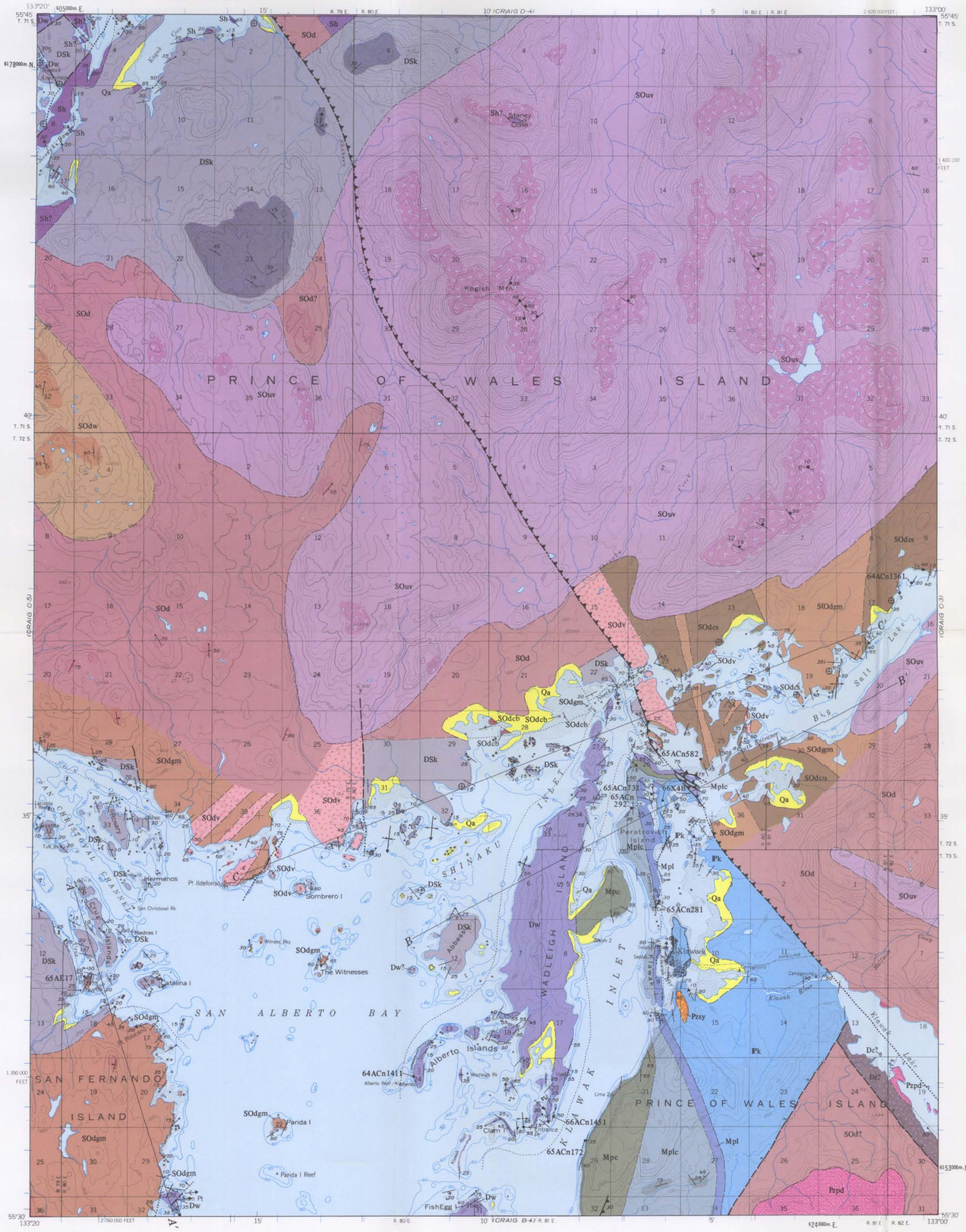
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

GEOLOGIC QUADRANGLE MAP
CRAIG C-4 QUADRANGLE, ALASKA
GQ-1169



CORRELATION OF MAP UNITS[1]

Qa			QUATERNARY
Unconformity			
Pzpd			PALEOZOIC(?)
Pzsy			UPPER PALEOZOIC
IPk		Middle and Lower Pennsylvanian	PENNSYLVANIAN
Mpl	Peratrovich Formation	Upper and Lower Mississippian	MISSISSIPPIAN
Mplc			
Mpc			
Dw		Upper Devonian	DEVONIAN
DSk		Middle Devonian	
	Dc	Lower Devonian and Upper Silurian	DEVONIAN AND SILURIAN
Unconformity (local conformity in northwestern part of area)			
Sh		Upper, Middle, and Lower Silurian	SILURIAN
	SOuv		SILURIAN OR ORDOVICIAN
Local unconformity			
SOd, SOdgm, SOdcb, SOdcs, SOdv, SOdw	Descon Formation	Lower Silurian to Lower Ordovician	SILURIAN AND ORDOVICIAN

DESCRIPTION OF MAP UNITS[1]

Qa — ALLUVIUM, TIDAL–FLAT MUD, AND GLACIOFLUVIAL DEPOSITS – Only major areas of distribution shown

Pzpd — PORPHYRITIC DIABASE – Phenocrysts of labradorite in a diabasic groundmass. Rock has secondary chlorite and calcite. Amygdules of chlorite and zeolite minerals locally developed. Marginal zones are finer grained

Pzsy — SYENITE – Biotite and hornblende bearing. Potassium-argon isotope age is 276±8 million years (biotite)

IPk — KLAWAK FORMATION (Lower and Middle Pennsylvanian) – Orange-weathering calcareous sandstone and siltstone; minor limestone and chert-pebble conglomerate. Characteristically contains small fusulinids *Fusulina* sp. and *Fusulinella* sp. At locality 66X4B, contains fusulinids *Millerella, Nankinella,* and *Staffella;* (Douglass,1971) also contains abundant productoid brachiopods, corals, bryozoans, and the trace fossil *Spirophyton.* Thickness 500-1,000 feet

PERATROVICH FORMATION (Lower and Upper Mississippian)

Mpl — Limestone member. Thick-bedded massive limestone and minor dolomitic limestone. Black chert nodules and lenses up to 25 percent of section. Limestone composed largely of echinoderm, bryozoan, and foraminiferal fragments and oolites. Lower part of limestone member contains Foraminifera and *Lithostrotionella* sp. fauna of Meramecian age, whereas upper beds of the member (fossil locality 65ACn281) have the coral *Lithostrotion (Siphonodendron)* sp., an endothyrid fauna *(Pseudoendothyra* sp., *Neoarchaediscus* sp., *Bradyina* spp., and *Archaediscus* spp.), and the fusulinid *Eostaffella* sp. of latest Chesterian age (Armstrong, 1970). Thickness 250-300 feet

Mplc — Limestone and chert member. Mainly limestone with grayish-black chert intervals. Chert forms 25-75 percent of section. Limestone is medium to thick bedded, massive, medium gray, and composed of bryozoan, echinoderm, brachiopod, and coral fragments in a lime-mud matrix (fossil locality 65 ACn 292). The corals *Lithostrotionella* spp., *Lithostrotion (Siphonodendron), Thysanophyllum, Diphyphyllum, Sciophyllum, Ekvasophyllum,* and *Faberophyllum,* together with the Foraminifera *Tournayella* and *Septatournayella* indicate a Meramecian age (Armstrong, 1970). Thickness about 400 feet but in places internal folding produces wide outcrop areas. Light color indicates areas inferred to be underlain by this unit; dark color indicates known outcrops

Mpc — Chert member. Thin-bedded grayish-black chert; rare lensoidal layers of medium-dark-gray aphanitic limestone, dolomite, and crinoidal limestone. Very rare brachiopods. Meager fauna of Foraminifera *(Archaediscus* sp. and *Globoendothyra* spp.) (fossil locality 65ACn172) indicate a Meramecian age. Lower part devoid of identifiable fossils; may be as old as Kinderhookian or Osagean. Thickness about 200 feet

Dw — WADLEIGH LIMESTONE (Middle and Upper Devonian) – Medium- to dark-gray, thick- to medium-bedded, massive limestone; minor argillaceous limestone and calcareous shale, especially in upper parts of the formation. Limestone is composed of fragmented shelly fossils in a dark lime-mudstone matrix frequently rich in the spaghetti-shaped stromatoporoid *Amphipora.* Corals and massive stromatoporoids are the most abundant fossils, forming reef-breccia deposits in places. Brachiopods, gastropods, ostracodes, pelecypods, and crinoids in places make up substantial quantities of the coarse fossil detritus in the limestone. Rich coral faunas (fossil locality 64ACn1411), below the brachiopod *Stringocephalus* horizon include *Acanthophyllum Digonophyllum, Arcophyllum, Xystriphyllum, Australophyllum, Loyolophyllum,* and *Yacutiopora,* which indicate a Middle Devonian (Eifelian) age. The following corals that indicate a Late Devonian (Frasnian) age occur in the upper part of the formation (fossil locality 66ACn1451): *Phillipsastrea (Pachyphyllum), Sociophyllum, Thamnopora, Syringoporella* and *Macgeea* (Oliver and others,1975; Tchudinova and others,1974). Thickness about 1,000 feet

Dc — CORONADOS VOLCANICS (Middle Devonian) – Fragmental basaltic volcanic rocks interlayered with massive fossiliferous limestone. Characterized by dark-greenish-gray porphyritic and amygdaloidal pillow basalts that are more or less fragmented and cemented by calcite (aquagene breccias and tuffs). Fragmental lavas range from coarse pillow breccia to fine-grained lithic lapilli tuff. Limestone composed almost entirely of abraded fossil fragments including abundant tabulate corals *(Favosites, Heliolites, Thamnopora,* and *Alveolites)* and massive stromatoporoids. Horn corals, gastropods, crinoids, and brachiopods *(Warranella, Hypothyridina,* and other Devonian forms) less common. This limestone is interlayered with the upper part of the volcanic rocks and is lithicly and faunally similar to the overlying Wadleigh Limestone, indicating that the Coronados is Middle Devonian (Eifelian) in age. Thickness about 500 feet

DSk — KARHEEN FORMATION (Upper Silurian and Lower Devonian) – Sandstone, shale, and pebble, cobble, and boulder conglomerate characterized by red beds, calcareous cement, and crossbedding (commonly of festoon type); locally contains thin- to medium-bedded gray limestone, calcareous pyritic siltstone, and thin-bedded platy limestone. Sandstone, green-gray, gray, and reddish-brown lithic wacke and graywacke. Shale is silty and red or green. Conglomerate clasts vary in lithology; mainly mafic volcanic rocks and greenish-gray chert, but graywacke, siltstone, red chert, quartzite, white quartz, and limestone present. Granitoid clasts are generally rare. In northern part of the area, the Karheen is mainly sandstone and shale that generally lie conformably on Heceta Limestone; in the southern part, the Karheen is dominantly conglomerate and lies with angular unconformity on the Descon Formation. Brachiopods of Late Silurian age have been described from limestone high in the Karheen several miles north of this area (Kirk and Amsden, 1952); however, associated corals and tentaculitids appear to be Early Devonian. To the west and south the graptolites *Monograptus yukonensis, M. pacificus, M. craigensis,* and *M. notoaequabilis,* corals *"Billingsastrea"* sp., *Tryplasma altaica,* and vascular plants *Drepanophycus* sp. and *Hostimella* sp. indicate a late Early Devonian and possibly early Middle Devonian age (Churkin, Eberlein, Hueber, and Mamay, 1969; Churkin, Jaeger, and Eberlein, 1970). Thickness about 6,000 feet. Light color indicates areas inferred to be underlain by this unit; dark color indicates known outcrops

Sh — HECETA LIMESTONE (uppermost Lower Silurian, Middle Silurian, and Upper Silurian) – Massive limestone, mostly thick bedded and sub lithographic. Ranges in color from light to medium dark gray; weathers light gray to buff. Bedding generally indistinct; contains intraformational limestone breccia. Just north of quadrangle, Heceta contains thick lenses of conglomerate and sandstone with a variety of plutonic, volcanic, and sedimentary rock fragments. Contact with the underlying Descon Formation is generally conformable, but limestone detritus resembling the Heceta in polymictic conglomerate that conformably underlies the Heceta in several places indicates that carbonate sediments were deposited, lithified, and eroded during the Early Silurian prior to the main period of Heceta Limestone deposition. Heceta Limestone is richly fossiliferous. Corals, dasycladacean algae, and brachiopods tend to predominate, but stromatoporoids (including *Amphipora*), gastropods, pelecypods (including *Pycinodesma*), bryozoans, trilobites, conodonts, and graptolites also occur. A *Pteros phathodus amorphognathoides* conodont zone fauna near the base of the Heceta indicates a latest Early Silurian (late Llandoverian) age (Ovenshine and Webster, 1970). The age of the upper part of the Heceta, based on conodonts, graptolites, and brachiopods, is Late Silurian (Ludlovian). Thickness varies strikingly over short distances in part due to pre-Karheen erosion (thickness is over 10,000 feet on Heceta Island northwest of map area)

SOuv — UNDIFFERENTIATED VOLCANIC ROCKS OF KOGISH MOUNTAIN AND STANEY CONE – Andesite to basalt porphyry, largely brecciated; andesitic varieties predominate. Forms massive dorne-shaped bodies. Porphyritic with partly saussuritized plagioclase phenocrysts of andesine to labradorite composition, also phenocrysts of clinopyroxene, some greenish-brown amphibole, and rare biotite. Abundant albite and quartz developed in fine-grained groundmass during deuteric alteration and late stages of consolidation. Heceta(?) Limestone (Sh?) interbedded with the volcanic rocks forming Staney Cone contains abundant chain coral species of *Catenipora* that range in age from late Middle Ordovician (Caradocian) to Upper Silurian (Ludlovian) and rugose corals that are more likely Middle and Upper Silurian than older (W. A. Oliver, Jr., written commun., 1972). This paleontologic dating is consistent with potassium-argon ages obtained on pyrogenic amphiboles from volcanic rocks 1.3 miles south of Staney Cone (438±13 m.y.) and along the southeast shore of Big Salt Lake (442±13 m.y.) (J. Von Essen, written commun., 1972). We believe that these rocks represent part of a lower Paleozoic volcanic island arc that furnished volcanic material to adjacent Lower Silurian and possibly Upper Ordovician intra-arc troughs and, on its fringes, provided a shallow-water environment in which various types of reef and carbonate-bank deposits developed. Light color indicates areas inferred to be underlain by this unit; patterned,dark color indicates known outcrops

SOd — DESCON FORMATION (Lower Ordovician through most of the Lower Silurian) – Mainly graywacke and mudstone with interbedded basaltic volcanic rocks, conglomerate, sedimentary breccia, chert, shale, and sandstone. Abundant graptolites collected mainly from different horizons of the chert and siliceous shale lithofacies, indicate that the Descon ranges from Early Ordovician (Arenigian) through the Middle Ordovician (Caradocian), Upper Ordovician (Ashgillian), and most of the lower Silurian (Llandoverian) (Churkin and Carter, 1970). Thickness at least 10,000 feet. Base not exposed. Light color indicates areas inferred to be underlain by this unit; dark color indicates known outcrops. Locally divided into five units as shown below:

SOdgm — Graywacke and banded mudstone – Graywacke is dark-greenish-gray, medium- to coarse-grained, poorly sized sandstone composed of mineral and rock fragments set in a chloritic matrix. Generally thick bedded and massive; graded bedding and rare cross laminae are developed, especially in the thinner beds. Banded mudstone interbedded with the graywacke occurs as rhythmically alternating thin beds of olive-gray to grayish-black siltstone and very fine grained sandstone. Light color indicates areas inferred to be underlain by this unit; dark color indicates known outcrops

SOdcb — Conglomerate and sedimentary breccia – Composition ranges from those with wholly volcanic (mainly basaltic but also felsitic) fragments to polymictic varieties with megaclasts of chert, graywacke, gabbro, granitic rocks, and, rarely, limestone

SOdcs — Black chert and siliceous shale – Thin-bedded chert and silty siliceous shale that has graptolitic shale partings and minor lenses of dark-gray fine-grained nonfossiliferous limestone. Large collections of Middle Ordovician (Caradocian) graptolites have been made from this unit in the Big Salt Lake area (fossil localities 65ACn582, 64ACn1361) and in the Cruz Pass area (fossil locality 65AE17)

SOdv — Basaltic volcanic rocks – Medium-olive-gray basalt flows, breccias, and tuff with locally developed pillow structure. Mineralogically characterized by stubby pyroxene phenocrysts (diopsidic augite) and lathlike plagioclase generally in the range An_{36-48} (andesine)

SOdw — Quartzo-feldspathic wacke – Impure gritstone to fine-grained sandstone rich in feldspar and containing 5-15 percent partly rounded clear quartz grains with bipyramidal terminations. Fresh surfaces are various shades of pistachio green (due mainly to secondary epidote in the matrix); weathered surfaces orange brown. Light color indicates areas inferred to be underlain by this unit; dark color indicates known outcrops

• 64ACn1361
KEY FOSSIL LOCALITIES–See "Description of map units" for fossil lists. Numbers refer to USGS field book station numbers

[1] See Eberlein and Churkin (1970) for detailed description and correlation of Paleozoic formations

Note.—Commonly used geologic symbols are printed on the map jacket; a separately printed list is available on request from the U.S. Geological Survey

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Base from U.S. Geological Survey, 1949
Universal Transverse Mercator projection, 1927 North American datum. 10,000-foot grid based on Alaska coordinate system, zone 1. 1000-metre Universal Transverse Mercator grid ticks, zone 8, shown in blue

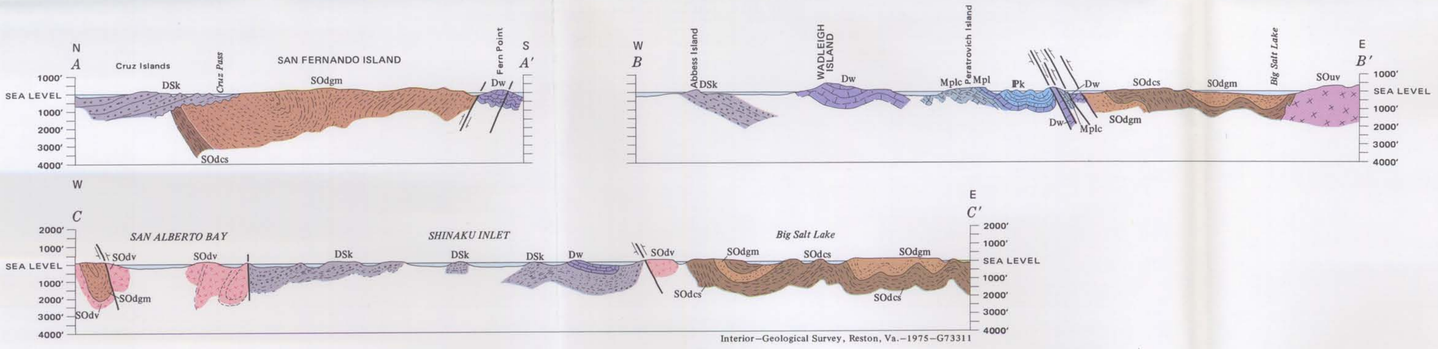
APPROXIMATE MEAN DECLINATION, 1975

SCALE 1:63 360
1 ½ 0 1 2 3 4 5 MILES
1 .5 0 1 2 3 4 5 6 7 KILOMETRES

CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL.
DEPTH CURVES IN FEET-DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE AVERAGE RANGE OF TIDE IS APPROXIMATELY 8 FEET

QUADRANGLE LOCATION

Geology by Michael Churkin, Jr., and G. D. Eberlein, 1965-66, and A. T. Ovenshine, 1965



GEOLOGIC MAP OF THE CRAIG C-4 QUADRANGLE, ALASKA

By

Michael Churkin, Jr., and G. Donald Eberlein

1975

For sale by U.S. Geological Survey, Fairbanks, Alaska 99701; Denver, Colo. 80225; or Reston, Va. 22092, price $1.00

Interior–Geological Survey, Reston, Va.–1975–G73311