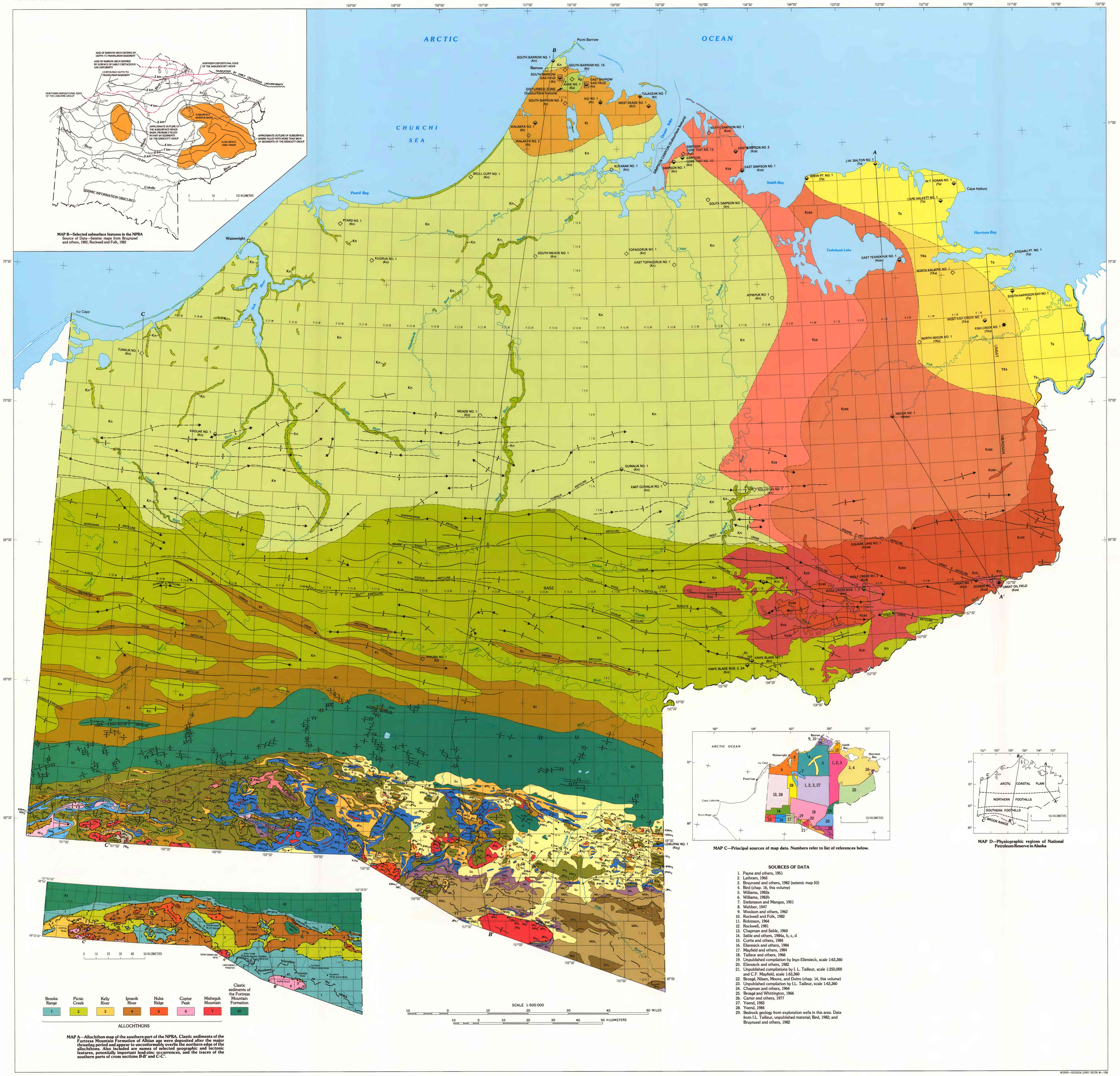
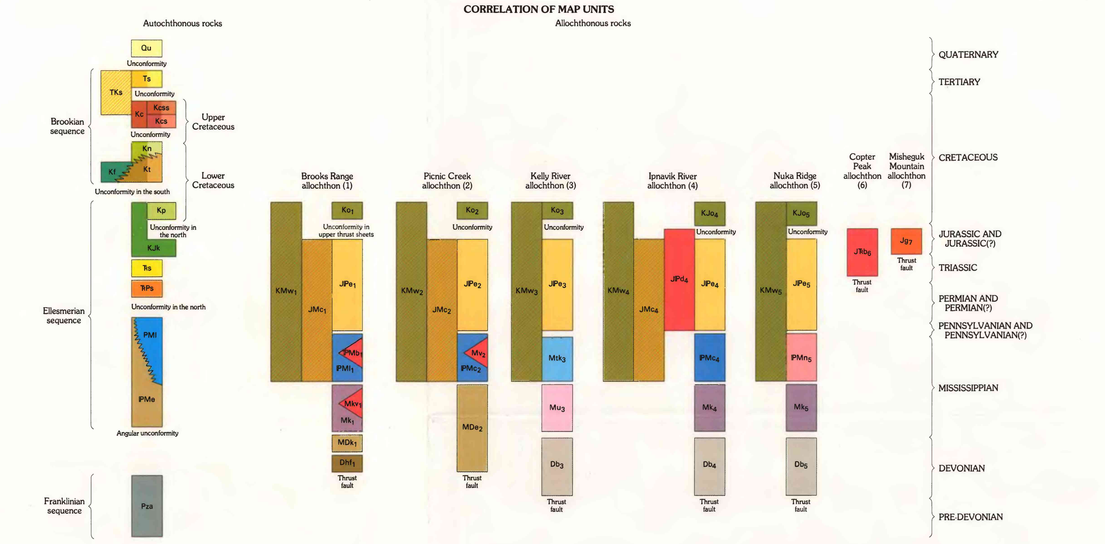


BEDROCK GEOLOGIC MAP OF THE NATIONAL PETROLEUM RESERVE IN ALASKA

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

AUTOCHTHONOUS ROCKS

Qu — **Surficial deposits, undivided (Quaternary)**—Consists of tundra, soil, alluvial, lacustrine, and glacial deposits. Mapped only in certain parts of the southern foothills and Brooks Range where identity of bedrock units cannot be inferred because of extreme structural complexities

TKs — **Sagavanirktok Formation (Tertiary) and (or) Colville Group (Upper Cretaceous), undivided**—Sandstone, siltstone, and shale. Mapped from subsurface in northeastern part of the reserve where available information from upper part of wells is inconclusive for distinction between Cretaceous and Tertiary rocks.

Ts — **Sagavanirktok Formation (Tertiary)**—Poorly indurated siltstone, shale, and sandstone with local ash beds. Only known outcrops of these rocks occur at the big bend on the lower Colville River (Carter and others, 1977). Contains Tertiary foraminifers and pollens. Maximum thickness is probably less than 160 m. Lighter shade of color indicates areas covered by unconsolidated Quaternary sediments

Kc — **Colville Group, undivided (Upper Cretaceous)**—Sandstone, shale, conglomerate, bentonite, and coal. Upper part is a northeastward-prograded deltaic complex composed of pensitic and fluvial sandstone, shale, conglomerate, coal, and bentonite of the Prince Creek Formation that interfingers northward with offshore marine facies of mostly shale, sandstone, and bentonite of the Schrader Bluff Formation. Lower part is composed of marine shale, bentonite, and sandstone of the Seabee Formation. Represents molasic sediments deposited during epeirogenic uplift in the Brooks Range. Most distinctive lithologic feature of this unit compared to the rock units above and beneath is the abundance of bentonite and tuff beds. Important fossils are pelecypods, gastropods, cephalopods, and foraminifers of Turonian to Maastrichtian(?) age. Thickness is up to 1,800 m in the Umiat area. Mapped only on cross section A-A'. Divided on geologic map into an upper part that consists primarily of sandstone and a lower part that consists primarily of shale. Divided into:

Kpss — **Sandstone**—Sandstone, conglomerate, shale, coal, and bentonite. Contains mostly deltaic sediments laid down in fluvial to paralic depositional settings. Consists of the Prince Creek Formation in the Umiat area and the Prince Creek Formation interfingered with the upper, sandier part of the Schrader Bluff Formation under the Arctic coastal plain. Forms the upper part of the Colville Group. Thickness north of the Umiat area is up to 750 m. Lighter shade of color indicates areas covered by unconsolidated Quaternary sediments. Not distinguished on cross sections

Kpsh — **Shale**—Shale and silty shale characteristically interbedded with light-colored bentonite layers that are commonly less than 2 cm thick; subordinate amounts of sandstone, calcareous sandstone, and siltstone. Consists primarily of the Seabee Formation in the Umiat area and includes lower part of the Schrader Bluff Formation under the Arctic coastal plain. Forms the lower part of the Colville Group. Southern part represents southward marine transgression between deltaic sandstone of the Colville Group and the Namuskuk Group. Potassium-argon dates from biotite collected in bentonite beds of the Seabee Formation range from 91.5 ± .9 to 93.6 ± 1.2 m.y. (Lanphere and Tailleur, 1983). Thickness in the Umiat area is approximately 300 m. Lighter shade of color indicates areas covered by unconsolidated Quaternary sediments. Unit not distinguished on cross sections

Kn — **Nanushuk Group (Upper and Lower Cretaceous)**—Sandstone, conglomerate, shale, and coal. Deposited in northeastward-prograded deltaic complexes with a major source area southeast of the Umiat area and another west of the Petroleum Reserve near Corwin Bluff (Ahlbrandt, 1979). In the southwest, marine shale and sandstone of the Lower Cretaceous Kukpowruk Formation grade upward into paralic and fluvial sandstone, conglomerate, and coal of the Lower and Upper Cretaceous Corwin Formation. In the southeast, marine shale and sandstone of the Lower Cretaceous Tuluvak and Lower Cretaceous Grandstand Formations grade upward into paralic and fluvial sandstone, conglomerate, and coal of the Lower and Upper Cretaceous Chandler Formation. A tongue of marine shale in the Chandler Formation is called the Nikaitchuk Formation (Upper Cretaceous) (Chapman and others, 1964). This deltaic complex prograded northeastward into the marine Torok Formation (Chapman and Sable, 1960; Bird and Andrews, 1979). Represents molasic sediments deposited during epeirogenic uplift in the Brooks Range. Important megafossils include pelecypods, cephalopods, and ammonites; important microfossils are foraminifers, dinoflagellates, pollens, and acritarchs of middle Albian to early Cenomanian age. Unit is approximately 3,000 m thick in the southwest part of the northern foothills and thins progressively toward the northeast where it is less than 300 m near the Colville River delta and has been eroded from an area south of Barrow. Lighter shade of color indicates areas covered by unconsolidated Quaternary sediments

Kt — **Torok Formation (Lower Cretaceous)**—Dark-gray to black clay shale, locally calcareous, and thin interbedded siltstone with subordinate wacke. Represents shaly distal marine deposits of same age as the Fortress Mountain Formation and the lower part of the Nanushuk Group. Important fossils are cephalopods, foraminifers, and dinoflagellates of Albian age. Thickness is over 5,000 m in the vicinity of the Colville River and thins northward to less than 300 m in the Barrow area. Lighter shade of color indicates areas covered by unconsolidated Quaternary sediments

Kf — **Fortress Mountain Formation (Lower Cretaceous)**—Wacke, conglomerate, and mudstone. Flyschoid sediments mainly deposited by turbidity currents. Represents fluvial, submarine canyon, and inner-fan channel facies on the south and outer-fan and basin-plain facies to the north (Molenaar, 1981). Interfingers northward and laterally with the Lower Cretaceous Torok Formation. Deposited after the close of the major thrusting episode of the Brooks Range orogeny. Contains pelecypods and ammonites of early Albian age. Maximum thickness is nearly 3 km in the southern foothills and thins rapidly northward. Southern outcrops appear to lie unconformably, possibly by disconformity, upon Neocomian and older allochthonous rocks

Ko — **Pebble shale unit (Lower Cretaceous)**—Black, organic-rich, marine shale distinguished by "floating" round quartz grains and scattered chert pebbles. More proximal, local facies consist of thin members or beds of arenite, of basal pebbly mudstone, or of thinly interlayered sandstone and shale that probably were displaced downslope by density flows (Blanchard and Tailleur, 1983). Grades into diachronous, condensed, radioactive zone at top. Penetrated in many North Slope wells but here mapped only in subcrop at Peak disturbed zone south of Point Barrow. Contains microfossils and megafossils at least as old as Berriasian and Valanginian in the south but no older than Hauterivian and Barremian in the north. Seismic and well data indicate a decrease in thickness to the north from more than 800 m in the area of the Kaolak No. 1 well to about 100 m in the Barrow area by merging intraformational unconformities. Succeeds the underlying Kingak Shale with probable conformity basinward (southeast) and a basal unconformity truncates down to Franklinian basement shoreward (northward).

Ksk — **Pebble shale unit and Kingak Shale (Lower Cretaceous and Jurassic), undivided**—The lithology for the pebble shale unit is listed above. The Upper Jurassic to Lower Cretaceous Kingak Shale consists of shale, siltstone, and sandstone with local limestone concretions. In the northern part of the reserve, the base of the Lower Cretaceous pebble shale unit is a major unconformity. In the southern and western parts of the reserve, the contact between the pebble shale unit and the Kingak Shale is obscure and appears to be gradational. The undivided unit is mapped only in cross sections. Important fossils are cephalopods, pelecypods, foraminifers, and dinoflagellates of Early Jurassic to Early Cretaceous age. Under the Arctic coastal plain, the thickness ranges to 1,500 m southward of the Kugrua No. 1 well and thins by deposition and truncation to less than 60 m along the northeast coast of the reserve

Ts — **Sag River Sandstone and Shublik Formation, undivided (Triassic)**—The Upper Triassic Sag River Sandstone gradationally overlies the Middle and Upper Triassic Shublik Formation and consists of fine-grained glauconitic sandstone and siltstone, locally dolomitic. The Shublik Formation consists of black organic shale, siltstone, and limestone. The undivided unit is mapped only in cross sections and contains pelecypods, foraminifers, dinoflagellates, and pollens of Middle and Late Triassic age. Thickness, determined from seismic sections (Bergquist and others, 1982), ranges from approximately 130 to 260 m

Ssf — **Sadlerochit Group (Triassic and Permian)**—Shale, siltstone, and sandstone of the Lower Triassic Ivishak Formation which is underlain by shale, limestone, sandstone, conglomerate, and siltstone of the Lower and Upper Permian Echooka Formation. The Sadlerochit Group is mapped only in cross sections and contains foraminifers, spores, and pollens of Permian and Early Triassic age. Under the Arctic coastal plain, thickness greater than 500 m in the south at Inigok No. 1 well and in the west at Tunalik No. 1 well and thins to the north and northeast (Map B)

PMl — **Lisburne Group (Permian to Mississippian)**—Limestone and shale of the Upper Mississippian to Middle Pennsylvanian Wahoo Formation which is underlain by shaly and cherty limestone and dolomite of the Upper Mississippian Alapah Limestone. In the northeastern part of the map area, also includes (subsurface) limestone and shale of Early Permian(?) age presently assigned to the undivided Lisburne (Bird, 1978). Represents a transgressive succession of carbonate rocks that is younger to the north. The Lisburne is mapped only in cross sections and contains corals, crinoids, brachiopods, foraminifers, and pollens. Thickness is greater than 1,000 m at Tunalik No. 1 well and Inigok No. 1 well and thins by deposition to the north and northeast (Map B)

PMe — **Endicott Group (Permian, Pennsylvanian, and Mississippian)**—In the mapped area includes dark-colored carbonaceous shale and sandstone of the Kayak Shale that is gradationally overlain by sandstone, shale, and conglomerate of the Kekiktuk Conglomerate; locally in the north, also includes marcon shale interbedded with sandstone, conglomerate, and limestone of the Itkillyariak Formation. Represents the basal shoreward lithofacies of sediments that transgressed an erosional plain developed upon the Franklinian sequence. Local thickening in structurally controlled basins occurs about midway between the southern boundary of the mapped area and the present-day coastline. The Endicott lithofacies are diachronous, ranging from Early Mississippian age in the south to Early Permian(?) age in the north, where the undivided Endicott (in subsurface) at the J.W. Dalton No. 1 well contains Early to Middle Pennsylvanian foraminifers and karnarozil algae. In the vicinity of the Topagoruk well, these proximal, extrabasinal deposits seem to be succeeded discontinuously by lithologically similar strata of the Sadlerochit Group. Mapped only in cross sections

Pzs — **Argillite, quartzite, and granite (pre-Devonian and Devonian)**—Steeply dipping, dark-gray argillite and subordinate quartzite and conglomerate in the Barrow area which contains Ordovician and Silurian chitinozoans at South Barrow No. 1 well and South Barrow No. 3 well (Carter and Laufeld, 1975); quartzite, conglomerate, and slate with Early(?) or Middle Devonian plant fossils at Topagoruk No. 1 well (Collins, 1958); and granite at East Teshepuk No. 1 well (Bird and others, 1978). Elsewhere, may include rocks of other lithologies. Represents pre-Mississippian (Paleozoic) basement rocks that were deformed and eroded during the Late Devonian Ellesmerian orogeny. Mapped only in cross sections

ALLOCHTHONOUS ROCKS

Brooks Range allochthon

Letter symbols for map units include the subscript number 1 to signify that they are part of the Brooks Range allochthon.

KMwc — **Wacke, shale, chert, and limestone, undivided (Cretaceous to Mississippian)**—Lower Cretaceous rocks are interbedded mudstone and subordinate wacke of the Okpikruak Formation overlying clay shale and conjoined limestone of the Ipewik Formation. Pennsylvanian to Middle Jurassic rocks are chert and siliceous shale of the Etivluk Group. Lower Mississippian to Lower or Middle Pennsylvanian rocks are black shale and chert of the Kuna Formation overlying light-gray limestone and dolomite. Mapped in areas of structural complexity where there are closely spaced thrust faults and folds

Kcs — **Okpikruak Formation and Ipewik unit, undivided (Cretaceous)**—Okpikruak Formation contains gray mudstone with subordinate interbedded medium- to fine-grained lithic wacke. Represents orogenic flyschoid sediments deposited by turbidity currents. In some places clastic beds may enclose olistoliths of older rocks. Okpikruak Formation is considered only Early Cretaceous in age in this allochthon. The Ipewik unit (Crane and Wiggins, 1976), locally present at base of section, contains a less than 15-m interval of pre-orogenic maroon and gray-weathering clay beds with sporadic coquinoid limestone that contains pelecypods of Valanginian age. Flyschoid beds also contain Early Cretaceous pelecypods. Thickness is greater than 300 m at the mountain front and thins rapidly northward in this allochthon. May be completely removed by the unconformity at base of the Fortress Mountain Formation in some parts of the southern foothills. Depositional thickness appears to be less than 50 m at the Brady anticline and probably thins to zero at the latitude of the Colville River

JMKc — **Chert and shale (Jurassic to Mississippian)**—Pennsylvanian to Middle Jurassic rocks are gray and maroon chert and siliceous shale of the Etivluk Group. Lower Mississippian to Lower or Middle Pennsylvanian rocks are black shale and chert of the Kuna Formation. Thickness is approximately 150 to 200 m

JPzs — **Etivluk Group (Jurassic to Pennsylvanian)**—Well-bedded gray chert and siliceous shale; weathers brown, yellow, gray, green, and maroon with light-cream-weathering limestone in Late Triassic beds. Consists of the Pennsylvanian to Lower Triassic Siksikpuk and Lower Triassic to Middle Triassic Otuk Formations. Contains Pennsylvanian to Triassic radiolarians and Late Triassic to Early and Middle(?) Jurassic pelecypods. Thickness is approximately 120 m

PMIs — **Lisburne Group (Pennsylvanian and Mississippian)**—Consists of black carbonaceous shale and chert of the Lower Mississippian to Lower or Middle Pennsylvanian Kuna Formation underlain by unnamed unit of discontinuous light-gray limestone and dolomite with black chert nodules. Contains Late Mississippian to Early Pennsylvanian radiolarians and Late Mississippian corals, brachiopods, conodonts, and foraminifers. Thickness of the Kuna Formation is 10 to 100 m. Carbonate rocks thicken eastward from 0 to 20 m in the southwest to greater than 200 m in the vicinity of Lisburne No. 1 well. Black shale and chert of the Kuna Formation are host for a stratiform lead-zinc deposit at Drenchwater Creek (fig. 3 in Nokleberg and Winkler, 1982)

Mzs — **Basalt, andesite, and latite (Pennsylvanian and Mississippian)**—Unit locally includes tuffaceous volcaniclastic beds assigned to the Kuna Formation. Potassium-argon dates from biotite range from approximately 330-320 m.y.

MDs — **Endicott Group (Mississippian and Devonian)**—Divided into:

Mk — **Kayak Shale (Mississippian)**—Upper part consists of dark-gray shale with a few interbeds of orange-weathering limestone and rusty manganese concretions. Lower part consists of interbedded shale and sandstone. Common fossils are brachiopods, crinoids, bryozoans, and foraminifers of Early Mississippian age. A few thin discontinuous coaly beds present. Thickness is approximately 400 m. Also includes:

Mmx — **Mafic volcanic rocks**—Greenish-weathering basalt and associated volcaniclastic rocks

MDks — **Kanayut Conglomerate and Noatak Sandstone, undivided (Mississippian and Devonian)**—Well-indurated sandstone, pebbly sandstone, conglomerate, and shale deposited in shallow marine and fluvial settings. Contains Late Devonian brachiopods and Early Mississippian(?) plant fossils. Thickness is approximately 300 to 600 m. Sandstone and shale in upper part are host rocks for vein-type lead-zinc occurrences (Map A) at Story Creek, Kayakitoot Mountain, and Kivitkroot Mountain (Jansons and Parke, 1981; Ellersieck and others, 1982b). Age of the Kanayut here is Late Devonian and Early Mississippian(?), and the Noatak here is Late Devonian and Early Mississippian

DMs — **Hunt Fork Shale (Devonian)**—Marine shale with subordinate interbedded fine-grained sandstone. Contains Late Devonian (Frasnian) brachiopods. Thickness is approximately 300 m

Picnic Creek allochthon

Letter symbols for map units include the subscript number 2 to signify that they are part of the Picnic Creek allochthon.

KMwc — **Wacke, shale, and chert, undivided (Cretaceous to Mississippian)**—Lower Cretaceous rocks are interbedded mudstone and wacke of the Okpikruak Formation. Pennsylvanian to Middle Jurassic rocks are chert and siliceous shale of the Etivluk Group. Mississippian and Lower Pennsylvanian rocks are black chert. Mapped in areas of structural complexity where there are closely spaced thrust faults and folds

Kcs — **Okpikruak Formation (Cretaceous)**—Gray mudstone and medium- to fine-grained lithic wacke. Represents orogenic flyschoid sediments deposited by turbidity currents. In some places clastic beds may enclose olistoliths of older rocks. Contains Early Cretaceous (Neocomian) pelecypods. Thickness ranges up to approximately 500 m. Unit considered only Early Cretaceous in age in this allochthon

JMKc — **Chert and shale (Jurassic to Mississippian)**—Pennsylvanian to Middle Jurassic rocks are gray and maroon chert and siliceous shale of the Etivluk Group. Mississippian and Lower Pennsylvanian rocks are dark-gray or black chert. Thickness is approximately 150 to 200 m

JPzs — **Etivluk Group (Jurassic to Pennsylvanian)**—Well-bedded gray chert and siliceous shale; weathers brown, yellow, gray, green, and maroon. Consists of the Pennsylvanian to Lower Triassic Siksikpuk and Lower Triassic to Middle Jurassic Otuk Formations. Contains Pennsylvanian to Triassic radiolarians and Late Triassic pelecypods in upper part. Thickness is approximately 110 m

PMIc — **Black chert (Pennsylvanian and Mississippian)**—Well-bedded black chert with subordinate amounts of dark siliceous shale. Chert overlies discontinuous micritic limestone in southeastern foothills. Contains Late Mississippian to Pennsylvanian radiolarians. Thickness is approximately 50 to 100 m

Mzs — **Mafic to intermediate volcanic rocks (Mississippian)**—Unit also locally includes light-green, yellow, and gray tuffaceous rocks interbedded with black chert. Only a few localized occurrences in the southeastern foothills. Thickness is highly variable but generally less than 100 m

MDcg — **Endicott Group (Mississippian to Devonian)**—Well-indurated shale, siltstone, sandstone, and subordinate conglomerate that is stratigraphically correlative with the Lower Mississippian Kayak Shale, Upper Devonian and Lower Mississippian Noatak Sandstone, and Upper Devonian and Lower Mississippian(?) Kanayut Conglomerate. Thickness approximately 100 m

Kelly River allochthon

Letter symbols for map units include the subscript number 3 to signify that they are part of the Kelly River allochthon. Present only in the western half of the map area except for small thrust slices south of the Drenchwater fenster and around the Pugok Hills (Map A).

KMwc — **Wacke, shale, chert, and limestone, undivided (Cretaceous to Mississippian)**—Lower Cretaceous rocks are interbedded wacke and mudstone of the Okpikruak Formation. Pennsylvanian to Middle Jurassic rocks are chert and siliceous shale of the Etivluk Group. Mississippian rocks are limestone with black chert nodules and lenses of the Lisburne Group. Mapped in areas of structural complexity where there are closely spaced thrust faults and folds

Kcs — **Okpikruak Formation (Cretaceous)**—Interbedded medium- to fine-grained lithic wacke and subordinate mudstone. Represents orogenic flyschoid sediments deposited by turbidity currents. In some places clastic beds may enclose olistoliths of older rocks. Contains Early Cretaceous (Neocomian) pelecypods. Thickness is approximately up to 1,000 m. Lower part of unit may possibly be Late Jurassic in age in this allochthon

JPzs — **Etivluk Group (Jurassic to Pennsylvanian)**—Well-bedded maroon and gray chert and siliceous shale. Consists of the Pennsylvanian to Lower Triassic Siksikpuk and Lower Triassic to Middle Jurassic Otuk Formations. Contains Pennsylvanian to Triassic radiolarians and Late Triassic pelecypods in upper part. Thickness is approximately 130 m. Base here is a possible disconformity

Mlsg — **Lisburne Group (Mississippian)**—Divided into:

Mt — **Tupik and Nogruk Formations, undivided (Mississippian)**—Upper part locally contains interbedded black chert and micritic limestone of the Upper Mississippian Tupik Formation. Lower part contains light-gray, medium- to coarse-grained, nodular limestone with scattered black chert nodules. Numerous fossils are corals, brachiopods, crinoids, conodonts, and foraminifers of Late Mississippian age. Uppermost part of the Tupik Formation is sparsely fossiliferous and may prove to be Early Pennsylvanian. The undivided unit is greater than 300 m thick in southwestern part of map area and thins eastward to less than 40 m thick at long 159° W. Not present at southeastern edge of map area. Nogruk Formation is Early and Late Mississippian in age

Mlu — **Utukok Formation (Mississippian)**—Buff-weathering limestone, sandy limestone, fine-grained sandstone, and shale. Numerous fossils consist of brachiopods, gastropods, pelecypods, crinoids, conodonts, and foraminifers of Early and Late Mississippian age. Thickness may be as much as 100 m in southwest part of map area and thins rapidly eastward. Not present in east half of map area

Dlg — **Baird Group (Devonian)**—Medium- to thick-bedded, light-gray limestone and dolomite. Common fossils include brachiopods, stromatoporoids, and conodonts of Middle and Late Devonian age. Thickness is approximately 700 m

Ipnavik River allochthon

Letter symbols for map units include the subscript number 4 to signify that they are part of the Ipnavik River allochthon.

KMwg — **Wacke, conglomerate, shale, chert, and limestone, undivided (Cretaceous to Mississippian)**—Lower Cretaceous rocks are wacke, conglomerate, and mudstone of the Okpikruak Formation. Pennsylvanian to Middle Jurassic rocks are chert and siliceous shale of the Etivluk Group. Mississippian and Lower Pennsylvanian rocks are black chert with subordinate limestone of the Lisburne Group. Mapped in areas of structural complexity where there are closely spaced thrust faults and folds

KJkg — **Okpikruak Formation (Cretaceous and Jurassic)**—Fine- to medium-grained lithic wacke, conglomerate, and subordinate mudstone. Pebble- to cobble-size conglomerate clasts consist of chert, mafic rocks, granite, and limestone. Represents orogenic flyschoid sediments deposited by turbidity currents. In some places clastic beds may enclose olistoliths of older rocks. Contains Early Cretaceous (Neocomian) pelecypods; lower part may prove to be Late Jurassic. Thickness ranges up to approximately 1000 m

JMKg — **Chert and shale (Jurassic to Mississippian)**—Pennsylvanian to Middle Jurassic rocks are maroon and gray chert and siliceous shale of the Etivluk Group. Mississippian and Lower Pennsylvanian rocks are mainly black chert with subordinate interbedded limestone of the Lisburne Group. Locally intruded by diabase sills. Thickness is approximately 200 m

JPRd — **Diabase (Jurassic to Pennsylvanian)**—Brown-weathering mafic sills and dikes. Age based on apparent intrusion of sills into at least the lower part of the Etivluk Group

JPwg — **Etivluk Group (Jurassic to Pennsylvanian)**—Well-bedded, maroon and gray chert and siliceous shale. Includes the Pennsylvanian to Lower Triassic Siksikpuk Formation. Contains Pennsylvanian to Jurassic radiolarians and rare Late Triassic pelecypods in upper part. Thickness ranges up to approximately 110 m

PMIg — **Black chert and limestone (Pennsylvanian and Mississippian)**—Well-bedded black chert and limestone. In most places fine-grained limestone is subordinate to chert, but in some areas lower part of section is predominantly limestone. Commonly intruded by prominent brown-weathering diabase sills. Contains Late Mississippian to Pennsylvanian radiolarians and Late Mississippian foraminifers. Thickness is approximately 100 m

Mkg — **Kayak Shale (Mississippian)**—Black shale with subordinate interbedded orange-weathering limestone, rusty-weathering concretions, and siltstone. Contains Early Mississippian corals and conodonts. Thickness is approximately 70 m

Dbg — **Baird Group (Devonian)**—Thin- to thick-bedded, light-gray limestone. Contains brachiopods, crinoids, and conodonts of Late Devonian age. Exposed thickness ranges up to approximately 75 m

Nuka Ridge allochthon

Letter symbols for map units include the subscript number 5 to signify that they are part of the Nuka Ridge allochthon.

KMwg — **Wacke, shale, chert, and arkosic limestone, undivided (Cretaceous to Mississippian)**—Lower Cretaceous rocks are wacke and mudstone of the Okpikruak Formation. Pennsylvanian to Middle Jurassic rocks are chert and siliceous shale of the Etivluk Group. Upper Mississippian and Lower Pennsylvanian(?) rocks are arkosic limestone of the Nuka Formation. Mapped in areas of structural complexity where there are closely spaced thrust faults and folds

KJkg — **Okpikruak Formation (Cretaceous and Jurassic)**—Fine- to medium-grained lithic wacke and mudstone. Represents orogenic flyschoid sediments deposited by turbidity currents. Lower part is apparently Late Jurassic based on regional stratigraphic correlation. Thickness ranges up to approximately 200 m

JPwg — **Etivluk Group (Jurassic to Pennsylvanian)**—Well-bedded, maroon and gray chert and subordinate siliceous shale. Contains Pennsylvanian to Triassic radiolarians and rare Late Triassic pelecypods in upper part. Thickness is approximately 110 m

PMNg — **Nuka Formation (Pennsylvanian? and Mississippian)**—Coarse- to fine-grained arkose, arkosic limestone, and limestone. Some beds have reddish hematite coloration; others contain distinctive greenish glauconite. Abundant fossils are brachiopods, crinoids, conodonts, and foraminifers. Microfossils are Late Mississippian to Early Pennsylvanian(?)

Mkg — **Kayak Shale (Mississippian)**—Dark-gray shale with interbedded orange-weathering limestone, siltstone, and minor fine-grained sandstone. Contains Early Mississippian brachiopods and foraminifers. Thickness ranges up to approximately 300 m

Dbg — **Baird Group (Devonian)**—Upper part is massive to thin-bedded limestone and subordinate dolomite with a few gray chert nodules. Lower part is shale interbedded with limestone, siltstone, and local fine-grained sandstone. Includes the Upper Devonian Kugururok Formation. Common fossils are corals, brachiopods, stromatoporoids, and conodonts of Middle and Late Devonian age

Copter Peak allochthon

Letter symbols for this map unit include the subscript number 6 to signify that they are part of the Copter Peak allochthon.

JRbg — **Basalt (Jurassic? and Triassic)**—Commonly has pillow structures. Andesitic rocks and a few granitic dikes present locally. Minor amounts of gray shale and chert intercalated with the basalt. Locally contains tectonic(?) blocks of Devonian limestone. Chert contains Triassic radiolarians. Jurassic age is less certain and is based on possibility that rocks equivalent to the gabbro in allochthon 7 may be the source for some of the basalt

Misheguk Mountain allochthon

Letter symbols for this map unit include the subscript number 7 to signify that they are part of the Misheguk Mountain allochthon.

Jgy — **Gabbro (Jurassic)**—Fine- to coarse-grained phases mainly consist of plagioclase, clinopyroxene, orthopyroxene, hornblende, and olivine. Commonly banded with plagioclase- and pyroxene-rich layers. Local diorite, quartz diorite, and granite. Using potassium-argon methods, hornblende from pegmatite in gabbro dated at approximately 164 m.y. and biotite from granitic rocks dated at approximately 163 and 172 m.y. These rocks and associated peridotite (exposed south of map area) are thought to be part of an ophiolite suite that cooled during obduction during the Middle Jurassic

EXPLANATION OF MAP SYMBOLS

Contact—Dashed where approximately located; dotted where concealed

Fault—Dashed where approximately located; U, upthrown side; D, downthrown side

Reverse fault—Showing direction of dip; dashed where approximately located; U, upthrown side; D, downthrown side

Interallochthon thrust fault—Dashed where approximately located; dotted where inferred

Intra-allochthon thrust fault—Dashed where approximately located; dotted where inferred. Map scale permits only selected faults to be shown.

Anticline—Showing direction of plunge; dashed where approximately located

Overturned anticline—Showing direction of dip of limbs

Syncline—Showing direction of plunge; dashed where approximately located

Overturned syncline—Showing direction of dip of limbs

MEADE NO. 1 (Kn) — Location and name of oil exploration wells—Symbol of first rock unit drilled at the well in parentheses

Dry and abandoned wells

No shows

Oil shows

Gas shows

Oil and gas shows

Suspended wells (includes shut in or temporarily abandoned)

Oil producer

Gas producer

Gas producer with oil shows

Producer wells

Gas with oil shows

Oil with gas shows (abandoned)