicornis*	Middle Ordovician	Claire Carter, written commun., 1981
G-38 Descon (SOd)	C-3	Churkin, 1973, 73ACn1491, on Klawak-Thorne Bay road	Graptolites, Zone of *N. gracilis*	Middle Ordovician	Claire Carter, written written commun., 1981
G-39 Descon (SOd)	C-3	Churkin, 1973, 73ACn1433, NW side of bridge across Rio Roberts	Graptolites, Zone of *C. bicornis*	Middle Ordovician	Claire Carter, written commun., 1981
G-40 Descon (SOd)	D-3	Churkin, 1975, 75ACn891, entrance to Gold and Galligan lagoon	Graptolites, Zones of *N. gracilis* and *C. bicornis*	Middle Ordovician	Claire Carter, written commun., 1981
G-41 Descon (SOd)	C-2	Churkin, 1974, 74ACn691, Tolstoi Bay. Volcanic conglomerate/graywacke and mudstone	Graptolites, Zone of *Dicranograptus clingani* (lower part)	Middle Ordovician (early Eastonian)	Claire Carter, written commun., 1981

Table 1. Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
G-42 Sedimentary rocks of Dall Island & vicinity (SOs)	A-4	Buddington, A. F., #3073, Hook Arm of Sea Otter Harbor, Dall Island	Graptolites	Lower Silurian	Ruedemann, Rudolph, in Buddington and Chapin 1929
G-43 Sedimentary rocks of Dall Island and vicinity (SOs)	A-4	Chapin, Theodore, Dall Island, View Cove	Graptolites	Silurian	Kirk, Edwin, in Buddington and Chapin, 1929
G-44 Dall Island and vicinity (SOs)	A-4	Ovenshine, 1968, 68AOv2592, south side of Breezy Bay; Ovenshine, 1968, 68AOv2611a,b, First Bay south of Breezy Bay	Graptolites, Zone of _N. gracilis_; Zones of _N. gracilis_, and _C. bicornis_	Middle Ordovician	Claire Carter, written commun., 1980
G-45 Descon (SOd)	D-5	Churkin, 1964, 64ACn1692; Eberlein, 1964, 64AE701. Banded mudstone underlying pillow lava. East side of island in Van Sants Cove	Graptolites, Zone of _D. clingani_	Middle Ordovician	Claire Carter, written commun., 1982

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
G-46 Descon (SOd)	D-5	Churkin, 1964, 64ACn1701; Eberlein, 1964, 64AE71, west side of Van Sants Cove	Graptolites, Zone of Monograptus turriculatus	Early Silurian (Late Llandoverian)	Claire Carter, written commun., 1981
G-47 Descon (SOd)	B-2	Churkin, 1972, 72ACn1272, Twelvemile Arm	Graptolites, fragments of Didymograptus sp. and Climacograptus?	Middle? Ordovician	M. Churkin, Jr., field determination, 1972; Claire Carter, written commun., 1981
G-48 Descon (SOd)	B-3	Churkin, 1966, 66ACn923, Harris River area near Hollis	Graptolites, Zone of Paraglossograptus tentaculatus	Middle Ordovician	Claire Carter, written commun., 1981

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
F-1 Klawak (Pk)	C-4	Armstrong, 1966, 66X48. Type area of Klawak Fm. Dates youngest Paleozoic formation in area	Fusulinids (*Millerella*, *Nankinella*, and *Staffela*)	Early and Middle Pennsylvanian	Douglass, R. C., 1971
F-2 Peratrovich Limestone Member (Mp)	C-4	Churkin, 1965, 65ACn281. Type area of Peratrovich Fm. Dates upper member of Peratrovich Fm.	Corals (*Lithostrotion*), foraminifera (*Pseudoendothyra*), fusulinids (*Eostaffela*)	Late Mississippian (Chesterian)	Armstrong, A. K., 1970
F-3 Peratrovich Limestone & chert member (Mp)	C-4	Churkin, 1965, 65ACn292. Type area of Peratrovich Fm. Dates middle member of Peratrovich Fm.	Corals (*Lithostrotionella*, *Lithostrotion*) Foraminifera (*Tourmayella*)	Middle Mississippian (Meramecian)	Armstrong, A. K., 1970
F-4 Peratrovich chert member (Mp)	C-4	Churkin, 1965, 65ACn172, Klawak Inlet. Dates lower member of Peratrovich Fm.	Foraminifera (*Arhaediscus* & *Globoendothyra*)	Mississippian (Meramecian)	Armstrong, A. K., 1970

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
F-5 Wadleigh (Dw)	C-4	Churkin, 1964, 64ACn1411, San Alberto Islands. Dates lower part of Wadleigh Ls.	Corals (*Acanthophyllum*, *Xystriphyllum*)	Middle Devonian (Eifelian)	Oliver and others, 1975
F-6 Wadleigh (Dw)	C-4	Churkin, 1966, 66ACn1451, Wadleigh Island. Dates upper part of Wadleigh Ls.	Corals (*Phillipsastrea*, *Sociophyllum*, *Syringoporella*)	Late Devonian (Frasnian)	Oliver and others, 1975; Tchudinova and others, 1974
F-7 Coronados (Dc)	B-4	Eberlein, 1966, 66AE43, Coronados Island. Dates Coronados Volcanics	Corals (*Heliolites*, *Thamnopora*), brachiopods (*Warranella*)	Middle Devonian	C. W. Merriam, written commun., 1973
F-8 Wadleigh (Dw)	B-4	Savage, Coronados Island. Dates the upper Wadleigh by conodonts	Conodonts (*Polygnathus* n. sp., *Pandorinellina*)	Late Devonian (Frasnian)	Savage, N. M., and Funai, C. A., 1980

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
F-9 Breccia of Luck Creek (SObl)	C-4	Churkin, 1966, 66ACn731; Churkin, 1971, 71ACn1051, Staney Cone. Dates major unit of andesitic breccia	Corals (*Catenipora*)	Late Ordovician-Early Silurian	W. A. Oliver, Jr., written commun., 1972
F-10 Ladrones (Pl)	B-4	Armstrong, 1966, Ladrones Islands. Dates Ladrones Limestone	Fusulinids, endothyroid foraminifera, and corals	Early and Middle Pennsylvanian	Douglass, R. C., 1971; Armstrong, A. K., 1970
F-11 Port Refugio (Dp)	B-4	Churkin, 1966, 66ACn1662, 66ACn1672; Savage and others loc. #1. Port Refugio. Dates Port Refugio Fm.	Brachiopods (*Cyrtospirifer*, *Mucrospirifer*), Fish (*Phoebodus*)	Late Ordovician (Middle to Late Famennian)	Savage, N. M., Eberlein, G. D., and Churkin, M., Jr., 1978; David H. Dunkle, written commun., 1976
F-12 Karheen (Dk)	C-5	Churkin, 1964, 64ACn1471; Eberlein, 1964, 64AE46; Eberlein, 1965, 65AE151	Conodonts, brachiopods	Early Devonian (Lochkovian)	Savage, N. M., Churkin, M., Jr., and Eberlein, G. D., 1977

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
F-13 Peratrovich Limestone & chert member (Mp)	B-4	Armstrong, 1966, 66X-6, Toti Island. Dates lower part of Peratrovich Fm.	Corals (*Ekvasophyllum*, *Lithostrotionella*, *Sociophyllum*)	Middle Mississippian (Meramecian)	Armstrong, A. K., 1970
F-14 Peratrovich (Mp)	B-4	Armstrong, 1966, 66X-7, Shelikof Island. Dates Peratrovich Fm. in its southern area of exposure	Corals (*Lithostrotion*, *Diphyllum*, *Sociophyllum*)	Middle Mississippian (Meramecian)	Armstrong, A. K., 1970
F-15 Heceta (Sh)	D-5	Eberlein, 1961, 61AE59, eastern Heceta Island. Dates upper part of Heceta Limestone	Brachiopods, corals and gastropod (*Atrypella murchisonia*)	Late Silurian (Ludlovian)	C. W. Merriam, oral commun., 1962
F-16 Karheen (Dk)	D-5	Reynolds, 1947, 47AR120; Eberlein, 1961, 61AE23; Ovenshine, 1968, 68AOv2504, 2491; Savage, 1977, loc. 1, eastern Heceta Island. Dates lower Karheen; defines *Phaulactis* Zone of Late Silurian and dates Silurian brachiopods	Brachiopods (*Atrypa*), coral (*Phaulactus*), tentaculitid (*Nowakia*), conodonts (*Eognathodus*, *Pelekysgnathus*)	Early Devonian (Early Pragian)	Kirk and Amsden, 1952; C. W. Merriam, in Oliver, Merriam, and Churkin, 1975; Savage, 1977a

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
F-17 Heceta (Sh)	D-5	Eberlein, 1961, 61AE17, north-central Heceta Island. Argillaceous limestone near top of Heceta Limestone. *Conchidium alaskease* in same area	Corals (*Zelophyllum*, *Microplasma*), stromatoporoid (*Amphipora*), brachiopods (*Brooksina*, *Harpidium*)	Late Silurian	C. W. Merriam, personal *commun.*, 1969; Merriam, in Oliver, Merriam, and Churkin, 1975
F-18 Heceta (Sh)	C-5	Kirk, Loc. 1019, "Bluebluff" in eastern Heceta Island. Base of Heceta Ls. below Descon Fm.	Brachiopods (*Atrypella scheii*)	Late Early or Early Middle Silurian	Kirk and Amsden, 1952
F-19 Rocks of Staney Creek region (DSs)	D-4	Churkin, 1973, 73ACn1871, Staney Creek area. Massive limestone overlying fragmental volcanic rocks (Descon). Directly overlain by G11	Corals (*Catenipora*, *Zelophyllum?*)	Late Early Silurian (Llandoverian)	W. A. Oliver, Jr., written commun., 1975
F-20 Wadleigh Ls (?) (Dw)	D-4	Churkin, 1973, 73ACn 1981, lower reaches of Staney Creek. Massive limestone overlying clastic section of DSs	Corals (*Xystriphyllum*, *Heliolites*, *Alveolites*)	Middle Devonian (Eifelian)	W. A. Oliver, Jr., written commun., 1975

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
F-21 Descon Fm (SOd)	C-2	Churkin, 1974, 74ACn791, 74ACn772, Thorne Bay. Limy lenses within volcaniclastic rocks. Very rare pre-Heceta shelly fossils	Corals (cf. *Renschia*, cf. *Streptelasma*)	Ordovician (?)	W. A. Oliver, Jr., written commun., 1975
F-22 Limestone of Kasaan Island (DKl)	B-2	Churkin, 1973, 73ACn92, 32, Kasaan Island. Limestone interlayered with keratophyre	Ostracodes (*Beyrichia*), corals (*Rhizophyllum*), conodonts, trilobites	Early Devonian (Emsian)	J. M. Berdan, written commun., 1973; Merriam, in Oliver, Merriam, and Churkin, 1975; N. Savage and A. R. Ormiston, 1973, written communications
F-23 Heceta Limestone (Sh)	D-5	Ovenshine, 1967, 67AOv761; Webster, 1967, 67AWd101, 111, Marble Island, middle part of the Heceta Ls.	Conodonts (*Polygnathoidas emarginatus*), brachiopods (*Atrypella*)	Late Silurian (Ludlovian)	Ovenshine and Webster, 1970; J. G. Johnson, in Ovenshine and Webster, 1970

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
F-24 (Dcb)	B-1	Eberlein, 1974, 74AE202, 200; Chapin, Theodore, 15ACh151, 153, 155, Clover Bay. Argillaceous limestone and plutonic-volcanic rock breccia derived from and intruded by Paleozoic ensimatic igneous complex. Triassic(?) fossil reported by Buddington and Chapin, 1929 (p. 313) is an error	Atrypoid brachiopods, corals (*Favosites* and *Cyathophyllum*)	Devonian	Kirk, Edwin, in Buddington and Chapin, 1929, p. 98.
F-25 (Ds)	A-2	Eberlein, 1972, 72AE106; Churkin, 1972, 72ACn161, Keete Inlet. Limestone clasts with shelly fossils in shale matrix	Trilobites, brachiopods, corals	Early Devonian	A. R. Ormiston, written commun., 1972
F-26 (DSs)	D-4	Churkin, 1974, 74ACn1491. Limestone, mudstone and graywacke interbedded	Brachipods (*Conchidium*, *Atrypella*), conodonts	Late Silurian (Ludlovian)	N. M. Savage, written commun., 1975

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
F-27 Wadleigh Ls. (Dw)	C-4	Buddington, #2017, Churkin, 1966, 66ACn551	Brachipods, corals	Late Middle or Late Devonian	Kirk, Edwin, in Buddington and Chapin, 1929; Merriam, in Oliver, Merriam, and Churkin, 1975
F-28 Wadleigh Ls. (Dw)	C-4	Churkin, 1965, 65ACn2021, Fish Egg Island	Corals, brachiopods	Devonian	
F-29 Wadleigh Ls. (Dw)	B-4	Churkin, 1966, 66ACn1612	Corals, conodonts	Middle Devonian	N. M. Savage, oral commun., 1977
F-30 Rocks of Staney Creek region (DSs)?	C-3	Churkin, 1973, 73ACn1511. Fossil fragmental limestone in sequence with reddish pebbly sandstone	Corals (<u>Amphipora</u>?)	Middle? Devonian	W. A. Oliver, Jr., written commun., 1975
F-31 Breccia of Luck Creek (SObl)	D-3	Churkin, 1975, 75ACn734. Limestone point east side of lake in area of porphyritic andesite breccia	Chain and horn corals (<u>Catenipora</u> sp.)	Silurian	W. A. Oliver, Jr., written commun., 1975

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
F-32 Rocks of the Staney Creek region (DSs)	D-3	Churkin, 1973, 73ACn1551. Logging road quarry pit exposing black shale	Branching plants (Psilophytid?)	Early Devonian ?	S. H. Mamay, written commun., 1974
F-33 Port Refugio (Dp)	B-3	Churkin, 1971, 71ACn731, 721. Limestone shell beds and pillow basalt, Soda Bay, south shore	Brachiopods (spiriferoid)	Devonian	M. Churkin, Jr., field determination, 1971
F-34 Coronados Volcanics (Dc)	B-3	Eberlein, 1965, 65AE251, Klawak Lake	Corals, brachiopods	Devonian	G. D. Eberlein, field determination, 1965
F-35 "Heceta Ls" ? (Sh)	A-4	Churkin, 1973, 73ACn931	Corals (<u>Catenipora</u>, <u>Favosites</u>)	Silurian	M. Churkin, Jr., field determination, 1973
F-36 Descon Fm. (SOd)	B-6	Churkin, 1973, 73ACn341. Ls. clasts in volcanic conglomerate/graywacke, west coast of Noyes Island	Chain coral, cystaphillid coral	Late Orodvician or Silurian	M. Churkin, Jr., field determination, 1973

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
F-37 Heceta Ls. (Sh)	D-4	Eberlein, 1975, 75AE184; Churkin, 1975, 75ACn781. Quarry in massive limestone	Corals, brachiopods, Dasycladachean algae. *Microplasma* sp., *Tryplasma* sp.	Middle or Late Silurian	W. A. Oliver, Jr., written commun., 1976
F-38 Heceta Ls. (Sh)	D-5	Eberlein, 1975, 75AE232. Quarry in limestone	*Amphipora*, Brachipods (*Conchidium*)	Middle or Late Silurian	G. D. Eberlein, field determination, 1975
F-39 Rocks of the Staney Creek region (DSs)	D-4	Churkin, 1975, 75ACn752, El Capitan Passage	Corals (*Zelophyllum* sp., *Microplasma* sp.)	Late Silurian	W. A. Oliver, Jr., written commun., 1975
F-40 Rocks of the Staney Creek region (DSs)	D-4	Churkin, 1975, 75ACn983, 75ACn991, Tuxekan Passage. Limestone in section with sandstone/conglomerate	Corals (*Tryplasma* sp., *Amphipora* sp.) brachiopod (*Atrypella* sp.), stromatoporoid	Late Silurian?	W. A. Oliver, Jr., and J. T. Dutro, Jr., written commun., 1975

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
F-41 Rocks of the Staney Creek region (DSs)	D-4	Churkin, 1966, 66ACn1331, 66ACn1351, 66ACn1352, 66ACn1361; Eberlein, 1966, 66AE205, 66AE207, 66AE209. Fossiliferous limestone interbedded with volcanic sandstone and conglomerate	Corals (*Amphipora* sp.?), brachiopod	Late Silurian-Early Devonian	M. Churkin, Jr., 1966, field determinations
F-42 Rocks of the Staney Creek region (DSs)	D-4	Churkin, 1974, 74ACn1401. Fossil-debris-limestone turbidites	Corals, stromatoporoids, and shelly fossils	Late Silurian-Early Devonian	M. Churkin, Jr., 1966, field determinations
F-43 Wadleigh Ls. (Dw)	D-4	Buddington, #2038, Eberlein, 1961, 61AE62. Ham Island in Karheen Passage	Corals and shelly fossils	Devonian	Kirk, Edwin, in Buddington and Chapin, 1929; C. W. Merriam, written commun., 1973
F-44 Wadleigh Ls. (Dw)	D-4	Eberlein, 1961, 61AE63. Small island of well-bedded limestone and minor black chert	Corals (*Dendiostella*), gastropods (*Naticopsis*), cephalopods (*Carlloceras*)	Devonian	C. W. Merriam, written commun., 1973

Table 1.--Key fossil localities of the Craig Quadrangle (Continued)

Map No., Formation (See Fig. 5)	15 min. Quad.	Collector, year, field number, locality name & geologic significance	Fossil Group(s)	Age and Correlation	Paleontologist and reference(s)
F-45 Wadleigh Ls. (Dw)	D-4	Eberlein, 1961, 61AE56. Limestone overlying Staney Fm.	Corals (*Grypohyllum*, *Amphipora* sp.)	Devonian	C. W. Merriam, oral commun.
F-46 Wadleigh Ls. (Dw)	D-5	Eberlein, 1961, 61AE26. Small island one mile west of north entrance to Karheen Passage	Corals (*Hexagonaria* sp., *Digonophyllum* sp.), brachiopods (*Camarotoechia* sp., *Cryptonella* sp.)	Middle Devonian	C. W. Merriam, written commun., 1973
F-47 Heceta Ls. (Sh)	D-5	Eberlein, 1961, 61AE10. Limestone with thick conglomerate and sandstone. NW Heceta Island	Brachiopods (*Brooksina* sp., *Harpidium* sp.), corals (*Zelophyllum* sp., *Cystiphyllum* sp.)	Late Silurian	C. W. Merriam, written commun., 1973