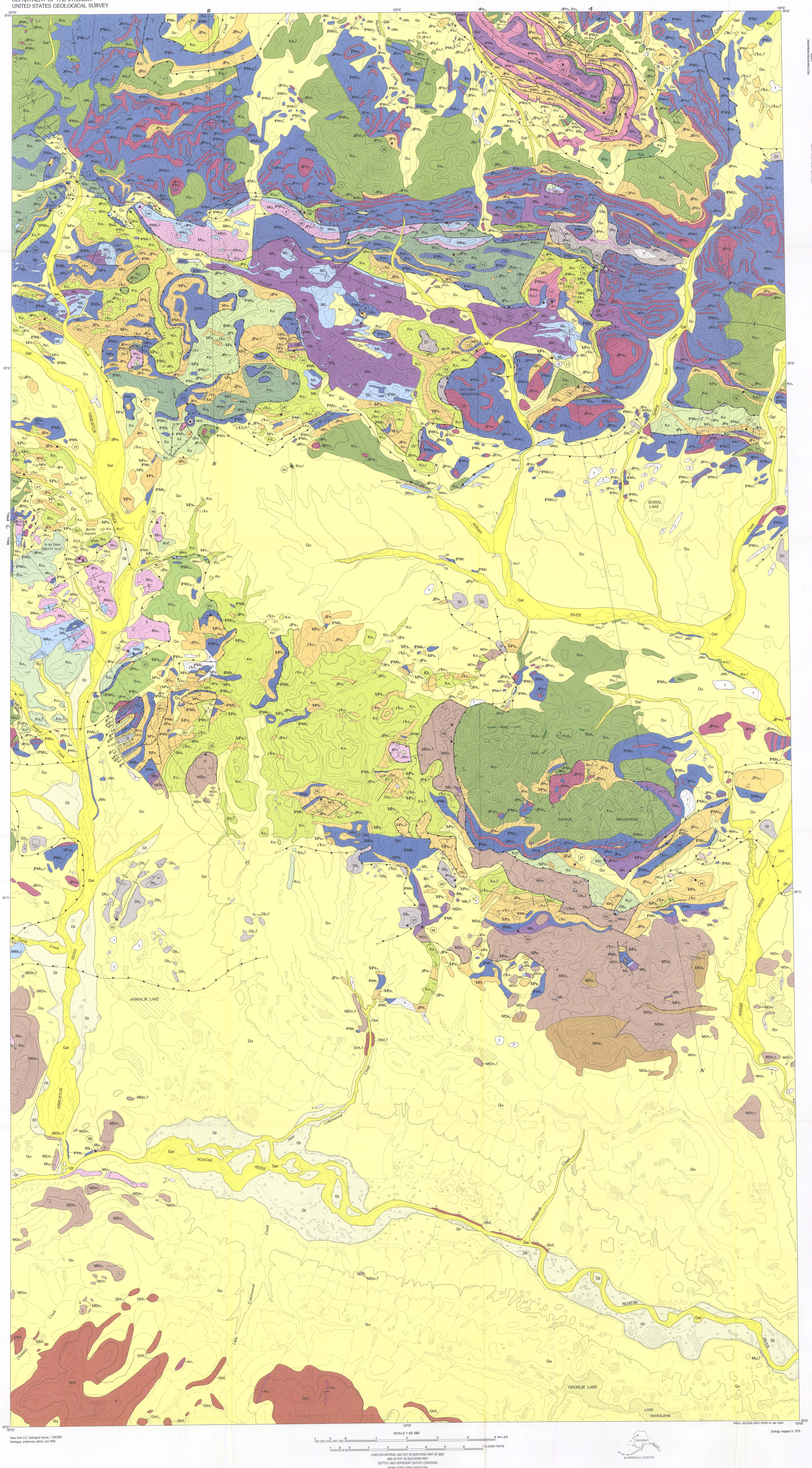


Base from U.S. Geological Survey, 1:250,000
Misheguk, preliminary edition, pre-1956

SCALE 1:63 360

1 ½ 0 1 2 3 4 5 MILES

1 .5 0 1 2 3 4 5 6 7 KILOMETERS

CONTOUR INTERVAL 200 FEET IN NORTHERN PART OF MAP
AND 50 FEET IN SOUTHERN PART
DOTTED LINES REPRESENT 25-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929
1961 MAGNETIC DECLINATION AT SOUTH EDGE OF SHEET VARIES FROM 19°30' TO 22° EAST

Geology mapped in 1978

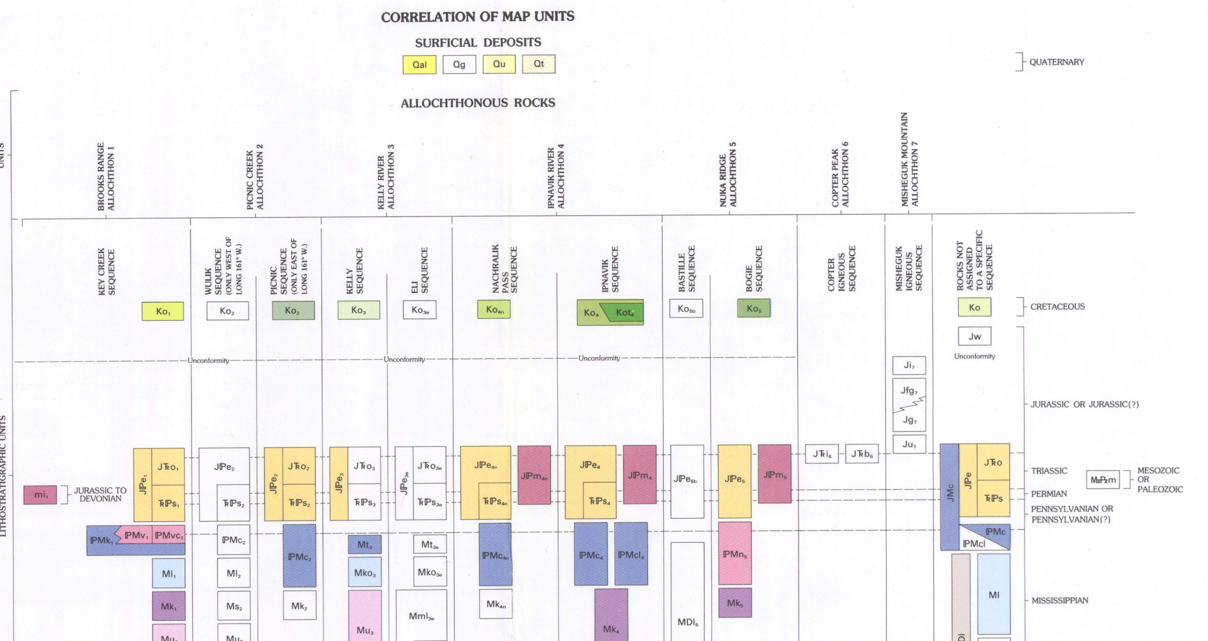
INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—1984—G82431

RECONNAISSANCE GEOLOGIC MAP OF SOUTHEASTERN MISHEGUK MOUNTAIN QUADRANGLE, ALASKA

By
C. F. Mayfield, S. M. Curtis, Inyo Ellersieck, and I. L. Tailleur
1984

For sale by Distribution Section, U.S. Geological Survey, Federal Bldg., Box 12, 101 Twelfth Avenue, Fairbanks, AK 99701, and Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

(Only allochthons and rock units that appear on this map are colored. Those that are not colored appear on the adjacent maps of this series in the 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°08′ N., long 162°29′ W.), De Long Mountains quadrangle. Letter symbols for map units in this sequence include the subscript number 1 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. Exposed thickness ranges from 0 to more than 1,000 m with an unconformity at base. Depositional thickness is probably variable

mi_1 — MAFIC IGNEOUS ROCKS (JURASSIC TO DEVONIAN)—Mafic igneous dikes that cut the Hunt Fork Shale and undifferentiated parts of the Noatak Sandstone and Kanayut Conglomerate. Age is uncertain

$JIPe_1$ — ETIVLUK GROUP (JURASSIC TO PENNSYLVANIAN)—Gray chert with minor amounts of shale; weathers to shades of brown, yellow, gray, green, and maroon. Contains 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 cream-colored or light-brown- and green-weathering rind on chert beds, and commonly contains a few carbonate beds. Lower part includes 5-m interval of black chert that resembles Carboniferous chert. Chert contains Triassic radiolarians. Depositional thickness is approximately 30–50 m. Base is probably gradational into the Siksikpuk Formation

$TRIPs_1$ — 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 are of regional extent

$IPMk_1$ — KUNA FORMATION (PENNSYLVANIAN AND MISSISSIPPIAN)—Black carbonaceous shale with subordinate interbedded black chert; contains 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 and Pennsylvanian age in Picnic Creek allochthon; limestone contains rare brachiopods and Mississippian conodonts. Radiolarians from beds near top indicate an Early and (or) Middle Pennsylvanian age and conodonts from limestone beds in lower part indicate an Early and Late Mississippian age. Depositional thickness is approximately 40–60 m. Basal contact is either sharp on gray limestone (unit Ml_1) or gradational into the Kayak Shale

$IPMv_1$ — 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±17 m.y. (Mayfield and others, 1979)

$IPMvc_1$ — VOLCANICLASTIC ROCKS (PENNSYLVANIAN AND (OR) MISSISSIPPIAN)—Thick-bedded to massive calcareous rocks with volcanic fragments. Commonly coarse-grained limestone with disseminated light-green chloritic minerals. Unit contains sparsely distributed and strongly altered mafic (basaltic?) volcanic rocks. Recognized only 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 — GRAY 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 foraminifers. 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, bryozoans, and foraminifers. 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 the 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; depositional thickness estimated to be approximately 0–50 m. Base seems to have been deposited conformably and possibly gradationally on the Noatak Sandstone or the Kanayut Conglomerate at the mouth of Nimiuktuk River and at west end of Ginny Creek lead-zinc-silver deposit (shown by pattern on southwestern Misheguk Mountain quadrangle map)

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. Contains 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 contain 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. Letter symbols for map units in this sequence include the subscript number 2 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. Exposed thickness ranges from 0 to more than 200 m with an unconformity at base. Depositional thickness is probably variable

$JIPe_2$ — ETIVLUK GROUP (JURASSIC TO PENNSYLVANIAN)—Gray chert with siliceous shale partings. Includes undifferentiated parts of the Siksikpuk and Otuk Formations. Chert contains radiolarians. Includes:

$TRIPs_2$ — 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

$IPMc_2$ — 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 fine-grained limestone (unit Ml_2)

Ml_2 — FINE-GRAINED LIMESTONE (MISSISSIPPIAN)—Black fine-grained limestone, weathers light gray. Beds from 0.3 to 5 cm thick weather flaggy to platy. Contains Late Mississippian foraminifers. 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 relations

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 relations

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 relation between Upper Devonian clastic rocks of the Noatak Sandstone and carbonate rocks of the Baird Group. Limestone beds contain numerous well-preserved Late Devonian (Famennian) 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°33′ N., long 159°17′ W.), Misheguk Mountain quadrangle. Letter symbols for map units in this sequence include the subscript number 2 to signify that they are part of the Picnic Creek allochthon. This sequence is mapped only 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. Exposed thickness ranges from 0 to more than 500 m with an unconformity at base. Depositional thickness is probably variable

$JIPe_2$ — ETIVLUK GROUP (JURASSIC TO PENNSYLVANIAN)—Gray chert with siliceous shale partings. Contains 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 approximately 30–40 m. Base is probably gradational into the Siksikpuk Formation

$TRIPs_2$ — SIKSIKPUK FORMATION (TRIASSIC TO PENNSYLVANIAN)—Olive-gray and maroon chert and siliceous shale. Chert contains Pennsylvanian to Permian radiolarians. Depositional thickness is approximately 40–60 m. Base is gradational into black chert (unit $IPMc_2$)

$IPMc_2$ — 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. Letter symbols for map units in this sequence include the subscript number 3 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-size conglomerate clasts are chert, mafic igneous rocks, granite, and limestone. Contains Neocomian pelecypod, *Buchia*. Lower part may be Late Jurassic. Exposed thickness ranges from 0 to more than 1,000 m with an unconformity at base. Depositional thickness is probably variable

$JIPe_3$ — 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 limestone beds near top contain Triassic pelecypod, *Monotis*, and Triassic radiolarians. Locally, chert, shale, and limestone are maroon in color. Chert and siliceous limestone beds contain radiolarians. Depositional thickness is approximately 30–40 m. Base is probably gradational into the Siksikpuk Formation

$TRIPs_3$ — 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 foraminifers 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 foraminifers (Sable and Dutro, 1961; Armstrong and Mamet, 1977). Depositional thickness ranges from about 30 m west of Nimiuktuk River in the southeastern part of Misheguk Mountain quadrangle to more than 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. Letter symbols for map units in this sequence include the subscript number 3 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. Exposed thickness ranges from 0 to more than 100 m with an unconformity at base. Depositional thickness is probably variable

$JIPe_{3e}$ — ETIVLUK GROUP (JURASSIC TO PENNSYLVANIAN)—Well-bedded gray chert with siliceous shale partings. Chert contains radiolarians. Consists of:

$JTRo_{3e}$ — 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 relations

$TRIPs_{3e}$ — 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 foraminifers. 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. Mapped only 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 foraminifers. Lower part contains Late Devonian to Early Mississippian foraminifers. 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 within this sequence. Depositional thickness probably ranges from 0 to greater than 30 m. Base is probably gradational into the 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 foraminifers of Mamet Zones 5 or 6. Lower part contains buff-weathering, thin-bedded limestone and minor shale with Late Devonian foraminifers of Mamet Zone 2 or older and may be lithologically similar 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 fault 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. Letter symbols for map units in this sequence include the subscript number 4 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-size conglomerate clasts are chert, mafic rocks, granite, and limestone. Age is Early Cretaceous based on regional stratigraphy but lower part may be Late Jurassic. Exposed thickness ranges from 0 to more than 300 m with an unconformity at base. Depositional thickness is probably variable

$JIPe_{4n}$ — ETIVLUK GROUP (JURASSIC TO PENNSYLVANIAN)—Gray and maroon chert with siliceous shale partings. Chert contains radiolarians. Includes:

$TRIPs_{4n}$ — 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 $IPMc_{4n}$)

$JIPm_{4n}$ — MAFIC SILLS AND DIKES (JURASSIC TO PENNSYLVANIAN)—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

$IPMc_{4n}$ — 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 $IPMc_4$) 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 as much as 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. Letter symbols for map units in this sequence include the subscript number 4 to signify that they belong to the part of the Ipnavik River allochthon that contains numerous mafic sills.

Ko_4 — OKPIKRUAK FORMATION (CRETACEOUS)—Interbedded coarse- to fine-grained lithic wacke, conglomerate, and mudstone. Pebble- to cobble-size conglomerate clasts consist of chert, mafic rocks, granite, and limestone. Contains early Valanginian pelecypod, *Buchia*. Lower part may be Late Jurassic. Exposed thickness ranges from 0 to more than 1,000 m with an unconformity at base. Depositional thickness is probably variable. As mapped 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 less than 4 m. Best exposures are in the northern part of the Iggiruk Mountains (southeast Misheguk Mountain quadrangle map)

$JIPe_4$ — ETIVLUK GROUP (JURASSIC TO PENNSYLVANIAN)—Gray or greenish-gray chert. Upper part rarely contains Triassic pelecypod, *Monotis*. Contains radiolarians. Includes:

$TRIPs_4$ — 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 $IPMc_4$)

$JIPm_4$ — MAFIC SILLS AND DIKES (JURASSIC? TO PENNSYLVANIAN)—Fine- to coarse-grained diabase mainly composed of plagioclase and augite. Commonly is partly or completely altered 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

$IPMc_4$ — 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 as much as 100 m thick. Contains Late Mississippian foraminifers of Mamet Zone 11 or younger. Upper part may be Pennsylvanian on the basis of stratigraphic correlation with black chert in structurally lower sequences. Intertongues with black chert and limestone (unit $IPMcl_4$). Depositional thickness is estimated to be less than 100 m. Basal contact is sharp on the Kayak Shale

$IPMcl_4$ — 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 relation with black chert (unit $IPMc_4$). 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 relations

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 elsewhere 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. Letter symbols for map units in this sequence include the subscript number 5 to signify that they are part of the Nuka Ridge 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. Exposed thickness ranges from 0 to 200 m with an unconformity at base. Depositional thickness is probably variable

$JIPe_{5b}$ — 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 (south-central Misheguk Mountain quadrangle map) base is gradational into shale, limestone, calcareous siltstone and sandstone (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 contains 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. Letter symbols for map units in this sequence include the subscript number 5 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. Exposed thickness ranges from 0 to more than 100 m with an unconformity at base. Depositional thickness is probably variable

$JIPe_5$ — ETIVLUK GROUP (JURASSIC TO PENNSYLVANIAN)—Gray, greenish-gray, black, and maroon chert and minor shale. May include part of the Siksikpuk Formation. Chert contains radiolarians. Upper part rarely contains Triassic pelecypod, *Monotis*. Depositional thickness estimated to be less than 150 m; base is gradational into the Nuka Formation at Nuka Ridge

$JIPm_5$ — MAFIC SILLS AND DIKES (JURASSIC TO PENNSYLVANIAN)—Sills or dikes are present north of lower Tumit Creek (south-central Misheguk Mountain quadrangle map) and dismembered shallow intrusive bodies occur around Nuka Ridge (southeastern Misheguk Mountain quadrangle map). Age based on lithologic similarity with mafic rocks in Ipnavik sequence

$IPMn_5$ — NUKA FORMATION (PENNSYLVANIAN? AND MISSISSIPPIAN)—Light-gray- to buff-weathering, coarse- to medium-grained arkose, arkosic limestone, and limestone. Contains locally abundant glauconite and rare hematite cemented beds. Arkose consists of quartz with potassium and plagioclase feldspars apparently derived from an unknown southern granitic source. The upper part of the Nuka Formation has previously been dated on the basis of brachiopod identifications as Permian in age (Tailleur and others, 1973). However recent collections of conodonts (Table 2) from the top beds of this unit at Nuka Ridge indicate that it is not older than Early Pennsylvanian (A. G. Harris, written commun., 1982). Mississippian foraminifers and conodonts occur in the Nuka from a wide area of the western Brooks Range. The age of the Nuka therefore is considered to be Late Mississippian and Early Pennsylvanian(?). 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 foraminifers and brachiopods. Maximum thickness in outcrop is estimated to be 350 m. Basal contact is a thrust fault. Includes beds formerly mapped as Lisburne Group by Tailleur and Sable (1963)

COPTER IGNEOUS SEQUENCE

Named for characteristic exposures at Copter Peak (lat 68°30′ N., long 161°18′ W.), Misheguk Mountain quadrangle. Letter symbols for map units in this sequence include the subscript number 6 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 dacitic, andesitic, and basaltic composition in lower Kugururok Valley (southwestern Misheguk Mountain quadrangle map). Age based upon common association and intrusive relation with basalt (unit $JTRb_6$)

$JTRb_6$ — BASALT (JURASSIC? AND TRIASSIC)—Pillow structures are common. Includes minor amounts of gray shale and radiolarian chert. Triassic age is based on radiolarian fossils 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°05′ W.), Misheguk Mountain quadrangle. Letter symbols for map units in this sequence include the subscript number 7 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 that intrude gabbro (unit Jg_7). Composition is diorite, quartz diorite, and granite with varying proportions of quartz, plagioclase, hornblende, and biotite. Potassium-argon dates from biotite and hornblende collected in rocks of similar lithology and geologic setting at Siniktanneyak Mountain mafic and ultramafic complex in Howard Pass quadrangle give ages of 163 and 172 m.y. respectively (M. L. Silberman, written commun., 1978)

GABBRO (JURASSIC)—As mapped 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

JMc — CHERT, UNDIVIDED (JURASSIC TO MISSISSIPPIAN)—As mapped may include one or more of the following units: Etivluk Group, Otuk Formation, Siksikpuk Formation, and black chert (unit IPMc)

JIPe — 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

TRIPs — SIKSIKPUK FORMATION (TRIASSIC TO PENNSYLVANIAN)—Maroon and gray chert and siliceous shale. Chert contains radiolarians

IPMc — BLACK CHERT (PENNSYLVANIAN AND MISSISSIPPIAN)—Well-bedded. Contains radiolarians

IPMcl — 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 within the 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)

MzPzm — 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. Mapped only north and west of Misheguk Mountain (southwestern and south-central Misheguk Mountain quadrangle maps). Basal contact is a thrust fault

MAP SYMBOLS

CONTACT—Dashed where approximately located; queried where doubtful

HIGH-ANGLE FAULT—Dotted where concealed; queried where extension of fault is doubtful

THRUST FAULTS—Dashed where approximately located; dotted where concealed; queried where doubtful. Sawteeth on upper plate. Half arrows show relative motion on cross section

Between allochthons (intersequence)—Where thrust fault can reasonably be inferred to occur near outcrop boundaries, a thrust fault symbol is shown next to Quaternary sedimentary deposits. In such places the bedrock is not thrust over the Quaternary deposits but is thrust over bedrock that occurs under a thin cover of unconsolidated sedimentary material

Overturned (intersequence)

Within an allochthon (intrasequence)

Overturned (intrasequence)

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

Inclined, dip specified

Inclined, dip not specified

Apparent inclined, dip approximated

Apparent inclined, dip not specified

Vertical

Overturned

(?) QUERIED OUTCROPS—Plotted from aerial photographs and not investigated in the field

(43) FOSSIL LOCALITY—Listed in table 2

REFERENCES

Armstrong, A. K., and Mamet, B. L., 1977, Carboniferous microfacies, microfossils, and corals, Lisburne Group, Arctic Alaska: U.S. Geological Survey Professional Paper 849, 144 p.

Churkin, Michael, Jr., Nokleberg, W. J., and Huie, Carl, 1979, Collision-deformed Paleozoic continent margin, western Brooks Range, Alaska: Geology, v. 7, no. 8, p. 379–383.

Curtis, S. M., Ellersieck, Inyo, Mayfield, C. F., and Tailleur, I. L., 1982, Reconnaissance geologic map of southwestern Misheguk Mountain quadrangle, Alaska: U.S. Geological Survey Open-File Report 82-611, scale 1:63,360.

Ellersieck, Inyo, Mayfield, C. F., Tailleur, I. L., and Curtis, S. M., 1979, Thrust sequences in the Misheguk Mountain quadrangle, Brooks Range, Alaska, *in* Johnson, K. M., and Williams, J. R., eds., The United States Geological Survey in Alaska—Accomplishments during 1978: U.S. Geological Survey Circular 804-B, p. B8.

Ellersieck, Inyo, Curtis, S. M., Mayfield, C. F., and Tailleur, I. L., 1982, Reconnaissance geologic map of south-central Misheguk Mountain quadrangle, Alaska: U.S. Geological Survey Open-File Report 82-612, scale 1:63,360.

Hsu, K. J., 1968, Principles of melanges and their bearing on the Franciscan-Knoxville paradox: Geological Society of America Bulletin, v. 79, no. 8, p. 1063–1074.

Martin, A. J., 1970, Structure and tectonic history of the western Brooks Range, De Long Mountains and Lisburne Hills, northern Alaska: Geological Society of America Bulletin, v. 81, no. 12, p. 3605–3622.

Mayfield, C. F., Curtis, S. M., Ellersieck, Inyo, and Tailleur, I. L., 1979, Reconnaissance geology of the Ginny Creek Zn-Pb-Ag and Nimiuktuk barite deposits, northwestern Brooks Range, Alaska: U.S. Geological Survey Open-File Report 79-1092, 19 p., scale 1:63,360, 2 sheets.

Mayfield, C. F., Tailleur, I. L., Mull, C. G., and Sable, E. G., 1978, Bedrock geologic map of the south half of National Petroleum Reserve in Alaska: U.S. Geological Survey Open-File Report 78-70B, scale 1:500,000, 2 sheets.

Mull, C. G., 1979, Nanushuk Group deposition and the late Mesozoic structural evolution of the central and western Brooks Range and Arctic Slope, *in* Albrandt, T. S., ed., Preliminary geologic, petrologic, and paleontologic results of the study of Nanushuk Group rocks, North Slope, Alaska: U.S. Geological Survey Circular 794, p. 5–13.

Mull, C. G., Tailleur, I. L., Mayfield, C. F., Ellersieck, Inyo, and Curtis, S. M., 1982, New Upper Paleozoic and Lower Mesozoic stratigraphic units, central and western Brooks Range, Alaska: American Association of Petroleum Geologists Bulletin, v. 66, no. 3, p. 348–362.

Mull, C. G., and Tailleur, I. L., 1977, Sadlerochit(?) Group in the Schwatka Mountains, south-central Brooks Range, *in* Blean, K. M., ed., The United States Geological Survey in Alaska—Accomplishments during 1976: U.S. Geological Survey Circular 751–B, p. 27–29.

Mull, C. G., Tailleur, I. L., Mayfield, C. F., and Pessel, G. H., 1976, New structural and stratigraphic interpretations, central and western Brooks Range and Arctic Slope, *in* Cobb, E. H., ed., The United States Geological Survey in Alaska—Accomplishments during 1975: U.S. Geological Survey Circular 733, p. 24–26.

Patton, W. W., Jr., Tailleur, I. L., Brosgé, W. P., and Lanphere, M. A., 1977, Preliminary report on the ophiolites of northern and western Alaska, *in* Coleman, R. G., and Irwin, W. P., eds., North American ophiolites: Oregon Department of Geology and Mineral Industries Bulletin 95, p. 51–57.

Roeder, Dietrich, and Mull, C. G., 1978, Tectonics of Brooks Range ophiolites, Alaska: American Association of Petroleum Geologists Bulletin, v. 62, no. 9, p. 1696–1702.

Sable, E. G., and Dutro, J. T., Jr., 1961, New Devonian and Mississippian formations in the De Long Mountains, northern Alaska: American Association of Petroleum Geologists Bulletin, v. 45, no. 5, p. 585–593.

Smith, P. S., and Mertie, J. B., Jr., 1930, Geology and mineral resources of northwestern Alaska: U.S. Geological Survey Bulletin 815, 351 p.

Snelson, Sigmund, and Tailleur, I. L., 1968, Large-scale thrusting and migrating Cretaceous foredeeps in the western Brooks Range and adjacent regions of northwestern Alaska [abs.]: American Association of Petroleum Geologists Bulletin, v. 52, no. 3, p. 567.

Tailleur, I. L., and Brosgé, W. P., 1970, Tectonic history of northern Alaska: *in* Adkinson, W. L., and Brosgé, M. M., eds., Geological seminar on the North Slope of Alaska, Palo Alto, Calif., 1970: Los Angeles, Calif., American Association of Petroleum Geologists, Pacific Section Meeting, Proceedings, p. E1–E19.

Tailleur, I. L., Brosgé, W. P., and Reiser, H. N., 1967, Palinspastic analysis of Devonian rocks in northwestern Alaska, *in* Oswald, D. H., ed., International Symposium on the Devonian System, Calgary, Alberta, 1967, Alberta Society of Petroleum Geologists, v. 2, p. 1345–1361.

Tailleur, I. L., Kent, B. H., Jr., and Reiser, H. N., 1966, Outcrop/geology maps of the Nuka-Etivluk region, northern Alaska: U.S. Geological Survey Open-File Report 66-128, scale 1:63,360, 7 sheets.

Tailleur, I. L., Mamet, B. L., and Dutro, J. T., Jr., 1973, Revised age and structural interpretations of Nuka Formation at Nuka Ridge, northwestern Alaska: American Associaton of Petroleum Geologists Bulletin, v. 57, no. 7, p. 1348-1352.

Tailleur, I. L., and Sable, E. G., 1963, Nuka Formation of Late Mississippian to Late Permian age, new formation in northern Alaska: American Association of Petroleum Geologists Bulletin, v. 47, no. 4, p. 632–642.

Zimmerman, Jay, and Soustek, P. G., 1979, The Avan Hills ultramafic complex, De Long Mountains, Alaska, *in* Johnson, K. M., and Williams, J. R., eds., The United States Geological Survey in Alaska—Accomplishments during 1978: U.S. Geological Survey Circular 804–B, p. B8–B11.