UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

EXPLANATION TO ACCOMPANY RECONNAISSANCE GEOLOGIC MAP OF SOUTH-CENTRAL MISHEGUK MOUNTAIN QUADRANGLE, ALASKA

By

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature

INTRODUCTION

This map is one of a series of three reconnaissance geologic maps of the southern Misheguk Mountain quadrangle (fig. 1). Because the geology in all three map areas is similar, a composite map explanation has been designed to facilitate their combined use and provide the reader with a better perspective of the regional geology. There are some rock units and allochthons which do not occur on all three maps. For this reason, the explanation contains more rock units than occur on any one map. Rock units which appear on the accompanying map are indicated by an asterisk beside the map symbol in the explanation.

Devonian to Cretaceous sedimentary rocks make up most of the bedrock in the southern part of the Misheguk Mountain quadrangle. We believe that these rocks were originally laid down as sedimentary deposits on an extensive continental platform located south of the present day Brooks Range. Marine deposition appears to have been nearly continuous, with only minor interruptions, from the Devonian through Middle Jurassic. Late Devonian rocks comprise two distinct and coeval sedimentary successions. One is mostly composed of shallow water limestone and dolomite, mapped as the Baird Group, and the other is a near shore clastic wedge, mapped as the Noatak Sandstone, Kanayut Conglomerate, and Hunt Fork Shale. Mississippian rocks record a variety of sedimentary facies including shallow water limestone and clastic rocks, mapped as the Kogruk, Utukok, and Nuka Formations, and basinal shale, chert, and micritic limestone, mapped as the Kayak Shale, Kuna Formation, Tupik Formation, black chert, and black chert and limestone. The rapid facies changes in Late Mississippian rocks may have been produced by aulacogen development across the previously formed Devonian and early Mississippian continental platform. We suspect that the middle or late Carboniferous was the time in which the granitic source area for the arkose in the Nuka Formation was rifted away from the south edge of the platform leaving behind a wide continental shelf on which Pennsylvanian and younger sedimentary rock materials were deposited.

A major change occurred during the Late Mississippian or Pennsylvanian as clastic and shallow water carbonate sedimentation ceased, and a condensed succession of deep water sedimentary materials was deposited. From Pennsylvanian to Middle Jurassic, radiolarian chert and siliceous shale of the Etivluk Group (Mull and others, 1982) were deposited over all the older sedimentary rocks of the shelf. During the Late Jurassic and Early Cretaceous another major change in sedimentation occurred as this old continental shelf was broken up and successively superimposed in broad allochthonous sheets during the Brooks Range orogeny. In the early stages of the orogeny two distinct suites of igneous rocks predominantly composed of either pillow basalt, mapped as the Copter igneous sequence, or peridotite and layered gabbro, mapped as the Misheguk igneous sequence, were thrust on top of the sedimentary rocks of the shelf. The new mountain range shed extensive flyschoid deposits of mudstone and graywacke on its north and south flanks. The sedimentary materials that were deposited on the north side of the Brooks Range are called the Okpikruak Formation. As the area affected by tectonism grew larger, many of the Early Cretaceous flyschoid deposits, with possible olistoliths composed of older rocks (Mull and others, 1976; Mull, 1979), also became greatly deformed and displaced by thrust faults.

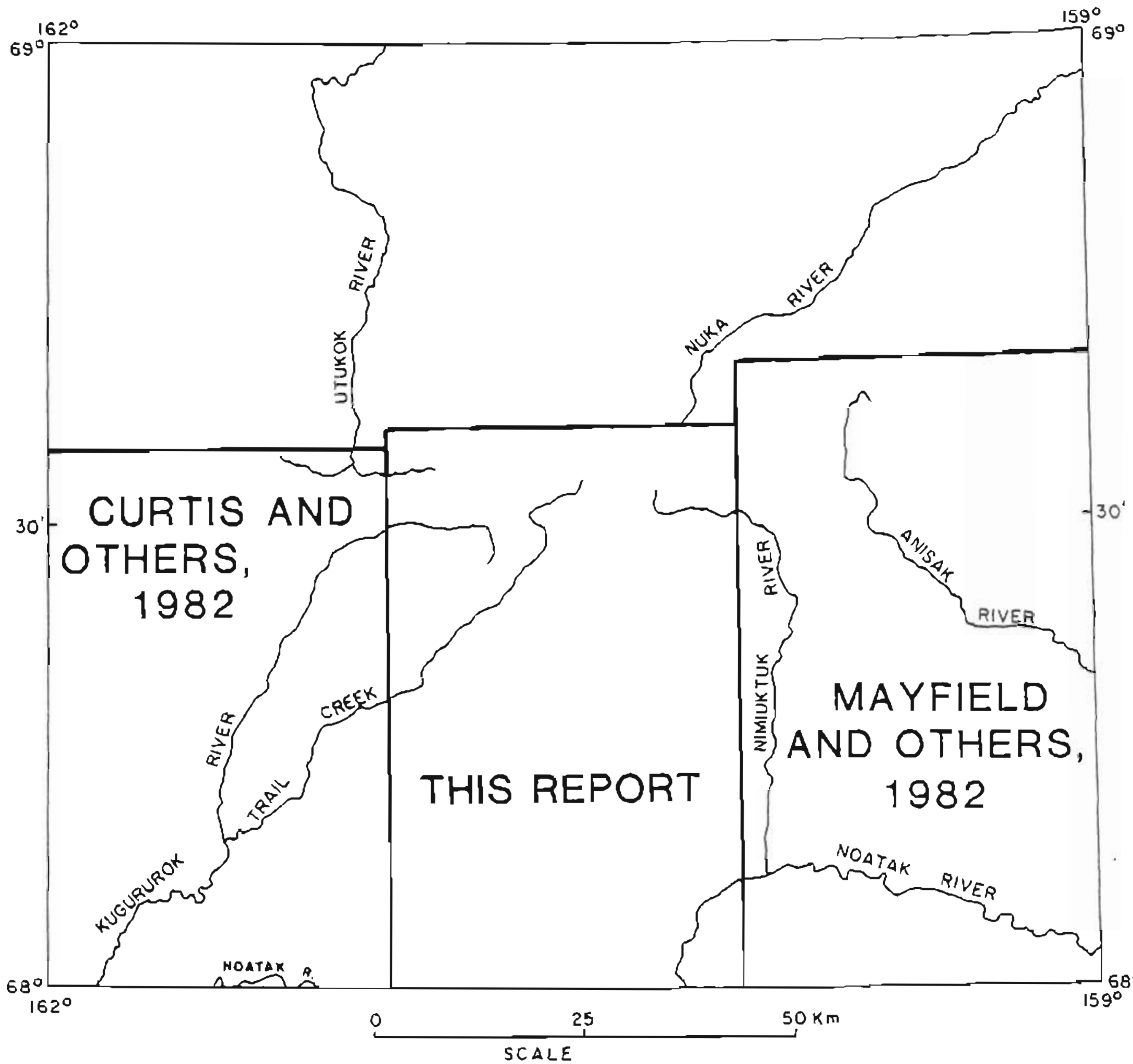


Figure 1.--Location of the Misheguk Mountain quadrangle, this map, and the two adjacent maps of this series.

The Late Jurassic and Early Cretaceous orogeny produced numerous thrust faults with up to tens of kilometers displacement. In localized areas where thrust faults are closely spaced, the structure is so complex that the terrane can be characterized as a "broken formation" (Hsu, 1968). The direction of thrust juxtaposition occurred such that upper thrust sheets traveled relatively northward over lower sheets. Total displacement of rock units across thrust faults was great enough to superimpose coeval rocks of different sedimentary facies so that rock units in one thrust sheet may be lithologically different from coeval rock units above and below. This is especially evident in Mississippian rocks which appear to have had more complex facies patterns in their original basins of deposition than younger rock units. Numerous tight folds, many with southward-dipping axial planes, were also developed in the rocks during the thrusting period. After the time of major thrust displacement (post late Albian), additional tectonism warped the thrust sheets into broad folds cut by some high angle faults and relatively minor thrust faults.

In order to describe our understanding of the complex stratigraphy and structure in the Misheguk Mountain quadrangle, most rock units on this map are grouped into both the named sequences and allochthons shown in figure 2. On this map, the word "sequence" is used as a stratigraphic term, meaning either a distinctive column of sedimentary rocks that were deposited contiguously or a group of associated and distinctive igneous rocks which have wide geographic extent. Thrust sheets that contain the same or similar sequences are herein grouped together into structural units called "allochthons". In contrast, previous reports often use the same terms, such as "thrust tectonic unit", "structural sequence", or "thrust sequence", for both litho-stratigraphic and tectono-stratigraphic units. This previous terminology can be confusing because there is commonly a lack of distinction between stratigraphic and structural terms. Figure 3 compares the named allochthons on this map with analogous terminology used in other reports.

Various parts of the same sequence are commonly superimposed several times in adjacent thrust sheets. Faults that bound thrust sheets may occur at any horizon within a sequence, so that each thrust sheet usually contains only part of a complete sequence. Thrust faults that separate thrust sheets with different sequences are mapped as "intersequence thrust faults", and those that separate thrust sheets with the same sequence are mapped as "intrasequence thrust faults".

Thrust sheets with the same sequence almost always occur in the same structural stacking position relative to thrust sheets with different sequences. This relationship has permitted us to construct the generalized model for the stacking positions of the various allochthons and sequences shown in figure 2. This model shows the relative structural position of the allochthons, and a schematic east to west cross section of the Misheguk Mountain quadrangle showing the lateral distribution of stratigraphic and igneous sequences within each allochthon. We believe that the simplest and most probable way to reconstruct the original depositional positions of the sequences is to unstack the allochthons in a regular manner such that upper allochthons are successively unstacked south of lower allochthons. When the sedimentary sequences are unstacked in this way, the sequences in the Nuka Ridge allochthon would have been deposited farthest to the south and the sequence in the Brooks Range allochthon farthest to the north. The igneous

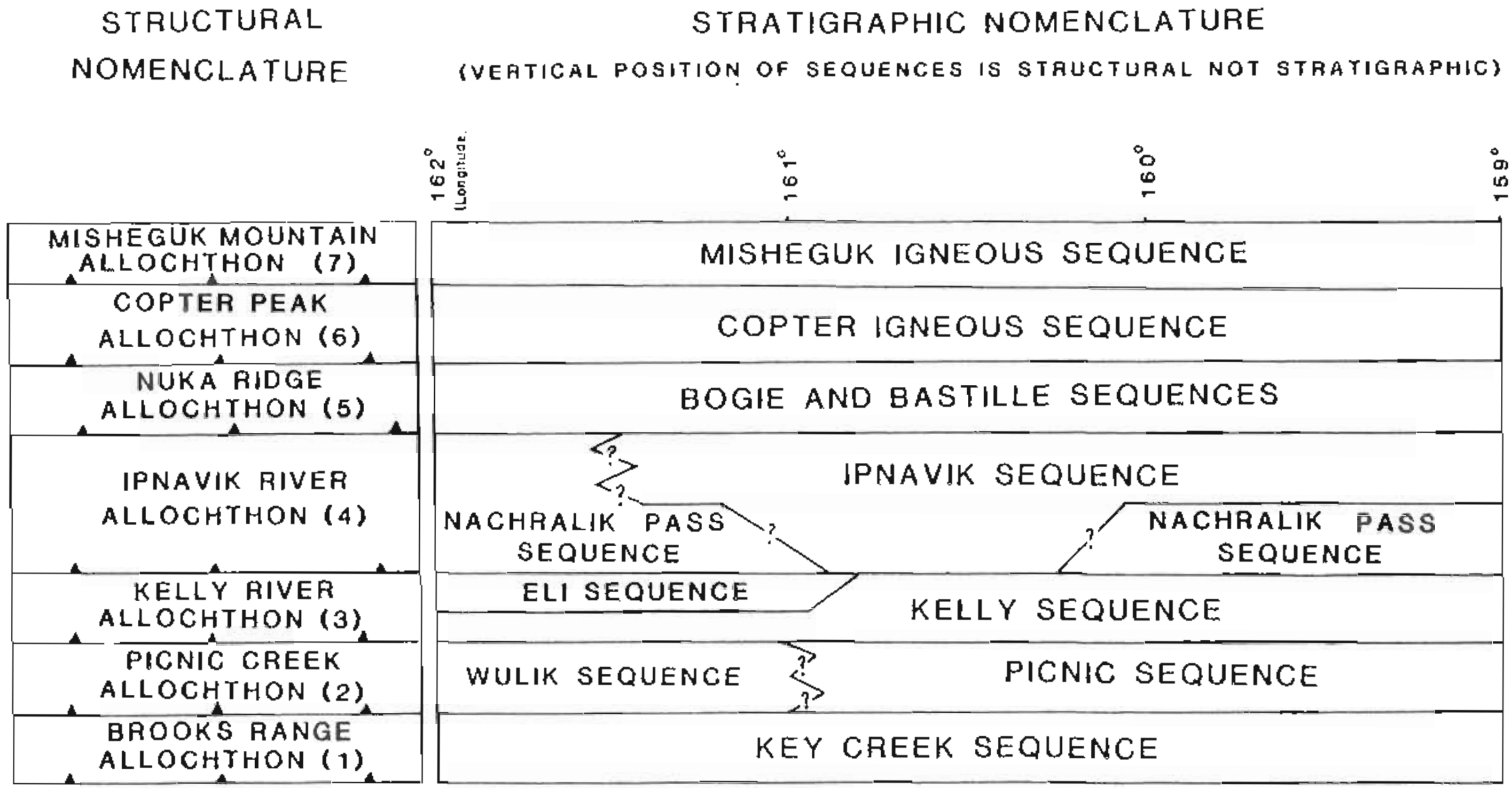


Figure 2.--Diagram showing the usual stacking positions of the structural units (allochthons, 1 lowest and 7 highest) and stratigraphic units (sequences) in the south half of the Misheguk Mountain quadrangle. Although the base of the Brooks Range allochthon is not exposed in the quadrangle, it is also allochthonous (Mull and others, 1976; Mull and Tailleur, 1977). Lateral and vertical positions of stratigraphic and igneous sequences are shown by a schematic cross section from west to east across the quadrangle.

Figure 3.--Comparison of allochthons in this report with equivalent structural units of other authors

This report	Ellersieck and others, 1979	Mayfield and others, 1979	Mull, 1979	Churkin and others, 1979	Mayfield and others, 1978	Martin, 1970	Snelson and Tailleur, 1968; Tailleur and Brosgè, 1970	Tailleur and others, 1966
Misheguk Mountain allochthon	Misheguk Mountain thrust sequence	Misheguk Mountain thrust sequence	Misheguk sequence	Not distinguished	Misheguk Mountain thrust sequence	Ultrabasic pluton sequence	Misheguk thrust tectonic unit	Not distinguished
Copter Peak allochthon	Copter Peak thrust sequence	Not distinguished	Misheguk sequence	Not distinguished	Misheguk Mountain thrust sequence	Ultrabasic pluton sequence	Misheguk thrust tectonic unit	Not distinguished
Nuka Ridge allochthon	Nuka Ridge thrust sequence	Not distinguished	Nuka sequence	Not distinguished	Nuka Ridge thrust sequence	Nuka Ridge sequence	Nuka Ridge thrust tectonic unit	Nuka Ridge sequence
Ipnavik River allochthon	Ipnavik River thrust sequence	Ipnavik River thrust sequence	Ipnavik sequence	Not distinguished	Ipnavik River thrust sequence	Ipnavik sequence	Ipnavik thrust tectonic unit	Ipnavik sequence
Kelly River allochthon	Kelly River thrust sequence	Kelly River thrust sequence	Kelly sequence	Not distinguished	Kelly River thrust sequence	De Long sequence	Kelly thrust tectonic unit	Not distinguished
Picnic Creek allochthon	Picnic Creek thrust sequence	Kuruk Creek thrust sequence	Not distinguished	Not distinguished	Northwestern Brooks Range thrust sequences	Not distinguished	Wulik thrust tectonic unit	Sequence at Kiligwa River (eastern facies)
Brooks Range allochthon	Brooks Range thrust sequence	Brooks Range thrust sequence	Endicott sequence (eastern facies)	Kagvik structural sequence	Northwestern Brooks Range thrust sequences; North central Brooks Range thrust sequence (eastern facies)	Brooks Range sequence; Ivotuk Hills sequence (eastern facies)	Foothills thrust tectonic unit	Foothills sequence; Assemblage on Drenchwater Creek; Sequence at Mount Bupto (eastern facies)

sequences of the Copter Peak and Misheguk Mountain allochthons were probably formed south of the sequences in the Nuka Ridge allochthon. The approximate relative locations of the sequences prior to thrust dislocation can be viewed on the right side of figure 2 if each lower sequence is considered to have been located contiguously north of the adjacent sequence(s) above.

Although post-Early Cretaceous erosion removed large parts of the upper allochthons from the area, they were never continuous across the quadrangle, as shown on figure 2. Instead, the allochthons are commonly in the form of large lens-shaped bodies or folded sheets from a few hundred meters to tens of kilometers across and from a few meters to a kilometer or more in thickness. In most vertical sections some of the allochthons are absent and others are internally repeated by intrasequence thrust faults. Some allochthons thin or pinch out southward. These observed relationships may indicate that parts of some sheets were displaced northward by gravity gliding or that a complex folding and thrust faulting process operated.

In a few places a structurally lower allochthon, shown in figure 2, appears to be locally thrust or folded over an allochthon regionally known to be structurally higher. For example, at the western end of the Poktovik Mountains on the southwestern Misheguk Mountain quadrangle map (lat 68°4.5'N., long 161°20'W.), the Ipnavik River allochthon is thrust over the Copter Peak allochthon. Along the east side of upper Trail Creek on the south-central Misheguk Mountain quadrangle map (lat 68°30'N., long 160°20'W.), the Kelly River allochthon is thrust over the Ipnavik River allochthon. Also, along the middle part of the Anisak River on the southeastern Misheguk Mountain quadrangle map (lat 68°26.5'N., long 159°29'W.), the Kelly River allochthon is locally thrust or folded over the Ipnavik River allochthon. See the appropriate geologic map or figure 4 for geographic locations. However, these examples cover only a small area on the maps, and they appear to be unusual.

In addition to abrupt facies changes across intersequence thrust faults, there are also more gradual facies changes between some stratigraphic sequences that occur at similar structural levels. These changes are most commonly noticeable in the Late Mississippian and Early Pennsylvanian rocks. Where two similar sequences occur at about the same structural level, they were probably deposited contiguously and displaced about the same amount by thrust faults. In such cases, the two similar sequences are grouped into the same allochthon. For example, this kind of gradual facies change occurs in an approximate east-west direction between an eastern facies, the Endicott sequence (Mull, 1979) or foothills sequence (Tailleur and others, 1966) and a western facies, the Key Creek sequence (this map) which compose the Brooks Range allochthon in the central and western Brooks Range (Mayfield and others, 1978). Within the Misheguk Mountain quadrangle, the Eli sequence and Kelly sequence are grouped into the same allochthon, because they are composed of similar sequences which occur at approximately the same structural level. Where the two sequences are in thrust fault contact south of Kuruk Creek (southwestern Misheguk Mountain quadrangle map), the Eli sequence is structurally higher suggesting that, in this area, the Kelly sequence was deposited north of the Eli sequence. Map units in the Eli sequence are distinguished from those in the Kelly sequence by an "e" which follows the allochthon number in the map symbol. Facies changes not separated by thrust faults of major displacement also probably occur between the Picnic and Wulik sequences and the Ipnavik and Nachralik Pass sequences. These are discussed in the next section.

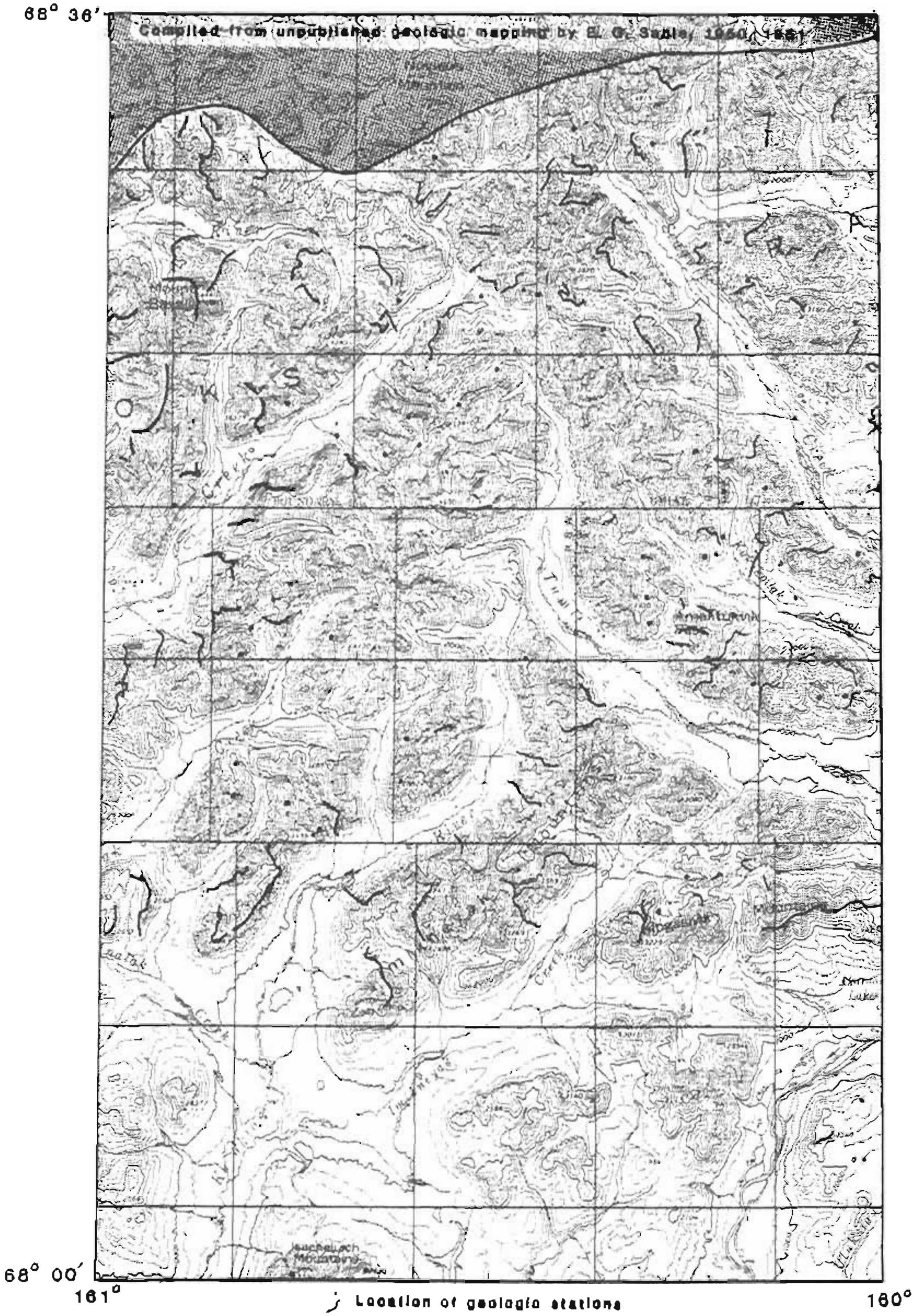


Figure 4.--Map showing locations of field traverses used by the geologists who compiled this map and areas of geologic mapping from other studies which are reinterpreted for this report.

Map symbols for rock units are numbered for easy identification of each allochthon. If individual map units are colored by the numbers, a tectonic map showing allochthons will result; if they are colored by letter symbols, a map showing lithologic units will result.

UNCERTAIN RELATIONSHIPS BETWEEN ALLOCHTHONS AND SEQUENCES

Where outcrops are poor or where facies changes may have been relatively rapid, continuity between sequences in similar structural positions may be difficult or impossible to establish. For example, the Picnic Creek allochthon has two lithologically similar stratigraphic sequences, called the Wulik and Picnic sequences. In the southern part of the Misheguk Mountain quadrangle, the Wulik sequence is mapped only west of 161° longitude and the Picnic sequence is mapped only east of 161° longitude. Because the differences in these stratigraphic sequences are probably due to gradational facies changes, rather than separation by major thrust faults, they are mapped as separate sequences within the same allochthon.

Within the Ipnavik River allochthon, mafic sills are rare west of the Kugururok River and common east of the Kugururok River. Sills are also rare in what appears to be a lower thrust sheet of the Ipnavik River allochthon east of the Kugururok River. The sequence of rocks with few mafic sills is called the Nachralik Pass sequence, and the one with numerous mafic sills is called the Ipnavik sequence (fig. 2). These two similar sequences are distinguished within this allochthon, because the presence or absence of mafic sills could have important structural implications in some areas. The Nachralik Pass sequence is distinguished by map symbols that have the letter "n" following the allochthon number. For example, the rock unit $\mathbb{P}Mc_{4n}$ in the Nachralik Pass sequence is stratigraphically equivalent to the rock unit $\mathbb{P}Mc_{4}$ in the Ipnavik sequence.

The Nachralik Pass sequence is also lithologically similar to the Picnic sequence. In places where the Kelly sequence does not occur between the Picnic and Nachralik Pass sequences, such as the central part of the Misheguk Mountain quadrangle, it is difficult to distinguish between them. There is a possibility that these two sequences may be the same sequence which has been thrust into different structural levels. However, it is more likely that the Picnic and Nachralik Pass sequences were deposited respectively north and south of the Kelly and Eli sequences, with the Picnic sequence deposited near the Wulik sequence and the Nachralik Pass sequence deposited near the Ipnavik sequence, as shown in figure 2.

The Bogie and Bastille sequences occur in the same structural level, beneath the Copter Peak allochthon (if it is present), and above the Ipnavik River allochthon and other underlying allochthons. For this reason, both sequences are included in the Nuka Ridge allochthon. The two sequences, although similar in many respects, appear to have some stratigraphic differences. The Nuka Formation in the Bogie sequence is underlain by the Kayak Shale, whereas possibly coeval rocks to the Nuka Formation in the Bastille sequence are conformably underlain by limestone or silty and sandy limestone. The Bogie sequence is the only sequence in which a rock unit (the Nuka Formation) underlying the Etivluk Group may be as young as Permian. The limestone unit underlying the Etivluk Group in the Bastille sequence (unit MDl_5) has not been precisely dated with fossils and is assigned its age on the basis that it conformably overlies fossiliferous Devonian limestone and regionally correlates with Mississippian and Devonian limestone units in other sequences. Should further investigation locate fossil evidence that the Nuka Formation and the upper part of unit MDl_5 are coeval, the age disparity would be removed, and the two sequences may have been deposited contiguously, with a local embayment of the Kayak Shale in parts of the Bogie sequence. However, should further investigations show that unit MDl_5 is not younger than Devonian in age, then it is possible that the Nuka Formation and Kayak Shale were deposited above unit MDl_5 which would make the Bogie and Bastille sequences a single sequence. Since rocks of the Bastille sequence and Nuka Formation are not found in contact with each other, their relative positions prior to thrusting are not known, and the trend of this possible facies change is unknown.

The location of intrusion of the Misheguk igneous sequence ultramafic rocks into the earth's crust relative to the location of extrusion of the Copter igneous sequence pillow basalts is uncertain. The contact between these sequences is always a thrust fault, with the Misheguk on top. No remnants of the Misheguk-type rocks are found within or at the lower contact of the Copter Peak allochthon. Although both the Copter Peak and Misheguk Mountain allochthons have been included in the dismembered ophiolites of Patton and others (1977), we find no evidence to indicate that these rocks are necessarily of the same origin. The basement upon which the Copter Peak basalts were erupted is either a shallow water Devonian limestone, or it is not preserved. The petrology of the Misheguk Mountain allochthon is typical of the lower parts of many ophiolites (Patton and others, 1977; Roeder and Mull, 1978, Zimmerman and Soustek, 1979), indicating that it is probably a remnant of oceanic crust which lay south of the Arctic Alaska continental plate prior to the Brooks Range orogeny. The basalts which were probably erupted atop the Misheguk Mountain plutonic rocks have been eroded away and are no longer preserved in the quadrangle.

ACKNOWLEDGMENTS

We wish to acknowledge R. C. Crane (of Standard Oil of California) for providing us with detailed information about some outcrops that we did not visit, and Crane and C. G. Mull for helpful discussions about the structural evolution of the western Brooks Range.

FOSSIL TABLE

Table 1 is a list of the fossils which have been identified from the area encompassed by the south-central Misheguk Mountain quadrangle geology map. Most fossils were collected in the summer of 1978 during fieldwork for this mapping project. However, they also include previously unpublished fossil collections dating back to the 1960's. A few of the collections were made by geologists from the petroleum industry and dated by U.S. Geological Survey paleontologists.

Table 1.--Selected fossils from south-central Misheguk Mountain quadrangle

Map number	Field number	Latitude	Longitude	USGS collection number	Age	Map unit	Fossil type	Identified by
1	78Ek62	68°32'18"	160°19'00"	--	Pennsylvanian to Early Permian	TRℙs$_2$	Radiolaria	B. K. Holdsworth
2	78Cx29C	68°32'04"	160°15'05"	--	Late Mississippian to Early Permian, probably Pennsylvanian	ℙMc$_2$	Radiolaria	B. L. Murchey
3	78Md75E	68°32'27"	160°08'33"	--	Early Pennsylvanian	Jℙe$_2$/ ℙMc$_2$ contact	Radiolaria	B. K. Holdsworth
3	78Md75E	68°32'27"	160°08'33"	--	Early Pennsylvanian (Morrowan)	Jℙe$_2$/ ℙMc$_2$ contact	Conodonts	B. R. Wardlaw
4	78Cx24D	68°33'02"	160°03'30"	--	Pennsylvanian to Permian	TRℙs$_1$	Radiolaria	B. L. Murchey
5	78Md160C	68°26'18"	160°58'20"	--	Mesozoic	Jℙe$_4$	Radiolaria	B. L. Murchey
6	78Tr171A	68°25'54"	160°55'12"	--	Late Triassic	Jℙe$_4$	Radiolaria	B. L. Murchey
7	78Tr171B	68°25'49"	160°55'17"	--	Mesozoic	Jℙe$_4$	Radiolaria	B. L. Murchey
8	78Tr90B.1	68°26'42"	160°34'36"	--	Late(?) Triassic	Jℙe$_4$	Radiolaria	B. K. Holdsworth
9	78Cx38D	68°27'39"	160°18'54"	--	Mesozoic	Jℙe$_4$	Radiolaria	B. L. Murchey
10	78Md90A	68°28'52"	160°05'18"	--	Late Triassic	Jℙe$_{4n}$	Radiolaria	B. K. Holdsworth

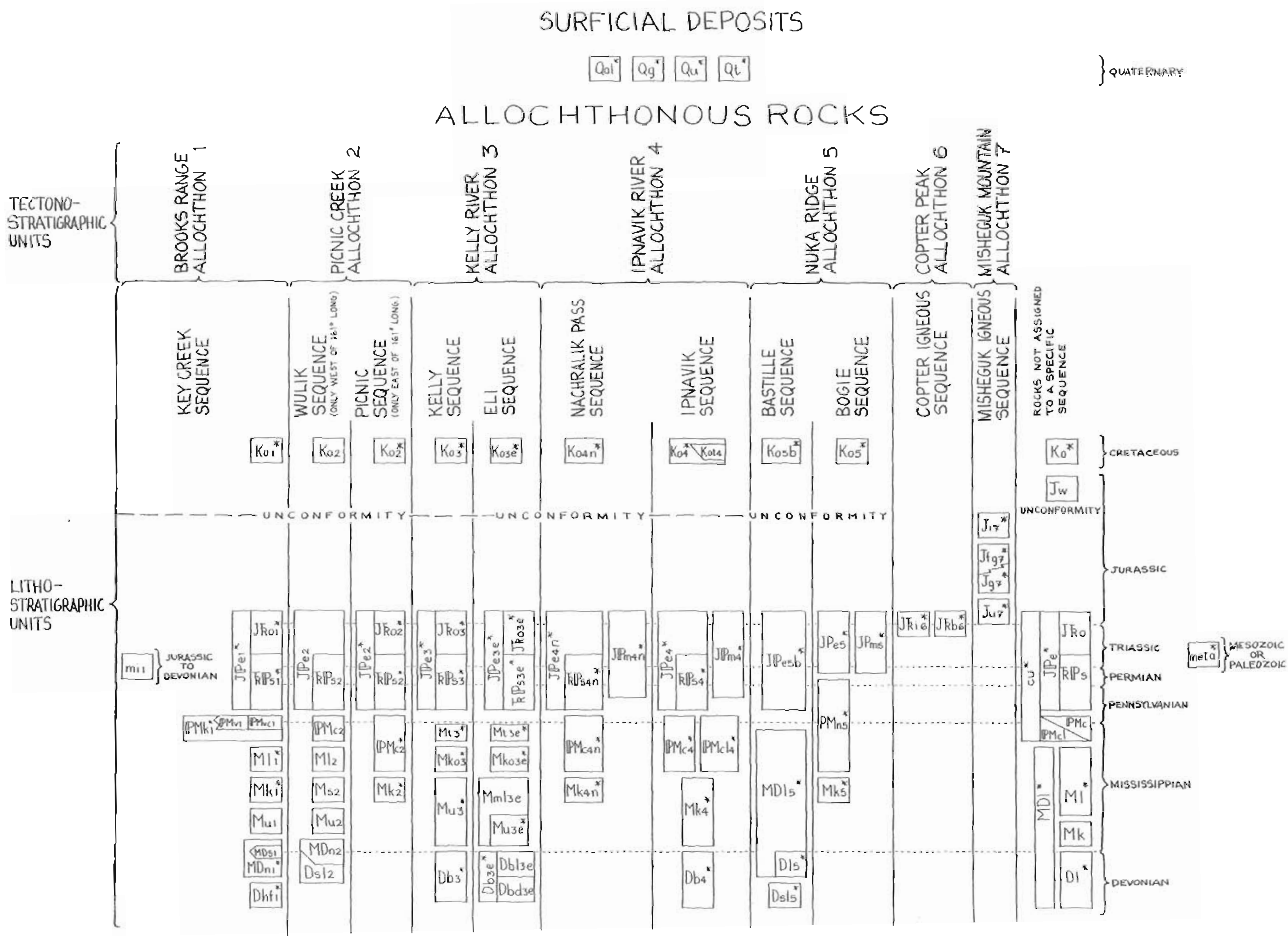
Table 1.--Selected fossils from south-central Misheguk Mountain quadrangle--Continued

Map number	Field number	Latitude	Longitude	USGS collection number	Age	Map unit	Fossil type	Identified by
11	77Ek39	68°19'22"	160°46'12"	--	Triassic	JTRb$_6$	Radiolaria	B. K. Holdsworth
12	78Ek58	68°19'56"	160°45'42"	--	Triassic	JTRb$_6$	Radiolaria	B. K. Holdsworth
13	78Md114D	68°10'45"	160°27'48"	--	Triassic	JPe$_4$	Radiolaria	B. K. Holdsworth
14	78Md160A	68°26'09"	160°57'15"	9993-SD	Middle Devonian [1]CAI=3	Dsl$_5$	Conodonts	A. G. Harris
15	78Ek116F	68°11'21"	160°46'42"	27416-PC	Late Mississippian [1]CAI=2$^1/_2$-3	Mk$_4$	Conodonts	A. G. Harris
16	78Tr120A	68°12'06"	160°10'42"	9992-SD	Middle to Late Devonian [1]CAI=4	Db$_3$	Conodonts	A. G. Harris
17	77Tr11.9	68°28'21"	160°53'18"	10352-SD	Middle Devonian (Givetian)	Dl$_5$	Brachiopods, corals, stromato-poroids	J. T. Dutro, Jr.
18	78Tr178A	68°28'27"	160°53'31"	10175-SD	Possibly Middle Devonian	Dsl$_5$	Brachiopods, cephalopods	J. T. Dutro, Jr.
19	78Tr170B	68°25'33"	160°49'12"	10174-SD	Early or middle Late Devonian	Dl$_5$	Brachiopods	J. T. Dutro, Jr.
20	78Tr185F	68°17'33"	160°58'18"	--	Possible Devonian	Db$_{3e}$	Amphipora, coral	J. T. Dutro, Jr.

See footnote at end of table.

CORRELATION OF MAP UNITS

(asterisks identify map units in the south-central Misheguk Mountain quadrangle)



DESCRIPTION OF MAP UNITS

(Asterisks identify map units exposed in south-central Misheguk Mountain quadrangle)

Surficial Deposits

Qal* ACTIVE ALLUVIAL DEPOSITS (Quaternary)--Unconsolidated silt, sand, and gravel which is actively reworked during stream floods. Surfaces marked by sparse vegetation in most places

Qg* GLACIAL MORAINE DEPOSITS (Quaternary)

Qu* SURFICIAL DEPOSITS, UNDIVIDED (Quaternary)--Includes tundra, soil, lacustrine, talus, and glacial deposits

Qt* TERRACE DEPOSITS (Quaternary)--Inactive alluvial deposits composed of silt, sand, and gravel at or above present high water stage. Surface covered by stable vegetation

Allochthonous Rocks
Key Creek sequence

Named for characteristic exposures along Key Creek (lat 68°8' N., long 162°29' W.), De Long Mountains quadrangle. Map units in this sequence include the subscript number 1 in their map symbols to signify that they are part of the Brooks Range allochthon.

Ko_1* OKPIKRUAK FORMATION (Cretaceous)--Gray mudstone with minor amounts of thin-bedded wacke. Contains Early Cretaceous pelecypod Buchia; lower part may be Late Jurassic. Thickness in outcrops varies from 0 to more than 1000 m with an unconformity at base. Depositional thickness is probably variable

mi_1 MAFIC IGNEOUS ROCKS (Jurassic to Devonian)--Mafic igneous dikes that cut Hunt Fork Shale and undifferentiated parts of the Noatak Sandstone and Kanayut Conglomerate. Age is uncertain

JPe_1* ETIVLUK GROUP (Jurassic to Pennsylvanian)--Gray chert with minor amounts of shale; weathers to shades of brown, yellow, gray, green, and maroon. Has Pennsylvanian to Triassic radiolarians and Triassic pelecypod Monotis in upper part. Consists of:

$JTRo_1$* OTUK FORMATION (Jurassic and Triassic)--Light gray to dark gray chert with thin siliceous shale partings (Mull and others, 1982). Upper part contains Triassic pelecypods, Monotis and Halobia, typically has cream-colored or light brown- and green-weathering rind on chert beds, and commonly has a few carbonate beds. Lower part has 5 m interval of black chert which resembles Carboniferous chert. Chert contains Triassic radiolarians. Depositional thickness is approximately 30-50 m. Base is probably gradational into the Siksikpuk Formation

$TRPs_1$* SIKSIKPUK FORMATION (Triassic to Pennsylvanian)--Gray chert and gray, olive, and maroon siliceous shale. Middle part of unit is mostly shale which grades both up and down into well-bedded gray chert with thin siliceous shale partings. Mammillary bedding structures locally common. Chert contains Pennsylvanian to Triassic radiolarians. Depositional thickness is approximately 40-60 m. Base contains bedded chert which appears to be gradational into the Kuna Formation, and one or more prominent orange- and yellow-weathering clay-rich horizons (bentonite?) that have regional extent

PMk_1* KUNA FORMATION (Pennsylvanian and Mississippian)--Black carbonaceous shale with subordinate interbedded black chert; has a few beds of gray to dark gray, medium- to fine-grained limestone (Mull and others, 1982). Chert predominates over shale in top 10 m of unit. Shale in lower part often weathers to a bluish silver sheen. Chert contains radiolarians and is correlative with black chert of Late Mississippian to Pennsylvanian age in Picnic Creek allochthon; limestone contains rare brachiopods and Mississippian conodonts. Radiolarians from beds near top indicate an Early to Middle Pennsylvanian age and conodonts from limestone beds in lower part indicate an Early to Late Mississippian age. Depositional thickness is approximately 40-60 m. Basal contact is either sharp on limestone (unit Ml_1) or gradational into the Kayak Shale

PMv_1 FELSIC VOLCANIC ROCKS (Pennsylvanian and (or) Mississippian)--Includes hypabyssal intrusive rocks. Biotite latite or andesite in exposures west of Nimiuktuk River (southeastern Misheguk Mountain quadrangle map); porphyritic biotite latite and tuffaceous sedimentary rocks west of Kugururok River (southwestern Misheguk Mountain quadrangle map). In uncertain stratigraphic position but probably in upper part or top of the Kuna Formation. Potassium-argon date from biotite in volcanic rocks near Nimiuktuk River is 333 $\pm$ 17 m.y. (Mayfield and others, 1979)

$PMvc_1$ VOLCANICLASTIC ROCKS (Pennsylvanian and (or) Mississippian)--Thick-bedded to massive calcareous rock with volcanic fragments. Commonly coarse-grained limestone with disseminated light green chloritic minerals. Unit has sparsely distributed and strongly altered mafic (basaltic?) volcanic rocks. Only recognized east of upper Picnic Creek (southeastern Misheguk Mountain quadrangle map). Mapped as Carboniferous because of apparent stratigraphic position near or at top of the Kuna Formation

Ml_1* LIMESTONE (Mississippian)--Gray, medium-grained limestone with black chert nodules and lenses. Resembles the Kogruk Formation of Kelly sequence and the Alapah and Wachsmuth Limestones of central Brooks Range. Contains crinoids, brachiopods, and Mississippian Foraminifera. Locally discontinuous, with depositional thickness approximately 0-20 m. Base is gradational into the Kayak Shale

Mk_1* KAYAK SHALE (Mississippian)--Dark gray and black shale with interbedded rusty-weathering fossiliferous limestone and pyritic ironstone concretions. Locally contains a few thin siltstone and fine-grained sandstone beds. Common fossils include Early Mississippian crinoids, brachiopods, bryozoa, and Foraminifera. Depositional thickness estimated to vary from 10 to more than 40 m. In some areas, such as around Ginny Creek (southwestern Misheguk Mountain quadrangle map) or at mouth of Nimiuktuk River (southeastern Misheguk Mountain quadrangle map), base is gradational into a thin tongue of the Utukok Formation. In places where the Utukok Formation was not deposited, such as the Iggiruk Hills or upper Picnic Creek area (southeastern Misheguk Mountain quadrangle map), base is gradational into the Noatak Sandstone or Kanayut Conglomerate

Mu_1 UTUKOK FORMATION (Mississippian)--Gray, coarse-grained limestone with interbeds of clean, fine-grained quartz sandstone. Locally contains numerous Mississippian crinoid and brachiopod fragments. Locally discontinuous, with depositional thickness estimated to be approximately 0-50 m. Base seems to have been deposited conformably and possibly gradationally on the Noatak Sandstone or Kanayut Conglomerate at the mouth of Nimiuktuk River and at west end of Ginny Creek lead-zinc deposit

MDn_1* NOATAK SANDSTONE AND KANAYUT CONGLOMERATE, UNDIVIDED (Mississippian and Devonian)--Interbedded fine- to coarse-grained, well-indurated sandstone, siltstone, and shale, commonly rusty-weathering. Has a few thin conglomerate beds. Marine calcareous sandstone beds locally contain Late Devonian crinoids and brachiopods. Top is also probably time equivalent to nonmarine sandstone that contains Mississippian plant fossils Lepidodendropsis sp. (S. H. Mamay, written commun., 1976) in Howard Pass quadrangle and Stigmaria varrucosa (Smith and Mertie, 1930) in Killik River quadrangle. Depositional thickness is probably greater than 200 m. Base is gradational into the Hunt Fork Shale

MDs_1 SANDSTONE (Mississippian and (or) Devonian)--Well-indurated, medium- to thick-bedded, medium-grained quartz sandstone. Commonly appears black or dark gray from covering of black lichens. Intertongues with the Noatak Sandstone, and may be partly equivalent to sandstone of the Kanayut Conglomerate. Depositional thickness probably less than 30 m

Dhf_1* HUNT FORK SHALE (Devonian)--Shale, slate, and phyllite with lesser amounts of well-indurated, thin interbedded siltstone and fine-grained sandstone. Calcareous beds have a few impressions of Late Devonian crinoids, brachiopods, and cephalopods. Depositional thickness probably greater than 300 m. Base not exposed in map area

Wulik sequence

Named for characteristic exposures along the upper Wulik River (lat 68°21' N., long 163° W.), De Long Mountains quadrangle. Map units in this sequence include the subscript number 2 in their map symbols to signify that they are part of the Picnic Creek allochthon. This sequence is only mapped west of longitude 161°W. on the southwestern Misheguk Mountain quadrangle map.

Ko_2 OKPIKRUAK FORMATION (Cretaceous)--Gray mudstone with minor amounts of thin-bedded, fine-grained wacke. Lower part may be Late Jurassic. Thickness in outcrops varies from 0 to more than 200 m with an unconformity at base. Depositional thickness is probably variable

$J\mathbb{P}e_2$ ETIVLUK GROUP (Jurassic to Pennsylvanian)--Gray chert with siliceous shale partings. Includes undifferentiated parts of the Siksikpuk and Otuk Formations. Cherts contain radiolarians. Includes:

$\mathrm{T\!\!\!\!\iota}\,\mathbb{P}s_2$ SIKSIKPUK FORMATION (Triassic to Pennsylvanian)--Gray and maroon chert and siliceous shale. Chert contains Pennsylvanian to Early Permian radiolarians. Depositional thickness is approximately 40-60 m

$\mathbb{P}Mc_2$ BLACK CHERT (Pennsylvanian and Mississippian)--Well-bedded black chert with a few siliceous black shale partings. Local white-weathering rind on bed surfaces. Chert contains Late Mississippian to Pennsylvanian radiolarians. Depositional thickness is 40-60 m. Sharp basal contact with limestone (unit Ml_2)

Ml_2 LIMESTONE (Mississippian)--Black, fine-grained limestone, weathers light gray. Beds from 0.3 to 5 cm thick weather flaggy to platy. Contains Late Mississippian Foraminifera. Depositional thickness probably varies from 5 to 30 m. Base is gradational into black shale (unit Ms_2)

Ms_2 BLACK SHALE (Mississippian)--Contains a few fine-grained limestone and black chert beds. Probably stratigraphically equivalent to the Kayak Shale or lower part of the Kuna Formation. Depositional thickness is more than 20 m. Depositional contact on the Utukok Formation is not exposed but is inferred from regional stratigraphic relationships

Mu_2 UTUKOK FORMATION (Mississippian)--Buff-weathering limestone, sandy limestone, and sandstone. Mapped only north of lower Kagvik Creek (southwestern Misheguk Mountain quadrangle map). Contains Early Mississippian brachiopods and crinoids. Depositional thickness probably more than 30 m. Depositional contact on the Noatak Sandstone is not exposed but is inferred from regional stratigraphic relationships

MDn_2 NOATAK SANDSTONE (Mississippian and Devonian)--Light brown, well-bedded, medium- to fine-grained sandstone. Only exposures located south of Kuruk Creek and north of lower Kagvik Creek (southwestern Misheguk Mountain quadrangle map). Thickness in outcrop is approximately 10 m and base is not exposed

Dsl_2 SANDSTONE, SHALE, AND LIMESTONE (Devonian)--These lithologies are interbedded and occur in only a few isolated places, mainly along tributaries of Kuruk and Kagvik Creeks north of Avan Hills mafic and ultramafic complex (southwestern Misheguk Mountain quadrangle map). Thought to represent intertonguing relationship between Late Devonian clastic rocks of the Noatak Sandstone and carbonate rocks of the Baird Group. Limestone beds contain numerous well-preserved Late Devonian brachiopods. Thickness in outcrop is approximately 150 m and base is not exposed

Picnic sequence

Named for characteristic exposures along upper Picnic Creek (lat $68^{\circ}33'$ N., long $159^{\circ}17'$ W.), Misheguk Mountain quadrangle. Map units in this sequence include the subscript number 2 in their map symbols to signify that they are part of the Picnic Creek allochthon. This sequence is only mapped east of longitude 161°W. on the south-central and southeastern Misheguk Mountain quadrangle maps.

Ko_2* OKPIKRUAK FORMATION (Cretaceous)--Gray mudstone with minor amounts of thin-bedded, fine-grained wacke. Contains Early Cretaceous pelecypod, Buchia; lower part may be Late Jurassic. Thickness in outcrops varies from 0 to more than 500 m with an unconformity at the base. Depositional thickness is probably variable

JPe_2* ETIVLUK GROUP (Jurassic to Pennsylvanian)--Gray chert with siliceous shale partings. Has Pennsylvanian to Triassic radiolarians. Consists of:

JTRo_2* OTUK FORMATION (Jurassic and Triassic)--Light to dark gray chert with thin siliceous shale partings. Locally cream-colored on bed surfaces. Commonly contains Triassic pelecypod, Monotis and Triassic radiolarians. Depositional thickness is approxmately 30-40 m. Base is probably gradational into the Siksikpuk Formation

TRPs_2* SIKSIKPUK FORMATION (Triassic to Pennsylvanian)--Olive gray and maroon chert and siliceous shale. Chert has Pennsylvanian to Permian radiolarians. Depositional thickness is approximately 40-60 m. Base is gradational into black chert (unit PMc_2)

PMc_2* BLACK CHERT (Pennsylvanian and Mississippian)--well-bedded. Contains a few black shale partings which are more common near bottom and a few thin rusty-weathering carbonate beds near top. Contains Mississippian to Early Pennsylvanian radiolarians and gradational zone at top contains conodonts of Morrowan age. Depositional thickness is approximately 40-60 m. Basal contact is sharp on the Kayak Shale

Mk_2* KAYAK SHALE (Mississippian)--Brown to black, fine-grained siltstone and shale with orange-weathering ironstone concretions. Some tan-weathering, thin limestone beds. Thickness in outcrop is about 20 m and basal contact is a thrust fault

Kelly sequence

Named for characteristic exposures along the Kelly River (lat 68°13' N., long 162°30' W.), De Long Mountains quadrangle. Map units in this sequence include the subscript number 3 in their map symbols to signify that they are part of the Kelly River allochthon.

Ko$_3$* OKPIKRUAK FORMATION (Cretaceous)--Interbedded medium- to fine-grained lithic wacke and mudstone with local conglomerate. Pebble- to cobble-sized conglomerate clasts are chert, mafic igneous rocks, granite, and limestone. Has Neocomian pelecypod, *Buchia*. Lower part may be Late Jurassic. Thickness in outcrops varies from 0 to more than 1000 m with an unconformity at base. Depositional thickness is probably variable

JPe$_3$* ETIVLUK GROUP (Jurassic to Pennsylvanian)--Gray chert with siliceous shale partings. Chert contains radiolarians. Consists of:

JTRo$_3$* OTUK FORMATION (Jurassic and Triassic) --Gray, well-bedded chert with siliceous shale partings. Cream-colored chert with a few interbedded limestones near top contains Triassic pelecypod, *Monotis* and Triassic radiolarians. Locally, chert, shale, and limestone is maroon in color. Chert and siliceous limestone beds have radiolarians. Depositional thickness is approximately 30-40 m. Base is probably gradational into the Siksikpuk Formation

TRPs$_3$* SIKSIKPUK FORMATION (Triassic to Pennsylvanian)--Gray chert and gray, olive, and maroon siliceous shale. Chert contains radiolarians. Age based on stratigraphic correlation with similar rocks in structurally lower sequences. Depositional thickness is approximately 20-40 m. Abrupt basal contact with the Tupik Formation could be a disconformity

Mt$_3$* TUPIK FORMATION (Mississippian)--Approximately equal amounts of interbedded fine-grained light gray limestone and black chert. A sparse fossil fauna includes Mississippian sponge spicules and cephalopods (Sable and Dutro, 1961) and Late Mississippian Foraminifera of Mamet Zones 14-15. Top beds of unit have not been systematically sampled for fossils and may prove to be Pennsylvanian in age. Depositional thickness is less than 30 m. Base is gradational into the Kogruk Formation

Mko$_3$* KOGRUK FORMATION (Mississippian)--Light gray-weathering limestone with black chert nodules and lenses. Common fossils are Mississippian corals, crinoids, brachiopods, and Foraminifera (Sable and Dutro, 1961; Armstrong and Mamet, 1977). Depositional thickness varies from about 30 m west of Nimiuktuk River in the southeastern part of Misheguk Mountain quadrangle to over 300 m west of Nunaviksak Creek in southwestern part of Misheguk Mountain quadrangle. Base is gradational into the Utukok Formation

Mu$_3$* UTUKOK FORMATION (Mississippian)--Buff-weathering limestone, sandy limestone, and fine-grained sandstone with a few thin, gray shale beds. Contains numerous Early to Late Mississippian brachiopods, gastropods, pelecypods, and crinoids (Sable and Dutro, 1961). Thickness in outcrop is less than 100 m. Basal contact is usually a thrust fault but may conformably overlie limestone of the Baird Group in upper Picnic Creek region (southeastern Misheguk Mountain quadrangle map)

Db_3* BAIRD GROUP (Devonian)--Medium to thick bedded, light gray limestone and dolomite. Most exposures are discontinuous thrust slivers, and greatest thickness of approximately 100 m occurs east of lower Nimiuktuk River. Where base is exposed, it is truncated by thrust faults

Eli sequence

Named for characteristic exposures in the drainage of the Eli River (lat 67° 38.5' N., long 162° 0-5' W.), Noatak quadrangle. Map units in this sequence include the subscript number 3 in their map symbols to signify that they belong to part of the Kelly River allochthon; the subscript number 3 is followed by the letter "e" so that rock units in this sequence can be distinguished from those in the Kelly sequence.

Ko_{3e}* OKPIKRUAK FORMATION (Cretaceous)--Interbedded medium- to fine-grained lithic wacke and mudstone with local conglomerate. Pebble- to cobble-size conglomerate clasts are limestone, chert, granite, and mafic igneous rocks. Lower part may be Late Jurassic. Thickness in outcrops varies from 0 to more than 100 m with an unconformity at base. Depositional thickness is probably variable

JPe_{3e}* ETIVLUK GROUP (Jurassic to Pennsylvanian)--Well-bedded gray chert with siliceous shale partings. Chert contains radiolarians. Consists of:

$J\text{Ŧ}o_{3e}$* OTUK FORMATION (Jurassic and Triassic)--Gray chert that commonly weathers brown or yellowish brown and has cream-colored bed surfaces in upper part. Contains Triassic pelecypod, Monotis, and radiolarians. Mapped in only a few small outcrops north and northwest of Misheguk Mountain (southwestern and south-central Misheguk Mountain quadrangle maps). Thickness in outcrop is approximately 20 m; depositional contact on the Siksikpuk Formation is not exposed but is inferred from regional stratigraphic relationships

$\text{Ŧ}Ps_{3e}$* SIKSIKPUK FORMATION (Triassic to Pennsylvanian)--Gray and maroon chert and shale. Chert contains radiolarians. Depositional thickness is estimated to be 20-40 m. Age based on stratigraphic correlation with similar rocks in structurally lower sequences

Mt_{3e}* TUPIK FORMATION (Mississippian)--Medium-grained, light gray limestone with 25-50 percent nodular to bedded black chert. Depositional thickness is approximately 20 m. Base is gradational into the Kogruk Formation

Mko_{3e}* KOGRUK FORMATION (Mississippian)--Light gray-weathering limestone with black chert nodules and lenses. Common fossils are Late Mississippian corals, crinoids, brachiopods, and Foraminifera. Depositional thickness is approximately 250 m. Base is gradational into micritic limestone (unit Mml_{3e})

Mml_{3e} MICRITIC LIMESTONE (Mississippian)--Light to dark gray-weathering, thinly laminated to platy micritic limestone and lesser thin-bedded or nodular black chert. Only mapped west of Kugururok River (southwestern Misheguk Mountain quadrangle map) where it probably intertongues with the Kogruk Formation. Upper part locally contains Late Mississippian brachiopods, bryozoans, and Foraminifera. Lower part contains Late Devonian to Early Mississippian Foraminifera. Depositional thickness is less than

500 m. Base lies on a thin tongue of the Utukok Formation north of Avan Hills mafic and ultramafic complex; east of the complex, it may lie conformably on limestone of the Baird Group

Mu_{3e}* UTUKOK FORMATION (Mississippian)--Buff-weathering limestone and locally calcareous, fine-grained sandstone. Contains brachiopods, crinoids, and corals. May represent a thin, discontinuous tongue below the Kogruk Formation or micritic limestone (unit Mml_{3e}), and may not have been deposited in some places in this sequence. Depositional thickness probably ranges from 0 to greater than 30 m. Base is probably gradational into Baird Group

Db_{3e}* BAIRD GROUP (Devonian)--Light gray limestone and dark gray dolomite (Tailleur and others, 1967). Probably correlative with some Devonian limestone thrust slivers mapped in uncertain sequence at base of Ipnavik allochthon. Common fossils are Late Devonian brachiopods, stromatoporoids, and conodonts. Thickness in outcrop is less than 700 m west of Kugururok River. Basal contact is a thrust fault. Locally divided into:

Dbl_{3e} UNNAMED LIMESTONE AND ELI(?) FORMATION--Massive, light gray limestone in upper part contains corals, brachiopods, and latest Devonian to earliest Mississippian Foraminifera of Mamet Zones 5 or 6. Lower part contains buff-weathering, thin-bedded limestone and minor shale with Late Devonian Foraminifera of Mamet Zone 2 or older and may be stratigraphically equivalent to the Eli Formation (Tailleur and others, 1967). Common fossils are brachiopods and stromatoporoids. Greatest thickness of about 500 m occurs west of Kugururok River

Dbd_{3e} DOLOMITE--Well-bedded, gray to dark gray dolomite. Common fossil is stromatoporoid, Amphipora. Thickness less than 200 m with thrust faults at base west of Kugururok River

Nachralik Pass sequence

Named for characteristic exposures near Nachralik Pass (lat 68°33' N., long 161°10' W.), Misheguk Mountain quadrangle. Map units in this sequence include the subscript number 4 in their map symbols to signify that they belong to part of the Ipnavik River allochthon; the subscript number 4 is followed by the letter "n" so that rock units in this sequence can be distinguished from those in the Ipnavik sequence.

Ko_{4n}* OKPIKRUAK FORMATION (Cretaceous)--Interbedded lithic, coarse- to fine-grained wacke, conglomerate, and mudstone. Pebble- to cobble-sized conglomerate clasts are chert, mafic rocks, granite, and limestone. Age is Early Cretaceous based on regional stratigraphy but lower part may be Late Jurassic. Thickness in outcrops varies from 0 to more than 300 m with an unconformity at base. Depositional thickness is probably variable

JPm_{4n}* MAFIC SILLS AND DIKES (Jurassic to Pennsylvanian)--Occurs as small and sparse sills and dikes. Mostly diabase mainly composed of plagioclase and augite. Age based on correlation with similar mafic rocks in Ipnavik sequence which intrude chert of the Etivluk Group

JPe_{4n}* ETIVLUK GROUP (Jurassic to Pennsylvanian)--Gray and maroon chert with siliceous shale partings. Chert contains radiolarians. Includes:

$TrPs_{4n}$* SIKSIKPUK FORMATION (Triassic to Pennsylvanian)--Maroon and gray chert and siliceous shale. Chert contains Pennsylvanian to Triassic radiolarians. Depositional thickness is estimated to be 30-60 m. Base is gradational into black chert (unit PMc_{4n})

PMc_{4n}* BLACK CHERT (Pennsylvanian? and Mississippian)--well-bedded. Rusty-weathering dolomite interbedded with chert in lower part near Nachralik Pass. Contains Late Mississippian to Pennsylvanian radiolarians. Age based on stratigraphic correlation with fossiliferous rocks in black chert (unit PMc_{4}) of Ipnavik sequence. Depositional thickness is estimated to be less than 100 m. Basal contact is sharp on the Kayak Shale

Mk_{4n}* KAYAK SHALE (Mississippian)--Dark gray shale with a few thin, fine-grained, brown sandstone beds. Contains sparse calcareous iron-stained concretions. Age based on identification of probable Early Mississippian corals and stratigraphic correlation with the fossiliferous Kayak Shale in Ipnavik sequence. Thickness in outcrop is up to 40 m. Basal contact is a thrust fault

Ipnavik sequence

Named for characteristic exposures along the Ipnavik River (lat 68°39' N., long 157°10' W.), Howard Pass quadrangle. Map units in this sequence include the subscript number 4 in their map symbols to signify that they belong to the part of the Ipnavik River allochthon that has numerous mafic sills.

Ko$_4$* OKPIKRUAK FORMATION (Cretaceous)--Interbedded coarse- to fine-grained lithic wacke, conglomerate, and mudstone. Pebble- to cobble-sized conglomerate clasts consist of chert, mafic rocks, granite, and limestone. Has early Valanginian pelecypod, Buchia. Lower part may be Late Jurassic. Thickness in outcrops varies from 0 to more than 1000 m with an unconformity at base. Depositional thickness is probably variable. Includes:

Kot$_4$ TUFF (Cretaceous)--Weathers light gray and occurs as thin discontinuous bed(s) in the Okpikruak Formation. Predominantly composed of clay, plagioclase, and quartz. Greatest thickness is less than 4 m. Best exposures are in the northern part of the Iggiruk Mountains (southeast Misheguk Mountain quadrangle map)

Jℙm$_4$* MAFIC SILLS AND DIKES (Jurassic? to Pennsylvanian)--Fine- to coarse-grained diabase mainly composed of plagioclase and augite. Commonly shows partial or complete alteration to clay minerals. Generalized age based upon apparent intrusion of diabase into imprecisely dated chert of the Etivluk Group. The authors are uncertain that this rock unit is as young as upper part of the Etivluk Group

Jℙe$_4$* ETIVLUK GROUP (Jurassic to Pennsylvanian)--Gray or greenish gray chert. Upper part rarely has Triassic pelecypod, Monotis. Contains radiolarians. Includes:

Ʀℙs$_4$* SIKSIKPUK FORMATION (Triassic to Pennsylvanian)--Maroon and gray chert and siliceous shale. Chert contains Pennsylvanian to Triassic radiolarians. Depositional thickness is approximately 30-60 m. Base is gradational into black chert (unit ℙMc$_4$)

ℙMc$_4$* BLACK CHERT (Pennsylvanian? and Mississippian)--well-bedded chert with a few shale partings. May contain minor amounts of interbedded limestone and black chert. Contains persistent mafic sills and dikes up to 100 m thick. Contains Late Mississippian Foraminifera of Mamet Zone 11 or younger. Upper part may be Pennsylvanian based on stratigraphic correlation with black chert in structurally lower sequences. Intertongues with black chert and limestone (unit ℙMcl$_4$). Depositional thickness is estimated to be less than 100 m. Basal contact is sharp on the Kayak Shale

ℙMcl$_4$* BLACK CHERT AND LIMESTONE (Pennsylvanian? and Mississippian)--Interbedded black chert and fine-grained limestone. Beds range from 1 to 20 cm thick. Rare sponge spicules and crinoids in limestone. Contains persistent mafic sills and dikes. Age based on stratigraphic correlation and intertonguing relationship with black chert (unit ℙMc$_4$). Depositional thickness is estimated to be less than 100 m. Basal contact is sharp on the Kayak Shale

Mk_4* KAYAK SHALE (Mississippian)--Black fissile shale with lesser amounts of interbedded orange-weathering limestone and rusty-weathering sandstone beds. Age based on presence of Mississippian conodonts. Thickness in outcrop is approximately 70 m; depositional contact on the Baird Group is not exposed but is inferred from regional stratigraphic relationships

Db_4* BAIRD GROUP (Devonian)--Thin-bedded, white to medium gray micritic limestone. Contains some thin beds of gray shale. Probably conformable with the overlying Kayak Shale. Fossils include brachiopods of Late Devonian age, crinoid columnals, and bryozoans. Thickness in outcrop is approximately 50 m, with a thrust fault at base at only mapped locality on upper Trail Creek (south-central Misheguk Mountain quadrangle map). Probably correlative with some Devonian limestone thrust slivers (unit Dl) mapped in uncertain sequence at base of Ipnavik River allochthon

Bastille sequence

Named for characteristic exposures at Mount Bastille (lat 68°28' N., long 160°53' W.), Misheguk Mountain quadrangle. Map units in this sequence include the subscript number 5 in their map symbols to signify that they are part of the Mount Bastille allochthon. The letter "b" following the allochthon subscript number 5 in the map symbol distinguishes the Okpikruak Formation and Etivluk Group from stratigraphically correlative units in the Bogie sequence.

Ko_{5b}* OKPIKRUAK FORMATION (Cretaceous)--Greenish gray, lithic, medium- to fine-grained wacke with lesser amounts of gray mudstone. Age is Early Cretaceous based on regional stratigraphy, but the lower part may be Late Jurassic. Thickness in outcrops varies from 0 to 200 m with an unconformity at base. Depositional thickness is probably variable

JPe_{5b}* ETIVLUK GROUP (Jurassic to Pennsylvanian)--Gray chert with siliceous shale partings. Contains radiolarians

MDl_5* LIMESTONE (Mississippian and (or) Devonian)--Light gray-weathering, well-bedded limestone. Locally contains glauconite. Interbedded coarse- to fine-grained feldspathic sandstone at top of Mount Bastille (south-central Misheguk Mountain quadrangle map) contains up to 15 percent potassium feldspar and may be equivalent to the Nuka Formation. Age based on uncertain correlation with fossiliferous Mississippian limestone in other sequences and Devonian limestone and dolomite (unit Dl_5). Includes upper part of the Kugururok Formation at Mount Bastille (Sable and Dutro, 1961). In most places base is a thrust fault; at Mount Bastille base is gradational into limestone and dolomite (unit Dl_5), and south of Copter Peak (southwestern Misheguk Mountain quadrangle map) base is gradational into calcareous siltstone of unit Dsl_5

Dl_5* LIMESTONE AND DOLOMITE (Devonian)--Massive to thin-bedded limestone and lesser dolomite. Gray chert nodules are locally common. Late Devonian horn corals and brachiopods are locally common in upper two-thirds of unit. Lower part has stromatoporoid, Amphipora. As mapped, includes upper part of the Kugururok Formation named by Sable and Dutro (1961). Depositional thickness is estimated to be greater than 300 m; basal contact is sharp on shale, limestone, calcareous siltstone, and sandstone (unit Dsl_5)

Dsl_5* SHALE, LIMESTONE, CALCAREOUS SILTSTONE, AND SANDSTONE (Devonian)--Contains a few hematitic conglomerate beds at Mount Bastille (south-central Misheguk Mountain quadrangle map). Predominant lithology is shale at Mount Bastille and calcareous siltstone south of Copter Peak. In part equivalent to lower part of the Kugururok Formation (named by Sable and Dutro, 1961). Contains brachiopods and conodonts of Middle to Late Devonian age. Thickness is less than 150 m. Basal contact is a thrust fault

Bogie sequence

Named for characteristic exposures along upper Bogie Creek at Nuka Ridge (lat 68°38' N., long 159°15' W.), Misheguk Mountain quadrangle. Map units in this sequence include the subscript number 5 in their map symbols to signify that they are part of the Nuka Ridge allochthon.

Ko_5* OKPIKRUAK FORMATION (Cretaceous)--Interbedded gray mudstone and minor greenish gray medium- to fine-grained lithic wacke. Distinctive cannon-ball concretions occur in mudstone around Nuka Ridge. Age is Early Cretaceous based on regional stratigraphy but lower part may be Late Jurassic. Thickness in outcrops varies from 0 to more than 100 m with an unconformity at base. Depositional thickness is probably variable

JPm_5* MAFIC SILLS AND DIKES (Jurassic to Permian)--Occurs as sills or dikes north of lower Tumit Creek (south-central Misheguk Mountain quadrangle map) and as dismembered shallow intrusive bodies around Nuka Ridge (southeastern Misheguk Mountain quadrangle map). Age based on lithologic similarity with mafic rocks in Ipnavik sequence

JPe_5* ETIVLUK GROUP (Jurassic to Permian)--Gray, greenish gray, black, and maroon chert and minor shale. May include part of the Siksikpuk Formation. Chert contains radiolarians. Upper part rarely has Triassic pelecypod, *Monotis*. Depositional thickness estimated to be less than 150 m; base is gradational into the Nuka Formation at Nuka Ridge

PMn_5* NUKA FORMATION (Permian? to Mississippian)--Light gray- to buff-weathering, coarse- to medium-grained arkose, arkosic limestone, and limestone. Has locally abundant glauconite and rare hematite cemented beds. Arkose consists of quartz with potassium and plagioclase feldspars apparently derived from an unknown granitic source. Locally contains numerous brachiopod, crinoid, goniatite, conodont, and Foraminifera fossils. Has been identified as Late Mississippian and Permian based on Permian brachiopods and Late Mississippian Foraminifera (Tailleur and others, 1973). One conodont sample is Early Pennsylvanian. (Note--the authors feel that a Late Mississippian and Early Pennsylvanian age for the Nuka Formation best fits the regional stratigraphy.) Depositional thickness is estimated to range from a few meters to 300 m; base is gradational into the Kayak Shale

Mk_5* KAYAK SHALE (Mississippian)--Dark gray shale, with interbedded, orange-weathering limestone, siltstone, and minor fine-grained sandstone. Contains Mississippian Foraminifera and brachiopods. Maximum thickness in outcrop is estimated to be 350 m. Basal contact is a thrust fault

Copter igneous sequence

Named for characteristic exposures at Copter Peak (lat 68°30' N., long 161°18' W.), Misheguk Mountain quadrangle. Map units in this sequence include the subscript number 6 in their map symbols to signify that they are part of the Copter Peak allochthon.

JTRi$_6$* INTERMEDIATE IGNEOUS ROCKS (Jurassic? and Triassic)--Includes a quartz diorite dike in mafic rocks southeast of upper Trail Creek (south-central Misheguk Mountain quadrangle map) and various fine-grained igneous rocks of dacite, andesite, and basaltic composition in lower Kugururok Valley (southwestern Misheguk Mountain quadrangle map) and southeast of Kaluktavik River (south-central Misheguk Mountain quadrangle map). Age based upon common association and intrusive relationship with basalt (unit JTRb$_6$)

JTRb$_6$* BASALT (Jurassic? and Triassic)--Commonly shows pillow structures. Includes minor amounts of gray shale and radiolarian chert. Triassic age based on radiolaria identifications from chert intercalated with pillow basalt. Jurassic age is more speculative and is based upon the possibility that gabbroic rocks of Jurassic age, equivalent to those exposed in the Misheguk igneous sequence, may have been the source for some of the basalt. Basal contact is a thrust fault

Misheguk igneous sequence

Named for characteristic exposures at Misheguk Mountain (lat 68°15' N., long 161°5' W.), Misheguk Mountain quadrangle. Map units in this sequence include the subscript number 7 in their map symbols to signify that they are part of the Misheguk Mountain allochthon.

Ji_7* INTERMEDIATE PLUTONIC ROCKS (Jurassic)--Coarse-grained plutonic rocks that occur as small dikes or plugs in gabbro (unit Jg_7). Composition is diorite, quartz diorite, and granite with varying proportions of quartz, plagioclase, hornblende, and biotite. Age based on intrusive relationship into gabbro (unit Jg_7) and potassium-argon dates from rocks of similar lithology and geologic setting at Siniktanneyak Mountain mafic and ultramafic complex in Howard Pass quadrangle where biotite and hornblende separates give ages of 163 and 172 m.y. respectively (M. L. Silberman, written commun., 1978)

GABBRO (Jurassic)--divided into:

Jfg_7* Fine- to medium-grained phases. Most minerals are plagioclase, clinopyroxene, and green amphibole

Jg_7* Medium- to coarse-grained phases. Most minerals are plagioclase, clinopyroxene, orthopyroxene, hornblende, and olivine. Commonly banded with plagioclase and pyroxene rich layers. Locally includes minor small dikes of peridotite, pyroxenite, and hornblende-plagioclase pegmatite. Age based on potassium-argon date of 164 m.y. from hornblende separate from gabbro collected at Misheguk Mountain mafic and ultramafic igneous complex (south-central Misheguk Mountain quadrangle map) (Patton and others, 1977)

Ju_7* ULTRAMAFIC ROCKS (Jurassic)--Includes mainly orange-weathering peridotite and partly serpentinized dunite with minor amounts of pyroxenite in small dikes. Basal contact is a thrust fault

Rocks not assigned a specific sequence

Ko* OKPIKRUAK FORMATION (Cretaceous)--Greenish gray lithic wacke and gray mudstone

Jw WACKE AND MUDSTONE (Jurassic)--Rhythmically bedded mudstone and wacke along the lower Kugururok River. Contains Late Jurassic species of pelecypod Buchia. Contacts are covered

cu* CHERT, UNDIVIDED (Jurassic to Mississippian)--May include units Jℙe, JTRo, TRℙs, and (or) ℙMc

Jℙe* ETIVLUK GROUP (Jurassic to Pennsylvanian)--Gray chert with siliceous shale partings. Chert contains radiolarians. Consists of:

JTRo OTUK FORMATION (Jurassic and Triassic)--Gray and cream-colored, well-bedded chert with siliceous shale partings

TRℙs SIKSIKPUK FORMATION (Triassic to Pennsylvanian)--Maroon and gray chert and siliceous shale. Chert contains radiolarians

ℙMc BLACK CHERT (Pennsylvanian and Mississippian)--well-bedded. Contains radiolarians

ℙMcl BLACK CHERT AND LIMESTONE (Pennsylvanian and Mississippian)--Interbedded black chert and fine-grained limestone. Mapped in only a few isolated outcrops west of lower Kugururok River (southwestern Misheguk Mountain quadrangle map), and may represent a transitional Mississippian facies between Nachralik Pass and Eli sequences

MDl* LIMESTONE, UNDIVIDED (Mississippian and (or) Devonian)--Occurs as isolated blocks along thrust faults and as possible olistoliths in Okpikruak Formation

Ml* LIMESTONE (Mississippian)--Occurs as isolated blocks commonly along thrust faults

Mk KAYAK SHALE (Mississippian)--Dark gray shale with a few interbeds of rusty-weathering limestone and ironstone concretions. Mapped in a few isolated outcrops in the hills west of lower Kugururok River (southwestern Misheguk Mountain quadrangle map)

Dl* LIMESTONE OR DOLOMITE (Devonian)--Occurs as isolated blocks commonly along thrust faults. Contains probable Middle and Late Devonian brachiopods and stromatoporoids. Gray chert nodules in dolomite are locally abundant in Picnic Creek area (southeastern Misheguk Mountain quadrangle map)

meta* METAMORPHOSED SEDIMENTARY AND IGNEOUS ROCKS (Mesozoic and (or) Paleozoic)--Includes quartz-muscovite-chlorite-garnet schist, actinolite-albite-chlorite schist, and marble probably derived from pelitic sedimentary rocks, mafic igneous rocks, and limestone. Metamorphism probably occurred during Late Jurassic and (or) Early Cretaceous at base of Misheguk Mountain allochthon during ophiolite obduction. Only mapped north and west of Misheguk Mountain (southwestern and south-central Misheguk Mountain quadrangle maps). Basal contact is a thrust fault

Explanation of map symbols

Contact, dashed where approximately located, queried where doubtful.

High-angle fault, dotted where concealed, queried where extension of fault is doubtful.

Thrust fault between allochthons (intersequence thrust fault) dashed were approximately located, dotted where concealed, saw teeth on upper plate. Queried where doubtful. Where thrust faults can reasonably be inferred to occur near outcrop boundaries a thrust fault symbol is shown next to Quaternary sediments. In such cases the bedrock is not thrust over the Quaternary sediments but is thrust over bedrock that occurs under a thin cover of unconsolidated sedimentary materials.

Overturned thrust fault between allochthons

Overturned thrust fault within an allochthon

Thrust fault which occurs within an allochthon (intrasequence thrust fault), dashed where approximately located, dotted where concealed, saw teeth on upper plate. Queried where doubtful

Anticline, showing trace of axial plane and plunge of axis, dashed where approximately located

Overturned anticline, showing trace of axial plane and plunge of axis, dashed where approximately located

Syncline, showing trace of axial plane and plunge of axis, dashed where approximately located

Overturned syncline, showing trace of axial plane and plunge of axis, dashed where approximately located

Strike and dip of beds:
- Horizontal
- 25 Inclined
- 30 Apparent inclined
- Vertical
- 70 Overturned

Queried outcrops are plotted from aerial photographs and have not been investigated in the field

17 Fossil locations on geologic map listed in table 1

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