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EAST HALF
PRELIMINARY GEOLOGIC MAP OF THE CHANDLER LAKE QUADRANGLE, ALASKA

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DESCRIPTION OF MAP UNITS

INTRODUCTION

This is a preliminary compilation of geologic mapping in the Chandler Lake quadrangle. Recently completed geologic field investigations in the Chandler Lake quadrangle are for the purpose of making a hydrocarbon and mineral resource assessment of the quadrangle as part of the Alaskan Mineral Resource Assessment Program (AMRAP). An AMRAP folio for the Chandler Lake quadrangle, however, will not be available in time to contribute to an oil and gas assessment required by statute.

This map is an interim product to provide new information for an oil and gas assessment of the Central Arctic Management Area (CAMA) required by Section 1002 of the Alaska National Interest Lands Conservation Act (ANILCA) of 1980. ANILCA requires oil and gas assessment of all Federal lands lying north of 68° N latitude exclusive of the National Petroleum Reserve-Alaska, Clatto Arctic National Wildlife Refuge, and submerged land on the Outer Continental Shelf.

The principal emphasis of this map is to provide a basis for determining the structural framework of the Chandler Lake quadrangle. Reconnaissance mapping showing the distribution of major rock types is available for most of the quadrangle but, detailed mapping is only available for small and widely scattered parts of the quadrangle prior to the present study. Structural framework is imperative to an oil and gas assessment, especially so in a fold and thrust belt where source, trap, reservoir, seal, and timing are interrelated to a great degree through structural geology.

The map incorporates new mapping and interpreted published mapping. New mapping includes a transect of the northeast boundary of the quadrangle. The generalized to 1:125,000 along the east-west structural style in the quadrangle and a transect provides an understanding of structural style in the quadrangle and a basis for incorporating published geologic mapping at varying scales, with and without topographic bases, and of differing detail and opinion, into a coherent geologic map. Map construction involves the transfer of information from air-photo interpretation to compensate the different sources of information. Scattered geological observations from spot checks, helicopter overflights, and foot traverses are part of the map compilation outside of the transect.

Two portions of the geologic map show structural and stratigraphic relations whereas an intervening part of the map is largely a outcrop map. Near-continuous outcrop south of the range front affords construction of a map showing distribution of structures, rock units, and contacts. Topography and single structural patterns underlying most of the area north of the escarpment including Mount Michelson, Gull Rock, Coughlin Mountain, Hammer Mountain, and Table Mountain afforded construction of a map showing structural and stratigraphic relations across the escarpment. Outcrop control and dip and structural complexity severely limit mapping between the escarpment and the range front, except in light-weathering chert occurring in the upper part of rock-units. Mapping between the escarpment and the range front is from field observations and from aerial reconnaissance at 1:120,000 and transferred by inspection to a topographic base at 1:125,000.

Qal QUATERNARY ALLUVIUM (Beaslton, T.D., 1979) (Holocene)--Unconsolidated debris forming boulders, gravel, sand, silt, clay and humic material. Primarily sediments in river channels, active floodplains, bogs and swamps. See Hamilton (1979) for more detail and descriptions of Quaternary deposits.

Qd QUATERNARY DEPOSITS (Beaslton, T.D., 1979) (Quaternary)--Unconsolidated unconsolidated Quaternary deposits, including glacial drift, outwash, and high-level terraces: boulders, gravel, sand, silt and clay. See Hamilton (1979) for more detail and descriptions of Quaternary deposits.

Ksb SCHRADER BLUFF FORMATION (Detterman and others, 1963) (Upper Cretaceous)--Three members make up the Schrader Bluff Formation, in ascending order, the Rogers Creek, Barrow Trail, and Seabee Head Hill Members. All three members occur in the Chandler Lake quadrangle but are not differentiated on the map. Total thickness is approximately 1800 feet (550 m) of Schrader Bluff Formation at Race Track Basin syncline.

Shale, claystone, sandstone, and bentonite. Medium- to light-gray bentonitic shale, clayey, fissile, and includes tuff beds. Medium-gray claystone, locally well indurated, locally tuffaceous in part. Light-gray to light-brown sandstone; fine-grained, laminated, and siliceous; weathers rusty brown; includes bentonite beds. Gray tuffaceous siltstone. Formation includes shell fragments and foraminifera in places.

Kp PRINCE CREEK FORMATION (Detterman and others, 1963) (Upper Cretaceous)--Only the Tuluvak Tongue of the Prince Creek Formation is recognized in the Chandler Lake quadrangle. Detterman and Reiser (1963) report 525 feet (175 m) of Tuluvak Tongue at the type locality at Schrader Bluff about 15 miles (24 km) north of Beechey Point Basin. The Tuluvak Tongue appears to thicken radically because outcrop widths and dips in the northeastern Chandler Lake quadrangle suggest thicknesses approaching 2,000 feet (610 m). The character of the Prince Creek Formation changes from southwest to northeast.

Northeast Sandstone, siltstone, mudstone, coal, and tuff. Medium- to light-medium-gray, yellowish-gray, and brownish-gray sandstone; thin- to medium-bedded, fine- to coarse-grained, locally conglomeratic, tuffaceous in part, includes conglomerate composed mostly of small pebbles of black chert and white quartz and quartzite. Mudstone, siltstone, and shale; medium-gray to dark-gray, fissile in part, bentonitic in part. Includes plant fragments, tuff beds, coal, and ironstone nodules.

Southwest Conglomerate, sandstone, siltstone, and shale. Basal conglomerate (10 m) think composed of well rounded pebbles of white to light-gray quartz and orthoquartzite and medium- to dark-gray chert. Conglomerate has a sandstone matrix and prominent quartz cement that reflects light. Conglomerate produces prominent positive topographic features such as cuestas and riarock. Sandstone in upper part of the unit is prominently cross bedded and very poorly exposed.

Ka SEABEE FORMATION (Detterman and others, 1963) (Upper Cretaceous)--Includes the Shale Wall Member and overlying Aviyak Member. Detterman and others (1963) report about 1,800 feet (550 m) of Shale Wall Member along the Nanushuk River at Rooftop Ridge. Detterman and others (1963) also report 360 feet (110 m) of Aviyak Member in the type locality along the Aviyak River and a generally persistent thickness also. Outcrop widths and dips suggest that the Seabee Formation is about 1,400 feet (425 m) thick and probably thins to the south, probably to the expense of the Shale Wall Member. Differences in reported thickness probably are related to structural complications in the southeast and should Shale Wall Member. Shale Wall Member Medium-gray shale; bentonitic, clayey, with bentonite beds. Laminated siltstone interbeds, and abundant siderite concretions. Includes dark-gray to black organic shale locally. Clayey limestone concretions up to 8 feet (2.4 m) across, and marine fossils. Also locally includes medium- to medium-light-gray fine- to very fine grained sandstone; thin-bedded, mostly fine-grained but locally coarse-grained and conglomeratic. Includes chert pebble conglomerate and conglomerate composed mostly of black chert and white quartz pebbles, lenses of conglomerate, calcareous concretions, shale, and ironstone concretions.

Kck KILLIK TONGUE OF THE CHANDLER FORMATION (Detterman and others, 1963; Patton and Tailleur, 1964). (Lower Cretaceous)--Detterman and others (1963) report thicknesses of 2,570 and 2,840 feet (785 and 865 m) from measured sections in the Chandler Lake quadrangle where the Killik tongue is not interfingered with other map units. Mapped outcrop widths and dips suggest that the Killik tongue is about 2,600 feet (790 m) thick but thins dramatically to the northeast, possibly by truncation beneath an unconformity at the base of the Seabee Formation or possibly by facies transition into marine map units. Sandstone, siltstone, claystone, shale, and coal. Light-olive-gray, greenish-gray, and medium-gray sandstone and conglomerate; weathers light brown and "salt and pepper" color where caused by dark gray chert and aphanitic rock fragments in contrast to very light gray weathering quartz, feldspar, and light-gray chert; medium-grained to fine-grained, and cross bedded. Conglomerate and sandstone and conglomerate beds commonly crossbedded and up to 10 quartz. Conglomerate is framework supported. Coal beds up to 10 feet (3 m) thick occur in the upper part of the unit and together with siltstone and shale are negative weathering and generally poorly exposed. Fresh coal exposures are common in the coal-bearing part of the tongue. Sandstone and conglomerate are very prominent ledge-forming cuestas.

Kkg TUKTU FORMATION AND GRANDSTAND FORMATION (Detterman and others, 1963; Patton and Tailleur, 1964) (Lower Cretaceous)--Detterman and others (1963) report that the Tuktu Formation and Grandstand Formations constitute the basal sandstone of the Nanushuk Group. The basal sandstone is time-transgressive to the north; the age of the Grandstand Formation is equivalent to that of the Killik tongue of the Chandler Formation and overlies the Torok Formation. The two formations are mapped as an undivided unit here although the Grandstand Formation is younger than the Tuktu Formation because (1) both formations occupy the same stratigraphic position at the base of the Nanushuk Group, (2) the units are chronologic and members of a time-transgressive depositional unit, and (3) a widespread structural detachment occurs between the Tuktu Formation and the underlying shale; the single map unit helps demonstrate the structural discontinuity and stratigraphic continuity.

Detterman and others (1963) report thicknesses of Tuktu Formation from measured sections to range from 960 to 1,250 feet (285 to 315 m). Detterman and others (1963) report 1,430 feet (435 m) of Grandstand Formation at the type section on the Anaktuvuk River. Outcrop widths and dips suggest that the Tuktu/Grandstand Formation attains thicknesses up to 1,500 feet (455 m). Graysh-green to greenish-gray sandstone; medium- to very fine grained, shale in part, cross bedded in part, includes ripple marks locally, wood debris, marine fossils, few conglomerate beds, and bioturbation. Conglomerate, gray siltstone and mudstone makes up a small part of the formations. The formations are resistant ledge-forming rocks together with the overlying nonmarine sandstone form prominent ridges.

Ks(Ks) FORTRESS MOUNTAIN FORMATION, (Patton and Tailleur, 1964) (Lower Cretaceous) Fortress Mountain Formation consists of (1) nonmarine conglomerate and associated marine sandstone (Ks) which occurs west of the Colville River, and (2) turbidite sandstone and conglomerate (Ks) east of the Anaktuvuk River. Patton and Tailleur (1964) report between 7,000 and 10,000 feet (760 and 3050 m) of Fortress Mountain Formation at Fortress and Castle Mountains. Outcrop widths and attitudes suggest the Fortress Mountain Formation, as used in this map and west of the Anaktuvuk River, is probably between 700 and 7,000 feet (215 and 610 m) thick in the Castle Mountains and Fortress Mountain area and thins to the east. Sandstone and conglomerate east of the Anaktuvuk River is possibly about 1,000 feet (305 m) thick; structural complexity, however, greatly limits confidence in this estimate.

Fortress Mountain Formation in this map differs from previous reconnaissance mapping in the Chandler Lake quadrangle. Previous workers (Patton and Tailleur, p. 458) consider the stratigraphic relations between the Fortress Mountain and Torok Formations Nanushuk Group unconformity, but state that the Fortress Mountain Formation is unlikely as young as middle Albian or equivalent to the Nanushuk Group. Other workers (Detterman and others, 1963, p. 230; Chapman and others, 1964; Grye, 1966; Patton, 1966; Jones and Gryc, 1980, p. 131; Molenaar, 1981, p. 31; Molenaar, 1981, p. 3; Molenaar, 1981, p. 3; and Ahlbrandt and others, 1979, p. 14) describe the Fortress Mountain Formation as the same as or equivalent to or below the Torok Formation, which underlies the Nanushuk Group. In this map, the term Fortress Mountain Formation applies to Lower Cretaceous sandstone and conglomerate that overlie the Torok Formation at least in part.

West of the Anaktuvuk River, the Fortress Mountain Formation comprises such nonmarine strata that occur in unlabelrate shallow-dipping high-like structural blocks that lie on complexly imbricated blocks of Mississippian to Lower Cretaceous strata, melange, and locally Torok Formation. Outcrops are mostly massive-weathering nonmarine conglomerate and sandstone but include locally marine sandstone. Most outcrops are erosional remnants of broad basin-shaped synclines comprising ridges underlain by beds of erosion-resistant conglomerate and sandstone arranged in a circular or ellipsoidal pattern and dipping toward a central point. The outcrops are remnants of more extensive structural blocks that in probable fault contact, possibly a fault superposed along a pre-existing unconformity with underlying older rocks. Outcrops of Torok Formation occur below the Fortress and Mountain Formations on the north flank of Fortress Mountain and east of Fortress Mountain to T.10S., R.5W., R.6W. Medium- and to a lesser degree sandstone, depositionally consanguinous with the Fortress Mountain Formation but structurally fault-emplaced interacted with older underlying graywacke and mudstone is operationally mapped as Kjhs or Kjs. Fossils from marine sandstone interbedded with pelecypodmately nonmarine strata in the Fortress Mountain Formation are middle to late Albian (J.W. Miller, 1981, p. 31) and equivalent to the lower part of the Nanushuk Group and Torok Formation. The Fortress Mountain may also include fossils as old as Barremian; however, formation assignments of strata containing pre-Albian fossils are in doubt.

East of the Anaktuvuk River, the Fortress Mountain Formation contrasts in some respects to the Fortress Mountain Formation west of the Anaktuvuk River. Outcrops east of the Anaktuvuk River occur along upper Cobblestone and May Creeks where the strata are submarine gravity flow deposits rather than interbedded nonmarine and marine deposits as west of the river. Torok Formation is not recognized beneath the Fortress Mountain Formation along upper Cobblestone and May Creeks although Torok Formation lies adjacent to the Fortress Mountain Formation along May Creek. Along upper Cobblestone and May Creeks, the Fortress Mountain formation occurs in imbricate south-dipping slab-like blocks in contrast to the unabstracte blocks west of the Anaktuvuk River; on both sides of the Anaktuvuk River, however, Fortress Mountain Formation lies in fault contact on complexly imbricated blocks of ribbon chert, mafic igneous rock, Neocomic clastic rock, and melange. Occurrence on both sides of the Anaktuvuk River include wood debris and framework compositions rich in chert clasts.

Kf Nonmarine conglomerate and associated marine sandstone Principally light-greenish-gray-weathering greenish-gray pebble conglomerate; framework-supported, characteristically consists of beds up to about 4 feet (1.2m) thick and lenticular on outcrop scale and cross bedded, prominent pebble imbrication, locally contains ripup clasts, scance mud cracks in thin discontinuous mudstone intervals, and plant debris ranging from small fragments to whole trees and logs. Although most clasts are well rounded, clasts of sedimentary rock are typically subrounded to subangular. Clasts include greenish-gray, light greenish-gray, gray, reddish-brown, and light-gray translucent varieties of chert, greenish-gray aphanitic, porphyritic vesicular, and nonvesicular mafic igneous rocks, light-gray to medium- light- gray limestone and dolomitic limestone, silicified argillite, organic shale, and granitic rocks. Conglomerate is interbedded with gray sandstone and siltstone. Sandstone is medium- fine- to coarse-grained thin-bedded to laminated sandstone with cross lamination, ripple marks, and bioturbation. Siltstone is gray in character. Sandstone includes scarce shell and wood debris. Sandstone is also locally cross bedded, bioturbated, ripple cross bedded and includes gravel lenses with abundant wood debris and marine mollusks.

Kft Turbidite sandstone and conglomerate Medium-greenish-gray sandstone; fine- to very coarse grained and granular, mostly fine- to medium-grained with scattered granules and small pebbles. Conglomerate in sandstone beds are up to 5 feet (1.5m) thick, but most beds are between 1 to 2 feet (0.3 to.6m) thick and thicker sandstone intervals are generally composed of amalgamated beds. Beds are massive, graded, laminated, and locally wispy cross bedded. Sole marks include flute casts and tool marks. Sandstone includes much carbonized wood debris some of which is up to 1 foot (0.3m) long. Most larger sand grains and granules are chert including light-gray, light-greenish-gray, dark-gray, and very light gray tripolitic chert. Sandstone is interbedded with siltstone and silty mudstone.

Kcg TORDK FORMATION (Detterman and others, 1963) (Lower Cretaceous)--Detterman and others (1963) report 9,120 feet (1850m) of Torok Formation in the type section along Torok Creek north-northwest of Castle Mountain. Outcrop character, inaccessibility, inaccessibility, incompetence, and incomplete exposure of this unit make estimates of thickness based on outcrop width and dip impossible. Shale, mudstone, siltstone, and sandstone. Mostly bluish-gray, dark-greenish-gray, medium-dark-gray and dark-gray shale, mudstone, and clayey siltstone; fissile in part, mostly very thin bedded, includes siltstone and fine-grained sandstone partings and thin interbeds. Sandstone, medium-light-gray and greenish-gray, very fine to very coarse grained, silty and shaly, conglomeratic in part with granules of mostly chert, includes some lenses of granule conglomerate. Formation includes abundant fine-grained and granule- to small-pebble-bearing shale, mudstone, and siltstone (Kkk). Some outcrops of pebbly strata are deeply reddened and weathered with greenish coatings that give some beds a metallic appearance. Clasts in pebbly beds are scattered, well rounded, pseudomorphic and mostly chert and mafic igneous rock. Iron-stained and pebbly units include ironstone lenses. Formation includes some thin beds which are tough, fissile, and carbonaceous shale.

Kcs COBBLESTONE SANDSTONE UNIT (Lower Cretaceous)--Cobblestone sandstone unit is a new and informal lithostratigraphic name proposed for lower Cretaceous sandstone that occurs in the lower part of the Torok Formation. The unit comprises lenticular and discontinuous bodies of sandstone and conglomerate that occur in structurally complex and south-dipping imbricate fault blocks. Outcrops occur discontinuous in a trend that parallels and lies south of the Tukto Escarpment.

Recognition of the Cobblestone sandstone unit differs from previous stratigraphic interpretations of Patton and Tailleur, 1964, pl. 50) stratigraphic interpretations of Patton and Tailleur, 1964, pl. 50) may strata herein assigned to the Cobblestone sandstone unit discriminate Fortress Mountain Formation. Cobblestone sandstone unit discriminates exclusively marine strata that occur in the lower part of the Torok Formation from nonmarine and marine strata of the Fortress Mountain Formation that overlie the Torok Formation and structurally complex rocks underlie the Torok Formation. The Cobblestone complex rocks exhibited a very complex fault fault fabric. Cobblestone sandstone unit comprises subunit structurally underlie dark-gray shale in the Torok turbidites, that depositionally overlie Fortress Mountain Formation. In contrast, Patton and Tailleur (1964) and other outcrops west of the section (Patton and Miller, 1966) include nonmarine strata and overlies dark-gray Anaktuvuk River lacked nonmarine. Fossils in the upper part of the shale of the Torok Formation are middle and late Albian (J.W. Miller, 1983, written commun.). Fossils are age correlative to fossils in the Nanushuk Group which overlies the Torok Formation along the Tukto Escarpment.

Map pattern suggests that sandstone bodies of the Cobblestone sandstone unit range up to 1,000 feet (305 m) thick and greater than 10 miles (16 km) in lateral continuity. Structural complexities too small to be shown at 1:125,000 and likely to produce repeated section suggest that the estimated thickness and lateral extent are at least maximum values.

--Sandstone, siltstone, mudstone, and conglomerate. Mostly yellow-brown-weathering olive- to greenish-gray crossbedded to very fine grained sandstone; very thin to massive-bedded, laminated in part, small-scale and wisps cross bedded in part, includes locally abundant carbonized small plant debris and carbonaceous films, includes flute marks, load casts, and tool marks. Sandstone comprises moderately sorted subangular to subrounded clasts of chert, quartz and rock fragments. Sandstone occurs in typically incomplete turbidite sequences. Sandstone beds are locally organized into thinning upward cycles consisting of amalgamated sandstone and gritty sandstone progressively overlain by thinner and fewer amalgamated sandstone beds interbedded with siltstone and mudstone. Yellowish-brown-weathering olive- to greenish-gray siltstone; is mostly thin-bedded to laminated, grades to very fine grained sandstone, and includes plant debris. Medium-dark-gray to medium-greenish-gray mudstone; mostly thin-bedded, very silty in part, very sandy in part, and locally includes sandstone partings. Conglomerate is framework-supported and consists mostly of well rounded clasts that range from granule to cobble size but are mostly pebble size; clasts are mostly chert, miscellaneous silicified sedimentary rock, mafic igneous rock, and carbonate rock.

COQUINOID LIMESTONE (Lower Cretaceous-Valanginian)--Brownish-gray and reddish-brown-weathering beds comprising bivalves, typically Buchia subleavis, algae, and shell hash. Typically these beds are broken slabs in association with the Otak Formation and probably in depositional contact with the Kankanushly Member of the Otak Formation in the Ekokpuk Creek area. The coquinoid limestone also occurs as slab-like blocks in highly sheared and disrupted Cretaceous and Upper Jurassic shale and sandstone. The coquinoid limestone occurs in reasonable deposition relations with Otak Formation on upper Ekokpuk Creek.

Kju, Jsd, Jsl, Jsl CRETACEOUS AND UPPER JURASSIC STRATA UNDIVIDED--Patton and Tailleur (1964, p. 447) report between 4,000 (590 m) and greater than 2,200 feet (670 m) of Berriasian and Valanginian strata in the Cretaceous and Jurassic strata undivided only because the total thickness of the Cretaceous and Jurassic strata undivided unit is unknown due to structural complexity, generally poor and discontinuous exposure, lack of reliable marker beds, and poor biostratigraphic control. This unit includes at least 4 facies: (1) sandstone (Sd) and shale (Sh), (2) conglomerate (Sgl), (3) tuffaceous sandstone, and (4) volcaniclastic breccia. The 4 facies, with the possible exception of the conglomerate facies, are probably and members of a continuum of rock-types. The sandstone and shale facies (s) make up the bulk of unit and range from shale with subordinate turbidite sandstone to amalgamated turbidite sandstone with subordinate shale. The sandstone and shale facies includes the Okgikruak Formation of Patton and Tailleur (1964). The unit probably includes exposures of Lower Cretaceous strata that with better exposure and closer examination would be assigned to the Cobblestone sandstone unit, Torok Formation, or Fortress Mountain Formation.

Sandstone and shale Light-olive-gray and greenish-gray sandstone; mostly medium- to fine-grained subangular to subrounded quartz, feldspar, chert, and greenish-gray rock fragments in a cherty matrix. Grain boundaries are typically obscure in more matrix-rich sandstone. Graded bedding and incomplete turbidite sequences are common. Wood debris, prod marks, flute casts, and load casts are common. Conglomerate in part with granules of mainly chert and aphanitic rock fragments. Includes medium-greenish-gray siltstone, mudstone, and shale.

Conglomerate Framework supported conglomerate that typically occurs as beds and lenses in association with turbidite sandstone; composed of well rounded to subangular granules and small pebbles of quartz, chert, and rock fragments. Chert includes greenish-gray, light-gray, and dark-gray varieties. Most rock fragments are greenish-gray and dark-gray, aphanitic, and silicified. Framework-supported conglomerate is also typically poorly sorted and contains sandstone that appear to site also typically poorly sorted and contains sandstone that appear to fill channels cut in sandstone and shale. Isolated bodies of phanerolithic conglomerate include matrix-supported subangular pebbles of greenish-gray and various colored chert, and yellowish-gray, weathering silicified limestone or mudstone, and organic shale.

Tuffaceous sandstone Grayish-green tuffaceous sandstone; fine- to coarse-grained, most grain boundaries are indistinct, very clastic, includes chloritized rock fragments, includes relict glass shard textures in thin section. Bedding ranges up to 1 foot (0.3m) thick and includes rare massive or abscence. Chlorite developed in and is commonly shale; is essentially pervasive along broken and wont and grain obliterates. Tuffaceous sandstone is interbedded with altkeonified surfaces and medium-dark-gray siltstone and shale. greenish-gray to olive-gray to medium-dark-gray.

Volcaniclastic breccia Grayish-green breccia; mostly granule to pebble size clasts of greenish-gray rock fragments in grayish-green matrix, includes framework- and matrix-supported breccias. Volcanic rock fragments are mostly chloritized aphanitic rock fragments but some fragments include fine-grained plagioclase laths. Clast fragments are vesicular and amygdaloidal. Scattered chert clasts occur locally in the breccias. The matrix is typically a dense felted mass of chlorite.

Jl MAFIC IGNEOUS ROCKS (Patton and Tailleur, 1964) (Jurassic)--Dark-greenish-gray, olive-gray, and light-olive-gray mafic igneous rocks; mostly fine-grained and aphanitic, but also aphanitic, porphyritic, and coarse-grained. Porphyritic varieties include plagioclase laths in a grayish-green groundmass of chloritized mafic minerals, mostly pyroxenes. Some rocks have diabase texture. Some are amygdaloidal and vesicular. Some are autoclastic, consisting of fine-grained to aphanitic clasts in a crystalline groundmass of similar apparent composition. Some sills, although most are pod-like masses in structurally disrupted contact with host rock. Undistorted chilled margins are rare. S. W. Karl (oral commun., 1976) reports dredging of lime stones on the Ugishpak Creek.

Jtos OTUK FORMATION (Null and others, 1982) (Lower Jurassic and Triassic)--Rodosar (1986) reports thicknesses of incomplete, and possibly structurally complex sections, ranging from 119 m (390 ft.) to 18 m (60 ft.) thick in the Chandler Lake quadrangle. Based on correlation and projection of the measured sections (Rodosar, 1986, fig. 10), the thickness of the Otuk formation is about 415 ft. (123m.). The formation consists of 4 members: shale member, chert member, and limestone member, and the Niglakleshly Member in ascending order. The shale, chert, and limestone members are not discriminated on mapping and the Niaskanshly Member is not widely recognized.

Shale Member Dark-gray, greenish-gray, and greenish-gray shale and mudstone; silty in part, fissile in part, soft and sooty in part, includes thin beds of dark-gray limestone that is locally phosphatic and dark-gray to black chert.

Chert Member Dark-gray to black chert, and silicified micritic limestone; typically rhythmically bedded and thin-bedded, laminated in part, wispy cross bedded in part, with interbeds and partings of dark-gray and commonly silty shale, and intervals up to 10 feet (3m) thick of black, soft, sooty shale. Tabbibb and Nomrik are locally abundant.

Limestone Member Rhythmically interbedded yellowish-gray, light-brownish-gray, and tan-weathering dark-gray fine-grained and very fine grained limestone and interbedded and interbeds of dark-gray and black shale. Includes very thin bedded intervals and partings of Nomrik and Nikhlik coquinas.

Niaskanshly Member Dark-gray to black shale; carbonaceous, includes brownish-gray-weathering fissile paper-like silt shale beds and thin chert beds.

Ts SHUBLIK FORMATION, (Patton and Tailleur, 1964) (Triassic)--The Shublik Formation is probably between 415 and 450 ft. (135m. and 137m.) thick. Biggest exposure of the Shublik Formation is along upper Cobblestone Creek. Structural complexity precludes accurate estimation of formation thickness. Shale and impure limestone, soft, sooty, fissile in part, very silty shale; soft, sooty, fissile in part with dark-gray and black chert and argillite. Shale includes abundant paper-thin laminations and separate concretions up to 1-3 inch (38mm) across, calcareous in part. Dark-gray limestone also weathers light-gray and brownish-gray, typically weathers in positive relief and lighter shades of gray than associated shale, includes locally abundant thin-shell bivalves including Halobia and Monotis. Unit locally includes ferruginous weathering limestone. Unit locally includes yellowish-gray-weathering silicified beds and grades to Otuk Formation.

JTos OTUK AND SHUBLIK FORMATIONS UNDIFFERENTIATED (Jurassic(?) and Triassic)--Shale, limestone, and chert. Dark-gray to very dark-gray shale; soft, recessive-weathering, sooty in part, fissile in part, and locally very calcareous. Dark-gray limestone; also brownish-gray, very argillaceous and grades to calcareous shale, very thin bedded, and locally included and Perten coquina. Yellowish-gray-weathering chert; grades to silicified limestone and mudstone, rhythmically bedded, and thin bedded. This unit is transitional between Shublik and Otuk Formations. Where well exposed the unit comprises much shale and limey shale, but includes yellowish-gray-weathering beds characteristic of the Otuk Formation.

TPc CHERT (Triassic and Permian)--Patton and Tailleur (1964, p. 439) report ribbon chert beds as much as 300 feet (90 m) thick in the Chandler Lake quadrangle. Although structural complexity, poor and discontinuous outcrop, and general lack of stratigraphic control from outcrop to outcrop, limit confidence in estimating the thickness of Triassic and Permian chert, the chert appears to be as much as 500 feet (150 m) thick east of the Anaktuvuk River and appears in general to thin eastward towards the Cobblestone Creek area. Chert occurs as structural blocks that range from hand specimen-size clasts in melange to large blocks that probably include the original depositional thickness of the chert. Medium-light-gray, grayish-green, very light gray, and moderate-yellowish-green to grayish-green ribbon chert; very finely laminated in part, locally obscurely graded, evenly parallel bedded with beds ranging from 1 to 6 inches (2.5 to 15cm) thick with most beds between 2 to 2.5 inches (5 to 6cm) thick, radiolarians are locally abundant and especially conspicuous in light-greenish-gray chert, locally includes siliceous shale partings and black-to-dark-gray shale partings, locally deeply ironstained on weathered surfaces, part of the Triassic cherts grade to the chert member of the Otuk Formation.

Pe SKSIKPUK FORMATION (Patton and Tailleur, 1964) (Permian)--Sisk (1985, pl. 7) reports 175 and 145 m (575 and 475 ft.) of Siksikpuk Formation in the two measured sections along the range front between Confusion Creek and Firestone Creeks. The top of the Siksikpuk Formation is not exposed in either section but, measured sections, especially those to 145 occur near the top of the section. Three lithofacies occur in the Siksikpuk Formation. Three lithofacies are end members of a continuum observed by structural complexity, especially north-south facies transitions. Lithofacies 1 occurs along the range front between the western and the Anaktuvuk River. Lithofacies 2 occurs east of the Anaktuvuk River along the range front. Lithofacies 3 occurs near the head of Ekokpuk Creek in the southwestern map area.

Lithofacies 1--Mostly mudstone and siltstone with smaller amounts of shale, and limestone. Variegated mudstone and siltstone; reddish-brown, grayish-red, light to dark-greenish-gray, and medium-dark-gray to black, laminated in part, thin- to medium-bedded, calcareous in part and grades to very silty shale and shaly limestone, locally weathers reddish-orange, locally pyritic, includes barite veins and nodules, carbonate concretions, and includes reddish-orange claystone partings and thin interbeds. Medium-dark-gray to black limestone, very impure, very shaly and silty, and locally fossiliferous. Black to dark-gray shale; fissile, includes siltstone and mudstone partings, and sooty in part. Includes medium-dark-gray to black and greenish-gray to dark-greenish gray siliceous mudstone; wispy laminated and resistant weathering.

Lithofacies 2--Mostly shale and mudstone with smaller amounts of very impure limestone. Medium-gray to black and dark-greenish-gray shale and mudstone; fissile in part, silty in part, calcareous in part; includes fissile dark-gray to black shale that is commonly soft, includes sooty to silty mudstone in which bedding is obscure, includes prominent barite nodules with radiating crystal structure and barite veins. Limestone makes up a very small part of the section; very impure, mostly shaly, and occurs in thin nodularform beds and concretions. Some of the limestone beds are ferruginous weathering. Slok (1985) reports Zoophycos on bedding surfaces near the base of the section.

Lithofacies 3--Siltstone and shale. Light-gray siltstone, also dark-to very dark gray, and some brownish-gray, hard siliceous, very uniform texture but with faint color lamination in part, conchoidal fracturing but blockly weathering, partly rhythmically bedded and thin- to medium-bedded, includes porcelanite beds. Shale is dark-gray to black, soft, sooty in part, and poorly exposed. Barite concretions and veinlets up to three inches in greatest dimension are rare.

Pzl SADLEROCHIT GROUP (Permian)--Slab-like bodies of Sadlerochit Group strata up to 50 feet (15 m) thick occur in lubricate fault blocks composed mostly of Lisburne Group carbonate strata east and adjacent to the head of the Nanushuk River. Siltstone, sandstone, and mudstone. Reddish-brown siltstone and mudstone; iron-oxide cemented and deeply iron-stained on weathered surfaces, also greenish-gray varieties without much iron-stain. Sandstone is very fine to fine-grained, ripple-scale cross bedded, and grades to siltstone. Includes conglomerate of basaltic-andesite, hornstone, and chert clasts. Large Zoophycos are prominent. Only the basal part of the rock unit is present.

Ml ALAPAH and WACHSMUTH LIMESTONES of the LISBURNE GROUP (Bowsher and Dutro, 1957; Armstrong and Mamet, 1977 and 1978) (Mississippian)--Mostly light-brownish-gray packstones and wackestones composed of bioclastic framework clasts and interstitial lime mud; abundantly fossiliferous including brachiopods, foraminifera, echinoderms, corals, bryozoans, and gastropods. In most places, the clastic character of the limestone is apparent, but diagenetic obscures the grain fabric locally. Bedding ranges from thin to massive and locally includes cross bedding and cross lamination. Shale is gray shale, carbonaceous limestone, shaly limestone, and limy shale occur locally. Dark-gray to light-gray chert occurs as nodules and nodularform beds. Ferruginous-weathering and especially fossiliferous beds occur near the base of the Wachsmuth Limestone. The Alapah and Wachsmuth Limestones are about 3,340 feet (1018 m.) thick (Bowsher and Dutro, 1957; Armstrong and Mamet, 1977; and Armstrong and Mamet, 1978) in aggregate throughout the quadrangle except in the Ekokpuk Creek area, southwest of confluence of Ekokpuk Creek and the John River, and between the John River and upper Inukpasugruk Creek where the Lisburne Group is hundreds of feet thick rather than thousands of feet thick.

The Alapah and Wachsmuth Limestones of the Lisburne Group include two facies mapped, Null and others, 1982) to be part of the Kuna formation. Both facies, a shale (Mlsh) and a chert facies (Mlch), are identified but not assigned to the Kuna Formation.

Mlsh SHALE FACIES OF THE ALAPAH LIMESTONE (Mississippian)--Very dark gray to medium-dark-gray argillaceous limestone, limy shale, and nodular-form chert. Includes locally abundant medium-light-gray chert nodules. Most of the limestone and limy shale is fine-grained, carbonaceous, thin bedded in places, locally platy weathering. Carbonaceous shale partings occur locally. Some outcrops have a sooty carbonaceous blow on weathered surfaces. The facies grades to medium-gray bioclastic limestone and dolomitized limestone. Null and others (1982) report that the shale facies in this map is likely the easternmost tongue of the black chert and shale facies of the Kuna Formation.

The shale facies are not herein assigned to the Kuna Formation because they lack lateral persistence, consistent stratigraphic position, and minor lithology. Most shale beds are lenticular, intervals separated by up to 400 feet (120 m) of Alapah Limestone. Identified herein as shaly facies (Mlsh) occur in the upper part of the section, transitional to the Sikubpak formation and the lower intervals of the previously identified as the black chert and shale member of the Alapah Limestone (Patton and Tailleur, 1964, p. 439). Neither interval is persistent in thickness or stratigraphic position. The lower interval, which is locally phosphate-bearing, does not have a locally persistent stratigraphic position, probably due to intertonguing of paralemic fossiliferous limestone and shale. The upper interval is locally subtle facies; Patton and Tailleur (1964) report a black chert and shale member within the resistant limestone of the Alapah Limestone.

Mlch CHERT FACIES OF ALAPAH AND WACHSMUTH LIMESTONES (Mississippian)--Very dark gray to black chert; dense, nearly opaque, mostly massive, conchoidal fracture, highly fractured, many white quartz veinlets, includes locally abundant medium-light-gray dolomitized micrite in shale; ellipsoidal beads, includes rare of dark to very dark gray argillaceous siltstone and medium-gray limestone, includes faint wispy structures which may be relict cross bedding. This is a replacement of Alapah and Wachsmuth Limestones undifferentiated.

The chert facies is not assigned herein to the Kuna Formation, because of contrasts in bedding characteristics and likely protolith between these strata and most of the strata assigned to the Kuna Formation. Prominent bedding, ranging from rhythmic to uneven, characterizes the Kuna Formation, whereas the chert facies along Ekokpuk Creek are massive. Protolith in replacement chert north of the Kuna Formation is fine-grained clastic strata, possibly mudstone turbidites, whereas protolith in the chert facies in the Chandler Lake Quadrangle is platform carbonate strata.

Regional facies changes suggest that the chert facies in the Chandler Lake quadrangle are part of a regional transition from shelf carbonate on the northeast to chert and possibly to Kuna Formation on the southwest. The transition takes place across a linear zone that extends southeast from the range front in the Outwash Creek area west of the Chandler Lake quadrangle, through the Ekokpuk Creek area, and thence south of Doonerak Mountain, south of the Chandler Lake quadrangle. Northwest of the transition zone the Lisburne Group is anomalously thin. Transition from limestone to chert takes place by replacement of platform carbonate in the Outwash Creek area and by Ekokpuk Creek area. Bedded chert occurs on upper Ot