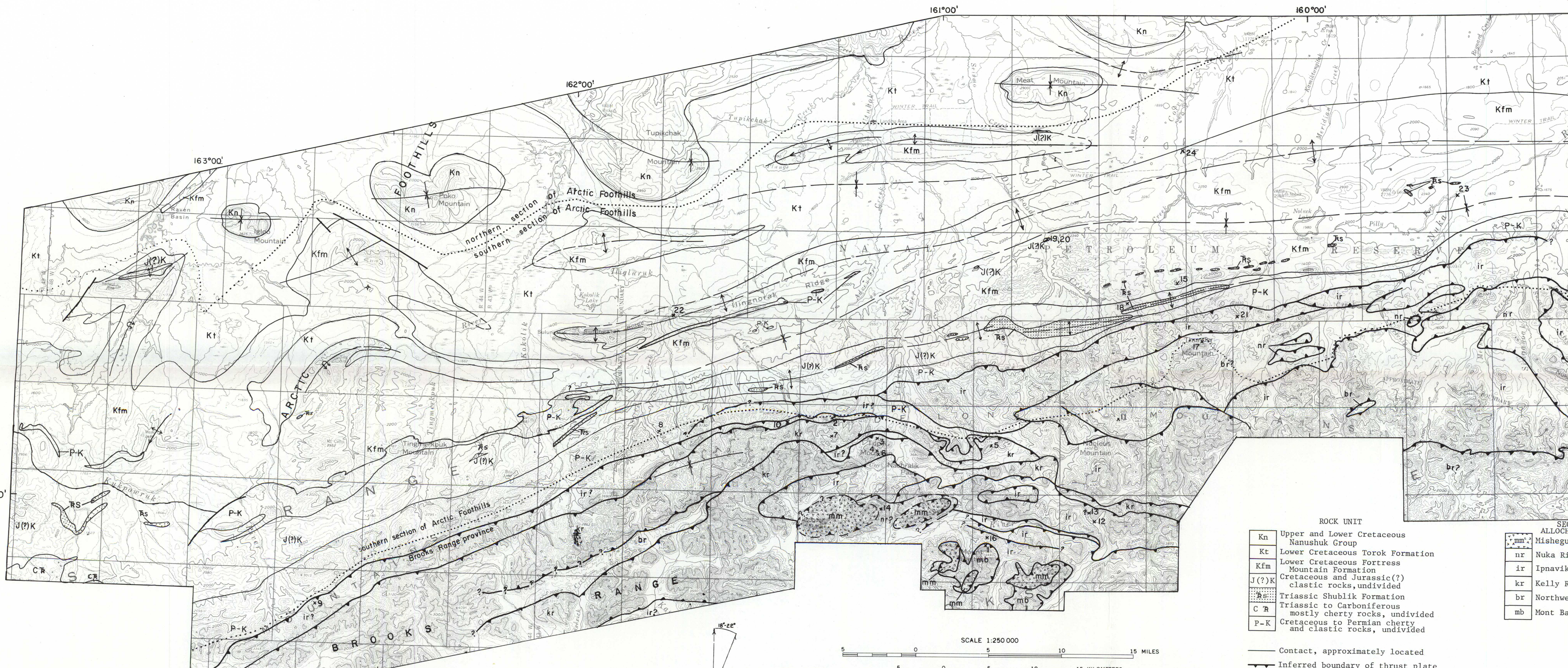
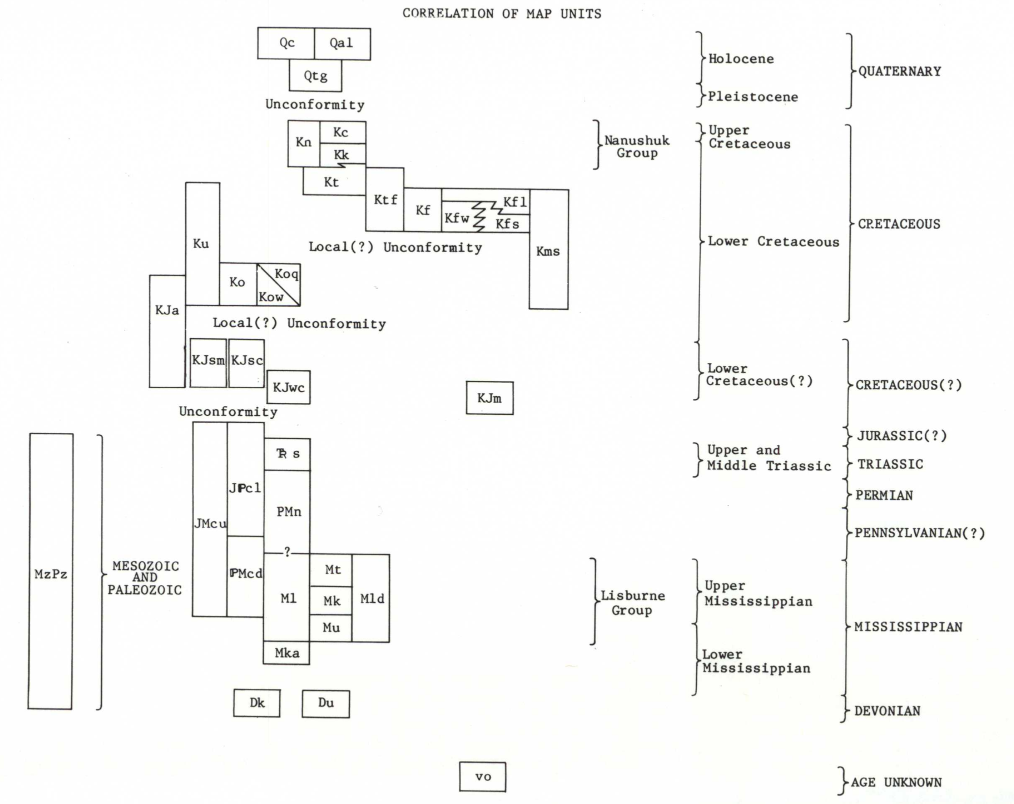
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1671
SHEET 2 OF 2



CORRELATION OF MAP UNITS



EXPLANATORY NOTES

By
E. G. Sable and I. L. Tailleur

This is one of four U.S. Geological Survey Miscellaneous Field Studies Maps showing the geology in the Kukpowruk-Nuka Rivers region, northwestern Alaska (see index map). Each map includes a list of map units shown on that map, as well as a combined correlation and description of map units for all four maps. The entire region shown on 4 maps covers about 11,000 sq km in parts of the Misheguk Mountain and De Long Mountains 1° x 3° quadrangles.

The geology shown here and described by Sable and others (1981) is largely the result of areal geologic mapping done during 1950 and 1951 as part of the exploration of Naval Petroleum Reserve No. 4 and adjoining areas (Reed, 1958, p. 128, 142). Smaller areas within the region were mapped in 1947, 1949, and 1953 during the exploration of the reserve (Reed, 1958, p. 73, 106, 168). Additional observations made in the 1960's and 1970's served to clarify some relationships of rock units. The areas mapped in the 1940's and 1950's were accessed mostly by tracked motor vehicle, foot, and boat transport, enabling observations to be made in a detail rarely afforded by later helicopter-based studies.

Nearly all of the geology was originally plotted on planimetric base maps by E. G. Sable at a different map scale and projection than the currently used topographic maps. Geology was replotted on the latter maps by Robert Rudser in 1976, and along border areas of the region by E. G. Sable and I. L. Tailleur in 1978. It should be emphasized here that the resultant geographic position of geologic units and features are approximately located. Classification of and relative movement along most faults are not shown on the maps, but interpretation of most major fault zones is shown on the generalized geologic and structural map. The extrapolation of units exposed in separate isolated outcrops is in many cases very tenuous because of the extremely complex and enigmatic structural relationships in parts of the region. Depiction of geology in the northern part of the region is not complete; for more detailed information on this part, see Chapman and Sable (1960).

DESCRIPTION OF MAP UNITS

(Combined map description for 4 adjoining U.S. Geological Survey Miscellaneous Field Studies Maps MF-1668-1671). See List of Map Units for specific units shown on this map.)

Qc COLLUVIUM (HOLOCENE)--This surficial material on shallow slopes; interpreted from streaky nonintegrated surface drainage pattern on aerial photographs where bedrock is not visible. Consists of plant (tundra) cover on frost- and gravity-worked accumulations of windblown detritus, vegetation remains, bedrock clasts, and alluvial debris. Contacts approximately located

Qal ALLUVIUM (HOLOCENE)--Gravel and finer-grained detritus along flood plains and on older, willow- and low plant-covered terraces as much as about 2 m above present stream levels. Deposits consist of locally derived materials and clasts from older gravels; includes minor lacustrine sediments. Contacts approximately located

Qtg HIGH-LEVEL GRAVEL (HOLOCENE AND PLEISTOCENE)--Gravel on remnants of formerly more extensive terraces from about 5 to 150 m above present stream levels; mapped mostly from nearly flat terrace surfaces as seen on aerial photographs. Clasts consist largely of chert, mafic igneous rocks, and quartzitic sandstone and wacke. The most prominent terraces trend northeastward across the northern part of the region and probably reflect the broad, subsequent valley of the ancestral Colville River prior to beheading of it by drainages of the Utukok River system. A noticeable knickline and scarp northwest of Lake Noluk terminates the gravels in the strike-controlled valley of the Colville; north of Lake Noluk, Utukok River drainage is within a few hundred meters axially and a few tens of meters vertically from capture of another 40 km-long segment of the Colville Valley. Contacts approximately located

Kn NANUSHUK GROUP (UPPER AND LOWER CRETACEOUS)--More than 2 km of northeastward prograded clastic wedge molassoid strata preserved along northernmost part of region (Chapman and Sable, 1960). Interpreted as a regressive deltaic succession of alluvial, delta-plain, and delta-front deposits derived from a provenance to the southwest (Sable, 1956; Ahlbrandt and others, 1979). Divided into the Corwin Formation (Kc) and the Kukpowruk Formation (Kk)

Kc Corwin Formation (Upper and Lower Cretaceous) (Sable, 1956; Smiley, 1966, 1969)--Continental to marginal-marine (lower delta plain) siltstone, subgraywacke sandstone, mudstone, coal, carbonaceous shale, ironstone, and bentonitic clay. More than 1 km thick along Kukpowruk River. Grades into and intertongues with the underlying Kukpowruk Formation

Kk Kukpowruk Formation (Lower Cretaceous) (Sable, 1956)--Mostly nearshore marine, with some continental-transitional strata; siltstone, subgraywacke sandstone, and mudstone with very minor thin coaly beds in the upper part. As much as about 1.4 km thick along the Kukpowruk River. Grades into and intertongues with a distal marine facies, the upper part of the underlying Torok Formation along a consistent trend, indicating northeastward deltaic progradation (Chapman and Sable, 1960)

Kt TOROK FORMATION (LOWER CRETACEOUS) (Gryc and others, 1956; Tailleur and others, 1966)--Probably more than 2 km of dark-gray claystone, mudstone, and siltstone and minor thin beds of turbidite subgraywacke sandstone. Upper part intertongues with Nanushuk Group (Kn) strata and probably contains intraformational unconformities or uneven deposition on growth folds; lower part probably intertongues with the flyschoid Fortress Mountain Formation (Kf)

Ktf TOROK AND FORTRESS MOUNTAIN FORMATIONS UNDIVIDED (LOWER CRETACEOUS)--At least 0.5 km of dark-gray shale, subgraywake, and wacke sandstones lithologically similar to those in the Torok Formation (Kt) and to those in the sandstone member of the Fortress Mountain Formation (Kfs), but contains intermediate proportions of these rocks. May be in part a relatively proximal facies of the Torok Formation

Ku CRETACEOUS ROCKS UNDIVIDED--Clastic rocks, mostly graywacke and subgraywacke, in areas which either have not been adequately examined or where poor exposures preclude identification of units. In the absence of age-diagnostic fauna, these are assumed to be equivalent to the Lower Cretaceous Fortress Mountain and Okpikruak Formations. Some fine-grained rocks may also be of Jurassic age

Kf FORTRESS MOUNTAIN FORMATION (LOWER CRETACEOUS)--Terriginously derived rocks of variable thickness, probably more than 1.5 km in places. Exposed in three belts of possibly coeval rocks. Distribution and thickness of rock facies in part controlled by deposition from centers. Members are, from south to north, the wacke and conglomerate member (Kfw), the shale member (Kfl), and the sandstone member (Kfs)

Kfl Shale member--Dark-gray claystone and mudstone with about 30 percent thin-bedded gray micaceous siltstone and sandstone which exhibit small-scale crossbedding, ripple marks, and rare mudcracks. More than 1.2 km thick along the Nuka River. Interpreted to be coeval with the lower part of the Torok Formation and part of the sandstone member of the Fortress Mountain Formation

Kfw Wacke and conglomerate member--Roughly 50 percent greenish-gray wacke and granule to pebble wacke conglomerate interbedded with siltstone and mudstone. Thickness estimated to range from 50 to 1,000 m. Common turbidite features are graded bedding, sole marks, and flute, groove, and striation casts. Very small scale crossbedding common in most wacke beds. Rocks are texturally and compositionally immature, with clasts of chert, quartz, claystone, carbonate and kerogenous rocks, igneous rocks, and carbonate rocks in a matrix of chlorite, calcite, quartz, and clay minerals

Kfs Sandstone member--Characterized by about 40 percent greenish-gray subgraywacke sandstone and granule- to pebble-conglomeratic sandstone interbedded with mudstone and siltstone. Estimated thicknesses are 1 to 1.5 km. Contains striking turbidite bedding features similar to those in the wacke and conglomerate member; matrix is calcite, chlorite, and clay minerals. Member is interpreted to be a basinward equivalent of the wacke and conglomerate member; possibly represents forset delta-front deposition. Contains rare impressions of Albian ammonites in nearby areas (Tailleur and others, 1966; Chapman and others, 1964; Patton and Tailleur, 1964)

Kms MICACEOUS SANDSTONE (LOWER CRETACEOUS)--Distinctive unit of rhythmically interbedded dark-gray, quartzitic, micaceous sandstone, siltstone, and claystone, with graded bedding and small-scale sole markings and ripple marks, minor granule conglomerate, and minor reddish and greenish shale. Unit is probably 300 to 500 m thick. Clasts are mostly quartz, carbonate rock, and chert, with minor plagioclase, muscovite, and opaque minerals. Unit resembles rhythmically bedded unit in the wacke member of the Okpikruak Formation (Kow) and includes sandstone like those in the quartzite member of the Okpikruak (Koq), but has yielded no Buchia. Inoceramus (D. L. Jones, written commun., 1962, 1964) collected from lithologically equivalent rocks to the west resemble those in the Fortress Mountain Formation (Kf) in other areas. A very rare conodont occurrence in these rocks on the Utukok River may represent reworked forms of late Paleozoic age (H. R. Berquist, written commun., 1952)

Ko OKPIKRUAK FORMATION (LOWER CRETACEOUS)--Persistent unit in southern part of region. Mostly interbedded wacke sandstone and mudstone with common fine- to coarse-ribbed pelecypod Buchia (Neocomian). The formation is distinctive in the Ipnavik thrust sequence of Tailleur and others (1966), in the Kelly thrust sequence of Snelson and Tailleur (1968), and in the De Long thrust sequence of Martin (1970). Consists of wacke member (Kow) and quartzite member (Koq) in Kukpowruk-Nuka Rivers region. In addition, other informally named post-Triassic clastic units in the region may in part or whole be equivalent to the Okpikruak Formation. Identification of formation queried (Ko?) in structural belts north and south of fossiliferous, unquestioned Okpikruak Formation rocks. There, thick sections of sandstone, conglomeratic wackes, and mudstone are similar to the wacke facies of the Okpikruak Formation but are not known to yield, or rarely yield, the characteristic pelecypod, Buchia. They locally contain pebble- to boulder-conglomerate and sedimentary breccia

Kow Wacke member--Consists of two units: a unit of interlensing wacke sandstone and conglomerate, with lesser ferruginous limestone, and a unit of rhythmically interbedded wacke, sandstone, and mudstone with distinctive ferruginous limestone lenses and nodules. Total thickness of wacke member is highly variable, as much as 500 m. Both units contain sole markings and graded bedding suggesting turbidite origin; and wacke member also contains coarse crossbedding features indicative of strong current activity. Most coarse-ribbed Buchia in lower part of unit

Koq Quartzite member--Exposed in narrow belts of strongly deformed strata between the Kukpowruk and Utukok Rivers; is at least a few hundred meters thick. Consists of light- to dark-gray siliceous, silty quartzitic subgraywacke to orthoquartzite sandstone interbedded with beds of siltstone, variegated shale, and coquinoid siltstone with fine-ribbed Buchia. Sandstone is ripple marked and thinly crossbedded; clasts are mostly quartz and chert. Included in Ipewik Formation of Crane and Wiggins (1976) and part of Wulik thrust sequence of Snelson and Tailleur (1968)

KJa ARGILLACEOUS UNIT (LOWER CRETACEOUS AND JURASSIC)--Occurs in small exposure areas north of highly deformed belts across the Kukpowruk River, Driftwood Creek, and Utukok River. Largely soft black claystone and gray clay with minor reddish and greenish claystone and unusual accessory rock types such as marcasite concretions, septarian concretions, limestone breccia, pebble conglomerate, and coquinoid limestone and claystone with fine- to coarse-ribbed Buchia of Early Cretaceous Valanginian Age. Included by Crane and Wiggins (1976) in the Ipewik Formation, which locally contains Early and Late Jurassic fossils also. Part of the Foothills thrust sequence of Tailleur and others (1966) and the Ivotuk and Brooks Range thrust sequences of Martin (1970)

KJsm WACKE, SANDSTONE, AND MUDSTONE (LOWER CRETACEOUS? AND JURASSIC?)--Interbedded and interlensed brownish weathering, gray to greenish subgraywacke sandstone, greenish wacke, siltstone, and mudstone. Maximum unit thickness more than 700 m. Local thick pebble to boulder conglomerate of two types, one characterized by clasts of mafic and felsic igneous rocks, the other by clasts of chert and mafic igneous rocks. Conglomerate is as much as 80 m thick in a 250-m-thick section on Thunder Mountain. Unit associated with Shublik Formation (TRs), light-colored cherty unit, and dark-colored cherty unit

KJsc WACKE, SANDSTONE, AND CONGLOMERATE (LOWER CRETACEOUS? AND JURASSIC?)--Differentiated from unit KJsm mainly on the basis of association with different older rocks such as undivided cherty units and rarely with Shublik Formation (TRs), and with more abundant and coarser conglomerates. As mapped, may locally include units Ko and Kms

KJwc WACKE WITH CANNONBALL CONCRETIONS (LOWER CRETACEOUS? AND JURASSIC?)--Unit distinguished by concretions in irregularly bedded wacke and mudstone. Wacke is fine grained, greenish gray, weathers dull brownish, and contains distinctive spheroidal concretions of similar but more calcareous wacke as much as 1 m in diameter. Unit estimated to be as much as 500 m thick. In outcrop, unit is associated with greenish and gray chert (JMcu), mafic sills and extrusive rocks, silty limestone lenses, and Nuka Formation (PMn). Contains wacke conglomerate and conglomeratic mudstone with pebble- to boulder-sized clasts of chert and less common argillite, sandstone, mudstone, and coarse-grained mafic igneous rocks. Unit locally contains few unidentifiable shell fragments. Unit is strongly deformed; part of a melange-like chaos east of the Utukok River. Melange is probably in part, at least, an olistostrome (Mull and others, 1976). As mapped includes other units too small to differentiate. Occurs underlying the Okpikruak Formation (Ko) in apparent angular unconformity relationship along the Nuka River. In part included in Nuka Ridge thrust sequence of Tailleur and others (1966)

KJm MAFIC IGNEOUS ROCKS (LOWER CRETACEOUS? TO JURASSIC?)--Gabbro, diabase, basalt, microgabbro, and minor diorite; dark grayish green to dark gray, weather distinctive reddish-brown, aphanitic to coarsely crystalline. Intrusive rocks are tabular sill-like bodies and complexes as much as 100 to 200 m thick. These intrude rocks as young as Triassic, and show contact effects with mudstone and sandstone in unit KJwc. Extensive sills are part of the Ipnavik sequence of Tailleur and others (1966), Snelson and Tailleur (1968), Martin (1970), and Mayfield and others (1978). Extrusive mafic rocks as much as 30 m thick locally and a few hundred meters thick in the vicinity of Copter Peak include chloritic vesicular and amygdaloidal rocks. Some of the extrusive rocks contains well-developed pillow, pillow-layer, or flow structures. As mapped, the unit includes minor varicolored chert and, in the vicinity of the Nuka River, interlayers of unit KJwc. Igneous rocks at Copter Peak are part of the Misheguk thrust sequence of Snelson and Tailleur (1968) and ultramafic pluton sequence of Martin (1970)

TRs SHUBLIK FORMATION (UPPER AND MIDDLE TRIASSIC)--Distinctive map unit probably less than 150 m thick. Upper part a fossiliferous light-hued calcilutite containing the Norian pelecypod Monotis, and interbedded gray, bluish, greenish, and locally reddish chert. Remainder of unit contains similar chert, siliceous shale, and black chert, dark-gray limestone, and black shale which contain the Karnian and Norian pelecypod Halobia. Shale member of eastern regions (Patton and Tailleur, 1964) not recognized. As mapped, locally includes organic shale of Jurassic(?) age, and some siliceous and argillaceous rocks possibly equivalent to the Permian Siksikpuk Formation (Patton, 1957) of eastern regions. Unit a distinctive part of the Foothills thrust sequence of Snelson and Tailleur (1968), Brooks Range and Ivotuk thrust sequences of Martin (1970), and Northwestern Brooks Range thrust sequences of Mayfield and others (1978). Approximately equivalent to the Otuk Formation (Mull and others, 1982)

JMcu CHERTY ROCKS UNDIVIDED (JURASSIC? TO MISSISSIPPIAN)--Includes two poorly defined cherty units; light-colored cherty unit (JPcl), and dark-colored cherty unit (PMcd)

JPcl Light-colored cherty unit (Jurassic? to Pennsylvanian)--Thin- to medium-bedded, vitreous to dull, gray, bluish, greenish, olive, reddish, and minor black chert, siliceous claystone, argillite, and siltstone, 100 to 200 m thick. Probably mostly Permian and Triassic in age, equivalent in large part to the Siksikpuk (Permian) and Shublik (Triassic) Formations but may contain chert equivalent to part of the Lisburne Group. Some beds on the dip slope of Mount Bastille yield radiolarians tentatively identified as Late Triassic (D. L. Jones, oral commun., 1978). Unit is approximately equivalent to the Pennsylvanian to Early Jurassic Etivluk Group (Mull and others, 1982)

PMcd Dark-colored cherty unit (Pennsylvanian and Mississippian)--Thin- to thick-bedded black to dark-gray chert interbedded with lesser amounts of light-colored chert, dark-colored limestone, claystone, siliceous claystone, and dolomite. May represent several coeval units, exposed in different thrust plates, that differ in proportion of chert, weathering color, and bedding thicknesses; may locally include dark-colored unit of Lisburne Group (Mld). This unit and the dark unit of Lisburne Group (Mld) are equivalent to the Kuna Formation (Mull and others, 1982)

PMn NUKA FORMATION (PERMIAN, PENNSYLVANIAN AND MISSISSIPPIAN)--Very distinctive unit characterized by light-hued, gray and greenish, arkosic, calcarenititc and glauconitic marine sandstone and conglomerate, intimately associated limy siltstone, platy limestone, sandy dolomite, dark claystone, and mostly light colored chert. Likely only a few hundred meters thick. Fossils consist mostly of brachiopods. As mapped west of Singayoyak Creek, corresponds to rocks included in the original Nuka Formation by Tailleur and Sable (1963), since revised by Tailleur and others (1973). East of Singayoyak Creek, mapped unit is restricted to coarse-grained arkosic rocks. Forms distinguishing unit of Nuka Ridge sequence of Snelson and Tailleur (1968) and Martin (1970)

Ml LISBURNE GROUP (MISSISSIPPIAN)--Largely carbonate rocks which in the headwaters of the Utukok River and Kelly River appear to represent a continuous section in the Kelly thrust sequence of Snelson and Tailleur (1968) and De Long thrust sequence of Martin (1970). Map unit represents carbonate, cherty, and clastic lutitic rocks of varying facies in different thrust sequences. Three formations, the Tupik (Mt), Kogruk (Mk), and Utukok (Mu) Formations were distinguished locally in what was considered to be a normal succession (Sable and Dutro, 1961)

Mt Tupik Formation (Upper Mississippian)--Dark-gray to black, micritic, silty, mostly thin bedded limestone with thin chert interbeds. Contains scattered rhynconellid, orbiculoid, and linguloid brachipods and crinoid fragments; 100-200 m thick

Mk Kogruk Formation (Upper and Lower Mississippian)--Mostly medium to light gray, medium- to thick-bedded limestone with about 15 percent dark-gray chert as lenses, nodules, and interbeds, and minor limy claystone and dolomitic limestone. Locally as much as 500 m thick. Contains locally abundant crinoid debris and corals, brachiopods and bryozoans of Late Mississippian age. The Kogruk Formation appears to be the light facies of the Lisburne Group of Tailleur and others (1966), and to correlate lithologically with the Wachsmuth and Alapah Limestones (Bowsher and Dutro, 1957)

Mu Utukok Formation (Lower Mississippian)--Mostly medium bedded, medium-dark-gray, ferruginous sandy limestone which weathers to distinctive dark yellowish brown and yellowish orange "rust" colors; interbedded with limy siltstone, limy sandstone, quartzite, minor limy claystone and coaly beds at the type locality. No complete section known; thickness may be as much as 1.4 km. Locally contains abundant spiriferoid brachiopods, gastropods, pelecypods, cephalopods, trilobites, and crinoidal debris of Early Mississippian age. Equivalent to most of the Nasorak Formation (Campbell, 1966) to the west

Mld Dark-colored facies of the Lisburne Group (Mississippian)--Locally distinguished black to dark-gray limestone, claystone, and chert. As much as 400 m exposed in incomplete section in headwaters of the Kukpowruk River (base of Wulik thrust sequence of Snelson and Tailleur (1968); other incomplete sections as much as about 150 m in thickness. Contains depauperate fauna of brachiopods, bryozoans, crinoidal debris, and rare goniatites. Resembles Tupik formation (Mt) but in places contains more abundant claystone (shale) and thicker beds of chert. Some dark-colored rocks of Triassic age may be mapped locally with this unit in the northern belts of outcrop east of Driftwood Creek. Probably equivalent to the lower part of the Kuna Formation (Mull and others, 1982)

Mka KAYAK SHALE (LOWER MISSISSIPPIAN)--Dark-gray shale, yellowish-weathering platy limestone, siltstone, and minor sandstone more than 450 m thick. Distinguished from similar lithologies in Nuka Formation only at Nuka Ridge and near Mount Bastille. Probably exposed elsewhere but mapped with other Paleozoic or Mesozoic units

Dk KUGURUROK FORMATION (DEVONIAN) (Sable and Dutro, 1961)--Mostly light colored calcarenite and crossbedded dolomite overlying claystone, sandstone, and conglomerate. In the 450-m-thick type section at Mount Bastille, Atrypa and spiriferoid brachiopods identified as Devonian in age are sparingly present. Subsequent workers have interpreted a thrust fault between the carbonate rocks and the underlying clastic rocks. The top of the type section is gradational upwards into arkosic carbonate strata which lie below Devonian carbonate rocks and mafic rock of the allochthonous Misheguk sequence, and which resemble the Nuka Formation (PMn) lithologically and in tectonic position

Du DEVONIAN ROCKS UNDIVIDED--Crystalline fossiliferous limestone and interbedded grayish-brown, gray, and black claystone of Late Devonian age. Occur in fault slivers. May locally represent base of Ipnavik River thrust sequence as used by Tailleur and others (1966) and Mayfield and others (1978)

MzPz MESOZOIC AND PALEOZOIC ROCKS UNDIVIDED--Mostly pre-Cretaceous cherty and carbonate rocks in highly complex structural relationships

vo VOLCANICLASTIC(?) ROCKS (AGE UNKNOWN)--Fine- to medium-grained greenish-gray tuffaceous carbonate or carbonatized clastic rock with abundant minerals in spherulitic grains, intruded by or interlayered with shallow-seated igneous rocks apparently less mafic in composition than rocks of unit KJm. Examined in the vicinity of Picnic Creek

CONTACT--Approximately located; includes inferred contacts

FAULT--Dashed where approximately located; short dashed where inferred; dotted where concealed

STRIKE AND DIP OF BEDS AND TABULAR IGNEOUS BODIES

55 Normal--May represent overturned beds in places

90 Vertical

Horizontal

40 Overturned

70 Contorted

Interpreted from aerial photographs

ANTICLINE OR ANTIFORM

Normal, showing crestline and direction of plunge--Dashed where approximatly located or inferred

Overturned

Minor

SYNCLINE OR SYNFORM

Normal, showing crestline and direction of plunge

Overturned

Minor

FA FOLD AXIS

SURFACE TRACE OF BEDS

TRACE OF APPARENT STRUCTURAL DISCORDANCE--Interpreted as possible unconformity

OIL AND GAS TEST WELL--Approximately located

INDEFINITE BOUNDARY--Found between map units and between mapped and unmapped areas

x49ASa15f PALEOZOIC FOSSIL COLLECTION LOCALITY--Field sample number

x22127 MESOZOIC FOSSIL COLLECTION LOCALITY--U.S. National Museum number

STRUCTURAL GEOLOGY

The Kukpowruk-Nuka Rivers region is structurally a part of the Brooks Range orogen (Tailleur and Brosgé, 1970). Two general structural belts in the region are the folded belt and the disturbed belt (Tailleur and Brosgé, 1970). The folded belt occupies the northern section of the Arctic Foothills and most of the southern section, and is interpreted to be essentially autochthonous relative to the disturbed belt, in the De Long Mountains and southernmost foothills, which is largely allochthonous, reflecting crustal shortening that may exceed 240 km.

The northern part of the folded belt consists almost entirely of exposed Lower Cretaceous stata (lower part of the Nanushuk Group and Torok Formation) in gently folded synclines alternating with steeply dipping beds in complex anticlinal trends which are likely surface expressions of south-dipping thrust faults (Chapman and Sable, 1960). Farther south, structures of the folded belt become more complex; south-dipping beds of mostly Lower Cretaceous wacke, conglomerate, and mudstone (Fortress Mountain and Okpikruak Formations) and Triassic and Permian rocks (Shublik Formation and associated siliceous shales and cherts) are predominant. Sinuous folds in the southern foothills section mostly west of the Kokolik River are interpreted to represent rootless detachment folds; they involve competent units of Fortress Mountain Formation and minor Lower Cretaceous, Jurassic(?), and Triassic rocks in a matrix of Torok Formation mudstone and claystone. The southern part of the southern foothills section is represented by linear belts of highly compressed and attenuated strata which dip south (mostly Lower Cretaceous wacke and mudstone and Triassic-Permian siliceous rocks). In large part, the structural style there appears to be the result of northward imbricate faulting of anticlinal south limbs over the corresponding north limbs, with resultant steeply to moderately dipping beds in repeated normal sections.

The boundary between the folded and disturbed belts is generally not distinct but lies approximately along the northern line of thrust faults shown on the generalized geologic and structural map. Beds in competent allochthonous blocks are mostly parallel to overridden strata, and thrusting within relatively competent units along the boundary has masked definitive relationships.

The disturbed belt consists of generally south dipping, folded overthrust plates of apparently northward thrust directions, and relatively autochthonous overridden terrain. Some plates are coextensive with plates in the Nuka-Etivluk region (Tailleur and others, 1966), east of and adjoining the Kukpowruk-Nuka Rivers region. Each plate contains stratigraphic succession of somewhat different coeval facies (Tailleur and Brosgé, 1970), and the successions have been termed thrust sequences, each characterized by distinctly different rock unit associations (Snelson and Trailleur, 1968). Names for the thrust sequences in the Brooks Range include those by Snelson and Tailleur (1968), Martin (1970), Mayfield and others (1978), and Ellersiek and others (1979). Named thrust sequences in the Kukpowruk-Nuka Rivers region are, from younger to older as follows:

1. Northwestern Brooks Range thrust sequence of Mayfield and others (1978), probably consisting of two or more thrust plates, and including areas of highly disordered strata and igneous rock. These sequences in the Misheguk Mountain quadrangle have recently been subdivided into the Brooks Range thrust sequence and the overlying Picnic Creek thrust sequence (Ellersiek and others, 1979).
2. Kelly River thrust sequence, characterized by the presence of the Utukok and Kogruk Formations of the Lisburne Group.
3. Ipnavik River thrust sequence, containing dark facies of the Lisburne Group and dark chert units of probable Mississippian age.
4. Nuka Ridge thrust sequence, with distinctive arkosic sandstone of the Nuka Formation.
5. Mount Bastille thrust sequence (new), herein tentatively named, which includes the characteristic light-colored dolomite and associated rocks of the Kugururok Formation. The sequence is interpreted to be contemporaneous with or younger than the Nuka Ridge sequence but older than Misheguk Mountain sequence plates.
6. Misheguk Mountain thrust sequence, characterized by thick, sill-like bodies of mafic and basic igneous rock.

Tectonic models which seek to explain thrust sequence relationships within the disturbed belt are described by Tailleur and Brosgé (1970) and include the following:

1. Northward overthrusting by either compressive stress or uplift with resultant gravity-induced stress.
2. Southward underthrusting, the result of collision of two continental blocks (Tailleur, 1969a, 1969b, 1973), resulting in juxtaposition of unrelated thrust sequences.

In parts of the region, such as in the area of the Nuka River and upper part of Driftwood Creek, a disordered arrangement of seemingly stratigraphically unrelated blocks from a few meters to as much as a kilometer in length resembles structural melange. In the Nuka-Etivluk region, just east of the Kukporuk-Nuka Rivers region, such relationships, called tectonic chaos by Tailleur and others (1966), were considered to be of direct tectonic origin, resulting in a partly autochthonous and partly allochthonous terrain in which highly disturbed overridden strata contain embedded fragments of the overriding thrust plates. Alternatively, they may represent fragmented margins of thrust plates, olistoliths, which were incorporated in contemporaneously deposited Lower Cretaceous flysch sediments (Mull and others, 1976).

The age of the large-scale thrusting is Early Cretaceous or post-Early Cretaceous; strata containing Buchia spp. of Valanginian Age occur in major allocthons, and strata of Albian Age are sharply folded north of the disturbed belt. It seems likely that thrusting was of continuous or sporadic nature during much of Cretaceous time. Major thrust plates are believed to have initially been emplaced as flat-lying or gently folded allocthons with little internal deformation; some were subsequently moderately to highly deformed by interraction with overriding plates, and finally, perhaps in Late Cretaceous and Tertiary times, the entire region was further deformed by tangential or coupling stresses with the resultant high degree of folding and attendant faulting.

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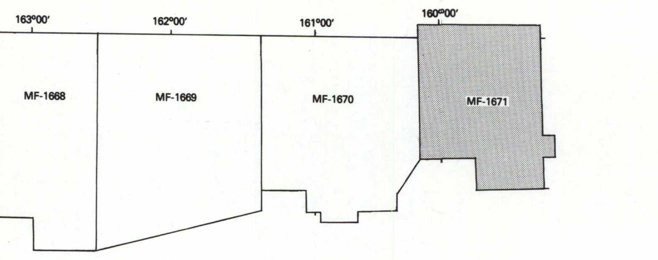

INDEX SHOWING RELATIVE LOCATION OF 4 GEOLOGIC MAPS IN THIS SERIES (U.S. GEOLOGICAL SURVEY MISCELLANEOUS FIELD STUDIES MAPS MF-1668, MF-1669, MF-1670, AND MF-1671).

ROCK UNIT

Kn	Upper and Lower Cretaceous Nanushuk Group
Kt	Lower Cretaceous Torok Formation
Kfm	Lower Cretaceous Fortress Mountain Formation
J(?)K	Cretaceous and Jurassic(?) clastic rocks, undivided
TRs	Triassic Shublik Formation
C TR	Triassic to Carboniferous mostly cherty rocks, undivided
P-K	Cretaceous to Permian cherty and clastic rocks, undivided

SEQUENCES OF ALLOCHTHONOUS ROCKS

mm	Misheguk Mountain
nr	Nuka Ridge
ir	Ipnavik River
kr	Kelly River
br	Northwestern Brooks Range
mb	Mont Bastille

Contact, approximately located

Inferred boundary of thrust plate

Syncline or synclinorium axis

Anticline or anticlinorium axis

Physiographic boundaries

x12 Location of measured section described in text of Sable and others (1981)

Approximate boundary of National Petroleum Reserve

GEOLOGIC MAP OF THE EASTERN KUKPOWRUK-NUKA RIVERS REGION, NORTHWESTERN ALASKA

By
E. G. Sable, J. T. Dutro, Jr., R. H. Morris, and I. L. Tailleur
1984

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