DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

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OPEN FILE MAP
78-120 A

FOLIO OF THE AMBLER RIVER QUADRANGLE, ALASKA

MAYFIELD - TAILLEUR GEOLOGY MAP

BASE BY U.S. GEOLOGICAL SURVEY, 1956

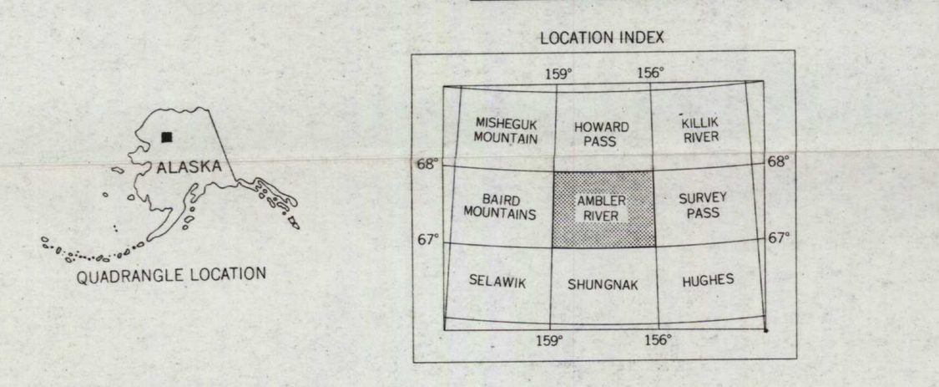
SCALE 1:250 000

5 0 5 10 15 20 25 MILES

5 0 5 10 15 20 25 KILOMETERS

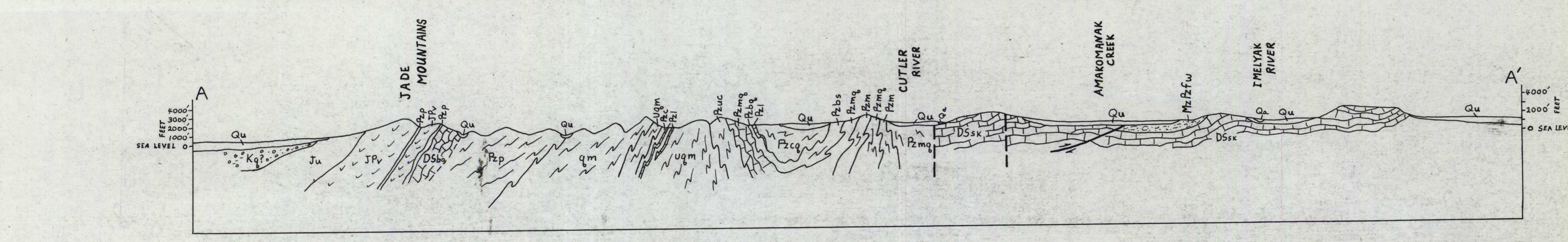
CONTOUR INTERVAL FEET
DATUM IS MEAN SEA LEVEL

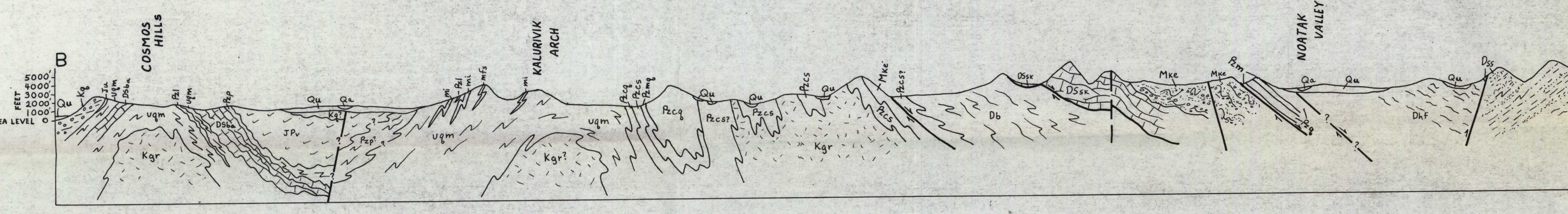
This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards and nomenclature.



This map represents the combined efforts of several geologists. Compilation of the geology of the southern schist belt appears in this map with only minor modification from Pessel and Brosgé (1977). The following is the list of geologists who have made significant contributions to the geologic mapping of the Ambler River quadrangle: from the U.S. Geological Survey - W.P. Brosgé, 1974, 73, 66, 65; C.F. Mayfield, 1976; T.P. Miller, 1966, 65; W.W. Patton, 1966, 65; H.N. Reiser, 1966; I.L. Tailleur, 1976, 74, 73, 72, 65, 58, 55; and from the Alaska Division of Geological and Geophysical Surveys - G.R. Eakins, 1972; C.E. Fritts, 1972, 71, 70, 69; R.E. Garland, 1972; G. H. Pessel, 1974, 73, 72.

CROSS SECTIONS AMBLER RIVER QUADRANGLE



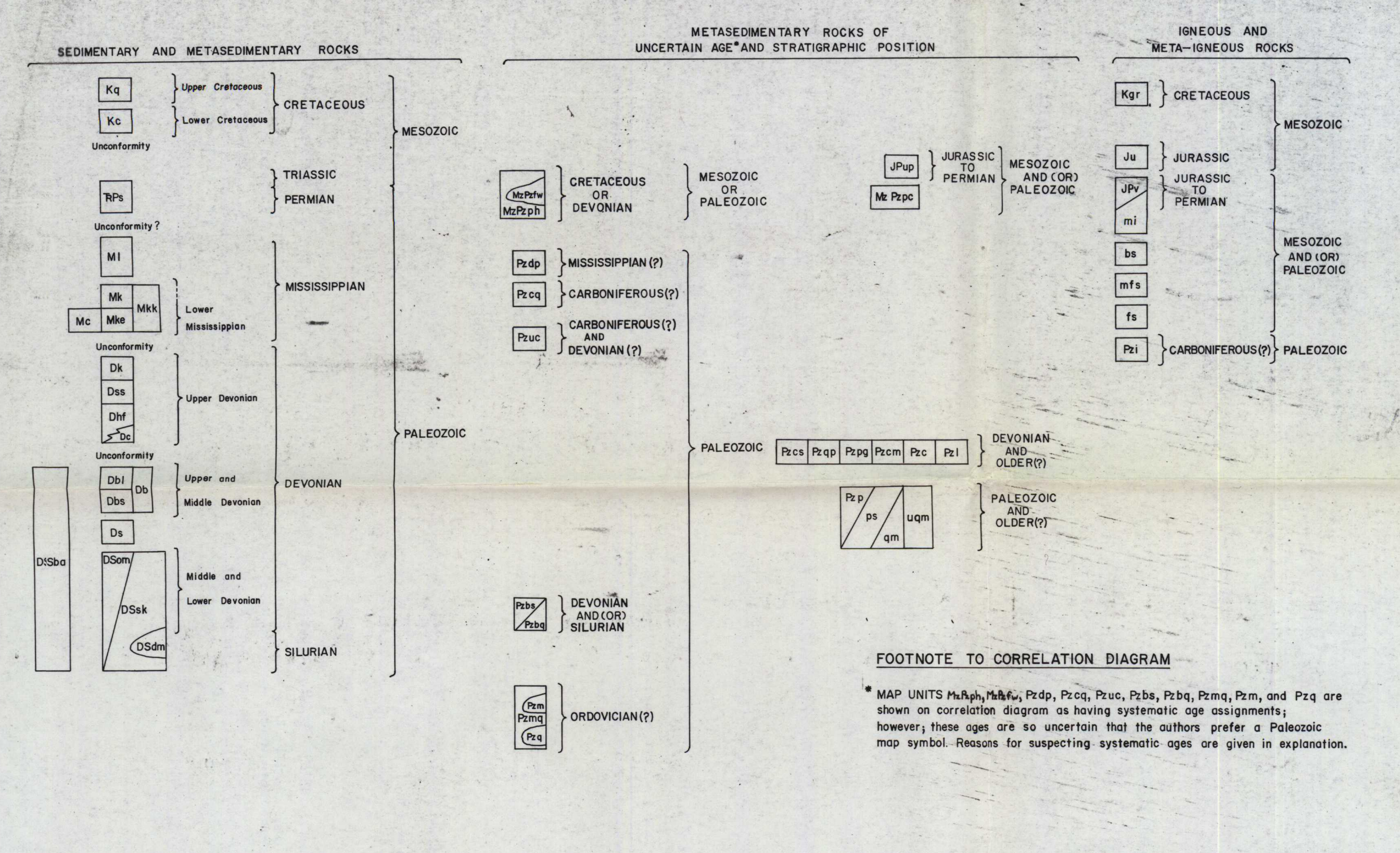


BEDROCK GEOLOGY MAP OF THE AMBLER RIVER QUADRANGLE, ALASKA

BY C.F. MAYFIELD AND I.L. TAILLEUR

1978

CORRELATION OF MAP UNITS



FOOTNOTE TO CORRELATION DIAGRAM

* MAP UNITS MzPzph, MzPzfw, Pzdp, Pzcq, Pzuc, Pzbs, Pzbq, Pzmq, Pzm, and Pzq are shown on correlation diagram as having systematic age assignments; however, these ages are so uncertain that the authors prefer a Paleozoic map symbol. Reasons for suspecting systematic ages are given in explanation.

EXPLANATION OF MAP SYMBOLS

Contact - Dashed where approximately located

Fault - Dashed where approximately located; dotted where concealed

Thrust Fault - Dashed where approximately located; dotted where concealed

Strike and dip of beds
- 25 Inclined
- Horizontal
- Vertical
- Overturned

Strike and dip of foliation
- 60 Inclined
- Vertical

30 Apparent strike and dip of bedding or prominent foliation

Anticline - Showing trace of axial plane and plunge of axis, dashed where approximately located; dotted where concealed

Syncline - Showing trace of axial plane and plunge of axis; dashed where approximately located

METAMORPHISM

Most rocks of the Ambler River quadrangle were regionally metamorphosed in the Cretaceous. Maximum recrystallization occurs in a broad linear zone stretching approximately east-west in the south central part of the mountainous belt. Metamorphic gradient declines progressively near the flanks of the mountains adjacent to the Kobuk and Noatak River valleys. The highest grade of metamorphism is generally in the greenschist facies, but low pressure amphibolite facies metamorphism occurs locally in thermal aureoles around some granitic plutons. The age of rock units shown on the map is the age of their deposition or intrusion, not metamorphism.

DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Qa ALLUVIAL DEPOSITS (Quaternary)--Boulders, gravel, and sand. Includes both active alluvium along larger stream courses and inactive alluvium under flood plains anchored by low willows and grasses.

Qu UNDIFFERENTIATED SURFICIAL DEPOSITS (Quaternary)--Veneer of tundra soils overlying unconsolidated glacial drift, morainal deposits, and old glacial stream outwash. Slope wash, solifluction creep surfaces, talus, and glacial terrace deposits predominate in more mountainous areas. Fluviolacustrian deposits of mud and organic material occur in lowlands under lakes, ponds, and marshes. The Great and Little Kobuk Sand Dunes in southwest corner of quadrangle consist predominantly of clean white sand.

SEDIMENTARY AND METASEDIMENTARY ROCKS

Kq QUARTZ CONGLOMERATE (Upper Cretaceous)--Conglomerate composed chiefly of white quartz pebbles in a quartzose and micaceous matrix; pebbles of phyllite, schist, greenstone, and chert in subordinate amounts. Interbedded quartzose and micaceous sandstone and mudstone. Local thin coal seams in outcrops along lower Ambler River. Lower part of unit exposed on flanks of Cosmos Hills has undergone low-grade dynamic metamorphism resulting in stretched and flattened conglomerate clasts, and sandstone and mudstone altered to semischist and phyllite (Patton and others, 1968).

Kc IGNEOUS PEBBLE-COBBLE CONGLOMERATE (Lower Cretaceous)--Massive poorly stratified and poorly sorted conglomerate composed of pebble- to cobble- size clasts of mafic extrusive rocks in a graywacke and mudstone matrix. Clasts of chert and limestone locally abundant (Patton and others, 1968).

ꝶPs SADLEROCHIT GROUP (Triassic and Permian)--Reddish brown weathering, fine-grained sandstone and quartzose siltstone grading to black phyllitic shale. Well-bedded but strongly folded and faulted. Crops out adjacent to Lisburne Group (Ml) in a structurally complex area at the headwaters of the Ipnelivik River (T. 23 & 24 N., R. 12 E.).

Ml LISBURNE GROUP (Mississippian)--Medium to thick well-bedded dolomite and limestone with local black chert nodules and thin irregular chert beds, especially near the base. Locally metamorphosed to marble and strongly sheared. Brachiopods, crinoids, and corals, Lithostrotionella sp. and Thysanophyllum sp. (Mississippian, probably Meramecian) occur in unmetamorphosed rocks. May be equivalent to Lisburne rocks exposed along north side of Mount Doonerak in Wiseman quadrangle (Armstrong and others, 1976). Best exposures crop out in headwaters of Ipnelivik River (T. 24 N., R. 12 E.). Isolated outcrops of unfossiliferous carbonate rocks containing numerous black chert nodules along south edge of Brooks Range are inferred to be Lisburne.

Mk KAYAK SHALE (Lower Mississippian)--Black carbonaceous slate and phyllite with a few thin interbeds of rusty to orange weathering fossiliferous limestone. In many places unit is sheared, isoclinally folded and exhibits crenulation cleavage. Thickness ranges from a few meters to more than 100 meters because of structural complexities. Crinoids, horn corals, brachiopods, molluscs, and eight genera of conodonts (probably early Osagean) come from rusty weathering limestone beds. Gradational at base into coarser clastic rocks of Kekiktuk Conglomerate (Mke). Exposures are at headwaters of Ipnelivik River and Komakak Creek drainages.

Mke KEKIKTUK CONGLOMERATE (Lower Mississippian)--Fine- to coarse- grained quartzite and quartz conglomerate. Clasts are well-rounded gray chert, quartz, and quartzite as much as 10 cm in diameter. Red, green, and gray phyllite and rare sandy weathering carbonate beds occur throughout unit. Top part of unit consists of black quartzite and phyllite. Total thickness is more than 100 m. Basal contact is a major (angular?) unconformity.

Mkk KAYAK SHALE AND KEKIKTUK CONGLOMERATE (Lower Mississippian)--Intercalated quartzite, conglomerate, and phyllite exposed in a structurally complex area at headwaters of Ipnelivik River (T. 23 & 24 N., R. 12 E.).

Mc QUARTZ CONGLOMERATE (Lower Mississippian)--Stretched clasts of milky quartz, varicolored chert, quartzite, and gray slate chips in a quartz-muscovite matrix comprise 90 percent of unit. Remainder of unit is coarse-grained quartzite and red and green phyllite. Apparent thickness ranges from 5 to more than 70 m. Overlain only by thrust faulted Devonian and older sedimentary rocks. Nearby in Baird Mountains quadrangle, the unit is overlain by either a thinner section of Kayak Shale and Lisburne Group or by rhyolite. Basal contact is a major (angular?) unconformity, and nonfaulted contacts rest upon a variety of older Paleozoic rock types. Similar to Kekiktuk Conglomerate (Mke) but is thinner, more conglomeratic, and crops out less continuously.

Dk KANAYUT CONGLOMERATE (Upper Devonian)--Medium- to thick-bedded clean quartzite and conglomerate. Clasts include milky quartz and gray quartzite. Slate and siltstone increased downward in section. Locally contains 1 to 5 cm thick beds of sandy calcareous tan weathering and somewhat fossliferous lenses. Basal contact is gradational. Poorly preserved crinoids and brachiopods occur in sandy calcareous layers near base. Exposures are recognized only on top of ridge east of Midas Creek (T. 28 N., R. 13 E.)

Dss SANDSTONE, SILTSTONE, AND SLATE (Upper Devonian)--Upper third of unit is predominantly fine-grained sandstone with a moderate amount of clay matrix. Lower two-thirds of unit is interbedded fine grained sandstone, siltstone, slate, and minor thin lenses of tan weathering gritty limestone with crinoid fragments. More than 300 m thick where best exposed on ridges flanking Midas Creek. Basal contact is gradational with Hunt Fork Shale (Dhf).

Dhf HUNT FORK SHALE (Upper Devonian)--Homogeneous gray phyllite. Upper half of unit contains a few thin interbeds of fine-grained siltstone. More than 600 m thick in mountains flanking Noatak River valley. Base is either gradational into chloritic siltstone and conglomerate (Dc) or in sharp contact with calcareous rocks of unit Db. No fossils have been found from Hunt Fork Shale (Dhf) in the quadrangle; however, farther east corals, brachiopods, mollusks, and gastropods of late Late Devonian age are reported (Brosgé and Pessel, 1977).

Dc CHLORITIC SILTSTONE AND CONGLOMERATE (Upper Devonian)--Gray green metasiltstone and gray phyllite. Interbedded quartz pebble and slate chip conglomerate beds, 1 to 3 m thick, occur in lower half of unit. Microscopically well foliated quartz-chlorite-sericite schist. Thickest near mountain front south of Noatak River and wedges out within a short distance northward. Overlies limestone or calcareous schist. Crinoids, brachiopods, and corals of probable Devonian age from lithologically and stratigraphically similar rocks in Survey Pass quadrangle have been reported (Brosgé and Pessel, 1977).

Dbl BLACK LIMESTONE AND CALCAREOUS SCHIST (Upper and Middle Devonian)--Black or gray medium- to thin-bedded limestone intercalated with thin-bedded graphitic calcareous schist. Minor graphitic phyllite occurs as smeared out layers between thin carbonate beds. Where erosion has formed steep slopes with good exposures, groundwater leaching develops a characteristic white surficial precipitate crust composed of dolomite and soluble salts epsomite ($MgSO_4 \cdot 7H_2O$) and hexahydrite ($(Mg_{32}Zn_{15}Fe_{13})SO_4 \cdot 6H_2O$). As much as 150 m thick along Noatak River valley. Best exposures are found at mouth of Tunukuchiak and Nushralutak Creeks.

Dbs BLACK SILICEOUS PHYLLITE (Upper and Middle Devonian)--Thin-bedded carbonaceous phyllite and impure chert. Usually less than 20 m thick in exposures along Noatak River valley; however, it is nearly 200 m thick at headwaters of Ipnelivik and Igning Rivers. May be in part equivalent to black phyllite and siliceous phyllite (Pzbs) mapped in western part of quadrangle.

Db BLACK LIMESTONE, CALCAREOUS SCHIST, AND BLACK SILICEOUS PHYLLITE UNDIVIDED (Upper and Middle Devonian)--Brachiopods of late Middle or early Late Devonian age occur in less metamorphosed, stratigraphically equivalent rocks in Survey Pass quadrangle (Brosgé and Pessel, 1977). Similar rocks extend eastward more than 100 km (Brosgé and Reiser, 1971). Local stratabound pyrite zones contain high zinc geochemical anomalies.

Ds SILTSTONE AND SLATE (Devonian)--Thin-bedded siltstone and slate with intercalated sandstone beds. Lower part of unit is mostly calcareous siltstone with a few thin limestone beds. Locally contains turbidite textures, flute casts, and graded beds. Less than 300 m thick. Gastropods, bryozoans, brachiopods, and Silurian or Devonian branching favositid corals are present. Unconformably underlies quartz conglomerate (Mc) and overlies Skajit limestone (DSsk) at the only recognized localities east and west of Kavachurak Creek.

DSba BAIRD GROUP (Devonian and Silurian?)--Massive light gray reefoid limestone and dolomite with local thin interbeds of calcareous phyllite. Includes tabulate and rugose corals, stromatoporoids, brachiopods, and gastropods (Patton and others, 1968) of Devonian and possible Silurian age (Oliver and others, 1975).

DSom ORANGE MARBLE (Devonian and Silurian)--Orange weathering, medium- to coarse- grained chloritic marble, locally highly sheared. Contains boudins and sills of chloritic greenstone (Pessel and Brosgé, 1977).

DSsk SKAJIT LIMESTONE (Devonian and Silurian)--Dark to light gray, thick-to massively-bedded limestone and dolomite usually recrystallized to marble and in many places more than 700 m thick. Contains corals, Favosites sp. and Tryplasma sp., of Devonian or Silurian age; Amphipora sp., Devonian or Silurian age, and gastropods (Oliver and others, 1975). Contains Devonian and Silurian fossils both east and west of the map area.

DSdm DARK GRAY MARBLE (Devonian or Silurian)--Dark gray weathering, strongly recrystallized marble apparently occurs locally in lower part of Skajit Limestone (DSsk) on the upper Cutler River (T. 25 N., R. 3 E.). More than 300 m thick. Contains massive stromatoporoids of probable Devonian or Silurian age. May represent a local reef facies.

METASEDIMENTARY ROCKS OF UNCERTAIN AGE AND STRATIGRAPHIC POSITION

MzPzph PHYLLITE AND SILTSTONE--A thick unit of gray thin bedded phyllite with few interbeds of calcareous siltstone and rare thin-bedded limestone. Some siltstone contains a high proportion of detrital plagioclase and is gradational with feldspathic wacke (MzPzfw). Mapped only in northwest part of quadrangle.

MzPzfw FELSPATHIC WACKE--Calcareous feldspathic volcanic wacke containing a few intercalated phyllite and limestone beds. Mostly fine-grained gray green sandstone and siltstone with local conglomerate clasts as much as 1 m in diameter. Detrital grains commonly consist of quartz, plagioclase, diabase, chert, limestone, phyllite, and more rarely garnet. Although this unit underlies quartz conglomerate (Mc) in eastern Baird Mountains quadrangle, it is lithologically similar to Cretaceous wacke farther north and may be Cretaceous.

Pzdp DARK PHYLLITE--Dark gray carbonaceous phyllite with a few thin intercalated limestone beds. Overlies quartz conglomerate (Mc) and may be equivalent to Kayak Shale (Mk). Mapped from only a few outcrops along lower Nanielik Creek in northwest part of quadrangle.

Pzcq CHLORITIC QUARTZITE--Consists of two different rock types that look similar in hand specimen. These are quartz-muscovite-chlorite paragneiss and albite-quartz-muscovite-chlorite orthogneiss. Paragneiss constitutes most of unit. It is massive to thick-bedded, clean, and usually light greenish gray quartzite with local thin quartz pebble conglomerate beds. Orthogneiss makes up a major part of unit in some places and is thin or absent in others. Igneous composition is mostly quartz diorite but locally is granodiorite. Lateral stratigraphic extent indicates a volcanic origin for orthogneiss. Intermediate igneous rocks (Pzi) probably are genetically related. May correlate with similar less metamorphosed Carboniferous coarse clastic-volcanic sequence in northeast Baird Mountains quadrangle. The unit extends more than 300 km into adjacent Survey Pass and Baird Mountains quadrangles.

Pzuc UNDIFFERENTIATED CHLORITIC QUARTZITE AND SCHIST--Mostly greenish gray quartz-chlorite-albite ± calcite schist that commonly includes feldspathic orthogneiss. Lesser amounts of undifferentiated quartz-mica schist, quartzite, marble, and calcareous schist may represent tectonic slivers of marble and quartzite (Pzmq), calc-schist (Pzcs), chloritic marble (Pzcm), undifferentiated quartz-mica schist (uqm), and intermediate igneous rocks (Pzi). In part equivalent to chloritic quartzite (Pzcq).

Pzbs BLACK PHYLLITE AND SILICEOUS PHYLLITE--Fine-grained gray to dark gray carbonaceous phyllite. Local siliceous zones may appear as black chert. Silurian graptolites are found in dark slate east of lower Nanielik Creek. Probably in part equivalent to black siliceous phyllite (Dbs). Occurs in a variety of stratigraphic positions and may represent several different rock units of similar lithology.

Pzbq BLACK QUARTZ-MICA SCHIST--Black fine-grained quartzose schist. Quartz and graphite commonly segregated along principal foliation planes. Thought to be a more completely recrystallized and higher grade metamorphic equivalent to black phyllite and siliceous phyllite (Pzbs).

Pzmq MARBLE AND QUARTZITE--Complex stratigraphic and structural unit composed of clean white fine-grained quartzite interbedded with marble or limestone. Contains varying amounts of gray phyllite, siltstone, and quartz-mica ± chlorite schist. Lithologic changes occur every few centimeters or over tens of meters. Lower to Middle Ordovician graptolites occur in similar rocks along strike 15 km west in Baird Mountains quadrangle (Tailleur and Carter, 1975). Along western edge of quadrangle marble and interbedded schist predominate. Quartzite (Pzq) and marble (Pzm) are mapped separately where possible.

Pzm MARBLE--Gray, buff or red weathering, light-gray, and commonly dolomitic marble. May include a few intercalated quartzite and quartz-muscovite-chlorite schist beds along western Natmotirok Creek and east of mouth of Ipnelivik River.

Pzq QUARTZITE--Clean white or gray, fine-grained quartzite weathering orange and yellow. Covered by black lichen in many places. May also include subordinate quartz-mica schist or gray phyllite. Usually massively bedded where lithologically homogeneous.

JPup UNDIFFERENTIATED PHYLLITE AND MAFIC IGNEOUS ROCKS--Gray phyllite interbedded or structurally mixed with mafic igneous rocks (Pessel and Brosgé, 1977). Mapped only in southeastern part of quadrangle.

MzPzpc PHYLLITE AND CHERT--Thin-bedded and fine-grained intercalated phyllite, black chert, and feldspathic wacke. Overlies or interfingers with phyllite (Pzp) between Miluet Creek and Redstone River. May be, in part, as young as Late Jurassic or Early Cretaceous but most is probably Paleozoic.

Pzcs CALC-SCHIST--Buff weathering calcite-quartz-muscovite-chlorite ± albite schist. Noncalcareous layers constitute a minor part of unit. Includes lesser greenstone and marble. Green and brown siltstone and pebbly quartzite are intercalated at top of visible section east of upper Imelyak River.

Pzqp QUARTZ PHYLLITE--Light gray, fine- to medium-grained quartzite interbedded with brown and gray phyllite (Pessel and Brosgé, 1977). Mapped only at east edge of quadrangle.

Pzpg CHLORITIC PHYLLITE AND GREENSTONE--Gray and green phyllite, calcareous schist, thin dolomite, black quartzose schist, and irregular lenses and pods of mafic igneous rocks (mi). May include tectonic slivers of marble (Pzl), calc-schist (Pzcs), and black quartz-mica schist (Pzbq). Calc-silicate hornfels developed near granitic rocks on upper Ipnelivik River. Mapped only near east edge of quadrangle.

Pzcm CHLORITIC MARBLE--Mostly orange weathering chloritic marble. Lithologically similar to orange marble (DSom) but distinguished because it is spacially separated and apparently stratigraphically different.

Pzc CALCAREOUS QUARTZ-MICA SCHIST--Brown weathering quartz-muscovite-calcite ± chlorite ± albite schist. Lithologically similar to calc-schist (Pzcs); but, unit is much thinner, lacks clean intercalated marble, and occurs in a different stratigraphic setting.

Pzl UNDIFFERENTIATED, LIMESTONE AND MARBLE--Light gray coarse- to fine-grained limestone. In many places recrystallized to marble and faulted into discontinuous contorted lenses. Probably includes rocks of many different ages.

Pzp PHYLLITE--Lithologically homogeneous brown and gray phyllite or slate composed of fine-grained quartz and sericite. Most of it is thought to be Paleozoic and upper part may be as young as early Mesozoic.

ps PHYLLITIC SCHIST--Lithologically homogenous gray fine-grained schistose phyllite with thin quartz segregations between phyllitic schist layers. Consists of sheared and isoclinally folded rocks microscopically composed of quartz-sericite ± chlorite. Compositionally similar to phyllite (Pzp) and massive quartz-mica schist (qm), and it is probably of intermediate metamorphic grade.

qm MASSIVE QUARTZ-MICA SCHIST--Lithologically homogeneous massive weathering quartz-mica schist. May include variable amounts of chlorite, albite, graphite, tourmaline, and garnet. White quartz veins are locally abundant. Sheared and isoclinally folded.

uqm UNDIFFERENTIATED QUARTZ-MICA-SCHIST--Predominantly quartz-mica schist (qm) or phyllitic schist (ps). Locally includes tectonic slivers of chlorite schist, greenstone, feldspathic schist, and marble.

IGNEOUS AND META-IGNEOUS ROCKS

Kgr META-GRANITE (Cretaceous)--Metamorphosed granitic plutonic rocks with roughly equal proportions of quartz, K-feldspar, and plagioclase, strongly to weakly metamorphosed and possessing a low color index. Usually recrystallized to quartz-K-feldspar-albite-muscovite ± biotite orthogneiss. Small sporadic skarn zones developed in calcareous rocks near contacts. Three K-Ar dates from the pluton at head of Kogoluktuk River are: muscovite-98.8 m.y. (Pessel and others, 1973), muscovite-97.9 m.y., and biotite-93.6 m.y. (Turner and others, 1978).

Ju ULTRAMAFIC ROCKS (Jurassic)--Sheared serpentinite locally mixed with basaltic rocks in Cosmos Hills. Partly serpentinized peridotite and dunite in the Jade Mountains and lower Hunt River areas. Locally contains asbestos and soapstone. Rare nephrite jade occurs in Jade Mountains and Cosmos Hills.

JPv MAFIC VOLCANIC ROCKS (Jurassic to Permian)--Strongly indurated hypabyssal and sea floor diabase and basalt. Contains local chert deposits. Some basalts have pillow structures. Mostly Jurassic to Permian and may be in part as old as Devonian in the Cosmos Hills (Fritts, 1970).

mi METAMAFIC IGNEOUS ROCKS--Predominantly greenstone derived from either diabase or basalt. Most rocks are believed to be either dikes or sills. Pillow structures occur in mafic rocks from terrane of felsic schist (fs, fms) and probably indicate some sea floor volcanism (Wiltse, 1975). Composed of actinolite-albite-chlorite-sphene-calcite ± epidote in areas of highest grade metamorphism. Locally contains glaucophane with K-Ar dates ranging from 1 to .6 billion years (Turner and others, 1978) in southern half of metamorphic belt. Contains visible diabasic and basaltic textures with relict igneous augite partly altered to actinolite and chlorite in areas of lower metamorphic grade. Probably in part equivalent to mafic volcanic rocks (JPv).

bs BIOTITE SCHIST--Plagioclase-quartz-biotite-schist. May be metamorphosed quartz diorite. Mesozoic or older.

mfs MEGACRYSTIC FELSIC SCHIST--Quartz-albite-muscovite ± feldspar ± biotite schist. Megacrysts of quartz and K-feldspar are thought to be either recrystallized phenocrysts or porphyroblasts. Interpreted to have volcanic and hypabyssal intrusive origin by Wiltse (1975). Equivalent igneous compositions range from quartz diorite to granite. Closely related in origin to felsic schist (fs) and locally associated with high grade massive sulfide deposits.

fs FELSIC SCHIST--Mostly quartz-albite ± muscovite ± K-feldspar ± biotite schist. Distinguished from megacrystic felsic schist (mfs) by being less schistose, nonmegacrystic, finer grained, and massive in part. Probably metamorphosed granitic hypabyssal and volcanic rocks.

Pzi INTERMEDIATE IGNEOUS ROCKS--Quartz-albite-muscovite ± stilpnomelane ± K-feldspar schist thought to be metamorphosed igneous rocks ranging from granodiorite to quartz diorite in composition. Occurrences at head of Imelyak and Akillik Rivers are similar to orthogneiss included in chloritic quartzite (Pzcq). The upper Imelyak River locality appears to have, in part, volcanic textures, and those from Ipnelivik River are plutonic and porphyritic.

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