Semi-detail reconnaissance of the Western Brooks Range, northern Alaska, 1971

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GEOLOGIC MATERIALS CENTER

SEMI-DETAIL RECONNAISSANCE OF THE
WESTERN BROOKS RANGE
NORTHERN ALASKA

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by

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1971

UNION OIL COMPANY OF CALIFORNIA
and
AMOCO PRODUCTION COMPANY

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ABSTRACT

The oldest rocks in the study area are the Precambrian(?) to Silurian(?) metamorphic units of the Basement Complex. These rocks are unconformably overlain by various Devonian carbonate units or the Hunt Fork Shale. Gradationally overlying the Hunt Fork Shale is the marine Noatak Formation or its continental correlative, the Kanayut Formation, both of Devonian age. The Early Mississippian Utukok Formation probably gradationally overlies the Noatak Formation. The Kayak Formation is a lateral correlative of the Utukok Formation and gradationally underlies the Lisburne Carbonate as does the Utukok Formation. Undifferentiated Permian Siksikpuk-Triassic Shublik Formations disconformably overlie the Lisburne. Along the north flank of the Brooks Range, the Lower Cretaceous rocks unconformably overlie the undifferentiated Permian-Triassic Formations. ? The lower contact of the Lower Cretaceous rocks is not exposed along the southern flank of the Brooks Range. The Upper Cretaceous rocks lie upon Lower Cretaceous rocks with unknown relationship south of the Brooks Range and unconformably upon the Basement Complex along the south flank of the Brooks Range.

SEMI-DETAIL RECONNAISSANCE OF THE WESTERN BROOKS RANGE, NORTHERN ALASKA

INTRODUCTION

The 1971 geological field work was carried out in the western Brooks Range by Union Oil Company of California (operator) and Amoco Production Company. Field personnel included Lloyd Furer and Robert Fehlmann of Amoco; John De Benedetti (party chief), Dave Abrahamson, Robert Rosé, and Chuck Bitgood of Union Oil. The area studied is shown on Figure 1.

The purpose of the field work was (1) to define the vertical and lateral extension of Paleozoic carbonate units, (2) to study the depositional environments of these units, (3) to delineate strand lines of the Paleozoic and Cretaceous rocks, (4) to evaluate petroleum source rock and reservoir rock potential in the sedimentary column, and (5) to study the geologic structure in relationship to the accumulation of hydrocarbons.

Seven weeks were spent in the western Brooks Range mapping 38,000 square miles and three days in the Sagwon area checking and sampling Cretaceous rocks. The objectives for the western Brooks Range study area were accomplished in 44 days including 14 days lost due to camp moves, bad weather, and loss of a helicopter in the Noatak River (no injuries). There were three base camps: one at Kiana, 75 miles east of Kotzebue; the second on the Noatak River six miles east of the Nimiuktuk River's confluence with the Noatak; and at Ambler, about 100 miles east of Kiana. The field parties were supported by a Jet Ranger Helicopter.


union 76
Northern Alaska District
INDEX MAP
1971 FIELD STUDY AREA
1970 FIELD STUDY AREA
Scale: 1" = approx. 80 Miles
DISTRIBUTION
FILE NO
MAP NO
FIGURE 1
ARCTIC OCEAN
NORTON SOUND
SEWARD PENINSULA
KOTZEBUE SOUND
BROOKS RANGE
De Long Mountains
BAIRD MOUNTAINS
Schwatka Mountains
Waring Mts.
NOATAK RIVER
YUKON RIVER
Barrow
Wainwright
Kivalina
Noatak
Kotzebue
Kiana
Shungnak
Kobuk
Selawik Lake
Hughes
Allakaket
Bettles
Wiseman
Nome
Solomon
Galena
Ruby
Tanana
Nenana
College
Fairbanks
Shishmaref Inlet
Goodhope Bay
Cape Espenberg
Pt Hope
C Thompson
C Lisburne
Pt Lay
Icy Cape
Sagwon
Colville River
Survey Pass
Anaktuvuk Pass
Chandler L
Arctic Circle
Koyukuk
Unalakleet
Stebbins
St Michael
Holy Cross
Marshall
Bethel
Flat
Iditarod

Geologic mapping was done on 1:250,000 topographic quadrangles and aerial photographs. The eleven plates accompanying this report cover the reconnaissance geologic mapping done in 1970 and 1971. Formation and/or rock unit contacts on plates are a result of field observation and aerial photographic interpretation. The geology mapped in the Cosmos Hills (north central Plate 10) was taken from Fritts (1970) and Patton et al (1968).

GEOLOGIC SUMMARY

In the study area, metamorphic rocks making up the Basement Complex possibly range in age from Precambrian to perhaps Silurian. The overlying sedimentary sequence ranges in age from Devonian through Cretaceous. Pennsylvanian and Jurassic rocks were not recognized and may be missing.

The metamorphic rocks of the basement consist of phyllite, schist, marble, and quartzite. These rocks are not petroleum source rocks but some of the recrystallized carbonates may prove to be reservoir rocks. The Basement Complex is overlain unconformably by an unnamed Devonian carbonate sequence and the Hunt Fork Shale. Locally, the carbonate is reefal and contains petroleum residues. In some localities the Hunt Fork Shale overlies carbonate of Devonian(?) age. Gradationally overlying the Hunt Fork Shale are the marine Noatak Formation and its continental equivalent, the Kanayut Formation, which consist mainly of sandstone with minor conglomerate.

The Early Mississippian Kayak Formation and Utukok Formation probably gradationally overlie the Noatak Formation. These two formations in turn are gradationally overlain by the Lisburne Carbonate of Mississippian age.

The Permian-Triassic rocks are grouped together for this study because of the difficulty of separating in the field the Permian Siksikpuk Formation from the Triassic Shublik Formation. Early Cretaceous shale, sandstone, and conglomerate crop out on the north and south sides of the western Brooks Range. In the mapped area, upper Cretaceous conglomerate and sandstone crop out on the south flank and south of the Brooks Range. A Tertiary outcrop in the Kivalina Village area, northwest of Kotzebue, was not located and will not be mentioned further.

STRATIGRAPHY

Precambrian(?) to Silurian(?)
Basement Complex

The Basement Complex is composed of phyllite, slate, marble, quartzite, and schist. These rocks are schistose to gneissic near the contact with the Schwatka Mountain igneous intrusion. Locally abundant white quartz veins, which could be as old as or younger than the metamorphic rocks, intrude the complex throughout the outcrop area.

In the northwestern part of the Schwatka Mountains, a thick unit of schistose carbonate crops out. This unit is estimated to be several thousand feet thick. The lower portion of the carbonate unit is interbedded with phyllite and schist whereas the upper part appears to overlie the phyllite-schist-carbonate sequence. The degree of metamorphism of the upper sequence appears to be the same as in the lower part. The upper part of this carbonate unit may have one of two age relationships: 1) it may be part of the pre-Middle Devonian Basement Complex, or 2) it may be correlative to the Middle and Late(?) Devonian carbonate units but has been metamorphosed more than other Devonian carbonate by extensive faulting and shearing of the rocks in the fault zone north of the outcrops (Plate 7).

No recognizeable fossil material was found in samples collected from the Basement Complex. The age of the Complex is pre-Middle Devonian based on the oldest date available from Devonian outcrops known to be stratigraphically above the Complex.

Silurian

Silurian rocks are assumed to be present in the Baird Mountain area based upon the identification of Silurian megafossils from carbonate float collected by Amoco in 1970 (Fehlmann, 1971). The exact location from which these Silurian fossils were collected is in question and Union, in 1971, could not find additional Silurian rocks. Further field work is necessary to prove whether the Silurian is present in the Baird Mountains.

Devonian Carbonate Units

Orange-Brown Weathering Metalimestone

An orange-brown weathering metalimestone is exposed in the west central Baird Mountains. Good outcrops were studied in the western half of T23N, R13W, and T21N, R15W, KRPM, but this unit was not delineated on the geologic maps. The unit is predominantly schistose, medium to coarsely crystalline, and weathers into "klinkly" plates. Locally, the limestone contains calcite and quartz veins, mica along foliation planes, wavy foliation planes and dolomite.

Depositional structures and fossils have not been preserved in the metalimestone; therefore, little inference can be made as to the environment of deposition. The lack of interbedded detrital sediments indicates a

A

Structure in the Metamorphic Basement
Complex-Central Schwatka Mountains
looking north

B

Strongly contorted marble in Metamorphic
Basement Complex-Central Schwatka Mountains
looking north

FIGURE 3

A

Part of upper unit of the massive carbonate sequence within the Metamorphic Basement Complex-Northwestern Schwatka Mts. looking east

B

Faulted, massive carbonates of the Metamorphic Basement Complex in the Western Schwatka Mountains looking southwest

FIGURE 4

A

Metacarbonates on Black Phyllite as seen
in ~~T14N, R25E~~ T25N R14E, Survey Pass Quadrangle
looking northeast

B

Marble and Schist interbeds as seen in the
Kiana Hills (June 21, stop 3). Man at upper
right for scale. looking northwest

FIGURE 5

depositional environment common in a carbonate platform or shelf which was free of terrigenous influxes.

This carbonate is stratigraphically fixed between underlying metamorphics and overlying light or dark gray-weathering carbonates. The orange-weathering unit rests unconformably above darker schists and phyllites of the Basement Complex. The unit was never seen interbedded with the underlying metamorphics. Depending upon the location, either a light gray-weathering carbonate (possibly Middle to Upper Devonian Skajit Formation) as in the NW 1/4, T22N, R9W, KRPM or a dark gray-weathering carbonate (in part Middle Devonian) as in the western half of T23N, R13W, KRPM unconformably overlies the formation. The paleontological information from these overlying units indicates that the metalimestone can be no younger than Middle Devonian and quite probably is older. The stratigraphically higher carbonate units, although locally recrystallized, do not exhibit the marked metamorphic textures of the orange-weathering metalimestone. This metacarbonate is thought to have poor reservoir potential.

Dark Gray-to Black-Weathering Carbonate

A dark gray-to black-weathering carbonate unit crops out in the Baird Mountains in the Squirrel Creek and in the Kanaktok Creek drainages. Good outcrops were studied in the western half of T23N, R13W, and NE 1/4 T27N, R4W, KRPM, but this unit was not outlined on the geologic maps. The fresh, dark gray-to black-colored dolomite and limestone is predominantly dense, fine to medium crystalline, and has low visible porosity and permeability. Nodules, bands, and discontinuous beds of gray chert are found locally as are thin interbeds of light gray dolomite with fetid odors. Fossils include large brachiopods, stromatoporoids(?), tetracorals, small unidentified fauna, and algal mats. Some outcrops are stromatoporoid(?) bioherms and biostromes.

The carbonate probably was deposited on a shallow-marine platform which at times was subaerially exposed. The stromatoporoid(?) biostromes and bioherms indicate a shallow, wave-agitated, oceanic platform. The algal mats are indicative of very shallow-marine sedimentation and possibly subaerial exposure.

The unmetamorphosed, dark carbonate unconformably overlies the orange-brown, schistose carbonate at several locations in the western half of T23N, R13W, KRPM, and field relationships in the western half of T27N, R4W, KRPM indicate that it may be overlain by a light gray-weathering limestone unit. Megafossil determinations indicate the dark carbonate unit to be Middle Devonian, Givetian, and thus equivalent to the lower(?) part of the light gray-weathering carbonate unit. The dark carbonate unit is possibly a facies of the light gray carbonate unit; subsequently, the black carbonate and the equivalent gray carbonate were overlain gradationally by younger carbonate deposits of the light gray unit. The formation is not thought to be a potential oil reservoir.

Light Gray-Weathering Carbonate (Skajit?)

A predominantly light gray-weathering, massive-appearing carbonate unit (Skajit?) is aerially extensive in the Baird and Schwatka Mountains (most CRB, GCRB, and BCRB on the geologic maps). Characteristically, the unit contains more limestone than dolomite, has a medium to dark gray fresh color, is micro- to coarsely recrystalline, and contains numerous recrystallized small limestone mounds and large organic buildups. In some localities, the formation is bedded, has a strong fetid odor, is fossiliferous, contains minor chert, is argillaceous, and gives a brownish "cut" with acid. Fossils include brachiopods, coelenterates, stromatoporoids, crinoidal debris, and unidentified microfauna.

This unit was deposited on a shallow-marine platform, a large portion of which (the larger organic buildups) was deposited at the high-energy margin. The large buildups, some hundreds of feet thick, are usually completely recrystallized, but locally large stromatoporoid masses and colonial corals are found to form the massive reefal cores. The smaller stromatoporoid and colonial coral lime mounds and biostromes may have grown on the platform lagoonward of the larger buildups. Algal mats and stromatolites in the carbonate are indicative of shallow subtidal, intertidal, and possibly even supratidal sedimentation.

In the central Baird Mountains and Kiana Hills, the light gray-weathering carbonate is underlain unconformably by metasediments as in the SE 1/4, T26N, R10W, and SE 1/4, T20N, R12W, KRPM or the orange-brown weathering metacarbonate as in the NW 1/4, T22N, R9W, KRPM. Field relationships as in the western half of T27N, R4W, KRPM indicate the unit may also overlie the dark gray-to black-carbonate unit in the central and northeastern Baird Mountains. In the western Baird Mountains and Igichuk Hills, the light gray unit overlies the metasediments and appears to change facies laterally to an interbedded, light brown and gray carbonate as in T21N, R16W, KRPM. This banded unit is also present in the central Baird Mountains as in the NW 1/4, T23N, R12W, KRPM and again is thought to be a facies of the light gray, massive appearing carbonate.

The Hunt Fork Formation was found overlying the light gray carbonate in the northeastern Baird Mountains in the center of T28N, R3E, KRPM. In the northern Schwatka Mountains, the carbonate is overlain by dark shales of the Hunt Fork Formation in T26N, R16E, KRPM and may interfinger with the Hunt Fork in this area. Nowhere else were younger rocks found overlying the light gray carbonate.

The light gray-weathering carbonate is thought to be equivalent and correlative to the Skajit Formation. Two Skajit stratigraphic sections, Lower Eli River, located in the SW 1/4, T28N, R14W, KRPM and Upper Agashashak River, located in the SE 1/4, T26N, R12W, KRPM, measured by Amoco in 1970 (Amoco Memo #152) are Middle and Late Devonian, Givetian, and Frasnian. Paleontological work on grab samples from the Baird Mountains, collected by Union's 1971 field party, indicate the light gray unit to be Devonian, much of it Middle Devonian.

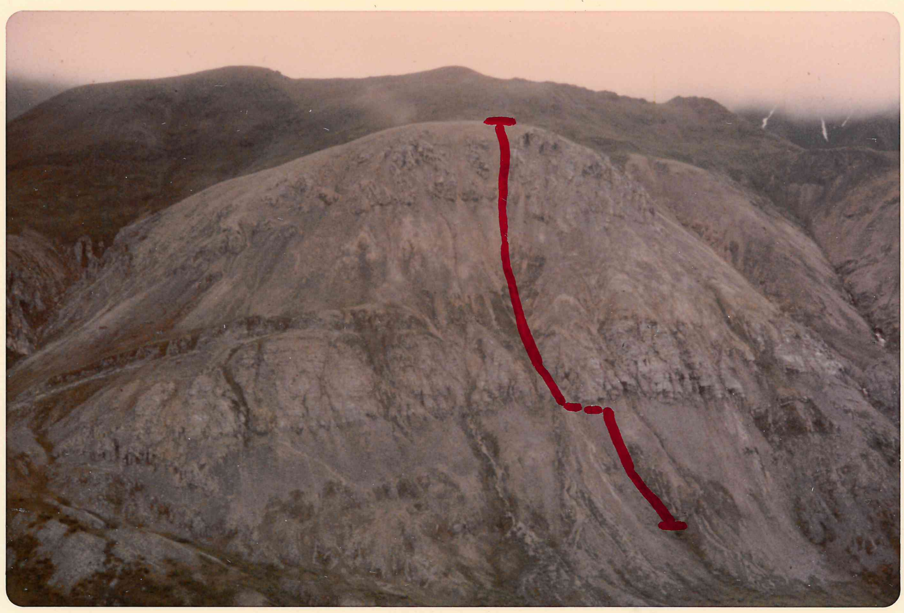
In the De Long Mountains, the light gray-weathering carbonate may be represented by the lower part of the Kugururok Formation found in the Mount Bastille area in the SW 1/4, T11S, R38W, UPM, and by an unnamed carbonate unit measured at the Trail Creek section in the SE 1/4, T34N, R10W, KRPM, Misheguk Mt. Quad. The Kugururok is lithologically similar to the light gray-weathering carbonate found in the Baird Mountains. The light gray-weathering lower portion of the Kugururok Formation at Mount Bastille overlies the Hunt Fork Shale(?) and is probably Frasnian or older in a section measured by Pan American in 1969 (Pan American Memo #127) and from grab samples collected by Amoco in 1970.

The unnamed unit at the Trail Creek Section is limestone and dolomite, dominantly weathered light gray to gray, thinly to massively bedded, and contains beds with high to low carbonate mud content. Fossils in the section include brachiopods, stromatoporids, colonial corals, and unidentified fauna. Carbonate deposits represented by the rocks in the section include shallow platform-edge stromatoporoid and coral(?) buildups, intertidal to supratidal algal mats, and probable shallow lagoonal to platform sediments.

The age of the Trail Creek Section, on the basis of smaller foraminifera, is Late Devonian-Early Mississippian, Kinderhookian or older. Megafauna from this section, however, are Middle Devonian in the basal and middle part to Late Devonian in the upper part of the section. The authors consider the megafossil dates to be the more accurate. The unnamed carbonate in the Trail Creek Section is thus equivalent to the Skajit Formation measured by Amoco in 1970 at the Lower Eli River and Upper Agashashak River sections and to the lower portion of the Kugururok Formation at Mount Bastille.

In addition, in the SE 1/4, T 33N, R 4W, KRPM in the De Long Mountains, the light gray-weathering unit overlies the Hunt Fork Shale(?) and is Middle Devonian, Eifelian, on the basis of megafossils. The light gray-weathering unit, therefore, ranges from at least Middle Devonian, Eifelian, to Upper Devonian, Frasnian, in the Baird-De Long Mountains area.

A



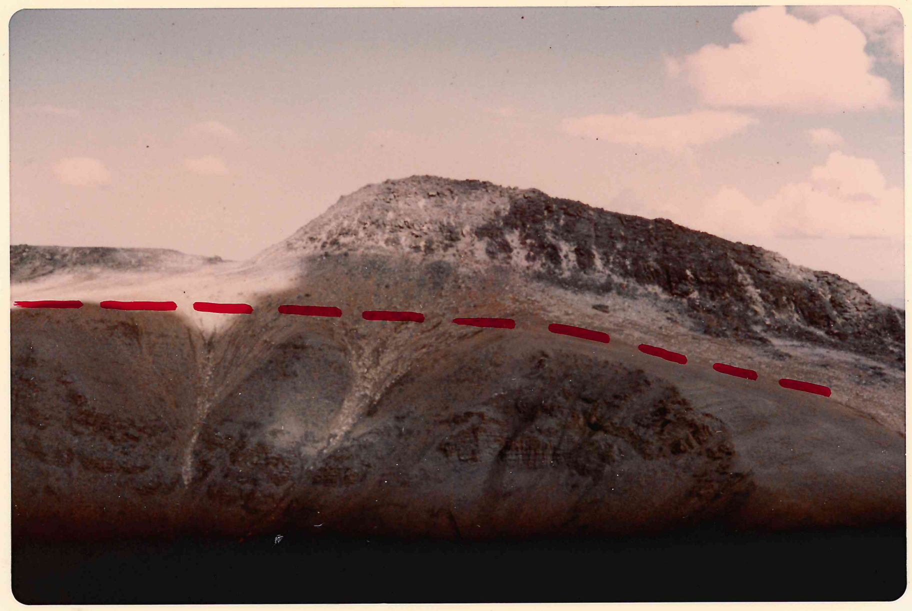
Middle to Upper Devonian
carbonate rock of Trail Creek Section
looking south

B

North face of Mt. Bastille with Hunt Fork Shale at base and Kugururok Fm. above it, all Late Devonian.

FIGURE 6

A



Kanayut and Hunt Fork overlying marble of
Metamorphic Basement Complex with fault contact.
Located at 156°52'30" E and 67°46'N
looking north

B

Cross-bedding in Noatak Formation sandstone
[near the Noatak River]
southwest of the type section
looking north

FIGURE 7

Hunt Fork Shale (HF)

The Hunt Fork Shale that crops out throughout the map area consists of shale and siltstone with fewer interbeds of silty limestone and sandstone. The areal distribution of this unit generally is within the northwestern Baird Mountains, eastern De Long Mountains, Howard Pass area, and north of the Schwatka Mountains (Plates 3, 4, 6-8). It is not known if the Hunt Fork Shale was even deposited in the southern part of the area mapped.

The Hunt Fork Shale appears to overlie the Basement Complex unconformably south of the Noatak River (Plates 6 & 7). In a few localities, it overlies (T28N, R3E of the Ambler River Quadrangle) Middle Devonian carbonate, but with an unknown relationship. The upper contact of the Shale is gradational into the Noatak Formation and also appears to grade into the Kanayut Formation (T27N, R9E of the Ambler River Quadrangle and the south central area of the Misheguk Mountain Quad.). The gradational sequence ranges in thickness from less than one hundred feet to several hundred feet. The change from Hunt Fork Shale to the Noatak occurs upwards by a gradual increase of sandstone accompanied by a decrease in shale interbeds until the sandstone becomes the predominate rock type. This contact is more abrupt into the Kanayut Formation where conglomerate or conglomeratic sandstone predominates.

The age of the Hunt Fork Shale is Middle to Late Devonian. The Middle Devonian (Eifelian) date comes from a carbonate unit sampled this season which overlies concordantly the shale considered Hunt Fork. Assuming this sequence is not overturned, the underlying shale unit is Eifelian and/or older. Fossils from the base of the Noatak Formation (Dutro, 1953) indicate a Late Devonian Age, which would be a minimum age for the Hunt Fork Shale.

Most of the Hunt Fork Shale encountered is probably Upper Devonian. Fossils and primary sedimentary structures found in the shale and limestone indicate a shallow water marine environment of deposition.

Noatak Formation-Kanayut Formation (Noa-Dk)

In the area of study the Kanayut Formation is primarily a continental unit and the Noatak Formation primarily a marine unit. The separation of these two units is very arbitrary at this time due to the geologic reconnaissance type of survey done during the 1971 field season. More detailed work probably would resolve the interrelation of the Noatak and Kanayut formations. As mapped, the Noatak Formation is restricted to the northwestern portion of the mapped area (Plates 2, 3, 5, and 6) while the Kanayut Formation is confined to the northeastern portion of the mapped area (Plates 4, 7, and 8).

The Kanayut Formation consists of quartz-rich conglomerate and silty quartzose sandstone. Shale with plant remains is present as thin interbeds in the sandstone sequence. The sporadic outcropping of conglomerate is believed controlled primarily by local deposition rather than erosion.

The Noatak Formation consists primarily of quartzose sandstone with minor shale and siltstone interbeds. According to Dutro (1953) at the type section, about five miles north-northwest of the Nimiuktuk River mouth, the Noatak sandstone is mainly very fine-grained, siliceous, ferruginous, and rarely conglomeratic. Commonly, it is cross-bedded, rippled, and occasionally channeled. In the field, it was observed that the grain size increases westward from the type section to fine- to medium-grained with numerous conglomerate beds (Knapp and Dalness, 1970). Thin beds of shale-pebble conglomerate are present sporadically in sandstone throughout the Noatak Formation.

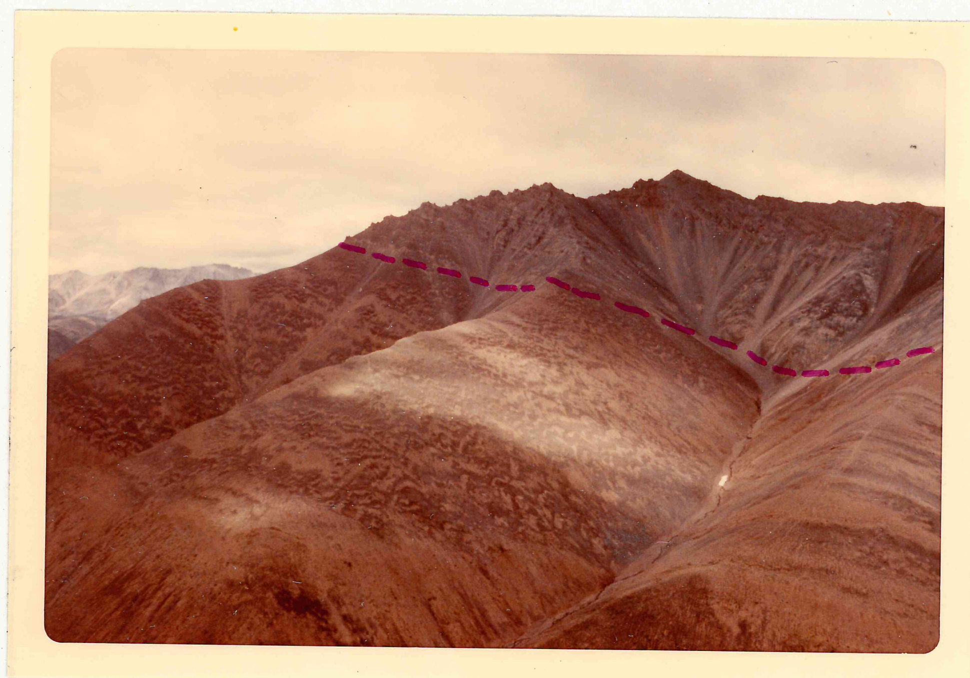
The upper contact of the Noatak Formation with the Kayak Formation or Utukok Formation and the Kanayut Formation with the Kayak Shale was not observed during the 1971 field season. Dutro (1953) states that the Noatak Formation is gradational with the Utukok Formation, and the data obtained during the 1971 field mapping also indicates a gradational contact. The upper contact of the Kanayut was not observed, but according to Bowsher and Dutro (1957), at the type section east of the mapped area near Shainin Lake, the Kanayut Formation is overlain disconformably by the Kayak Formation.

Dutro (1953) states that the Noatak Formation contains a few Late Devonian plant genera and a diagnostic brachiopod species of Late Devonian age. No fossils have been dated so far from samples collected during the 1971 field expedition.

Mississippian

Utukok Formation (Utu)

The Utukok Formation consists of sandy and silty limestone, limy siltstone, and calcareous to siliceous sandstone interbeds. The limestone is commonly a fossil hash and it contains abundant quartz sand and silt and tiny iron specks. The limestone is ripple cross-bedded where clean and burrowed where argillaceous. The interbedded sandstone is very fine-grained, silty, ferruginous, and usually limy. The quartz silt and sand appear to have the same source as the Noatak Formation. The carbonate was provided



Gradational contact between the Utukok Formation below and the Lisburne Formation above. Line indicates approximate position of contact. Looking north. Location: T12S R13W (north central part) Misheguk Mountain Quadrangle.

FIGURE 8

by marine organisms. This formation is a shallow water marine shelf edge deposit.

The lower contact of the Utukok Formation was not observed, but according to Dutro (1953), it is gradational with the Noatak Formation. The boundary between the Utukok and Noatak Formations occurs where the rocks are predominantly calcareous. The upper contact is gradational with the Lisburne Carbonate. The change between the two formations is a decrease of terrigenous clastic rocks upward, replaced by fossiliferous carbonate grainstones of the Lisburne Carbonate.

The age of the Utukok Formation, according to Dutro (1953), is upper Kinderhookian to lower Osagean. This unit laterally, at least in part, grades into the Kayak Formation.

Kayak Formation (Mk)

The Kayak Formation crops out mainly along a narrow belt in the northern flank of the De Long Mountains (Plate 2 and 3). It consists mainly of dark gray shale with thin laminae of white siliceous(?) rock and thin limestone interbeds toward the top. Dark gray chert beds are commonly interbedded with the shale. In places, sequences of black silicified fossiliferous limestone and black chert are present near the base of the Lisburne Carbonate, or these beds could be considered as being the upper portion of the Kayak Formation. The upper contact between the Kayak and Lisburne Formations was not studied but is considered to be gradational.

The Kayak Formation interfingers laterally with the Utukok Formation and represents a basinward facies of that unit. Due to the lateral interfingering with the Utukok Formation, the Kayak Formation is considered to be Early Mississippian in age.

Lisburne (Ml)

The Lisburne Carbonate, aerially extensive in the De Long Mountains and locally present in the northwestern Baird Mountains, was not primarily studied this field season. The gray-colored unit is a sequence of Mississippian limestone, dolomite, and chert. The Lisburne Carbonate is composed of a wide variety of carbonate rock types which were deposited on an open marine platform.

Conformably underlying the Lisburne in the De Long Mountains are the Kayak Shale, or the Utukok Formation. The carbonate unit is unconformably overlain by the undifferentiated Siksikpuk-Shublik Formations.

The Lisburne Carbonate is thought to be a potential hydrocarbon reservoir offshore of Cape Lisburne and the Lisburne Hills area and possibly in the foothills belt north of the Brooks Range. For more details about the Lisburne Carbonate, refer to Union Oil Company's report on the Western Brooks Range by Chauvel, 1969; Pan American's Geological Memorandum No. 127, 1970; and Amoco's Denver Division Memorandum No. 152, 1971.

Permian-Triassic (₨sh)

Siksikpuk Formation-Shublik Formation

These formations are discussed under one heading because in the field, often it was not possible to separate them due to their similar lithotypes, lack of diagnostic fossils, tectonic complexity, and poor outcrops. The usual lack of fossils in both formations restricts the determination of the range of the Siksikpuk Formation in the Permian and the range of the Shublik Formation in the Triassic.

The two formations consist of gray to black fractured chert, gray siliceous shale and associated siliceous claystone, and greenish-gray to gray siliceous siltstone. Minor lithotypes include sooty black shale, shaly sandstone, siliceous coquina, and manganese(?) rich sandstone. The chert and siliceous shale usually weather brownish-red to rusty-brown. The diversified lithotypes indicate that part of the Shublik was deposited in locally restricted marine water with little influx of coarse-grained terrigenous clastic sediments.

The areal extent of the Siksikpuk and Shublik Formations is confined to the northern one-half of the mapped area. The rocks are generally contorted and sheared and crop out in valleys between fault-block mountains of Lisburne, Utukok, and Noatak Formations. Along the northern flank of the Brooks Range, they are, at least in part, deformed by gravity sliding.

Cretaceous

The Cretaceous studied during the 1971 field season will be discussed in two separate sections because of the differing geologic histories of the areas. The areas are: the Kotzebue-Kobuk Basin and the foothills region of the western Brooks Range. The Cretaceous outcrops studied in the Sagwon area will be discussed in a preliminary report and will later be integrated into the 1972 field report of that area.

Kotzebue-Kobuk Basin

Early Cretaceous

The lower Cretaceous rocks cropping out in the Waring Mountains consist of mudstone, conglomerate, siltstone, and sandstone. The conglomerate and sandstone form prominent mountains and bluffs while valleys and low subdued hills are formed of mudstone and siltstone. The highest mountains are located where concentrations of conglomerate are most abundant.

The western part of the Waring Mountains (Hockley Hills and Hotham Peak) contain the greatest percentage of conglomerate. The conglomerate and sandstone are composed primarily of cobbles, pebbles, and grains derived from igneous rocks. Other minor but significant framework constituents include limestone, chert, acid volcanics, sandstone (quartzite), siltstone, and vein quartz (Appendix B, pebble counts). The matrix of the sandstone is clay, silt, carbonate, and iron oxide. Matrix constituents of the conglomerate are sandstone, carbonate silt, iron, and clay.

Above and below the conglomerate-sandstone interval there are mudstone and sandstone with occasional conglomerate interbeds. This lithology is the most widespread and appears to have been deposited in a marine environment below wave base.

In the central and eastern Waring Mountains, the lithology is sandstone, siltstone, mudstone, and conglomerate. The conglomerate framework is primarily igneous clasts (64-100%) with minor chert, quartzite, and silicified shale. The igneous clasts include acid volcanic, granite, basalt, dark igneous and intermediate igneous. The matrix is sand, silt, and mud intermixed or separated, with silica and iron cement. Scattered sandstone beds have calcareous cement. The conglomerate of the central Waring Mountains appear as lensing pods and are interpreted as being discrete channel deposits as opposed to outcrops in the west and east end of the Mountains where they appear more massive and probably represent coalescing channel deposits.

Siltstone and mudstone are abundant above and below the sandstone-conglomerate interval and common within it. They appear to be marine with the siltstone commonly containing carbonized plant fragments. Along the southern margin of the Waring Mountains, it is common to find pebbly to conglomeratic mudstone and siltstone. These units are thin and grade vertically into mudstone, siltstone, and sandstone.

The source terrane for the Early Cretaceous of the Waring Mountains is thought to be portions of the Baird and western Schwatka Mountains and possibly parts of the southern De Long Mountains. Extrusive volcanic rocks probably covered much of the northwestern Baird Mountains and provided much of the detritus for the sediments. A few cobbles of Lisburne limestone were collected from the conglomerate in the central Waring Mountains (sample locality RRR 215, Plate 9). These cobbles probably came from the Lisburne Carbonate cropping out in the northwestern Baird Mountains (Plate 6) and possibly the southern De Long Mountains. Minor clastic constituents probably came from the Metamorphic Complex in the Baird Mountains and the overlying Devonian carbonate in the Baird and western Schwatka Mountains.

The lower Cretaceous rocks of the Sheklukshuk Range and Lockwood Hills (Plates 10 and 11) area differ from the rocks described above. They consist mainly of sandstone, siltstone, and mudstone with a lesser amount of conglomerate and volcanic rocks mixed with mudstone and sandstone. In this area, Cretaceous igneous extrusive rocks are closely associated with the sedimentary rocks and probably were a significant source of sediments. The volcanic rocks consist of porphyritic basalt with phenocrysts of olivine, feldspar, and unknown minerals. The associated sandstone and siltstone consist of volcanic grains, and because of grain size and closeness to the source, they are difficult to distinguish from the volcanic rocks.

Conglomerate is most abundant in the central Lockwood Hills and decreases in abundance eastward; they were not found in the western portion of the Hills. The framework consists of granules to medium sized cobbles of intermediate and basic igneous rocks (90%); the remainder of the detritus is acidic igneous, siliceous claystone, and quartz. The matrix is sandstone as described above, and it is highly cemented by iron and silica. Igneous derived "dirty" sandstone of all grain sizes are abundant in the Hills and are usually cemented by silica and iron. The framework of the sands is made of abundant feldspar, pyroxene, and/or amphibole, and rock grains, with minor red grains and quartz. Mudstone occurs interbedded with the sandstone and siltstone and is usually silty and hard with probably silica and iron cement. Carbonaceous fragments are common, and locally, oyster shells are present (Patton et al, 1968).

The lower Cretaceous of the western end of the Alatna Hills (NE Plate 11) is different from those rocks previously described. The bottommost beds of the section examined are part of a sequence of graded units. Many units have coarse sand at the base and grade upward to silty shale before the next graded unit occurs. There are occasional graded limestone beds. The section is probably several thousand feet thick. Stratigraphically above the graded beds are interbedded conglomerate and shale beds overlain by massive conglomerate with interbedded sandstone. The predominant framework constituents for the conglomerate and sandstone are basic igneous rocks and their mineral grains plus minor dark and light chert and quartz.

The age of all the lower Cretaceous rocks discussed is based on U. S. G. S. fossil collections and radiometric dates and two radiometric dates obtained from samples collected during the 1971 field party. Buchia sublaevis found by the U. S. G. S. (Patton et al, 1968) indicate an early Neocomian age while radiometric dating indicates a range from 87.8 ± 3.9 m. y. to 125 ± 3.3 m. y. (top of the Turonian down to the middle of the Neocomian). The older radiometric dates agree fairly well with the paleontology but the younger dates are in large error. This error may be due to surface weathering of the sample or remobilization of the rock during later Cretaceous igneous activity. Additional fossil collections throughout the area are needed to provide a better understanding of the stratigraphic relationships of the Kotzebue-Kobuk Basin lower Cretaceous.

Late Cretaceous

The upper Cretaceous rocks crop out along most of the northern flank of the Waring Mountains, on the Kobuk River, around the Cosmos Hills, and in a narrow band in the Helpmejack Hills area (northern part of Plates 9, 10, and 11 and southern part of Plates 6 and 7). The rocks comprising the upper Cretaceous are primarily sandstone, and conglomerate with minor amounts of siltstone, mudstone, and coal. These coarser grained rocks are easily distinguished from the Early Cretaceous rocks because of the abundance of white vein quartz as a dominant framework constituent.

The conglomerate is abundant in outcrop and consists primarily of granules to medium-sized cobbles of vein quartz, schist, phyllite, and limestone with minor dark volcanics, quartzite, chert, and sideritic siltstone. Locally, the sideritic siltstone clasts are abundant. The matrix is medium- to coarse-sand that is medium- to well-sorted and cemented with silica, carbonate, and iron in order of decreasing abundance. The conglomerate observed along the Kobuk River was cross-bedded and appeared in most places to be fluvial in origin. Sandstone occurs as thin lenses within the conglomerate beds and above them as upward gradational units laid down during primary deposition. The sandstone in turn grades upward into siltstone and ranges from very fine- to coarse-grained with matrix content

A

Upper Cretaceous conglomerate in Kobuk basin near contact with the Metamorphic Basement complex. White cobbles are veinqtz. Taken July 24 @ Stop 11. Looking south [Sec. 29 T18N R19E]

B

Upper Cretaceous conglomerate consisting of gray carbonate, white vein quartz, and very dark metamorphic cobbles & pebbles. Outcrop on Kobuk River (June 22, stop 5) Baird Mountain Quad.

FIGURE 9

increasing with decreasing grain size. The cement is carbonate, silica, and iron. The siltstone varies in color from red to gray depending upon the carbonaceous content and degree of oxidation. It crops out only rarely, but it seems to cap the channel deposit sequence of conglomerate and sandstone. Coal was found in two localities as float and possibly it overlies very fine-grained sediments.

The lower contact of the upper Cretaceous rocks was not observed in outcrop, but reconnaissance mapping indicates that it is angular in the Helpmejack Hills area where Cretaceous rests on the Metamorphic Complex. At Hotham Peak (T 16N, R 9W, Plate 9) the upper Cretaceous rests on the lower Cretaceous with unconformity, but of an unknown type (Patton and Miller, 1968).

The primary source terrane for the upper Cretaceous sequence was the Metamorphic Complex of the Baird and Schwatka Mountains. Additional detritals came from the Devonian carbonate and lower Cretaceous igneous rocks. These sources were north of the depositional area.

The age of the Cretaceous sequence based upon palynology is Late Cretaceous, Campanian-Maestrichtian. A radiometric age date from a tuff indicates middle Late Cretaceous deposition (Patton and Miller, 1968). Plant fossils have been collected by Union Oil Company geologists in 1971 and U. S. G. S. geologists, but they are not good index fossils (Patton and Miller, 1968 and 1966).

Foothills of western Brooks Range

The Cretaceous rocks in this area were observed only in a few outcrops and, therefore, a detailed description is not possible. The lithotypes are mainly siltstone, shale, and sandstone with minor conglomerate. The siltstone and shale lithotypes are poorly exposed and form rounded hills and valleys in the northern foothills of the Brooks Range. These rocks are usually dark gray to black and contain scattered carbonaceous plant debris. The sandstone usually is a dark wacke (>10% matrix) with calcareous to siliceous cement. The grain size ranges from very fine to coarse but the majority are fine-grained. The framework constituents were not studied in detail but include rock, quartz of various types and chert grains. The sandstone is laminated to thin-bedded, rippled, and locally graded. It is often interbedded with shale and locally contains shale pebbles. The conglomerate is associated with the sandstone and in several places, it grades upward into it. The clasts are granules to small pebbles of varied undocumented lithotypes.

The lower contact of these Cretaceous rocks is unconformable. It overlies Triassic Shublik and the Lisburne Carbonate within and along the north flank of the De Long Mountains. The upper contact was not observed.

Foraminiferal assembledges found in several samples collected by members of this survey were not diagnostic enough to give a reliable date. An Early Cretaceous age is given as a best guess. This agrees with the age as inferred by the U. S. G. S. (Sable, Dutro, Morris, 1951).

Igneous Rocks

Plates 2-6, 8, 10, and 11 of this report illustrate the widespread occurrence of igneous rocks in the western Brooks Range. The great majority of these igneous rocks are fine to coarsely crystalline mafic sills, dikes, and stocks. The cores of the larger intrusive bodies are

Light orange, snow capped Cretaceous igneous instrusive in central De Long Mountains (southcentral, Plate 3) Intruded sediments form the flanks of the mountains. looking northwest.

FIGURE 10

composed of very dark and heavy ultramafic igneous rocks. Granitic rocks occur locally in small outcrops and are not widespread except in the Survey Pass Quadrangle where they form the core of the Schwatka Mountains (Fritts, 1970). Gneissic rocks occur at the periphery of this large intrusive.

The exposed igneous rocks suggest emplacement as stocks, batholiths, dikes, and sills with some subaerial and submarine basic flows. In the map area, igneous rocks are associated with Devonian carbonate and clastic rocks, Mississippian carbonate and shale, Permian and Triassic chert and clastic rocks, and Cretaceous clastic rocks. Several places in the De Long Mountains, Devonian carbonate blocks occur as large xenoliths. In the Sheklukshuk Range, about 135 miles east of Kotzebue (Plate 10), it appears as though submarine igneous flows are mixed with volcanic breccia and sandstone of Early(?) Cretaceous age.

The igneous rocks were intruded along faults and shear zones throughout the mapped area. These intrusive rocks are commonly aligned along and near normal faults bounding the grabens of the western Brooks Range area. Repeated igneous intrusions since Paleozoic time are suggested by scattered radiometric dating (Fehlmann, 1971). Radiometric dating and field observations indicate major igneous activity during the Cretaceous Period.

STRUCTURE

The structural deformation undergone by rocks making up the Baird Mountains probably is the result of orogenic movements that possibly began in the Precambrian and later recurred at the close of Silurian time and continued intermittently into Early Tertiary.

Orogenic movements caused the regional dynamic metamorphism of the Lower Paleozoic and possibly Precambrian sediments. Evidence of dynamic metamorphism also can be observed locally in the carbonate and shale of Middle and Upper Devonian age. The metamorphism undergone by the Devonian sediments, however, is not as intense as the metamorphism of the underlying metamorphic complex.

The sequence making up the metamorphic complex that crops out in the Baird Mountains, at least in part, is considered in this report the probable age equivalent of the Neurokpuk Formation observed on the eastern portion of the Brooks Range.

It is postulated that the area occupied by the Baird Mountains underwent at least two major orogenies during lower Paleozoic time. It should be pointed out that the writers believe a milder orogeny also occurred near the close of the Devonian. This milder orogeny, which affected principally the Baird Mountains, caused the regional metamorphism of the Hunt Fork Shale observed in those mountains. In most areas visited on the north flank of the Baird Mountains south of the Noatak River, the Hunt Fork Shale has been altered to a sericitic phyllite which at some localities is almost a schist. North of the Noatak River, however, the metamorphism gradually diminishes, becoming nearly absent. In the central and eastern Brooks Range, where the Hunt Fork crops out, the same relation can be observed; the metamorphism of the shale on the south flank of the range is greater than it is to the north where it is very mild or not present. This metamorphism of the shale was caused by the gliding of overlying sediments over the Hunt Fork Shale which served as the plane of detachment.

It is postulated that during the Early Paleozoic orogenies, block faulting, intense folding, and thrusting occurred in the Baird Mountains.

These orogenies created more intense metamorphism than that undergone by the Middle and Upper Devonian rocks.

The regional dynamic metamorphism undergone by the Precambrian(?) and early Paleozoic sediments and the age of the overlying sedimentary rocks and their relation to the metamorphic complex indicate that the Baird and western Schwatka Mountains are the oldest mountains of the western Brooks Range. The age of the rocks and the structures making up the De Long Mountains indicate that together with most of the northern flank of the Brooks Range, they are the youngest; possibly they are Late Cretaceous-Early Tertiary in age. The structural features observed across most of the northern flank of the Brooks Range probably were caused by gravity sliding that took place during the Late Cretaceous uplift of the southern part of the range.

Gravity sliding, however, is not the solution that explains all the structural complications observed in the De Long Mountains. Other stresses, or the combination of differential stresses and gravity sliding may be closer to a solution than any single answer. For instance, the large graben present to the west and south of Feniak Lake (Plate 3 and 4), a tension feature, cannot be accounted for by gravity sliding. The same reasoning applies for another tensional feature making up the wide valley of the lower Noatak River near its mouth (Plate 5). These two features are the result of tension, but possibly they were not caused by one and the same stress. This stress differential possibly is indicated by the orientation of each graben. The presence of tensional structures definitely indicates some type of differential block faulting, at least in the vicinity of the grabens. It can, therefore, be postulated that in all probability the Baird Mountains, or a portion of them, are made up of up-thrown blocks.

The movements along the boundaries of the blocks appear, at least in some cases, to have been not only vertical but also considerably lateral as postulated in Plate 6.

It should be noted that if block faulting and lateral displacements did occur in the Baird Mountains, they were contemporaneous with the development of the Noatak River Graben but ended before the development of the Feniak Lake Graben.

The De Long Mountains, therefore, are believed to have formed after the differential block faulting took place in the Baird Mountains. The uplift of the blocks making up the Baird Mountains caused the gravity sliding responsible for the structural complications observed in the De Long Mountains. It is postulated that stresses of probable Early Tertiary age produced the arcuate shape of the De Long Mountains as well as wrench type faulting, additional thrusting and gliding, and fracturing resembling block faulting in the mountains.

It should be emphasized that the structural review just made of the Baird and De Long Mountains is very schematic. To be able to understand the complicated structure of the area being described, additional field work, stratigraphic in nature, must be done before a reasonable answer to the problem can be reached.

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APPENDIX A

BRACHIOPODS

BRYOZOANS, FENESTRATE

CEPHALOPODS

CORAL, COLONIAL

CORAL, SOLITARY

ECHINODERM

GASTROPODS

PELECYPODS

SPONGE

ALGAL STRUCTURES

BONE FRAGMENTS

F FOSSILS

STROMATOPOROIDS

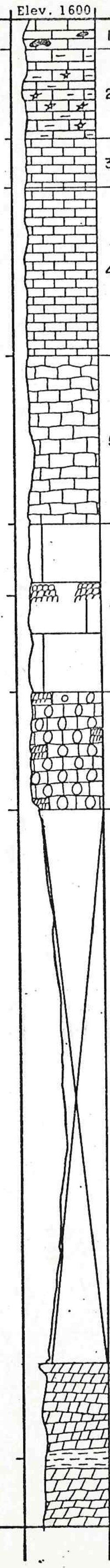
ALASKA, MISHEGUK MOUNTAIN QUADRANGLE 1:250,000 1956
Top: Long: 160° 52' 00" Lat: 68° 19' 2"
Bottom: Long: 160° 53' 00" Lat: 68° 19' 8"

Scale: 0' – 50' – 100'

System: DEVONIAN

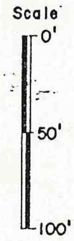
Formation: LOWER KUGURUROK FORMATION?

Elev. 1600

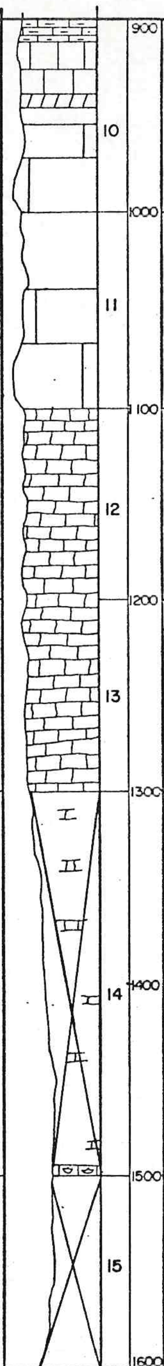


Sample	Unit	Footage	Thickness	Description
	1	0	15'	Dark gray siliceous and cherty limestone with calcite veins. Top of section at contact of igneous rocks and limestone described above.
RRR 285-C, f	2		55'	Thin bedded, shaley limestone. Weathers gray to yellow-tan. Crinoids in packstone. <u>Douvillinaria</u> sp., <u>Schellwienella</u> sp., <u>Crurithyris</u>? sp. — Upper Devonian
RRR 286-F, C	3		30'	Limestone, gray to light gray, mostly finely crystalline, brecciated, fetid odor, slight cut with HCL.
RRR 287-f, C	4	100		Limestone, as unit 3, except less fractured, dense, very finely crystalline (wackestone).
RRR 288-L, C	5	200	100'	Limestone, as unit 3. Fractured and shatters rather easily, no visible fossils, calcite veins along the fractures.
RRR 289-L, C; RRR 290-F	6	300	100'	Limestone, as unit 3, possible fossils, no apparent bedding. All massive limestone (may be stromatoporoid buildups). Stromatoporoids at 340'. <u>Chaetetes</u> sp., <u>Alveolites</u> sp., <u>Thamnopora</u> sp., <u>Trupetostroma</u> sp., <u>Syringostroma</u> sp., and <u>Charactophyllum</u>? sp. — Givetian or Frasnian
RRR 291-C, f	7	400	70'	Limestone, as unit 3. Intraformational conglomerate with stromatoporoids in float. <u>Syringostroma</u> cf <u>bifurcum</u> — Givetian or Frasnian
RRR 292-F	8	500, 600, 700	330'	Covered. (May be dolomite as @ 800'). Gray, very finely crystalline, saccharoidal dolomite. Dense, no P&P. Thinly bedded.
RRR 293-P, SR; RRR 294-L, C	9	800	100'	Gray, very finely crystalline, fractured dolomite with dolomite veins. Shale, brown to green, some black.

R. Rose, R. Fehlmann, C. Bitgood



DEVONIAN — **LOWER KUGURUROK FORMATION?** (1600)



Samples	Unit	Depth	Thickness	Description
RRR 295-F RRR 296-F	10	900	100'	Gray to dark gray, very finely crystalline limestone. It is thinly bedded to shaley as at the top of the section. It becomes massive lower on the outcrop. Slight fetid odor. Warrenella franklinii, Leiorhynchus miriam, Parapholidostrophia sp., Devonoproductus primus, Dechenella osborni, Carinatina sp. Bellerophon sp., Devonozyga sp., Grammysia sp. — Middle Devonian early Givetian
	11	1000	100'	Very thinly to massively bedded limestone as unit 10. Light tan to gray in color. Packstone.
RRR 297-L, C	12	1100	100'	Limestone. Packstone, highly fractured. RRR 297 L, C — common Radiosphaera ?, rare Bisphaera elegans, Bisphaera molevkensis, and Earlandinita? very rare. Upper Devonian-Lower Mississippian (Mamet zones 1—7 undifferentiated) RRR 298 L, C rare Radiosphaera and Bisphaera— Upper Devonian-Lower Mississippian (Mamet zones 1—7 undifferentiated)
RRR 298-L, C	13	1200	100'	Gray to brown, very finely crystalline packstone. RRR 299 L, C rare Radiosphaera? - probably Upper Devonian-Lower Mississippian, undifferentiated
RRR 299-L, C	14	1300	200'	Covered; limestone rubble From RRR 300 F & C — Anatrypa? sp., Emanuella aff. richardsoni, Stachyodes sp. Middle Devonian RRR 300 F, C Radiosphaera few, Bisphaera grandis, Bisphaera molevkensis, and Parathurammina rare. Upper Devonian-Lower Mississippian
RRR 300-F, C	15	1500	100'	Covered; limestone rubble. At 1500' limestone; light brown to gray, very finely crystalline. Fossils (brachiopods), packstone. End of section at base of hill. Note: Authors believe the megafossils age dates represent a truer estimate of the age of the Trail Creek carbonate section.
		1600		

STANDARDS FOR GEOLOGICAL TIME

APPALACHIAN OROGENIES	TIME ROCK M.Y.	TIME-STRATIGRAPHIC STAGE	STAGE	SERIES	TIME PERIOD	ERA	EON
		RECENT		NEOGENE	QUATERNARY	CENOZOIC	
	1.5-2	PLEISTOCENE					
	7	PLIOCENE			TERTIARY		
	26	MIOCENE					
	37-38	OLIGOCENE		PALEOGENE			
	53-54	EOCENE					
	65	PALEOCENE					
	70	MAESTRICHTIAN	(SENONIAN)	UPPER	CRETACEOUS	MESOZOIC	
	76	CAMPANIAN					
	82	SANTONIAN					
	85	CONIACIAN					
	94	TURONIAN					
	100	CENOMANIAN					
	106	ALBIAN		LOWER			
	112	APTIAN					
	118	BARREMIAN	(NEOCOMIAN)				
	124	HAUTERIVIAN					
	130	VALANGINIAN					
	136	BERRIASIAN					
	141	UPPER VOLGIAN	UPPER TITHONIAN	UPPER	JURASSIC		
	146	LOWER VOLGIAN	PORTLANDIAN				
	151	KIMMERIDGIAN					
	157	OXFORDIAN					
	162	CALLOVIAN		MIDDLE			
	167	BATHONIAN					
	172	BAJOCIAN					
	178	TOARCIAN		LOWER			
	183	PLIENSBACHIAN					
	188	SINEMURIAN					
	190-195	HETTANGIAN					
PALISADES DISTURBANCE		RHAETIAN		UPPER	TRIASSIC		
		NORIAN					
	(205)	KARNIAN					
		LADINIAN		MIDDLE			
	(215)	ANISIAN					
		SPATHIAN		LOWER			
		SMITHIAN					
		DIENERIAN					
	225	GRIESBACHIAN					
	230	DZHULFIAN	OCHOAN	U	PERMIAN	PALEOZOIC	PHANEROZOIC
	240	KAZANIAN	GUADALUPIAN				
	265	ARTINSKIAN	LEONARDIAN	LOWER			
	268	SAKMARIAN	WOLFCAMPIAN				
	280	ASSELIAN					
	290	STEPHANIAN: ORENBURGIAN (U. CARBONIFEROUS)	VIRGILIAN	U	PENNSYLVANIAN		
	295	GZHELIAN	MISSOURIAN				
		WESTPHALIAN: MOSCOVIAN	DESMOINESIAN	M			
	310		ATOKAN				
	315	BASHKIRIAN	MORROWAN	L			
	325	NAMURIAN					
MARITIME DISTURBANCE		VISEAN (L. CARBONIFEROUS)	CHESTERAN	UPPER	MISSISSIPPIAN		
			MERAMECIAN				
	335		OSAGIAN	LOWER			
	340-345	TOURNAISIAN	KINDERHOOKIAN				
		FAMENNIAN	CONEWANGOAN	UPPER	DEVONIAN		
	353		CASSADAGAN				
		FRASNIAN	CHEMUNGIAN				
	359		FINGERLAKESIAN				
ACADIAN OROGENY		GIVETIAN	ERIAN	MIDDLE			
	370	EIFELIAN					
	374	EMSIAN	ULSTERIAN	LOWER			
	390	SIEGENIAN					
	395	GEDINNIAN	HELDERBERGIAN				
		LUDLOVIAN	CAYUGAN		SILURIAN		
		WENLOCKIAN	NIAGARAN				
		LLANDOVERIAN					
	430-440		ALEXANDRIAN				
TACONIAN OROGENY		ASHGILLIAN	RICHMONDIAN (CINCINNATIAN)	UPPER	ORDOVICIAN		
			MAYSVILLIAN				
		CARADOCIAN	EDENIAN				
			BARNEVELD (MOHAWKIAN)	MIDDLE			
			WILDERNESS				
	445		PORTERFIELD				
		LLANDEILIAN	ASHBY				
		LLANVIRNIAN	MARMOR (CHAZYAN)				
			WHITEROCK				
	500?	ARENIGIAN	CANADIAN	L			
		TREMADOCIAN					
		TREMPEALEAUAN		UPPER	CAMBRIAN		
		FRANCONIAN					
	515	DRESBACHIAN					
	540	ALBERTAN		MIDDLE			
	570	WAUCOBAN		LOWER			
AVALONIAN OROGENY					HADRYNIAN		PROTEROZOIC
GRENVILLIAN OROGENY	955	GRENVILLIAN	NEOHELIKIAN		HELIKIAN		
	1370	ELSONIAN	PALEOHELIKIAN				
	1735	HUDSONIAN			APHEBIAN		
	2480	KENORAN	ARCHEAN				

Printed by the Surveys and Mapping Branch

Chart II
Southeastern Canada

APPENDIX B

Micro Fossils

DATE SUBMITTED TO PALEO. LABORATORY ____________ ____________

SUBMITTED BY ____________

TO ACCOMPANY REPORT NO. ____________ NORTH SLOPE (AREA) ALASKA (STATE) COUNTY

FORM 1-53 2M PRINTED IN U.S.A.

RESULTS OF MICROSCOPIC EXAMINATION OF SURFACE SAMPLES BY PALEONTOLOGY LABORATORY

PAGE 1

REPORT NO. ____________

DATE EXAMINED Oct./Nov. 1971

MICROPALEONTOLOGY DETERMINATIONS BY F. G. Blake

[redacted]	SAMPLE NUMBER	[redacted]	FORMATION OR AGE	LAB. NUMBER	[redacted] CONTENT OF ORIGINAL MATERIAL	FORAMINIFERAL ZONE OR SUBZONE	FORMATION OR AGE	CERTAINTY OF CORRELATION (POOR, FAIR, GOOD)	BASIS OF CORRELATION (LITHOLOGIC OR FORAMINIFERAL)	REMARKS OR CORRELATION WITH ADJACENT AREAS AND SAMPLES
RRR	213		CRETACEOUS	14	shale	Radiolarians	nondiag.			
✓	215		✓	16	limestone	barren				
✓	217		✓	18	shale	Haplophragmoides sp. (v.rare) Radiolarians (rare)	Lower Cret. ?	guess	f	
✓	253		✓	54	sandstone	barren				
✓	320		✓	105	siltstone	✓				
✓	321	SAMPLES	CRET.-JURA	106	shale and sandstone	✓				
✓	322		CRETACEOUS	107	siltshale	✓				
✓	328		✓	113	shale and sandstone	✓				
✓	335		✓	120	siltstone	Haplophragmoides or Trochammina sp. (v.rare)	Lower Cret. ?	guess	f	
✓	337		✓	122	mudstone	barren				
✓	339		✓	124	mudstone	Haplophragmoides or Trochammina sp. (v.rare)	Lower Cret. ?	guess	f	
✓	377		✓	162	shale	barren				
✓	380	GRAB	✓	165	claystone	✓				
✓	406		TERTIARY	191	shale	Verneuilinoides cf. V. fischeri (v.rare) Saccammina lathrami (v.rare)	Upper Cretaceous	good	f	Colville Group
✓	415		CRETACEOUS	200	shale	barren				
✓	417		✓	202	siltstone	✓				
✓	419		✓	204	clayshale	✓				
✓	420		✓	205	shale	✓				
✓	422		✓	207	sandstone	✓				
✓	423	MISC.	✓	208	clayshale	✓				
✓	425		✓	210	clayshale	Radiolarians (common)	nondiag.			
✓	427		✓	212	shale	barren				
✓	428		✓	213	clayshale	✓				
✓	429		✓	214	sandstone	✓				
✓	[illegible]		✓	[illegible]	sandstone	✓				

DATE SUBMITTED TO PALEO. LABORATORY

SUBMITTED BY

TO ACCOMPANY REPORT NO.

North Slope (AREA)

COUNTY ALASKA (STATE)

FO 6 1-53 2M PRI IN U.S.A.

RESULTS OF MICROSCOPIC EXAMINATION OF SURFACE SAMPLES BY PALEONTOLOGY LABORATORY

PAGE 2

REPORT NO.

DATE EXAMINED Oct./Nov. 1971

MICROPALEONTOLOGY DETERMINATIONS BY F. G. Blake

[redacted]	SAMPLE NUMBER	[redacted]	FORMATION OR AGE	LAB. NUMBER	[redacted] CONTENT OF ORIGINAL MATERIAL	FORAMINIFERAL ZONE OR SUBZONE	FORMATION OR AGE	CERTAINTY OF CORRELATION (POOR, FAIR, GOOD)	BASIS OF CORRELATION (LITHOLOGIC OR FORAMINIFERAL)	REMARKS OR CORRELATION WITH ADJACENT AREAS AND SAMPLES
RRR	432		CRETACEOUS	217	sandstone	barren				
✓	433		✓	218	"pebble shale"	Trochammina gryci, "Tritaxia" athabascensis, Haplo. canui/topagorukensis, Trochammina #13	NEOCOMIAN VALANG.-BERR.	good	f	
✓	434	GRAB SAMPLES	✓	219	siltstone	Troch.? gryci, Haplo.? canui/topagorukensis Arenoturrispirillina jeletzkyi, Ammobac. alaskensis	NEOCOMIAN BERRIASIAN	good	f	
✓	436		✓	221	clayshale	barren				
✓	437		✓	222	clayshale	✓				
✓	438		✓	223	clayshale	✓				
✓	439		✓	224	clayshale	✓				
✓	441		✓	226	clayshale	Glomospirella sp., Verneuilinoides sp.?, Radio. Haplophragmoides canui/topagorukensis?	NEOCOMIAN?	poor	f	
✓	443		OKPIKRUAK	228	"pebble shale"	Haplo. canui/topagorukensis, Troch. gryci Gaud. tappanae/hectori, G. kelleri, Ammodiscus mangusi/mackenziensis, Ammobac. sp.	NEOCOMIAN BARREMIAN?	good(?)	f	Appears to correlate to Canadian Barremian Interval
✓	444		✓	229	"pebble shale"	Eggerella cf. E. "kalubikensis", Troch. gryci, Troch. #13 Text. cf. T. topagorukensis, Ammobac. cf. A. "barrowensis" Gaud. topagorukensis, Ammobac. alaskensis,	NEOCOMIAN VALANG.-BERR.	good	f	
✓	445		✓	230	"pebble shale"	Troch. gryci, Glomospira sp #6 Trochammina #13 Ammobac. cf. A. "barrowensis", Verneuilinoides? sp.	✓	✓	f	
✓	446		✓	231	"pebble shale"	Haplo. canui/topagorukensis, Troch. gryci Text. areoplecta?, Verneuilinoides? sp. Ammobac. cf. A. "barrowensis" Glomo. sp #6?	✓	✓		
DWA	297		?	251	chert	barren				
✓	320		CRETACEOUS?	274	mudstone	Haplophragmoides or Trochammina sp. (v. rare)	NEOCOMIAN?	guess	f	
✓	326		?	280	claystone	barren				
✓	327		?	281	claystone	✓				
✓	328		?	282	claystone	✓				
✓	330	MISC.	?	284	clayshale	Radiolarian (v. rare)	nondiag.			
✓	331		?	285	shale	barren				
✓	338		?	292	clayshale	✓				
✓	342		SHUBLIK?	296	shale	Radiolarians (common)	nondiag.			
✓	343		?	297	limestone + siltstone	barren				
✓	373		JURA.-CRET.	327	siltstone	✓				

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Memorandum

Union Oil Company of California

union 76

May 16, 1972

TO: D. W. Abrahamson, Anchorage, Alaska

FROM: A. A. Almgren, A.A.A. Paleo. Lab, Santa Fe Springs

SUBJECT: 1971 Field Party Sample RRR-215

As per your memo request dated May 9, 1972, four carbonate pebbles from the subject sample have been processed. The age of the carbonate is Mississippian no older than Zone 10 of Mamet, probably Meramec in age. Smaller foraminifera present include species of Endothyra, Globoendothyra?, Tetrataxis, Earlandia, and Eotuberitina. The carbonate rock is lime packstone/grainstone with abundant crinoid and bryozoa fragments.

AAA:go

rm 935A (Rev 11/67)

Union Oil Company of California

UNION 76

In Reply Give No.

December 8, 1971

Mr. R. A. Saunders
Dist. Exploration Manager
Northern Alaska District

PALEO. CORRELATIONS
Union Oil 1971 Field Party
North Slope Surface
Section E-128
Trail Creek Measured Section

The following paleontologic correlations are based on a study of smaller foraminifera in thin sections:

RRR-288, 289, 290,
RRR-292, 294, 295,
RRR-296 ---------------- Age: Indeterminate.

Barren of foraminifera. Dolomite.

Note: RRR-295 contains scattered, poorly preserved forms that may be arenaceous foraminifera.

RRR-297 ---------------- Age: Upper Devonian--Lower Mississippian, Zones 1 - 7 of Mamet, undifferentiated. Kinderhook or older.

Common Radiosphaera?, rare Bisphaera elegans, Bisphaera molevkensis and Earlandinita? very rare.

Lime mudstone.

December 8, 1971

1971 North Slope Surface
Sec. E-128, Trail Crk. Mea. Sec.

RRR-298 ---------------- Age: Upper Devonian--Lower Mississippian, undifferentiated, Zones 1 - 7 of Mamet. Kinderhook or older.

Rare Radiosphaera and Bisphaera.

Lime mudstone.

RRR-299 ---------------- Age: Probably Upper Devonian--Lower Mississippian, undifferentiated.

Rare Radiosphaera? in dolomite.

RRR-300 ---------------- Age: Upper Devonian--Lower Mississippian, Zones 1 - 7 of Mamet, undifferentiated. Kinderhook or older.

Radiosphaera few, Bisphaera grandis, Bisphaera moleviensis, and Parathurammina rare.

Lime mudstone.

ORIGINAL SIGNED BY
A. A. ALMGREN

A. A. ALMGREN
Sr. Paleontologist

AAA:GO

cc: G. Feister
R. Rose ✓

Union Oil and Gas Division: Western Region

Union Oil Company of California
9645 So. Santa Fe Springs Rd., Santa Fe Springs, Calif. 90670
Telephone (213) 945-1221

UNION 76

Paleontology Laboratory

April 5, 1972

Mr. Robert A. Saunders
Dist. Exploration Manager
Northern Alaska District
Anchorage

PALEO. CORRELATIONS
North Slope - 1971
Western Party Grab Samples
Lab Acc. No. E127

The following paleontologic determinations are based on the examination of thin sections of samples for which foraminiferal study was requested:

RRR-235 ------ Age: Upper Devonian-Mississippian, pre-Zone 18 of Mamet.

Scattered *Radiosphaera* in lime mudstone.

Similar to RRR-300 - Trail Creek Section.

RRR-237 ------ Age: Upper Devonian-Mississippian, pre-Zone 18 and probably pre-Zone 8 of Mamet.

Scattered *Parathurammina* and rare *Bisphaera* (?).

Buff lime mudstone, in part, with fine ?spicules.

RRR-262 ------ Age: Indeterminate.

Barren of foraminifera. Dolomite, gray-black.

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April 5, 1972

North Slope - 1971
Western Party Grab Samples

RRR-263 ------ Age: Indeterminate.

Barren of foraminifera. Dolomite, gray-black.

RRR-279 ------ Age: Devonian-Mississippian.

Very rare ?Parathurammina.

Sandstone, very fine grained, angular, clean with rare crinoid ossicles.

RRR-281 ------- Age: Devonian-Mississippian, pre-Zone 18 of Mamet.

Radiosphaera few, Calcisphaera few, ?Vicinisphaera very rare.

Assemblage is, in part, similar to RRR-324.

Lime mudstone, buff.

RRR-301 ------ Age: Indeterminate.

Barren of foraminifera. Dolomite, gray-black with small ghosts of crinoid ossicles.

RRR-303 ------ Age: Indeterminate.

Barren of foraminifera. Sandstone, angular.

RRR-306 ------ Age: Indeterminate.

Barren of foraminifera. Lime mudstone, buff, fractured.

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April 5, 1972

North Slope - 1971
Western Party Grab Samples

RRR-308 ------ Age: Indeterminate.

Barren of foraminifera.

Lime packstone, with common small fragments of megafossils including pelecypods, gastropods and crinoids, plus ostracods and rare algae.

Sandstone, fine grained, angular with abundant crinoid ossicles.

RRR-311 ------ Age: Indeterminate.

Barren of foraminifera. Sandstone.

RRR-315 ------ Age: Mississippian, probably Zones 13-15 of Mamet, or younger.

RRR-317 ------ Age: Indeterminate.

Barren of foraminifera.

Dolomite, medium brown with small ghosts of crinoid ossicles.

RRR-324 ------ Age: Upper Devonian-Mississippian, pre-Zone 18 of Mamet.

Rare Calcisphaera and other uncertain forms similar, in part, to RRR-281

Lime packstone, skeletal, pelletoidal.

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April 5, 1972

North Slope - 1971
Western Party Grab Samples

RRR-353 ------ Age: Indeterminate.

Barren of foraminifera. Dolomite, buff, very fine grained.

RRR-365 ------ Age: Indeterminate.

Barren of foraminifera. Dolomite, highly fractured.

RRR-366 ------ Age: Indeterminate.

Barren of foraminifera. Dolomite, gray-black, silty.

JDB-5 -------- Age: Indeterminate.

Barren of foraminifera.

All samples collected for megafossils and conodonts were thin sectioned to check for presence of smaller foraminifera.

The following four samples contained foraminifera:

RRR-369 ------ Age: Mississippian, Zones 14-15, within "Brunsia facies."

Brunsia and Archaediscus of the group Archaediscus krestovnikovi common, Endothyra, Tuberitina and Calcisphaera few, Earlandia elegans very rare.

This assemblage is similar to Shainin Lake Section samples FCH-113 and FCH-115.

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April 5, 1972

North Slope - 1971
Western Party Grab Samples

RRR-370 ------ Age: Mississippian, Zones 14-15, within Zones 14-15.

The assemblage in this sample is similar to RRR-369.

RRR-371 ------ Age: Mississippian, probably Zone 14-15, "Brunsia facies."

Brunsia few, Endothyra few, and Calcisphaera rare, similar to those in RRR-369 and RRR-370. No Archaediscus are present.

RRR-372 -------Age: Mississippian, Zones 14-17 of Mamet, undifferentiated; in "Brunsia facies."

Brunsia common, Endothyra few, Earlandia elegans, Earlandia clavatula and Globoendothyra sp. rare.

A. A. Almgren

A. A. ALMGREN
Sr. Paleontologist

AAA:go

cc: G. Feister
R. Rose

Palynology

Union Oil and Gas Division: Western Region
Union Oil Company of California
P.O. Box 76, Brea, Calif. 92621
Telephone (714) 528-7201

42021

Palynology Laboratory

September 5, 1972

Mr. R. A. Saunders
Dist. Exploration Manager
Northern Alaska District
Anchorage

Atten: J. P. Chauvel
R. R. Rosé

Dear Bob:

The accompanying two-part report summarizes the results of palynologic dating and carbonization analysis of the 1971 North Slope, Brooks Range surface samples, selected for our examination by Bob Rosé.

For convenience, the samples are listed in numerical order under the priority catagories set forth in the requesting letter (R. R. Rosé to R. E. Malloy, February 4, 1972). Detailed lists of species identified in the fossiliferous samples are not included in this report, but are recorded on sample study cards on file here.

A majority of the samples are only slightly to moderately altered (i.e. carbonized); however, a large number show the effects of surface weathering, either as "rust" stains on fractures or in their degraded palynologic residues. In some cases thermal alterations ratings are tentative or undeterminable for this reason.

If there are questions concerning any of this work, please do not hesitate to write me at any time.

Yours very truly,

R. E. Malloy

RAYMOND E. MALLOY
Palynologist

REM:go

cc: G. H. Feister
R. D. McLennan, Atten: F. G. Blake

PALYNOLOGIC AGE DETERMINATIONS
1971 NORTH SLOPE ALASKAN SURFACE SAMPLES

SAMPLE NO.	AGE AND PALYNOZONE *	DEPOSITIONAL ENVIRONMENT	COMMENTS
PRIORITY I			
RRR-405	Upper Cretaceous, Aquilapollenites-Azonia	Open marine, shelf or slope	Rich sample, probable Maestrichtian
" 407	Upper Cretaceous, Chlamydophorella sp. 1, Diplotesta anglica Zone (lower)	Open marine, shelf or slope	Reworked Mississippian present
" 408	Upper Cretaceous, Aquilapollenites-Azonia	Open marine, shelf	Minor reworking (Cretaceous), probable Maestrichtian
" 409	Upper Cretaceous, probable Aquilapollenites-Azonia Zone	Open marine, shelf or slope	Specific markers absent, poor preservation
" 411	Upper Cretaceous, Aquilapollenites-Azonia	Open marine	Dinoflagellates sparse; Campanian on negative evidence
" 412	Upper Cretaceous, Aquilapollenites-Azonia	Nonmarine (?)	Preservation poor; Campanian on negative evidence
" 415	Upper Cretaceous, Aquilapollenites-Azonia	Open marine	Dinoflagellates sparse; Campanian on negative evidence
" 417	Upper Cretaceous, Cenomanian--Lower Senonian, Chlamydophorella sp. 1, Diplotesta anglica Zone	Open marine	Preservation poor
" 419	Upper Cretaceous, undifferentiated	Open marine	Very poor preservation
" 420	Upper Cretaceous, probable Chlamydophorella sp. 1, Diplotesta anglica Zone	Open Marine, shelf or slope	Dinoflagellates abundant

* = As defined in H. Leffingwell's Project Report #72-31

SAMPLE NO.	AGE AND PALYNOZONE *	DEPOSITIONAL ENVIRONMENT	COMMENTS
RRR-422	Upper Cretaceous, undifferentiated	Open marine	Very sparse microflora
" 423	Cretaceous, undiff.	Open marine	As above
" 425	Upper Cretaceous, probable Chlamydophorella sp. 1, Diplotesta anglica Zone	Open marine, shelf or slope	Poor preservation
" 427	Upper Cretaceous, Aquilapollenites-Azonia Zone (?)	Open marine, shelf or slope	Poor preservation, much reworking
" 428	Upper Cretaceous, Aquilapollenites-Azonia Zone	Open marine, shelf or slope	Rich assemblage
" 429	Upper Cretaceous, Aquilapollenites-Azonia Zone	Open marine	As above
" 430	Upper Cretaceous, Aquilapollenites-Azonia Zone	Open marine	Preservation poor
" 432	Upper Cretaceous, Aquilapollenites-Azonia Zone	Open marine, shelf or slope	Abundant dinoflagellates
" 447	Paleocene, "Unamed" Zone	Nonmarine	Probable Upper Paleocene (H.A.L.)
" 434	Cretaceous, Neocomian	Open marine	Sparse assemblage, carbonized

PRIORITY II

RRR-202	Upper Cretaceous (?)	Marine	Palynomorphs sparse, preservation poor
" 204	Indeterminate	Indeterminate	Barren of palynomorphs
" 205	Cretaceous, Upper (?)	Marine	Weathered sample
" 206	Indeterminate	Indeterminate	Barren of palynomorphs, weathered

* = As defined in H. Leffingwell's Project Report #72-31

SAMPLE NO.	AGE AND PALYNOZONE *	DEPOSITIONAL ENVIRONMENT	COMMENTS
RRR-207	Cretaceous, probable Neocomian	Marine	Mixed assemblage of poor preservation
" 208	Lower Cretaceous, probable Neocomian	Marine	Very poor preservation, weathered sample
" 209	Indeterminate	Indeterminate	Barren of palynomorphs, weathered
" 210	Upper Cretaceous, Chlamydophorella sp. 1, Diplotesta anglica Zone, (Probable Cenomanian)	Open marine, shelf or slope	Very poor preservation, weathered sample
" 211	Indeterminate	Indeterminate	Barren of palynomorphs
" 212	Cretaceous, Albian--Cenomanian	Marine	Sparse fossils, weathered sample
" 213	Indeterminate	Indeterminate	Very rare, nondiagnostic palynomorphs, weathered sample
" 214	Indeterminate	Indeterminate	Barren of palynomorphs, weathered
" 215	Indeterminate	Indeterminate	Barren of palynomorphs, weathered
" 216	Cretaceous, undiff.	Indeterminate	Very poor preservation, weathered sample
" 217	Indeterminate	Indeterminate	Very rare, poorly preserved palynomorphs
" 218	Indeterminate	Indeterminate	Barren of palynomorphs
" 219	Indeterminate	Indeterminate	Barren of palynomorphs
" 221	Indeterminate	Indeterminate	Completely carbonized sample
" 225	Upper Mississippian to Lower Pennsylvanian	Indeterminate	Sample altered, fossils rare
" 226	Indeterminate	Indeterminate	Barren of palynomorphs and strongly pyritized

* = As defined in H. Leffingwell's Project Report #72-31

SAMPLE NO.	AGE AND PALYNOZONE *	DEPOSITIONAL ENVIRONMENT	COMMENTS
RRR-227	Indeterminate	Indeterminate	Barren of palynomorphs
" 228	Probable Jurassic (Upper?)	Near shore marine	Dinoflagellates very rare
" 265	Indeterminate	Indeterminate	"Redbed" lithology--barren
" 266	Indeterminate	Indeterminate	Barren of palynomorphs, weathered
" 267	Upper Cretaceous, Aquilapollenites-Azonia Zone	Nonmarine or near shore marine	Poor preservation
" 268	Upper Cretaceous, Aquilapollenites-Azonia Zone	Nonmarine, possibly near shore marine	Poor preservation
" 269	Upper Cretaceous, Aquilapollenites-Azonia Zone	Nonmarine possibly near shore marine	Poor preservation
" 270	Upper Cretaceous, Aquilapollenites-Azonia Zone	Nonmarine possibly near shore marine	Poor preservation, weathered
" 271	Indeterminate	Indeterminate	Barren of palynomorphs
" 272	Upper Cretaceous, probable Cenomanian to Lower Senonian	Nonmarine, possibly near shore marine	Sparse palynomorphs
" 273	Indeterminate	Indeterminate	Barren of palynomorphs
" 274	Upper Cretaceous, Chlamydophorella sp. 1, Diplotesta anglica Zone	Marine	Sparse, poorly preserved assemblage, weathered
" 284	Indeterminate	Indeterminate	Rare, carbonized spores only
" 293	Paleozoic, undiff.	Nonmarine (?)	Carbonized spores only, weathered
" 328	Indeterminate	Indeterminate	Barren of palynomorphs--carbonized, weathered

* = As defined in H. Leffingwell's Project Report #72-31

SAMPLE NO.	AGE AND PALYNOZONE *	DEPOSITIONAL ENVIRONMENT	COMMENTS
RRR-330	Upper Paleozoic, undiff.	Nonmarine (?)	Rare, carbonized palynomorphs
" 331	Indeterminate	Indeterminate	Rare, carbonized palynomorphs only
" 332	Indeterminate	Indeterminate	Rare, carbonized palynomorphs only, weathered
" 335	Indeterminate	Indeterminate	Rare, carbonized palynomorphs only, weathered
" 336	Indeterminate	Indeterminate	Rare, carbonized palynomorphs only, weathered
" 337	Indeterminate	Indeterminate	Barren of palynomorphs
" 338	Indeterminate	Indeterminate	Barren of palynomorphs
" 339	Indeterminate	Indeterminate	Rare, carbonized palynomorphs only
" 361	Indeterminate	Indeterminate	Barren of palynomorphs
" 362	Indeterminate	Indeterminate	Barren of palynomorphs
" 363	Indeterminate	Indeterminate	Rare, carbonized palynomorphs only
" 364	Indeterminate	Indeterminate	Barren of palynomorphs
" 367	Indeterminate	Indeterminate	Barren of palynomorphs
" 374	Indeterminate	Indeterminate	Barren of palynomorphs
" 377	Indeterminate	Indeterminate	Barren of palynomorphs, weathered
" 380	Mesozoic, Jurassic--Cretaceous	Indeterminate	Rare, poorly preserved palynomorphs
" 400	Indeterminate	Indeterminate	Barren of palynomorphs, weathered

* = As defined in H. Leffingwell's Project Report #72-31

SAMPLE NO.	AGE AND PALYNOZONE *	DEPOSITIONAL ENVIRONMENT	COMMENTS
DWA-285	Indeterminate	Indeterminate	No identifiable plant material
" 291	Indeterminate	Indeterminate	Barren of palynomorphs, weathered
" 292	Indeterminate	Indeterminate	Palynomorphs rare and carbonized
" 293	Indeterminate	Indeterminate	Barren of palynomorphs, carbonized
" 294	Indeterminate	Indeterminate	Palynomorphs rare and poorly preserved
" 306	Indeterminate	Indeterminate	Rare, carbonized palynomorphs only
" 307	Indeterminate	Indeterminate	Rare, carbonized palynomorphs only
" 308	Indeterminate	Indeterminate	Rare, carbonized palynomorphs only
" 309	Indeterminate	Indeterminate	Very rare, poorly perserved palynomorphs
" 310	Indeterminate	Indeterminate	Barren of palynomorphs
" 320	Cretaceous, undiff.	Nonmarine (?)	Sparse, carbonized palynomorphs
" 330	Indeterminate	Indeterminate	Very rare, carbonized palynomorphs
" 331	Indeterminate	Indeterminate	Rare, carbonized palynomorphs only
" 364	Indeterminate	Indeterminate	Rare, carbonized palynomorphs only
" 365	Paleozoic, probable Lower Mississippian	Nonmarine (?)	Sparse, poorly perserved palynomorphs
" 366	Indeterminate	Indeterminate	Barren of palynomorphs
" 367	Paleozoic, Lower Mississippian (?)	Indeterminate	Rare, carbonized palynomorphs, weathered
" 373	Upper Triassic, Lower Jurassic	Nonmarine (?)	Dinoflagellates absent, acritarchs present, weathered

* = As defined in H. Leffingwell's Project Report #72-31

SAMPLE NO.	AGE AND PALYNOZONE *	DEPOSITIONAL ENVIRONMENT	COMMENTS
PRIORITY III			
RRR-230	Permo--Triassic (?)	Indeterminate	Sparse, carbonized palynomorphs only
" 232	Jurassic--Cretaceous, undifferentiated	Indeterminate	Rare, carbonized palynomorphs
" 236	Indeterminate	Indeterminate	Essentially barren
" 248	Indeterminate	Indeterminate	Barren of palynomorphs, weathered
" 249	Indeterminate	Indeterminate	Rare, carbonized palynomorphs
" 253	Indeterminate	Indeterminate	Barren of palynomorphs
" 254	Indeterminate	Indeterminate	Essentially barren
" 255	Indeterminate	Indeterminate	Barren of palynomorphs
" 256	Indeterminate	Indeterminate	Barren of palynomorphs
" 302	Indeterminate	Indeterminate	Barren of palynomorphs
" 304	Indeterminate	Indeterminate	Barren of palynomorphs
" 312	Indeterminate	Indeterminate	Rare, poorly preserved palynomorphs
" 314	Indeterminate	Indeterminate	Rare, poorly preserved palynomorphs
" 316	Indeterminate	Indeterminate	Barren of palynomorphs
" 320	Probably Cretaceous	Indeterminate	Very rare, poorly preserved palynomorphs
" 321	Indeterminate	Indeterminate	Essentially barren
" 322	Indeterminate	Indeterminate	Rare, poorly preserved palynomorphs
" 385	Indeterminate	Indeterminate	Rare, poorly preserved palynomorphs
" 394	Indeterminate	Indeterminate	Essentially barren, weathered

* = As defined in H. Leffingwell's Project Report #72-31

SAMPLE NO.	AGE AND PALYNOZONE *	DEPOSITIONAL ENVIRONMENT	COMMENTS
RRR-396	Indeterminate	Indeterminate	Rare, poorly preserved palynomorphs, weathered
" 398	Indeterminate	Indeterminate	Rare, poorly preserved palynomorphs, weathered
DWA-298	Upper Cretaceous, Cenomanian, Chlamydophorella sp. 1, Diplotesta anglica Zone	Open marine, shelf or slope	Preservation relatively poor, weathered
" 300	Upper Cretaceous (?)	Indeterminate	Rare, poorly preserved palynomorphs, weathered
" 301	Upper Cretaceous (?)	Indeterminate	Rare, poorly preserved palynomorphs, weathered
" 302	Paleozoic (?)	Indeterminate	Rare, carbonized palynomorphs
" 303	Indeterminate	Indeterminate	Rare, carbonized palynomorphs
" 304	Indeterminate	Indeterminate	Rare, carbonized palynomorphs
" 314	Indeterminate	Indeterminate	Rare, carbonized palynomorphs, weathered
" 318	Indeterminate	Indeterminate	Rare, carbonized palynomorphs
" 338	Indeterminate	Indeterminate	Barren of palynomorphs
" 342	Indeterminate	Indeterminate	Barren of palynomorphs, weathered
" 344	Paleozoic, Upper Mississippian--Lower Pennsylvanian	Nonmarine (?)	Sparse palynomorphs
" 345	Upper Paleozoic, Carboniferous (?)	Indeterminate	Rare palynomorphs
" 357	Indeterminate	Indeterminate	Barren of palynomorphs

* = As defined in H. Leffingwell's Project Report #72-31

SAMPLE NO.	AGE AND PALYNOZONE *	DEPOSITIONAL ENVIRONMENT	COMMENTS
DWA-359	Paleozoic (?)	Indeterminate	Rare, carbonized palynomorphs
" 369	Indeterminate	Indeterminate	Rare, poorly preserved palynomorphs
" 371	Indeterminate	Indeterminate	Barren of palynomorphs, weathered
" 382	Indeterminate	Indeterminate	Rare, carbonized palynomorphs, weathered

* = As defined in H. Leffingwell's Project Report #72-31

CARBONIZATION (THERMAL ALTERATION) ANALYSIS OF 1971 NORTH SLOPE SURFACE SAMPLES

Examination of separate residue slides, treated chemically only to remove mineral material and not to isolate palynomorphs, was carried out for each of the previously discussed palynologic samples.

Kerogen (dispersed organic material) residues examined for evidence of thermal alteration consist predominantly of plant materials identifiable as cuticle, spores, pollen, woody tissue, and algal remains. Other elements often present in kerogen samples are amorphous (structureless) material, coaly fragments, and disseminated, very fine nonmineral particles. These last are probably of plant origin, but cannot be positively identified with any specific plant entity.

From laboratory experiments, performed by heating fossil kerogen residues through a range of temperatures up to 700° F, it is known that these plant residues originally unaltered, will undergo color changes and selective destruction of certain elements until a totally black residue is obtained. This carbonized residue may often contain only rare identifiable plant entities. A similar "alteration series" can be observed by field sampling fossil materials (from shales) at varying distances from igneous dikes or sills and observing the color changes in residues taken from the contact zone with the igneous body and outward to areas where no igneous intrusions are present. Such a progression of samples obviously furnishes an approximate declining paleotemperature scale; in this case beginning with temperatures in excess of those known, from laboratory experiments, to alter plant materials.

A systematic study of these organic residues has resulted in a semi-quantitative ranking system similar to those now in use by several major oil companies. This ranking system, expressed in alteration indices from 1 through 5, is based in part on that proposed by F. L. Staplin (Bull. of Canadian Petroleum Geology, March 1969) and in part on a scale described by J. D. Burgess. As used in this report, the scale is based entirely on inspection of a sample's plant residues and does not rely on mineralogic evidence of metamorphism, as does the Staplin method.

The outline of the alteration "series" below and its suggested relationship to world-wide hydrocarbon occurrences is based on the work of F. L. Staplin, J. D. Burgess, and other geologists and geochemists formerly with the Esso Production Research Company and, to a lesser degree, the experience of the writer.

Thermal Alteration Index		Organic Residue, Color and Composition	Commercial Hydrocarbon Occurrences
1.	(No Alteration)	Color yellow-green, woody tissue cuticle, palynomorphs, amorphous vegetable matter, coaly fragments	Principally oil and wet gas
2.	(Slight Alteration)	Color light brown to bright orange-brown; organic components as above	Oil, wet and dry gas
3.	(Moderate Alteration)	Color deep brown; organic matter as in 1, but with amorphous matter sparse or absent	Oil, wet and dry gas
4.	(Strong Alteration)	Color very dark brown to black with brown translucent borders; cuticle and amorphous matter normally absent palynomorphs often unidentifiable	Minor wet gas to dry gas only
5.	(Severe Alteration)	Black color, particles' surfaces often reflective; palynomorphs, if present, opaque; amorphous material absent	Dry gas or no fluid hydrocarbons

In reporting on carbonization analysis the form used here is a simplified version of a work sheet used in recording the raw data. Some of the headings on these sheets (pages 13 to 16) require explanation or clarification. Under "Alteration Index" the decimal point figures (.5) are added to indicate intermediate alteration stages on the horizontal 1 through 5 scale; and do not necessarily imply greater degrees of numerical precision. "Residue Type," for the purpose of our analysis is characterized as either "amorphous" or "structured." Amorphous material, most abundant in relatively unaltered samples, is fluffy, wispy, light colored, irregularly fibrous matter, sometimes mixed with gel-like masses--all with no organized structure. It can occur in both marine and nonmarine paleoenvironments, but for the Alaskan

North Slope is most abundant in and characteristic of the marine Seabee formation. Geochemical analysis made at Brea Research indicates that the Seabee amorphous material contains petroleum-related hydrocarbons and analysis of other amorphous material from rocks of world-wide distribution, made both at Brea Research and at the Esso Production Research Laboratories, show similar, general results.

"Structured" material, present in nearly all samples in one form or another, is that which shows identifiable organic structures and includes woody tissue, cuticle, spores, pollen, microplankton, acritarchs, and, rarely, algal filaments. It is this group of residue components, particularly the palynomorphs (spores, pollen, etc.) which is most useful in determining the alteration stage of the organic residues. A high proportion of structured material, in Upper Paleozoic and younger samples, is woody tissue which, by its known chemical composition, would not be expected to have furnished abundant petroleum-related hydrocarbons in the geologic record.

The balance of dispersed organic matter observed in a majority of samples can be described either as "coaly fragments" or "finely disseminated organic matter." The former are black particles showing no organized structure and are composed of more or less pure carbon of biochemical origin or that resulting from natural combustion processes. The latter, "finely disseminated material," is simply small (1 μ or less) particles of a nonmineral (i.e. biologic) origin.

The above discussion is necessarily oversimplified and the presence or absence of a particular type of organic material should not be interpreted as relating directly to the petroleum source potential of a rock unit.

The following data sheets, among other things, demonstrate the effects of surface weathering, past and present, on dispersed organic material in sediments (see "indeterminate" samples). Chemical and biochemical processes can destroy the fractions which are most useful in determining degrees of thermal alteration, and the last components to be destroyed in the weathering process are the "coaly fragments."

REM:go

9-5-72

IDENTIFICATION				
Company	Union Oil Co. of California			
Area	Alaska, Northern District			
Well				
Surface Section	1971 RRR-# & DWA-# Palyn.			

Sample No. / Depth	ALTERATION INDEX: 1 NO ALTERATION	(.5)	2 SLIGHT ALTERATION	(.5)	3 MODERATE ALTERATION	(.5)	4 STRONG ALTERATION	(.5)	5 SEVERE ALTERATION	RESIDUE TYPE: AMORPHOUS (%)	STRUCTURED (%)	Remarks (T = trace only)
Priority I												
RRR-405			X							10	70	
" -407			X							10	60	
" -408			X							10	70	
" -409			X							T	50	
" -411			X							T	70	
" -412			X							20	60	
" -415			X							T	60	
" -417			X							T	70	
" -419			X							60	20	
" -420			X							T	70	
" -422			X							T	60	
" -423			X							T	60	
" -425			X							60	20	
" -427			X							60	30	
" -428			X							30	60	
" -429			X							T	70	
" -430			X							10	70	
" -432			X							T	70	
" -434					X					T	70	
"- 447			X							10	60	
Priority II												
RRR -202			X							T	70	
" -204			X							T	70	
" -205			X							T	70	
" -206			X							T	60	
" -207			X							10	60	
" -208			X							T	40	
" -209			X							5	--	very sparse resid.
" -210			X							0	40	
" -211					X					T	60	
" -212			X							T	60	
" -213			X							T	60	
" -214			indeterminate							0	0	coaly fragments only
" -215			X							0	40	
" -216				X						T	60	
" -217					X					0	40	
" -218			indeterminate							0	0	coaly fragments only
" -219				"						0	0	" " "
" -221									X	0	50	
" -225				X						0	60	
" -226			indeterminate							0	0	coaly fragments only
" -227				"						0	0	" " "
" -228							X			0	40	

IDENTIFICATION	ALTERATION INDEX									RESIDUE TYPE		
Company Union Oil Co. of California Area Alaska, Northern District Well Surface Section 1971 RRR-# & DWA-# Palyn.	NO ALTERATION	(.5)	SLIGHT ALTERATION	(.5)	MODERATE ALTERATION	(.5)	STRONG ALTERATION	(.5)	SEVERE ALTERATION	AMORPHOUS (%)	STRUCTURED (%)	T = trace only
Sample No. / Depth	1		2		3		4		5			Remarks
Priority II (contin.)												
RRR-265					Indeterminate					0	0	coaly fragments only
" -266					"					0	0	" " "
" -267			X							T	40	
" -268			X							T	40	
" -269			X							T	70	
" -270			X							T	70	
" -271			X							T	60	
" -272			X							T	40	
" -273			X							T	40	
" - 274			X							T	40	
" - 284							X			T	60	
" - 293					X					10	60	
" - 328					X					T	40	
" - 330						X				0	40	
"- 331							X			0	40	
" -332							X			0	40	
" -335						X				0	40	
" -336						X				T	40	
" -337					indeterminate					0	0	coaly fragments only
" -338					"					0	0	" " "
" -339							X			0	40	
" -361					indeterminate					0	0	coaly fragments only
" -362					"					0	0	no carb. residue
" -363									X	0	40	
" -364									X?	95	0	bl."relict" amorphous
" -367					indeterminate					0	0	coaly fragments only
" -374					"					0	0	" " "
" -377					"					0	0	" " "
" -380					X					0	40	
" -400				X						0	5	
DWA-285								X?		10	40	no palyn's or cuticle
" -292						X				0	40	
" -293								X?		10	40	bl. " relict" amorph.
" -291					indeterminate					0	0	coaly fragments only
" -294						X				0	40	
" - 306								X		0	40	
" -307							X			0	40	
" -308						X				T	40	
" - 309					X					0	40	
" - 310					X?					0	20	nearly barren
" - 320						X				T	40	
" - 330							X			0	40	
" - 331							X			0	40	

IDENTIFICATION	ALTERATION INDEX									RESIDUE TYPE		
Company Union Oil Co. of California Area Alaska, Northern District Well Surface Section 1971 RRR-# & DWA-# Palyn.	NO ALTERATION		SLIGHT ALTERATION		MODERATE ALTERATION		STRONG ALTERATION		SEVERE ALTERATION	AMORPHOUS (%)	STRUCTURED (%)	T= trace only
Sample No. / Depth	1	(.5)	2	(.5)	3	(.5)	4	(.5)	5			Remarks
Priority II(contin.)												
DWA - 364							X			0	40	
" - 365						X				0	60	
" - 366					indeterminate					0	0	coaly fragments only
" - 367						X				0	40	
" - 373					X					0	40	
Priority III												
RRR - 230							X			0	40	
" - 232								X		0	20	
" - 236									X?	0	T	99% coaly fragments
" - 248					indeterminate					0	0	
" - 249									X	0	40	
" - 253					Indeterminate					0	0	
" - 254				X?						0	T	nearly barren
" - 255					X					0	40	
" - 256					indeterminate					0	40	woody mater. only
" - 302						"				0	0	coaly fragments only
" - 304						"				0	0	coaly fragments only
" - 312						X				0	40	
" - 314					X					0	40	
" - 316					X?					0	20	very poor preserv.
" - 320					X					0	20	
" - 321					X					0	20	
" - 322					X					0	40	
" - 385						X				0	40	
" - 394					X					0	40	
" - 396			X							0	60	
" - 398					indeterminate					0	0	coaly fragments only
DWA - 298			X							40	50	
" - 300				X						0	40	
" - 301			X							0	40	
" - 302							X			0	10	
" - 303								X		0	40	
" - 304							X			0	20	
" - 314									X	0	20	
" - 318									X	0	20	
" - 338					indeterminate					0	0	coaly fragments only
" - 342					"					0	0	" " "
" - 344					X					0	40	
" - 345					X					0	30	
" - 357							X?			0	20	Bl. amorph. abundant
" - 359									X	0	10	
" - 369							X?			0	30	very poor preserv.

IDENTIFICATION	ALTERATION INDEX						RESIDUE TYPE		
Company Union Oil Co. of California Area Alaska, Northern District Well Surface Section 1971 RRR-# & DWA-# Palyn	NO ALTERATION	(.5) SLIGHT ALTERATION	(.5) MODERATE ALTERATION	(.5) STRONG ALTERATION	(.5) SEVERE ALTERATION		AMORPHOUS (%)	STRUCTURED (%)	
Sample No. / Depth	1	2	3	4	5				Remarks
Priority III (contin.)									
DWA - 371			indeterminate				0	0	coaly fragments only
" - 382				X			0	10	

Megafossils

Xerox to Rose -
circulate to geologists & file
Paleo-surface
JPC

AMOCO

Amoco Production Company

Tulsa, Oklahoma
October 20, 1971

Re: Megafossils from three Union Oil 1971 grab samples, Baird and Delong Mtns., Alaska

File: Technical Service No. 5719IR
Locality No. 6186

MEMORANDUM

Early examination of the following Union 1971 grab samples was specifically requested by the Denver Division: RRR-262, RRR-263, JDB-4. The following taxa have been identified:

Field No.	Taxa	Age
RRR-262	Stringocephalus sp. planar stromatolites	Middle Devonian Givetian
RRR-263	Stringocephalus aff. axius indet. tetracorals	Middle Devonian Givetian
JDB-4	Syringopora sp. indet. tetracorals barren of conodonts	Paleozoic Silurian to Mississippian

Allen R. Ormiston

Allen R. Ormiston

ARO:sd

Amoco Production Company
Research Department
Tulsa, Oklahoma

June 23, 1972

Re: Union 1971 megafossil collections, DeLong and Baird Mountains, Western Alaska

File: Technical Service 5719IR
Locality 6186

MEMORANDUM

Following priorities established in C. L. Conrad's letter of February 10, 1972, work has begun on selected megafossil samples from Union's 1971 collections. Eleven samples have been completed and are reported here. Work on the remainder of the forty priority I samples is in progress.

Field No.	Sample No.	Taxa	Age
DWA 287F	6186-4	Siphonodendron? sp.	Mississippian ?
DWA 281F	6186-5	Ekvasophyllum sp. Amplexizaphrentis sp. Bembexia sp.	Mississippian Meramec
DWA 288F	6186-6	Amphipora? sp.	Devonian?
DWA 282F	6186-7	crinoid columnals	Paleozoic
DWA 284F	6186-8	crinoid columnals	Paleozoic
RRR 442F	6186-9	Inoceramus sp. Buchia sp.	Late Jurassic or early Cretaceous
RRR 410	6186-10	Mytilus sp. Mya cf. producta Macoma sp. Polinices?	Oligocene to Recent
RRR 349	6186-11	Disphyllum cf. elongatum Psuedoactinodictyon sp. Thamnopora sp. crinoid columnals	Middle Devonian
DWA 368	6186-12	barren of megafossils	-

Field No.	Sample No.	Taxa	Age
RRR 244	6186-17	Desquamatia sp. Squameofavosites sp. Stringocephalus? sp. Thamnopora sp. Chaetetid indet.	Devonian probably Givetian
RRR 326	6186-18	Homalophyllites cf. calceolus crinoid columnals	Lower Mississippian

Allen R. Ormiston

Allen R. Ormiston

ARO:cme

AMOCO

Amoco Production Company
Research Center
Tulsa, Oklahoma

June 30, 1972

Re: Megafossils from Union's 1971 Trail Creek Section,
NE SE T34N, R39W, Misheguk Mtn. Quad., Alaska

File: Technical Service 5719IR
Locality 6623

MEMORANDUM

Megafossils recovered from the subject section demonstrate it is all Devonian and that at least the lower half is of Middle Devonian age.

Field No.	Sample No.	Taxa	Age
RRR-286	6623-15	Douvillinaria sp. Schellwienella sp. Crurithyris? sp. bryozoan crinoid columnals	Upper Devonian
RRR-290	6623-11	Chaetetes sp. Alveolites sp. Thamnopora sp. Trupetostroma sp. Syringostroma sp. Charactophyllum? sp.	Givetian or Frasnian
RRR-292	6623-9	Syringostroma cf. bifurcum	Givetian or Frasnian
RRR-295	6623-6	Warrenella franklinii Leiorhynchus miriam Parapholidostrophia sp. Devonoproductus primus Dechenella osborni indet. nautiloid	Middle Devonian early Givetian
RRR-296	6623-5	Warrenella franklinii Devonoproductus primus Carinatina sp. Parapholidostrophia sp. indet. rhynchonellid Bellerophon sp. Devonozyga sp. Grammysia sp. pterioid clams Dechenella osborni	Middle Devonian early Givetian

Field No.	Sample No.	Taxa	Age
RRR-300	6623-1	Anatrypa? sp. Emanuella aff. richardsoni Stachyodes sp. indet. rhynchonellid	Middle Devonian

Discussion

The early Givetian assemblage of samples RRR-295 and RRR-296 contains elements indicating correlation with the Pine Point Limestone of the Northwest Territories. The presence of Dechenella osborni permits correlation with the Bird Fiord Formation of Bathurst Island and indicates the existence of Givetian marine connection between western Alaska and the Canadian Arctic Islands.

Sample RRR-290 is a stromatoporoid boundstone, presumably part of a reefoid buildup.

Allen R. Ormiston

Allen R. Ormiston

ARO:cme

AMOCO

Amoco Production Company
Research Center
Tulsa, Oklahoma

July 3, 1972

Re: Megafossils from Union 1971 grab samples,
Baird and Delong Mts., Alaska

File: Technical Service 5719IR
Locality 6186

MEMORANDUM

Further samples from the priority I group of Union's 1971 collections are reported. Original textures of fossils in many of these samples have been so altered that positive identifications are difficult.

Field No.	Sample No.	Taxa	Age
RRR 352	6186-13	Thamnopora sp. indet. brachiopods	Devonian
RRR 342	6186-14	massive stromatoporoids	Paleozoic
RRR 346	6186-19	Squameofavosites sp. Anostylostroma sp. Amphipora sp. Coenites sp. Cystiphylloides? sp. Spinatrypa sp. indet. brachiopods crinoid columnals	Devonian Givetian
DWA 319	6186-20	barren of megafossils	-
RRR 245	6186-21	Squameofavosites sp. Thamnopora sp.	Devonian Givetian
RRR 240	6186-22	Thamnopora? sp. indet. tetracoral crinoid columnals	Devonian?
RRR 241	6186-23	Thamnopora? sp.	Devonian
RRR 203	6186-24	Crassatellites sp.	Cretaceous or Tertiar
RRR 243	6186-25	Alveolites sp. Parachaetetes sp. indet. tetracoral	Devonian

Field No.	Sample No.	Taxa	Age
RRR 234	6186-26	Leperditia sp. indet. ostracodes indet. large clams indet. gastropods	age unknown environment lagoonal
RRR 222	6186-27	Stachyodes sp.	Devonian
RRR 223	6186-28	Amphipora cf. ramosa Thamnopora sp. Idiostroma sp. Pseudoactinodictyon? sp.	Middle or Upper Devonian
DWA 317	6186-29	Amphipora sp. Thamnopora? sp.	Devonian
RRR 264	6186-30	indet. tetracoral	-
RRR 347	6186-31	Coenites sp. Amphipora sp. indet. tetracoral	Devonian
RRR 307	6186-32	indet. ostracodes productid spines? oolitic grains	Carboniferous?
RRR 246	6186-33	Squameofavosites sp. crinoid columnals	Middle Devonian

Allen R. Ormiston /tdj

Allen R. Ormiston

Thomas L. DeKeyser /tdj

Thomas L. DeKeyser

ARO/TLD:cme

Amoco Production Company
Research Center
Tulsa, Oklahoma

July 5, 1972

Re: Union 1971 megafossil grab samples from NE SE T33N, R33W, Misheguk Mtn. Quad., Alaska

File: Technical Service 5719IR
Locality 6186

MEMORANDUM

Field No.	Sample No.	Taxa	Age
RRR-282	6186-15	*Hysterolites* cf. sp. A. Johnson *Carinatina* cf. *lowtherensis* *Atrypa* aff. *devoniana* *Leptostrophia* sp. *Plicodevonaria* sp. *Gypidula* sp. *Spinatrypa* cf. *spinosaeformis* *Cyrtina* sp. *Eostrophalosia* sp. *Leptagonia* cf. *boueii* *Heliolites* cf. *porosa* *Heliophyllum* sp. *Alveolites* sp. indet. disphyllids *Parallelopora* sp.	Middle Devonian Eifelian
RRR-283	6186-16	*Hysterolites* cf. sp. A. Johnson *Plicodevonaria* sp. *Barrandella* sp. *Gypidula* sp. *Spinatrypa* cf. *spinosaeformis* *Eostrophalosia* sp. *Leptostrophia* sp. *Reticulariopsis* sp. *Heliolites* cf. *porosa* *Heliophyllum* sp. *Thamnopora* sp. stromatoporoids indet. clams *Dechenella* sp. indet. *Leptagonia* cf. *boueii*	Middle Devonian Eifelian

Discussion: These samples represent the oldest Devonian so far reported from northwestern Alaska.

Allen R. Ormiston

ARO:cme

Conodonts

42021

Amoco Production Company
4502 East 41st Street
P.O. Box 591
Tulsa, Oklahoma 74102

Research Center

September 29, 1972

Re: Conodonts from the Union Oil 1971 Grab Samples, Baird and Delong Mtns., Alaska

File: Technical Service 5719IR
Job No. 9704
Locality No. 6186

MEMORANDUM

Sample No.	Footage	IBM No.	Identification	Count
15	RRR-282F	2901	Belodella sp.	3

The specimens in sample 15 appear to be Lower or Middle Devonian representatives of the genus Belodella.

Sample No.	Footage	IBM No.	Identification	Count
18	RRR-326F	2831	Siphonodella 2831	2
		2620	Siphonodella sp.	15
		2618	Indet. conodonts	33

The fauna in sample 18 is Kinderhookian (Lower Mississippian) in age.

Sample No.	Footage	IBM No.	Identification	Count
34	RRR-220	0501	Barren of conodonts	
35	RRR-238	0501	Barren of conodonts	
36	RRR-242	0501	Barren of conodonts	
37	RRR-247	1370	Polygnathus 1370	2
		2618	Indet. conodonts	7

Polygnathus 1370 occurs in lower to middle Famennian (Upper Devonian) rocks.

Sample No.	Footage	IBM No.	Identification	Count
38	RRR-258	0501	Barren of conodonts	
39	RRR-259	0501	Barren of conodonts	
40	RRR-260	0501	Barren of conodonts	
41	RRR-261	0501	Barren of conodonts	

Sample No.	Footage	IBM No.	Identification	Count
42	RRR-327C	0501	Barren of conodonts	
43	RRR-340	0501	Barren of conodonts	
44	RRR-343	0501	Barren of conodonts	
45	RRR-344	0501	Barren of conodonts	
46	RRR-345	0501	Barren of conodonts	
47	RRR-355	0501	Barren of conodonts	
48	RRR-356	0501	Barren of conodonts	
49	RRR-358	0501	Barren of conodonts	
50	DWA-280	2717	Polygnathus 2717	1
		2700	Polygnathus sp.	1

The fauna in sample 50 indicates a Kinderhookian (Lower Mississippian) age.

51	DWA-286	2865	Panderodus sp.	2

The specimens in sample 51 suggest an Ordovician age; however, it is possible that they are as young as Middle Devonian.

52	DWA-296	0501	Barren of conodonts	
53	DWA-305	2831	Siphonodella 2831	1
		2620	Siphonodella sp.	3
		2618	Indet. conodonts	6

The fauna in sample 53 is Kinderhookian (Lower Mississippian) in age and approximately correlates with the faunas in samples 18 and 50.

55	DWA-337	2712	Polygnathus 2712	1
		2618	Indet. conodonts	

The fauna in sample 55 is Middle Devonian in age.

56	DWA-339	0501	Barren of conodonts	
57	DWA-340	0501	Barren of conodonts	
59	DWA-361	0501	Barren of conodonts	

Sample No.	Footage	IBM No.	Identification	Count
60	DWA-375	0501	Barren of conodonts	
61	JDB-2	0501	Barren of conodonts	
62	JDB-3	2618	Indet. conodonts	2

The fragments in sample 62 suggest an Ordovician age.

Sample No.	Footage	IBM No.	Identification	Count
63	RRR-224C	0501	Barren of conodonts	
64	RRR-257C	0501	Barren of conodonts	
65	RRR-309C	0501	Barren of conodonts	
66	RRR-313CL	0501	Barren of conodonts	
67	RRR-325C	2620	*Siphonodella* sp.	1
		2700	*Polygnathus* sp.	1
		2618	Indet. conoconts	11

The conodonts in sample 67 are Kinderhookian (L. Mississippian) in age and approximately correlate with the faunas in samples 18, 50 and 53.

Sample No.	Footage	IBM No.	Identification	Count
68	RRR-353F, C	0501	Barren of conodonts	
69	RRR-360C	0501	Barren of conodonts	
70	RRR-369C	0501	Barren of conodonts	
71	RRR-370C	2828	Cavusgnathus 2828	1
		2826	Cavusgnathus 2826	2
		2618	Indet. conodonts	5

The fauna in sample 71 is upper Meramec or Chester (Upper Mississippian) in age.

Sample No.	Footage	IBM No.	Identification	Count
73	RRR-373C	0501	Barren of conodonts	
74	RRR-375C	0501	Barren of conodonts	
75	DWA-283C	0501	Barren of conodonts	
76	DWA-289C	2618	Indet. conodonts	3
77	DWA-295C	2811	*Gnathodus* sp.	3
		2618	Indet. conodonts	2

Sample No.	Footage	IBM No.	Identification	Count

The conodonts in sample 77 are Mississippian in age.

Sample No.	Footage	IBM No.	Identification	Count
78	DWA-313C	2717	Polygnathus 2717	45
		2736	Spathognathodus 2736	16
		2831	Siphonodella 2831	1
		2718	Polygnathus 2718	1
		2726	Spathognathodus sp.	2
		2618	Indet. conodonts	31

The fauna in sample 78 is Kinderhookian (L. Mississippian) in age and approximately correlates with the faunas in samples 18, 50, 53, and 67.

Sample No.	Footage	IBM No.	Identification	Count
79	DWA-323C	0501	Barren of conodonts	
80	DWA-358C	0501	Barren of conodonts	
81	DWA-363C	2811	Gnathodus sp.	1
		2858	Neoprioniodus sp.	1
		2618	Indet. conodonts	2

The fauna in sample 81 suggests a Mississippian age.

Sample No.	Footage	IBM No.	Identification	Count
82	DWA-381C	0501	Barren of conodonts	
83	RRR-281 C & F	0501	Barren of conodonts	
84	RRR-301 F,f,C	0501	Barren of conodonts	

H. Richard Lane

H. Richard Lane

HRL:vm

42021

AMOCO

Amoco Production Company
Tulsa, Oklahoma
Research Center

September 19, 1972

Re: Conodonts from the Union Trail Creek Section, NE 1/4, SE 1/4, T34N, R39W, Lat. 68° 19' 2" N., Long. 160° 52' W., Misheguk Mountain Quad., Alaska

R10W (KRM)

File: Technical Service No. 5719IR
Job No. 9704
Locality No. 6623

MEMORANDUM

Sample No.	Footage	IBM No.	Identification	Count
1	RRR 300	0501	Barren of conodonts	
2	RRR 299	0501	Barren of conodonts	
3	RRR 298	0501	Barren of conodonts	
4	RRR 297	0501	Barren of conodonts	
6	RRR 295	2705	*Polygnathus* 2705	1
		2712	*Polygnathus* 2712	7
		2618	Indet. conodonts	16

The conodonts in sample 6 suggest an upper Eifelian age (Middle Devonian).

Sample No.	Footage	IBM No.	Identification	Count
7	RRR 294	0501	Barren of conodonts	
12	RRR 289	0501	Barren of conodonts	
13	RRR 288	0501	Barren of conodonts	
15	RRR 286	20314	*Polygnathus* 20314	1
		2779	*Palmatolepis* 2779	2
		2618	Indet. conodonts	8

The fauna in sample 15 is lower Famennian (Upper Devonian) in age.

H. Richard Lane

H. Richard Lane

HRL:skw

Radiogenic Age
Dating

42021 file

42021 FILE

Geochron Laboratories, Inc.

24 Blackstone Street, Cambridge, Mass. 02139
Telephone TRowbridge 6-3691

1 copy sent to Amoco

18 January 1972

Roderick D. McLennan
Union Oil Co. of Calif.
9645 So. Santa Fe Springs Road
Santa Fe Springs, Calif. 90670

Dear Mr. McLennan:

Enclosed are the analytical reports of the K-Ar age determinations on five (5) of the six (6) rock samples described in your letter of 23 November 1971.

We were unable to make a satisfactory mineral concentrate from your sample JDB-1 and the sample is not really suitable for a whole-rock analysis, consequently there is no report for this sample. The other five samples gave ages ranging from about 75 to 217 million years. As you gave no indication of the magnitude of the ages you expected for these samples I cannot comment too much about them.

The age of sample JDB-6 should be considered to be a minimum age and may closely approximate the time of shearing and alteration of the rock. The age of RRR-275 should be a good metamorphic age for the rock. I would expect the ages of the other three samples to be rather reliable ages of formation of the individual rock units.

If you should have any questions about these analyses, please do not hesitate to contact me. In the meantime, I am enclosing our invoice for this work. I hope that we may be able to serve you again in the near future.

Sincerely,
GEOCHRON LABORATORIES DIV.

Richard H. Reesman

Richard H. Reesman
General Manager

RHR/dm

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
24 BLACKSTONE STREET • CAMBRIDGE, MA. 02139 • (617)-876-3691

POTASSIUM-ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. R-2172 — **Date Received:** 30 November 1971

Your Reference: JDB-6 — **Date Reported:** 18 January 1972

Submitted by: Roderick D. McLennan
Union Oil Co. of Calif.
9645 So. Santa Fe Springs Road
Santa Fe Springs, Calif. 90670

Sample Description & Locality: Sheared and altered basalt (?)
Alaska

Material Analyzed: Whole rock, crushed to -40/+100 mesh.

Ar^{40*}/K^{40} = .006212 — AGE = 103 ± 4 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.04376	.814	.04331
.04286	.927	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
5.691	5.715	6.972
5.739		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$ / year

$\lambda_e = 0.585 \times 10^{-10}$ / year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln \left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1 \right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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GEOCHRON LABORATORIES DIVISION

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POTASSIUM–ARGON AGE DETERMINATION — **REPORT OF ANALYTICAL WORK**

Our Sample No. R- 2173

Date Received: 30 November 1971

Your Reference: RRR-275

Date Reported: 18 January 1972

Submitted by: Roderick D. McLennan
Union Oil Co. of Calif.
9645 So. Santa Fe Springs Road
Santa Fe Springs, Calif. 90670

Sample Description & Locality: Slate
Alaska

Material Analyzed: Whole rock, crushed to -40/+100 mesh.

Ar^{40*}/K^{40} = .01347

AGE = 217 $\pm$ 8 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.03924	.836	.03946
.03968	.817	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
2.407	2.401	2.929
2.396		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM-ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. M-2174

Date Received: 30 November 1971

Your Reference: RRR-368

Date Reported: 18 January 1972

Submitted by: Roderick D. McLennan
Union Oil Co. of California
9645 So. Santa Fe Springs Road
Santa Fe Springs, California 90670

Sample Description & Locality: Gneiss (Coarser-grained sample used)
Alaska

Material Analyzed: Muscovite concentrate, -100/+200 mesh.

Ar^{40*}/K^{40} = .006478

AGE = 108 ± 4 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.05613	.703	.05647
.05680	.666	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
7.141	7.145	8.716
7.149		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln \left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1 \right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM-ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. R-2175

Your Reference: RRR-386

Date Received: 30 November 1971

Date Reported: 18 January 1972

Submitted by: Roderick D. McLennan
Union Oil Co. of Calif.
9645 So. Santa Fe Springs Road
Santa Fe Springs, Calif. 90670

Sample Description & Locality: Olivine basalt
Alaska

Material Analyzed: Whole rock, crushed to -40/+100 mesh.

Ar^{40*}/K^{40} = .004436

AGE = 74.3 ± 4.2 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.003080	.427	.002771
.002585	.193	
.002647	.267	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
.521	.512	.624
.503		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln \left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1 \right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM–ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No.: R-2176

Date Received: 30 November 1971

Your Reference: RRR-390

Date Reported: 18 January 1972

Submitted by: Roderick D. McLennan
Union Oil Co. of Calif.
9645 So. Santa Fe Springs Road
Santa Fe Springs, Calif. 90670

Sample Description & Locality: Basalt
Alaska

Material Analyzed: Whole rock, crushed to -40/+100 mesh.

Ar^{40*}/K^{40} = .005258

AGE = 87.8 ± 3.9 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.008468	.536	.008279
.008090	.499	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
1.279	1.290	1.574
1.302		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln \left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1 \right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

Source Rock
Evaluation

AMOCO PRODUCTION COMPANY
RESEARCH CENTER

SOURCE ROCK EVALUATION

- 5 outcrop samples from North Slope, Alaska -

Geochemistry Group

R. M. Byington
J. A. Williams

Distribution: B. F. Baldwin, Attn G. F. Stansberry and Lloyd Fuhrer
R. K. Taylor
B. G. Newton
W. R. Walton
J. A. Momper

Technical Service 8308CR
Denver, Northwest District

James A Momper
2-29-72

RECEIVED
APR 5 1972

1 42021 file
2 Xerox to Rose -
3 Xerox-geochem file

T.S. 8308CR
Denver, Northwest District
North Slope, Alaska

INTRODUCTION

Five outcrop samples collected by Union Oil Company of California in the extreme western portion of the Brooks Range, Alaska, were analysed for source rock quality. The samples were of Cretaceous, Jurassic and Mississippian age.

OBSERVATIONS AND CONCLUSIONS

1. The samples have source rock quality ratings ranging from NON-SOURCE (1) to GOOD (2) - (Table 1).

2. There were very small amounts of mature hydrocarbon extracts from all the samples (Figs. 1 and 2), which is suggestive of gas sources. However, the possibility of oil generation cannot be ruled out on the basis of the present data.

R. M. Byington

RMB:glj

OFFICE Denver Division AREA North Slope, Alaska

AUTHORIZED BY D. R. Hembre DATE 11-22-71

TECHNICAL SERVICE NUMBER 8308CR

STATE (PROVINCE) Alaska COUNTY WELL LOCATION

Amoco Production Company

RESEARCH CENTER

SOURCE ROCK EVALUATIONS

SAMPLE			FORMATION	LITHOLOGY	~~DEPTH~~	INSOLUBLE RESIDUE %	ORGANIC CARBON WT. %	EXTRACTABLE ORGANIC Bbl/ACRE FT.	EXTRACT. HYDROCARBON Bbl/ACRE FT.	EXTRACT. ORG. / TOTAL ORG.	RATING	C Isotope
NUMBER	TYPE	QUALITY										
ANS-71	Out-crop	RRR229	Ogotoruk Jur.-Early Cret.	silty sh.	NE, 31N-60W	87.6	0.5	1.4	0.5	0.01	poor	-25.4
-72	"	RRR231	Telavirak Jur.-Early Cret.	shale	SW ~~NE~~, NW 31N-59W	84.5	1.3	0.7	0.2	0.00	good	-25.9
-73	"	RRR233	"	shale	C, 31N-59W	84.0	0.8	1.3	0.5	0.01	fair	--
-74	"	RRR381	Cretaceous ?	shale	66°40'N 156°13'W	73.8	0.3	1.0	0.3	0.02	non-source	-26.2
-75	"	DWH321	Kayak Mississippian	shale	NE NE, 12S-44W	63.6	1.1	0.7	0.1	0.00	good	-26.2

REMARKS:

ANALYST [signature] DATE FEB 2 9 1972

TABLE 1

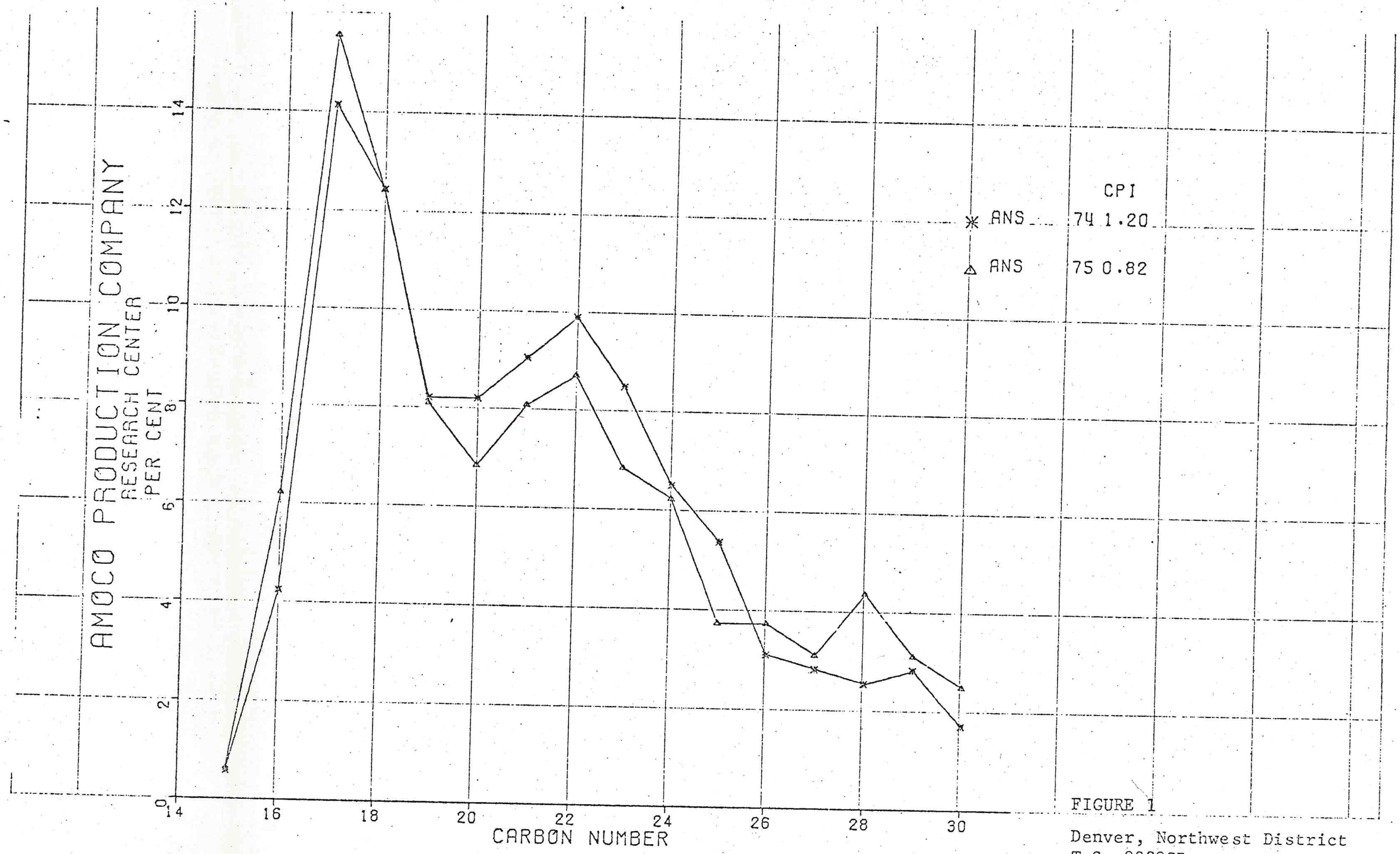


FIGURE 1

Denver, Northwest District
T.S. 8308CR

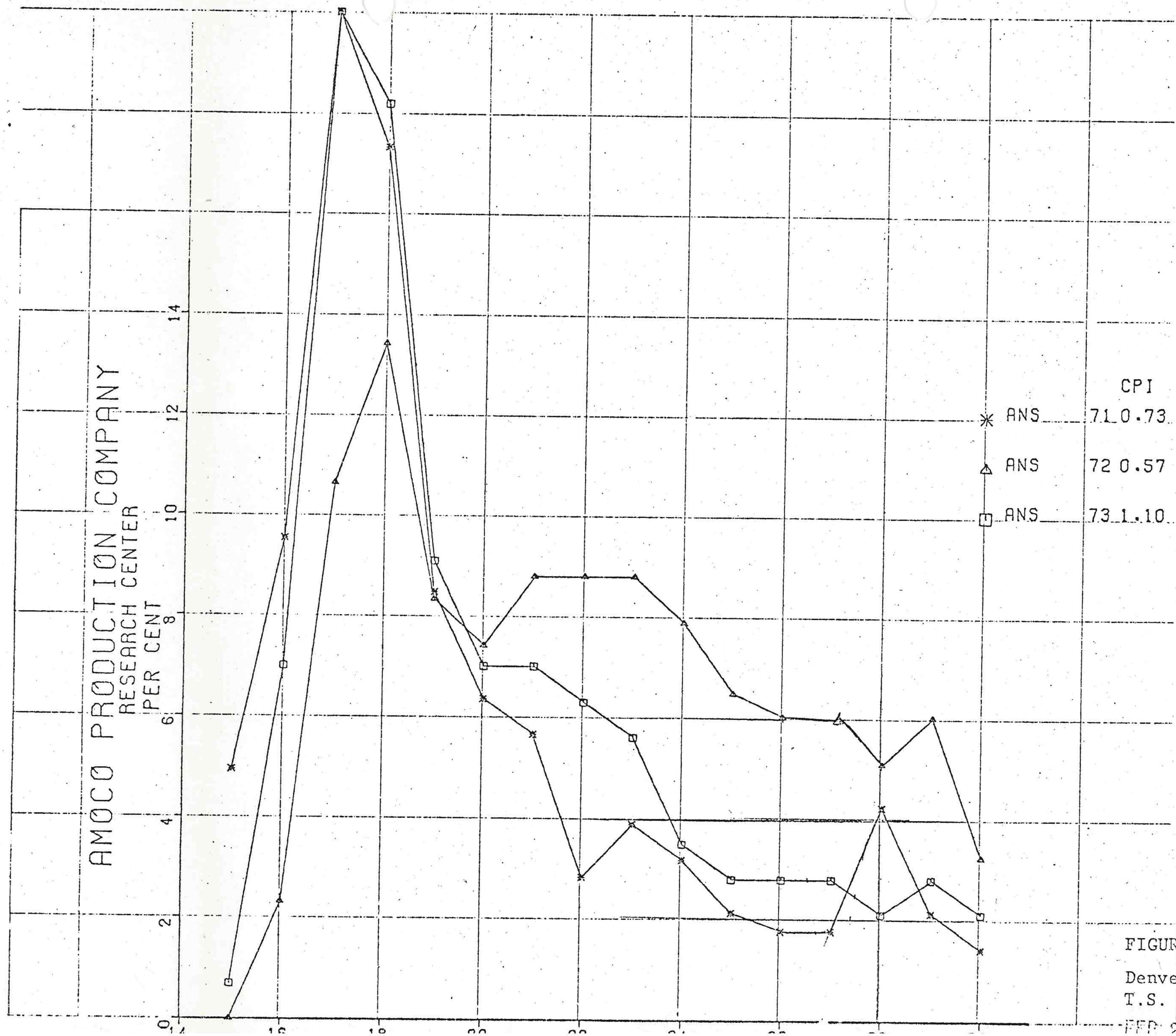
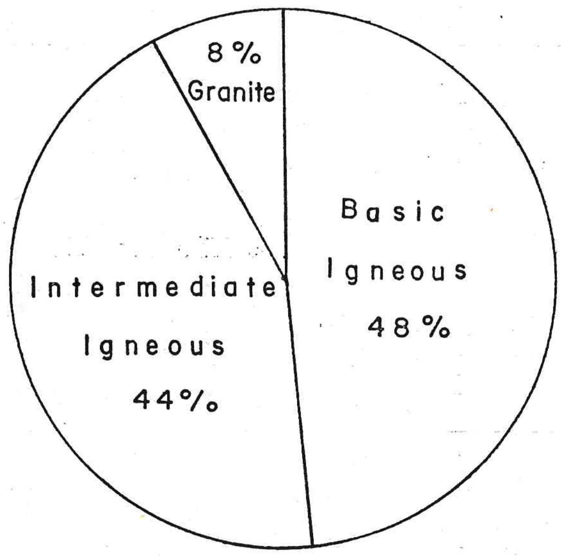


FIGURE 2

Denver, Northwest District
T.S. 8308CR

Pebble Counts

Pbl. Count From 1-6-26



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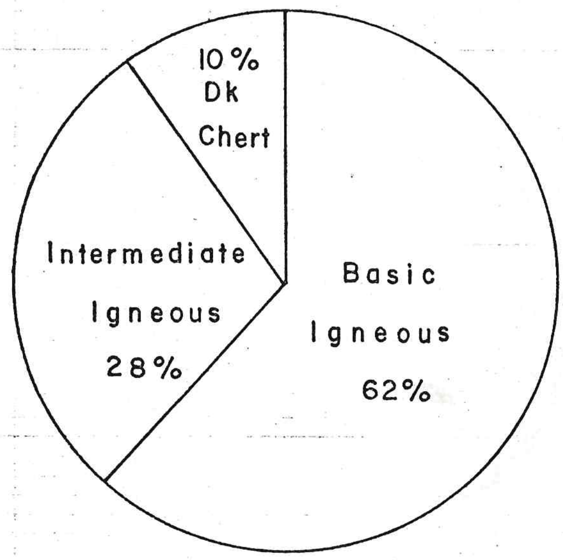

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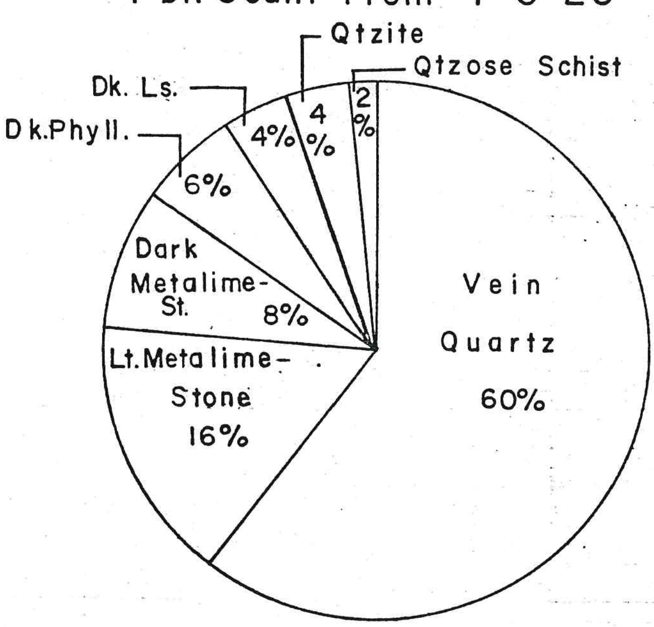
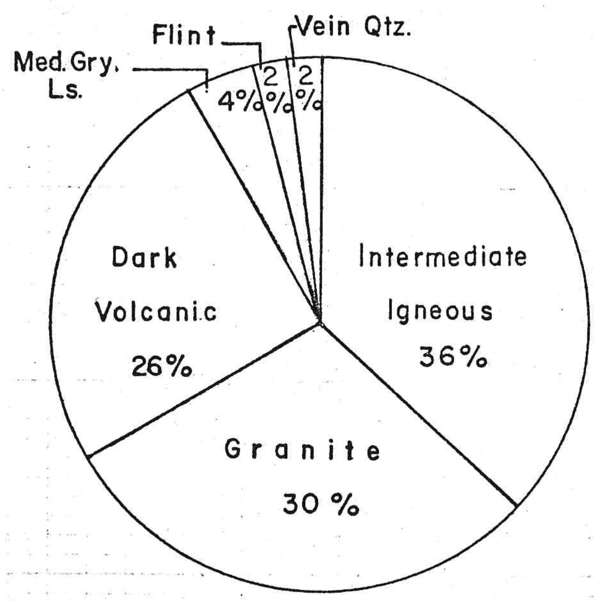
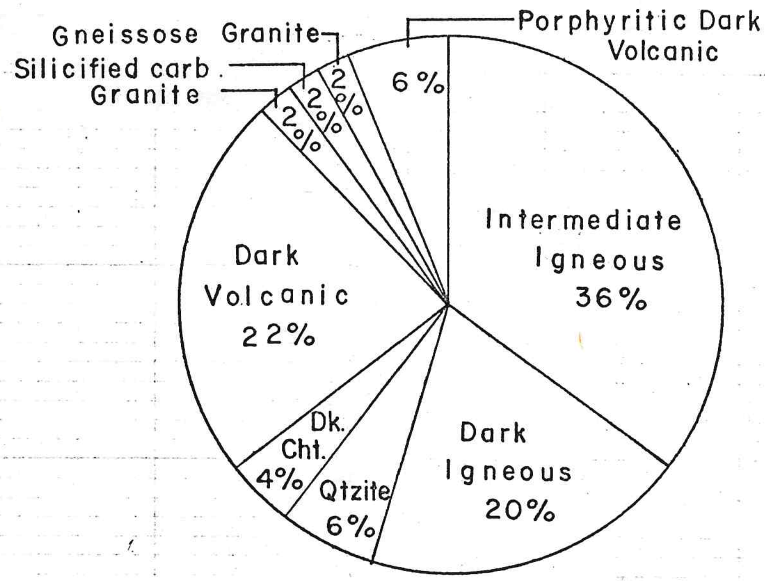


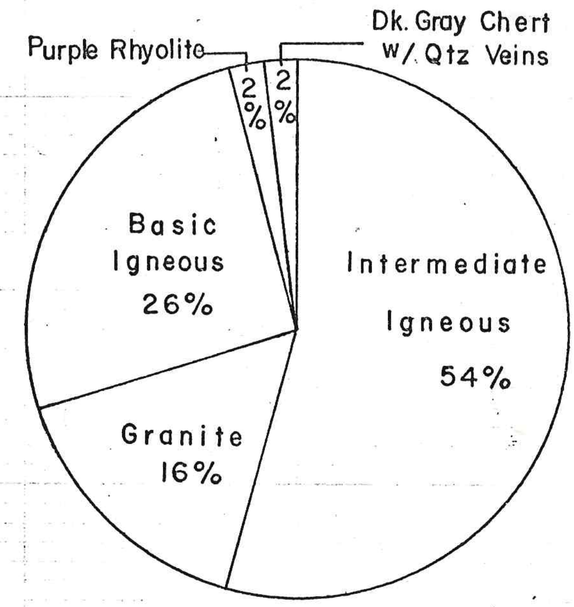
Pbl. Count From 5-6-24



Pbl. Count From 7-6-24



Pbl. Count From 14-6-24



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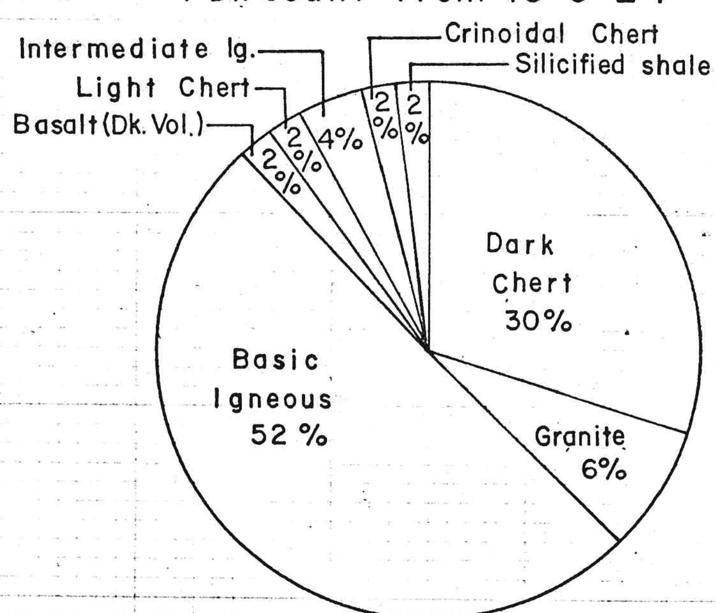

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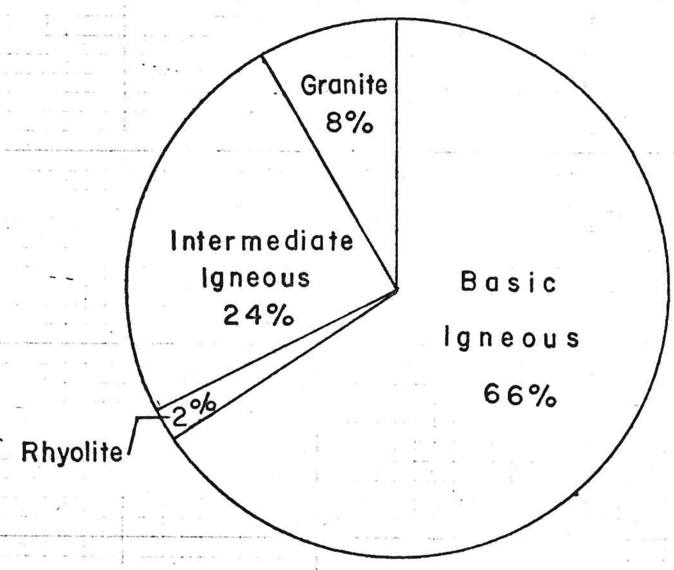
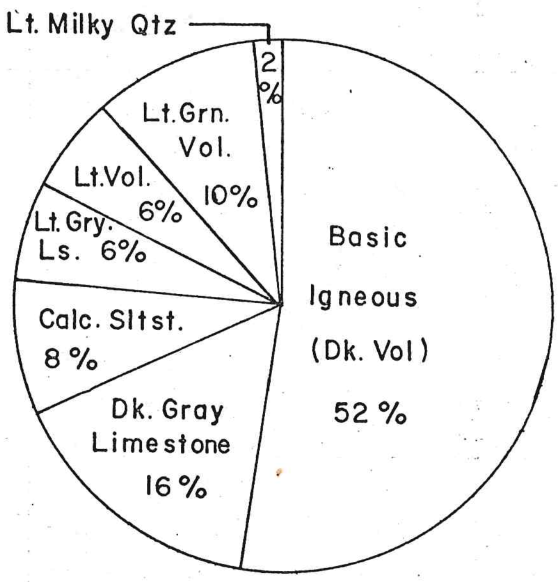


Pebble Count # 1



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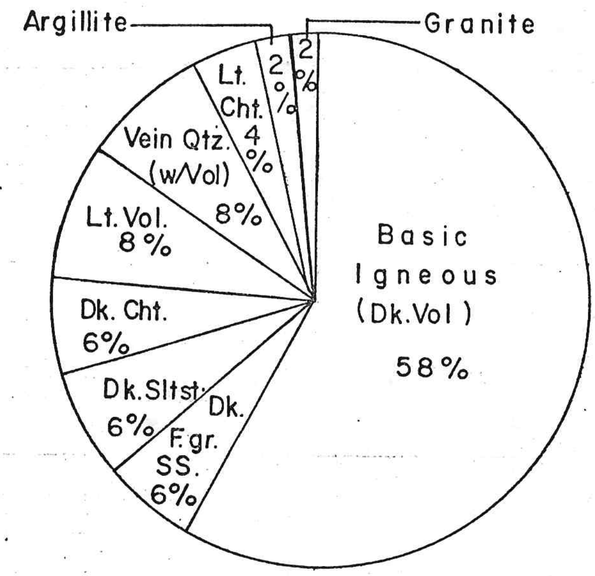

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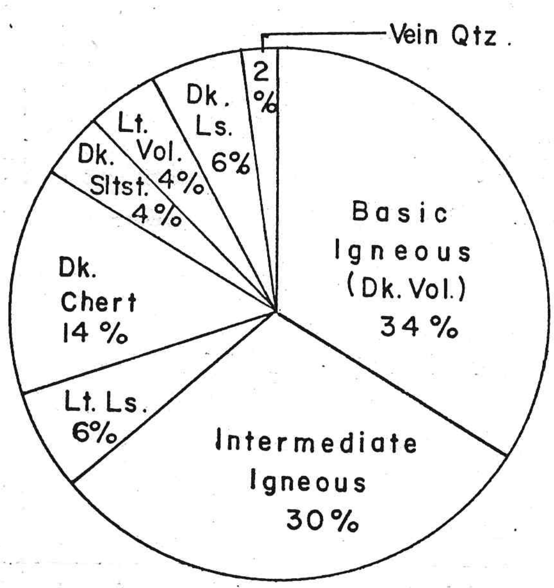

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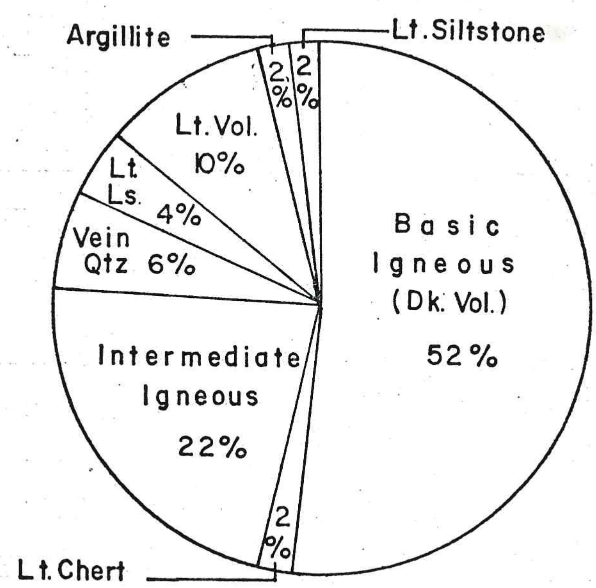

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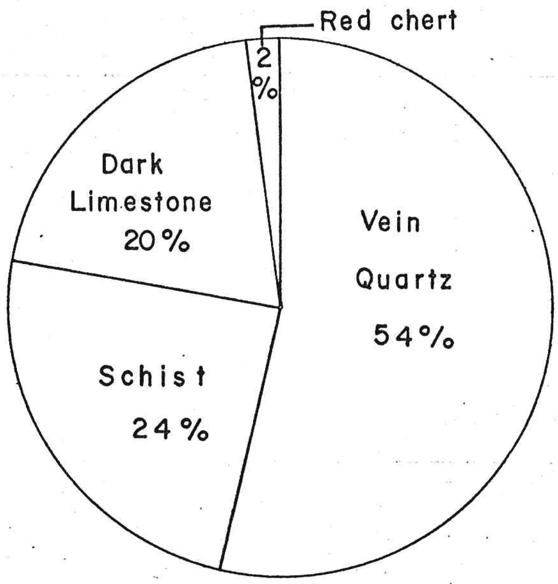

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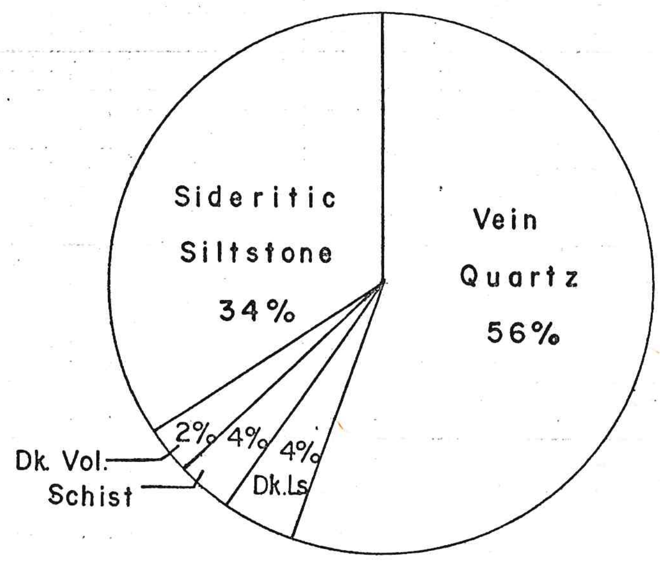

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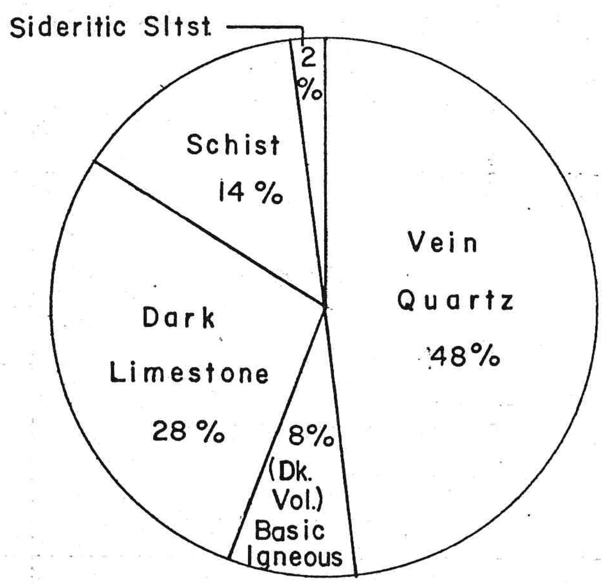

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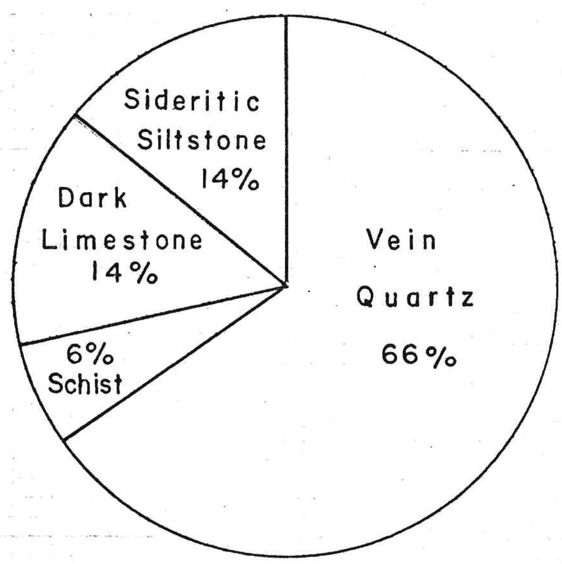

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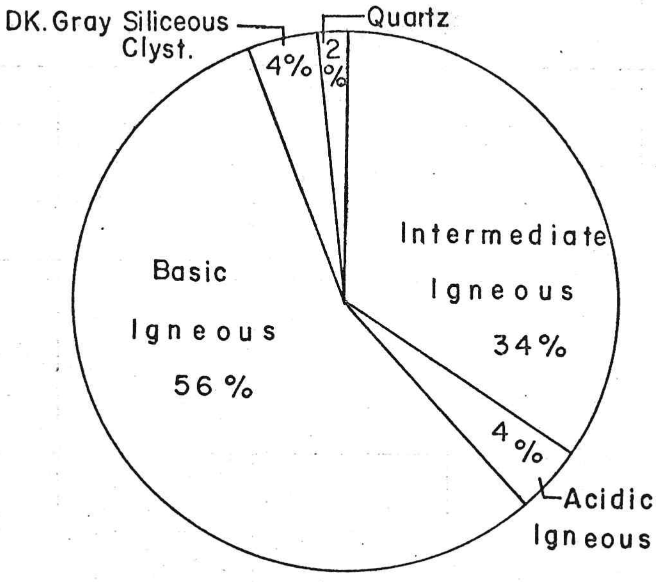
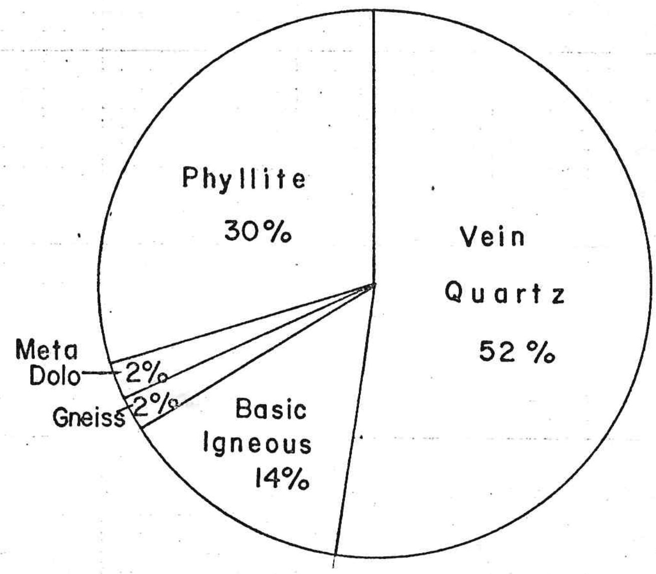


Pbl. Count From 11-7-24



PRINTED ON CLEARPRINT 1000H

SAMPLE REGISTER

SAMPLE REGISTER

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
DWA 280	Grab	2	Mississippian			C	North-central Noatak
DWA 281	"	2	Mississippian			F	"
DWA 282	"	2	Skajit (?)			F	"
DWA 283	"	2	Kayak?			C	S.Central DeLong Mtns.
DWA 284	"	2	"			F	"
DWA 285	"	2	"			Paly	"
DWA 286	"	2	Utukok?			C	Central Baird Mtns.
DWA 287	"	2	Devonian or older			F	W.Central Baird Mtns.
DWA 288	"	2				F	"
DWA 289	"	2	Lisburne?			C	Southedge DeLong Mtns-
DWA 290	"	2	Lisburne?			F	"
DWA 291	"	2	Kayak?			Paly	"
DWA 292	"	2	Kayak?			Paly	"
DWA 293	"	2				Paly	"
DWA 294	"	2				Paly	SW DeLong Mtns.

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
DWA 295	Grab	2	Kayak?			C	W.Central Misheguk Mtns.
DWA 296	"	2				C	Central Misheguk Mtn.
DWA 297	"	2				f	"
DWA 298	"	2	Cretaceous			Paly	North-central Selawik
DWA 299	"	2	Cretaceous			L	"
DWA 300	"	2	Cretaceous			Paly	NE Selawik
DWA 301	"	2	Cretaceous			Paly	NW Shungnak
DWA 302	"	2	Noatak			Paly	SE Misheguk Mtn.
DWA 303	"	2	Noatak			Paly	"
DWA 304	"	2	Noatak			Paly	"
DWA 305	"	2				C	"
DWA 306	"	2	Huntfork?			Paly	S.Central Misheguk Mtns.
DWA 307	"	2	Shublik?			Paly	E.Central Misheguk Mtn.
DWA 308	"	2	Shublik?			Paly	"

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
DWA 309	Grab	2	Shublik?			Paly	E. Central Misheguk Mtn.
DWA 310	"	2				Paly	"
DWA 311	"	2	Kayak			F	"
DWA 312	"	3	Utukok			F	SE Misheguk Mtn.
DWA 313	"	3	Utukok			C	"
DWA 314	"	3	Noatak?			Paly	"
DWA 315	"	3	Utukok			F & C	"
DWA 316	"	3	Noatak?			F	S. Central Misheguk Mtn.
DWA #17	"	3	Skajit?			F	SW Misheguk Mtn.
DWA 318	"	3	Huntfork			Paly	"
DWA 319	"	3				F & C	"
DWA 320	"	3	Cretaceous			Paly & f	East-central DeLong Mtns.
DWA 321	"	3	Kayak			SR	"
DWA 322	"	3	Utukok			F	W.Central Misheguk Mtn.
DWA 323	"	3	"			C	"

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
DWA 324	Grab	3	Utukok			F & C	W.Central Misheguk Mtns.
DWA 325	"	3	Lisburne?			F	"
DWA 326	"	3	Shublik?			f	"
DWA 327	"	3				f	"
DWA 328	"	3	Shublik?			f	"
DWA 329	"	3	Shublik			L	"
DWA 330	"	3				Paly & f	"
DWA 331	"	3	Cretaceous			Paly & f	"
DWA 332	"	3	Skajit			C	S.Central Misheguk Mtn.
DWA 333	"	3	Skajit			F	"
DWA 334	"	3	Skajit?			F	"
DWA 335	"	3	Skajit?			F	"
DWA 336	"	3	Skajit?			C	"
DWA 337	"	3	Skajit?			C	"

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
DWA 338	Grab	2 & 3	Unknown			Paly & f	NW Baird Mtns.
DWA 339	"	"	"			C	"
DWA 340	"	"	"			C	"
DWA 341	"	"	Lisburne			F	SE DeLong Mtns.
DWA 342	"	"	Shublik?			Paly & f	"
DWA 343	"	2				f	NW Baird Mtns.
DWA 344	"	2	Kayak			Paly	SE DeLong Mtns.
DWA 345	"	2	Utukok?			Paly	"
DWA 346	"	2	Utukok?			F	"
DWA 347	"	2	Noatak			F	"
DWA 348	"	3	Noatak			F	N.Central Baird Mtns.
DWA 349	"	3	Noatak			F	"
DWA 350	"	3	Noatak			F	"
DWA 351	"	3	Noatak			F & C	"

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
DWA 352	Grab	3	Huntfork?			F & C	NW Baird Mtns.
DWA 353	"	3	Huntfork?			F	"
DWA 354	"	3	Lisburne			F	"
DWA 355	"	3	Lisburne			F	"
DWA 356	"	3	Lisburne			F	"
DWA 357	"	3	Kayak			Paly	"
DWA 358	"	3	Lisburne			C	"
DWA 359	"	3	Noatak-Huntfork			Paly	"
DWA 360	"	3	Shublik			F	SE DeLong Mountains
DWA 361	"	3				C	NW Baird Mtns.
DWA 362	"	3	Utukok?			L & F	Central Misheguk Mtn.
DWA 363	"	3	Utukok?			C	"
DWA 364	"	3	Utukok?			Paly & SR	"
DWA 365	"	3	Probable lower Mississippian			Paly & SR	"

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
DWA 366	Grab	3	Unknown			Paly & SR	Central Misheguk Mtn.
DWA 367	"	3	Lower Mississippian(?)			Paly & SR	"
DWA 368	"	3	"			F & L	"
DWA 369	"	3	Utukok			f & Paly	E.Central Misheguk Mtn.
DWA 370	"	3	Utukok			F	"
DWA 371	"	3	Utukok			Paly & SR	"
DWA 372	"	3	Unknown			L & C	"
DWA 373	"	3	Jur.-Cretaceous			Paly & f	"
DWA 374	"	3	Jur.-Cretaceous			L	"
DWA 375	"	3	Unknown			C	"
DWA 376	"	3	Nuka (Permian)			F	NE Misheguk Mtn.
DWA 377	"	3	Nuka (Permian)			F & C	"
DWA 378	"	3	Nuka			F	"
DWA 379	"	3	Nuka			F & C	"

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
DWA 380	Grab	3	Unknown			F	N.Central Misheguk Mtn.
DWA 381	"	"	"			C	"
DWA 382	"	"	"			L & Paly	"
DWA 383	"	"	"			F	"
DWA 384	"	"	"			F	"

SAMPLE REGISTER

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 200	Grab	1	Cretaceous			L	North Central Selawik
RRR 201	"	1	Cretaceous			L	"
RRR 202	"	1	Cretaceous			Paly	"
RRR 203	"	1	Cretaceous			F	"
RRR 204	"	1	Cretaceous			Paly	"
RRR 205	"	1	Cretaceous			Paly	"
RRR 206	"	1	Cretaceous			Paly	"
RRR 207	"	1	Cretaceous			Paly	"
RRR 208	"	1	Cretaceous			Paly	North East Selawik
RRR 209	"	1	Cretaceous			Lith	"
RRR 210	"	1	Cretaceous			Paly	"
RRR 211	"	1	Cretaceous			Paly	"
RRR 212	"	1	Cretaceous			Paly	"

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 213	Grab	1	Cretaceous			Forams	Northeast Selawik
RRR 214	"	1	Cretaceous			L	"
RRR 215	"	1	Cretaceous			Forams	"
RRR 216	"	1	Cretaceous			Paly	"
RRR 217	"	1	Cretaceous			Forams	"
RRR 218	"	1	Cretaceous			Paly	North-central Selawik
RRR 219	"	1	Cretaceous			Mega flora	"
RRR 220	"	1	Devonian			C	Central Baird Mtns.
RRR 221	"	1	Unknown			Paly	NW Baird Mountains
RRR 222	"	1	Skajit			F	NW Noatak
RRR 223	"	1	Skajit			F	"
RRR 224	"	1	Kayak			C	Central Point Hope
RRR 225	"	1	Kayak			Paly	"
RRR 226	"	1	Unknown			Paly	"

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 227	Grab	1	Unknown			Paly	Central Point Hope
RRR 228	"	1	Jur.-Cret.			Paly	SE Point Hope
RRR 229	"	1	Jur.-Cret.			SR	"
RRR 230	"	1	Jur.-Cret.			Paly	"
RRR 231	"	1	Jur.-Cret.			SR	"
RRR 232	"	1	Jur.-Cret.			Paly	"
RRR 233	"	1	Jur.-Cret.			SR	"
RRR 234	"	1	Skajit			F	NW Noatak
RRR 235	"	1	Skajit			f	"
RRR 236	"	1	Huntfork			Paly	NW Survey Pass
RRR 237	"	1	Unknown			f	SE Howard Pass
RRR 238	"	1				C	S.Central Baird Mtns.
RRR 239	"	1	Meta Sediments			L	"
RRR 240	"	1	Skajit			F	Central Baird Mtns.

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 241	Grab	1	Skajit			F	Central Baird Mtns.
RRR 242	"	1	Skajit			C	"
RRR 243	"	1	Skajit			F	"
RRR 244	"	1	Skajit			F	"
RRR 245	"	1	Skajit			F	"
RRR 246	"	1	Skajit			F	"
RRR 247	"	1	Skajit			C	"
RRR 248	"	1	Huntfork			Paly	W.Central Baird Mtns.
RRR 249	"	1	Huntfork			Paly	S.Central Misheguk Mtn.
RRR 250	"	1	Huntfork			F	"
RRR 251	"	1	Huntfork			F	"
RRR 252	"	1	Devonian?			L	NE Baird Mtns.
RRR 253	"	1	Cretaceous			f	North-central Selawik

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 254	Grab	1	Cretaceous			Paly	North-central Selawik
RRR 255	"	1	Cretaceous			Megaflora	"
RRR 256	"	1	Cretaceous			Megaflora	"
RRR 257	"	1	Pre Devonian			C	S. Central Baird Mtns.
RRR 258	"	1				C	SW Baird Mtns.
RRR 259	"	1				C	"
RRR 260	"	1				C	"
RRR 261	"	1				C	"
RRR 262	"	1	Middle Devonian			F & f	"
RRR 263	"	1	Middle Devonian			F & f	"
RRR 264	"	1				F & C	W. Central Baird Mtns.
RRR 265	"	1	Cretaceous			Paly	Northedge Selawik
RRR 266	"	1	Cretaceous			L	"
RRR 267	"	1	Cretaceous			Paly	Kobuk Rv. Baird Mtns.

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 268	Grab	1	Cretaceous			Megaflora	Kobuk Rv.-Baird Mtns.
RRR 269	"	1	Cretaceous			Paly	"
RRR 270	"	1	Cretaceous			Megaflora	"
RRR 271	"	1	Cretaceous			Megaflora	"
RRR 272	"	1	Cretaceous			Paly	"
RRR 273	"	1	Cretaceous			Paly	"
RRR 274	"	1	Cretaceous			Paly	NE Selawik
RRR 275	"	3	Huntfork			L & Geo~~chem~~chron	S.Central Misheguk Mtn.
RRR 276	"	3	Kanyut			L	NE Ambler River
RRR 277	"	3	Lisburne			C & F	East-Central Misheguk Mtn.
RRR 278	"	3	Lisburne			F	"
RRR 279	"	3	Utukok			f & C	"
RRR 280	"	3	Utukok			F	"
RRR 281	"	3	Devonian?			C & f	SE Misheguk Mtn.
RRR 282	"	3	Devonian?			F	"

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 283	Grab	3	Devonian?			F	SE Misheguk Mtn.
RRR 284	"	3	Devonian?			SR & Paly	"
RRR 285	Trail Crk.Meas.sec.	3	Devonian?	1	15'	C & f	Central Misheguk Mtn.
RRR 286	"	3	Devonian?	2	70'	C & f	"
RRR 287	"	3	Devonian?	3	100'	C & f	"
RRR 288	"	3	Devonian?	4	200'	L & C	"
RRR 289	"	3	Devonian?	5	300'	L & C	"
RRR 290	"	3	Devonian?	6	340'	F	"
RRR 291	"	3	Devonian?	6	400'	C & f	"
RRR 292	"	3	Devonian?	7	470'	F	"
RRR 293	"	3	Devonian?	9	870'	Paly & SR	"
RRR 294	"	3	Devonian?	9	870'	L & C	"
RRR 295	"	3	Devonian?	10	940'	F	"
RRR 296	"	3	Devonian?	10	940'	F	"
RRR 297	"	3	Upper Dev.-Lower Miss.	11	1100'	L & C	"

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 298	Trail Crk.Meas.Sec.	3	Upper Dev.-Lower Miss.	12	1200	L & C	Central Misheguk Mtn.
RRR 299	"	3	"	13	1300	L & C	"
RRR 300	"	3	"	14	1500	F & C	"
RRR 301	Grab	3	Devonian			f & F & C	S.Central Misheguk Mtn.
RRR 302	"	3	Devonian			Paly	"
RRR 303	"	3	Kayak-Utukok			L & f	"
RRR 304	"	3	Kayak-Utukok			Paly & SR	"
RRR 305	"	3	Kayak-Utukok			C & F & L	"
RRR 306	"	3	Devonian			f & C	"
RRR 307	"	3	"			F & f	SW Misheguk Mtn.
RRR308	"	3	Utukok?			F & f	"
RRR 309	"	3	Unknown			C	"
RRR 310	"	3	Noatak			L	Central Misheguk Mtn.
RRR 311	"	3	Devonian			f & C	"

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 312	Grab	3	Devonian			Paly & SR	Central Misheguk Mtn.
RRR 313	"	3	"			L & C	"
RRR 314	"	3	Huntfork & Noatak			Paly	"
RRR 315	"	3	"			f & C	"
RRR 316	"	3	"			Paly	"
RRR 317	"	3	Lisburne			F & f	W.Central Misheguk Mtn.
RRR 318	"	3	"			F	"
RRR 319	"	3	"			F (3)	"
RRR 320	"	3	Cretaceous			f & Paly	E.Central DeLong Mtns.
RRR 321	"	3	Cretaceous-Jur.			f & Paly	W.Central Misheguk Mtn.
RRR 322	"	3	Cretaceous			f & Paly	N.Central Misheguk Mtn.
RRR 323	"	3	Cretaceous			L	"
RRR 324	"	3	Unknown			f & C	SE Misheguk Mtn.
RRR 325	"	3	"			C	"

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 326	Grab	3	Lower Mississippian			F	SE Misheguk Mtn.
RRR 327	"	3	"			C (F?)	"
RRR 328	"	3	Cretaceous			f & Paly	Central Misheguk Mtn.
RRR 329	"	3	Shublik			F	"
RRR 330	"	3	Unknown			Paly & SR	"
RRR 331	"	3	"			Paly & SR	"
RRR 332	"	3	"			Paly & SR	"
RRR 333	"	3	Cretaceous-Jur.			L	"
RRR 334	"	3	Utukok			F	W.Central Misheguk Mtn.
RRR 335	"	3	Cretaceous			f & Paly	NE Misheguk Mtn.
RRR 336	"	3	Cretaceous			L & Paly	"
RRR 337	"	3	Cretaceous			f & Paly	Central Misheguk Mtn.
RRR 338	"	3	Cretaceous			Paly & SR	"
RRR 339	"	3	Cretaceous			f & Paly	"
RRR 340	"	3				C	SW Ambler Rv.

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 341	Grab	3	Devonian or older			L	W.Central Ambler Rv.
RRR 342	"	3	"			F	"
RRR 343	"	3	"			C	"
RRR 344	"	3	"			C	"
RRR 345	"	3	Middle Devonian			C	NW Ambler Rv.
RRR 346	"	3	"			F	"
RRR 347	"	3	"			F	"
RRR 348	"	3	"			L	"
RRR 349	"	3	"			(2)F	"
RRR 350	"	3	"			F	"
RRR 351	"	3				F	"
RRR 352	"	3	Devonian			F & C	"
RRR 353	"	3				f & C	"
RRR 354	"	3	Devonian or older			L	Central Ambler Rv.

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 355	Grab	3	Devonian or older			C	N.Central Ambler Rv.
RRR 356	"	3	"			C	"
RRR 357	"	3	Huntfork			Paly	NE Ambler Rv.
RRR 358	"	3	Huntfork			C	"
RRR 359	"	3	Kanyut			L	"
RRR 360	"	3	Pre-Devonian			C	"
RRR 361	"	3	"			Paly & SR	East edge Ambler Rv.
RRR 362	"	3	Devonian			Paly & SR	NW Survey Pass
RRR 363	"	3	"			Paly	"
RRR 364	"	3	Unknown			Paly	W. Central Survey Pass
RRR 365	"	3	Unknown			L & f	"
RRR 366	"	3	Unknown			L & f	"
RRR 367	"	3	Pre-Devonian			Paly & SR	"
RRR 368	"	3	Early Cretaceous			Geochron	SW Survey Pass

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 369	Grab	3	Lisburne			F & C	S. Central DeLong Mtns.
RRR 370	"	3	"			C	"
RRR 371	"	3	"			F	"
RRR 372	"	3	"			F	"
RRR 373	"	3	Unknown			C	Central Misheguk Mtn.
RRR 374	"	3	"			Paly	"
RRR 375	"	3	"			C	"
RRR 376	"	3	Cretaceous			L	NE Shungnak
RRR 377	"	3	"			Paly & f	"
RRR 378	"	3	"			L	"
RRR 379	"	3	"			L	"
RRR 380	"	3	"			Paly & f	"
RRR 381	"	3	"			SR	"
RRR 382	"	3	"			L	NW Hughes

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 383	Grab	3	Cretaceous			L	NW Hughes
RRR 384	"	3	"			L	"
RRR 385	"	4	"			Paly	"
RRR 386	"	4	"			L & Geochron	North-central Hughes
RRR 387	"	4	"			L	"
RRR 388	"	4	Unknown			L	E.Central Survey Pass
RRR 389	"	4	Cretaceous			L	near Bettles (West of,)
RRR 390	"	4	Cretaceous			Geochron	North-central Shungnak
RRR 391	"	4	Cretaceous			L	"
RRR 392	"	4	Cretaceous			L	"
RRR 393	"	4	Cretaceous			L	East-central Shungnak
RRR 394	"	4	Cretaceous			Paly	West-central Hughes
RRR 395	"	4	Cretaceous			L	"
RRR 396	"	4	Cretaceous			Paly	"
RRR.397	"	4	Cretaceous			L	Central Hughes

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 398	Grab	4	Cretaceous			Paly	Central Hughes
RRR 399	"	4	"			L	NE Hughes
RRR 400	"	4	"			Paly	"
RRR 401	"	4	"			L	"
RRR 402	"	4	"			L	"
RRR 403	"	4	"			L	North-central Hughes
RRR 404	"	4	"			L	"
RRR 405	"	4	Upper Cretaceous			Paly & SR	SW Sagavanirktok
RRR 406	"	4	"			f	"
RRR 407	"	4	Cretaceous?			Paly	"
RRR 408	"	4	"			Paly & SR	"
RRR 409	"	4	Cretaceous			Paly	"
RRR 410	"	4	"			F & L	"
RRR 411	"	4	"			Paly	"
RRR 412	"	4	"			L	"

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 413	Grab	4	Cretaceous			L	SW Sagavanirktok
RRR 414	"	4	"			L	"
RRR 415	"	4	"			Paly & f	S.Central Sagavanirktok
RRR 416	"	4	"			L	"
RRR 417	"	4	"			Paly & f	"
RRR 418	"	4	"			L	"
RRR 419	"	4	"			Paly & f	"
RRR 420	"	4	"			Paly & f	"
RRR 421	"	4	"			L	"
RRR 422	"	4	"			Paly & f	"
RRR 423	"	4	"			Paly & f	"
RRR 424	"	4	"			L	"
RRR 425	"	4	"			Paly & f & SR	"
RRR 426	"	4	"			L	"
RRR 427	"	4	"			Paly & f	"

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 428	Grab	4	Cretaceous			Paly & f	S.Central Sagavanirktok
RRR 429	"	4	"			Paly & f	"
RRR 430	"	4	"			Paly & f	"
RRR 431	"	4	"			L	"
RRR 432	"	4	"			Paly & f	"
RRR 433	"	4	Neocomian			Paly & f	E.Central Sagavanirktok
RRR 434	"	4	"			Paly & f	"
RRR 435	"	4	"			L	"
RRR 436	"	4	Cretaceous			Paly & f	"
RRR 437	"	4	"			Paly & f	"
RRR 438	"	4	"			Paly & f	"
RRR 439	"	4	"			Paly & f	"
RRR 440	"	4	"			L	"
RRR 441	"	4	Neocomian			Paly & f	"
RRR 442	"	4	Okpikruak			F	SE Sagavanirktok

Continued

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
RRR 443	Grab	4	Okpikruak			Paly & f	SE Sagavanirktok
RRR 444	"	4	"			"	"
RRR 445	"	4	"			"	"
RRR 446	"	4	"			"	"
RRR 447	"	4	Tertiary?			Paly	E.Central Sagavanirktok
RRR 448	"	4	Tertiary?			L	"

Sample No (1)	Type (2)	Field Book (3)	Formation or Age (4)	Unit (5)	Footage (6)	Purpose (7)	Location (Quad) (8)
JDB 1-71	Grab	2	Unknown			Geochron	NE Baird Mtns.
JDB 2-71	"	2	Devonian			C	"
JDB 3-71	"	2	Devonian			C	"
JDB 4-71	"	2	Paleozoic			F	"
JDB 5-71	"	2	Devonian?			f	"
JDB 6-71	"	2	Early Cretaceous			Geochron	"

Book #1

Table of Contents

1

Sample No. RRR 200 - 273

Sample No. RRR 274

June 14 afternoon

Waring Mtns - westernmost end

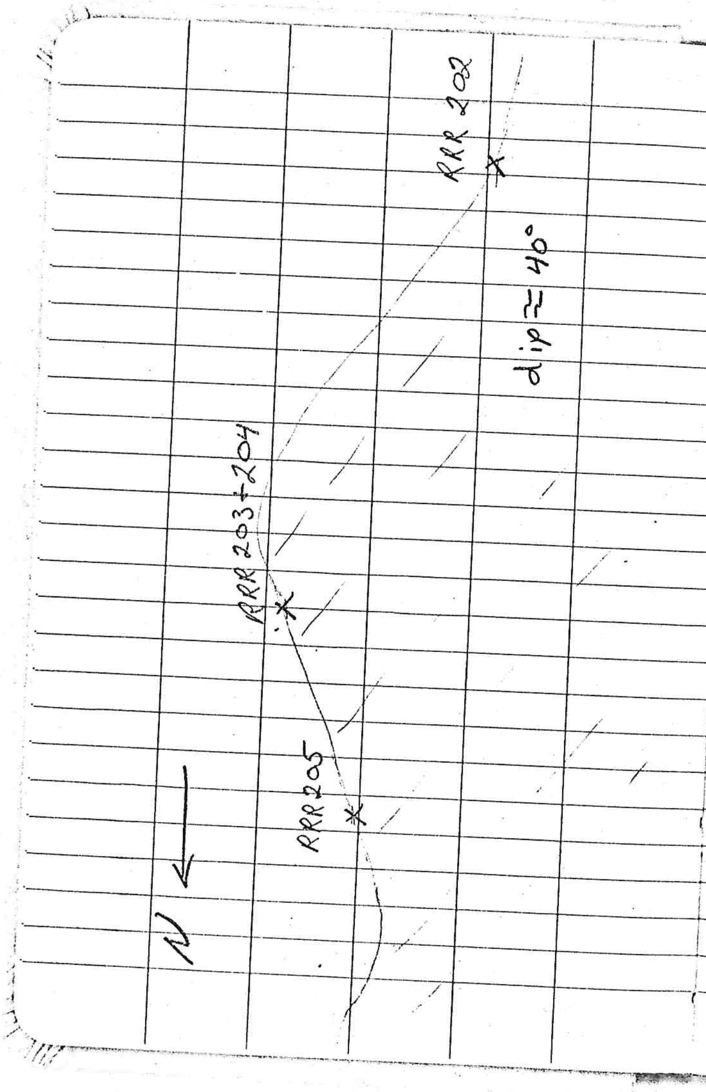
RRR200L

N 80°W 38°N Taken on
gritst. - cross bdd.
N 40°W 43°N taken on bedding
Thick & Thin bedded. dk. gray congl.
v. crse gr. ss. - poorly srtd.
made of felds., wh. qtz., black min.
larger pbls. are mostly metamorphic
wh. qtz. Thick bdd. rock has
pbls. while thin bdd. rock is fine
gr. black ss. w/ no pbls.
Thin phyllitic intrbds.

strike measurement taken
w/ brunton declination of 30°

RRR 201 L

Congl. outcrop in Waring Mtns.
N55°E 45°S taken on
congl. outcrop.
Congl., (w) olive drab, framework
grades from pebbles to boulders,
matrix of silt & sd.
Framework of rounded granite,
gneiss, basalt, rhyolite, crs. xln.
granite. Some pbls. slickensided



2

Pbls. are aligned along bedding planes. Poor srty. Grades in places to half sand & half pbls.
Picture – Roll 1 frame 29 (DWA)

RRR 202
Paly

Dk. grn gry sltst., look for palyno-morphs.

RRR 203
F

Dk gry. shaly sltst. – stratigraphically below sample 202. Contains clam shells & reed frag. Check for mega fauna & flora

RRR 204
Paly

Same loc. as sample 203 but check for palynomorphs

N 68°E 41°S taken on silty v.f. gr. ss. small scall x. bdg. & channel

RRR 205
Paly

Dk gry. silty mudst. strat. below sample 204. Check for seeds & weeds.

RRR 206
Paly

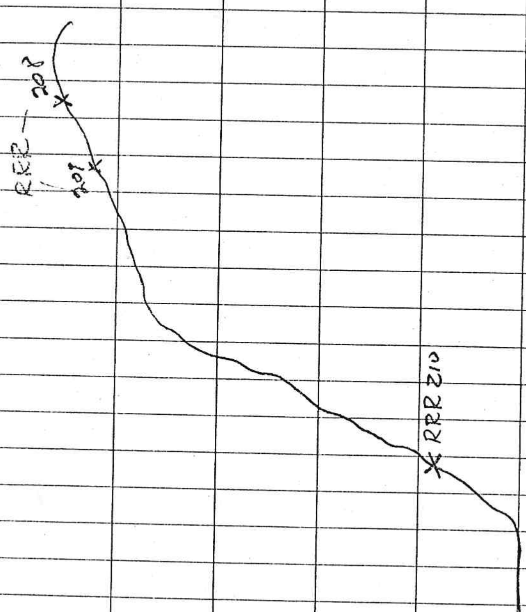
Clyst., w drab olive gry, f. dk gry., splintery fract. collected for palynology.
Occurs as thin intrbd. between crs. congl. & Congl. are channel deposits.

RRR 207
paly

rounded low hill w/ no outcrop. Only rubble of silty clyst. & crs. ss.
collected for weeds & seeds.
stratigraphically above sample RRR 206.

RRR 208
Paly

Taken on top of bald hill.
mudst. w/ rounded pbls.
Top of hill has congl., ss., & pbly mdst.
cobbles & boulders of congl. made of chert, rhyolite, metamorphics, granitic types, argillite



RRR 209
Lith

Ss., w/ rddsh. brn, f med. grn gry, med. gr., poor-fair srtg., sli. calc., glauc?, sa, made of qtz. grs., fair por., x-bdd., few scatt. pbls. w/ thin pbl. cgl. lenses. Thin bdd.

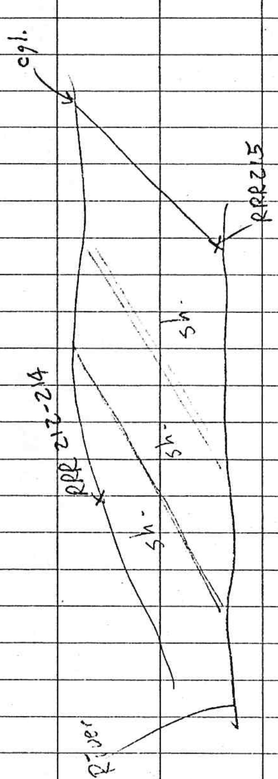
RRR 210
Paly

small outcrop of hd. mdst. w/ splintery fracture.

RRR 211
Paly & Lith

N 85° W ~70° N Taken on cgl. & ss. contact. Dk gry pbl. cgl. w/ ss. lenses.
Congl. w/ vf sand to silt matrix.
Ss. is grn olive brn., pred. qtz grs. w/ felds., abund. matrix, sa, non calc., fair por., poor-fair srtg. Contains carbonized wood & wood chips.

N 85° E 45° N



RRR 212
paly

Mdst. out crop along stream cut in valley bottom. Look for palynomorphs

RRR213
forams

same loc. but look for forams

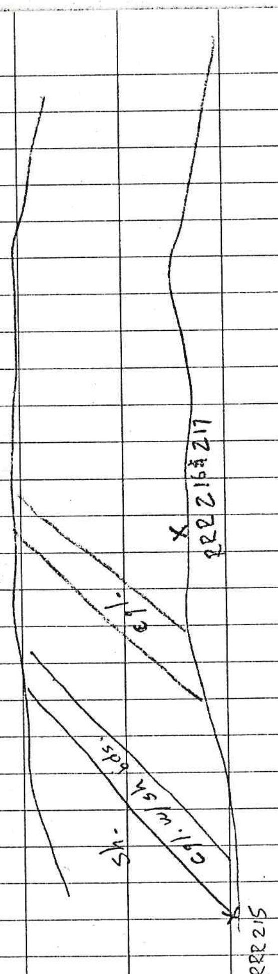
RRR 214
lith

Lith sample is from thin widely spaced beds in mdst seq.
dip dir. N 10°W 45°N
strike N 87°E
Mdst. seq. is about 1000' thick

RRR215
foram

Pebble from pbl. & cobble mdst. at lower end of mdst. seq. Pble. should be looked @ for micro bugs.

Upper contact of cgl. w/ mdst. is sharp. Cgl. contain clasts of ls., cht., grnst. (altered basalt?). Pbls. & cobbles are disoriented & poorly srtd.



RRR 216
Paly
RRR 217
f

Mdst, dk gry, hd. w/
splintery fract., clyst. nod.
that are v. calc.
run for palynology & forams

RRR 218
Paly

Grab of slty. mdst. & vf gr.
ss. Contains plant frags. check
for pollen & spores.

RRR 219
megaflora

Collect for mega flora
One sample is large slab
w/ good plant imprints

June 16

RRR 220 Conodont — Reddish gry calc. Dolo. Look for conodonts. Seq. of carbonates, very dns.

RRR 221 Paly — Med. gry. phyllitic shale. Dips below thick gry. carbonate sequence to the West. Shale taken for palynology.

RRR 222 F — Carbonate outcrop of brown ls. w/ poss. mega foss. Area sli. metamorphosed.

RRR 223 F — Good coelenterate (branching) Amphipora??

RRR 224 C — Taken from outcrop just South of Cape Lewis.

RRR 225 Paly — Sequence is thin-med. bdd.; thin bdd. rock is dk gray, v. calc. shale (foss.) while med bdd. rock is v. arg. foss. ls.

Ls. contains, colonial corals, crinoids, solitary corals, bryozoans & brachs. Small core holes have been taken in Ls. by some unknown party. Ls. weathers reddish-brnsh-gray.

RRR 226
paly

Shale, blk., silty to sandy, micromic. w/ splintery fract. v.v. sli. calc
Taken on Cape Dyer

South of Cape Dyer in thick folded f gr. clastic seq.
N55E 70-90° N

RRR 227
paly

Dk gray sil. sh. w/ slaty cleavage abund. wavy bddg & penecontemp. defor.

RRR 228 paly	Sh., blk.-dk.gry, silty, w/ abund. bdd. plane features (burrows etc.) carbonaceous
RRR 229 SR	Out crop is southeast of Chariot.
RRR 230 paly	Sh., blk., fissile, hd., splintery fract. Taken on small out-crop in small creek cut bank south of samples 228 & 229. Contains elongate concretions finger-size
RRR 231 SR	
RRR 232 paly	Sh., dk.gry to blk., fissile hd. Taken in stream cut-bank. South of previous two sample loc. All 3 sample loc. are in similar material thought to be late J. to earliest Cret.
RRR 233 SR	

11

RRR 234
F

Small outcrop of limy dolo.
w/ brachs. & microfossils.

RRR 235
F

Dolo., lt. brn., dns., wackestone...
med. bdd. & jointed
Taken near Astro Az benchmark
Noatak Quad.

June 17

weather better than yesterday - low cumulus @ 1500' w/ patches of blue. Aim today is to recon east to Ambler and Walker Lake then north to Howard Pass and west to site of Camp #2 (Warren Thompson's cabin).

1st landing site at confluence of Mauneluk River w/ the Kobuk - Purpose is to look for gas seep. No indication of active gas seep.

Landed @ Walker lake to refuel - now 4 1/3 barrels left.

The sequence of rocks encountered in the Walker Lake - Noatak headwaters area is intrbdd. metamorphosed ls. & schist. The seq. is at least 5000' thick and was @ one time intrbdd. ls., ss., & sh. The core of the area - Mt Igikpak - is an augen gneiss.

RRR 236
Paly

Shale, silver gry., phyllitic w/ pyrite cubes and qtz veins
Loc. north of Walkers cabin
These shales may be Huntfork and they lie on a thick carbonate sequence w/ normal contact. Carbonates may be Skajit.

RRR 237
F

Ls., w lt. gry., f. med. gry., micritic to crs. xln (recrystallized) sli. foss. Check for forams & conodonts.

Recon. after lunch showed likely fault zones in the upper reaches of the Nigu River & Flora Creek (Howard Pass Area) as well as the entire Noatak River valley

Also the shale encountered @ RRR 236 grades into sandy shale, sand, and cong. ss up section in the headwaters of the Alatna River. The ss. could be called Kanayut.

June 18

Benny, Lloyd, Dave & Bob on recon into area North of Kiana - Baird Mtns.

1st stop on carbonate hill near Kleary. Dolo., v.lt. brn., microxln., calc. in places. Scattered pieces of box work assoc. & tectonic breccia. No apparent body. Check sample for conodonts. This carb. is on the Meta sed.

RRR 238 conodonts

2nd stop just north about a mile from 1st stop had a good pyrite cube schist.

The & schist could be called meta sediments (MS)

RRR 239

stop 3 just north of Spruce Cr. metamor. banded calc. dolo. w/ assoc. qtz veins. Thin section

stop 4. schist (MS)

stop #5

Metamorphosed Ls., dk gry, coarsely xln., w/ petroleum odor & sli. cust w/ acid. weathers med to lt. gry.
May be a carbonate buildup. No discernable fossils.

stop 6

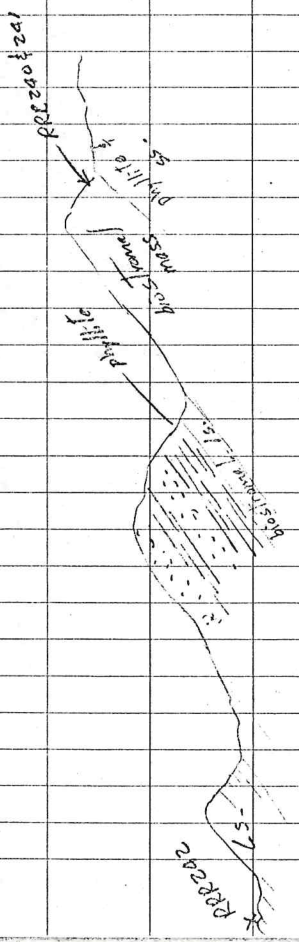
Ls., black, f.xln. in saddle with Dolo., microxln., lmy, dns. w/ crinkley laminae on ridge to the south.
Appears to have been carb. mud orig. and may be burrowed (?).
Dolo. weathers lt. gry to orng. brn. and brn. (f)

stop #7

intr bdd. graphitic phyllite and sil. sltst. (shist) and meta. ls.
All MS

stop 8

Metamorphosed ss., weathers org. brn. mixture of carbonate & silica grains, x-bdd., w/ ripple marks. Contains chloritic bands. Intrbdd w/ meta. ls. Sandy ls. is in places highly burrowed. Burrows // to bddg.



RRR 240
F

Base of thick carbonate unit w/ possible fossils. Ls., lt. gry. (w), med. gry. (f), f. xln., w/ fract. fillings. Strong fetid odor in some pieces. This ls. may be biostromal (contains colonial corals, and branching coelenterates possibly stroms or corals)

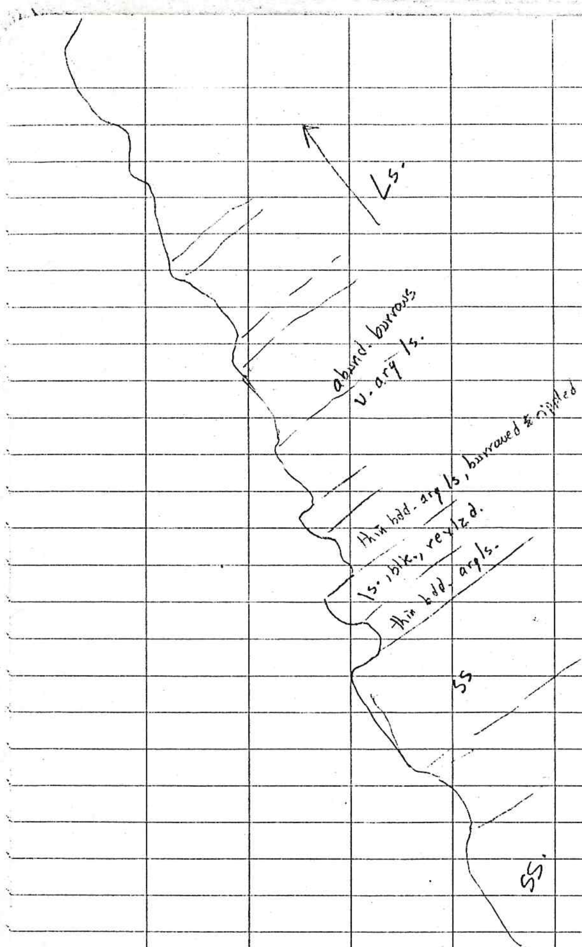
RRR 241
F

stop 9 — down the ridge from the last stop and up stratigraphically in the carbonate unit. Here the Ls. is thin bdd., v. arg., micro xln. w/ foss. Minor intbdd. phyllitic ls.

RRR 242
conodont

RRR 243
F

V. arg. med. gry. Ls. that is a biostromal mass. Thin bdd. w/ occas. v. calc. sh. bdds.



stop 10 Area of 1970 Pan Am Upper Omar River Section of Utukok(?)

Took 1 Picture

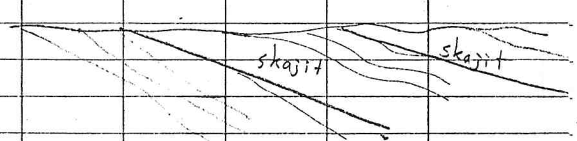
135° az. 55° S

Sequence is intrbdd. sss & ls. (mostly ss.)

Ss., gry., silica & calc. grs., low angle x-bdds., v thin-thin bdd.; Ls., gry. thin bdd. w/ few foss., sndy.

Ls. is predominant on top of Mtn. and down the other side.

The contact w/ lt. gry carbonate is a fault. On ridge to the east there are two thrust sheets bringing lt. gray carbonate (Skajit?) over Utukok(?)



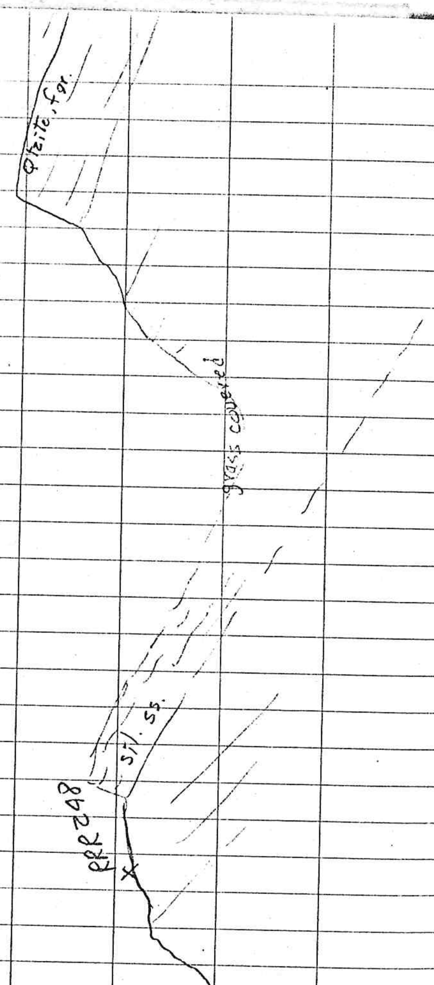
The general feeling is that there is more faulting in the area than can be seen readily. There is folding and possible overturning in the area.

Stop 11 — Ls., lt. gry (w), med gry (f), rexlzd. f-crs xln., silicified w/ abund. stroms., some brachs. Minor black chert. This carb. is Skajit. Some has fetid odor. There is scattered ss. float coming from top of Mtn. that may be Wtukok

RRR 244
F
&
one large
rock

RRR 245
F

The large specimen has the number RRR 244



June 19

Fog in the morning and could not start work until 10 am.
Many cumulus clouds in the Baird Mtns.

RRR 246 F
RRR 247 C
one open sample w/ RRR 246

Dolo.; gry, microxln., w/ abund. qtz. veins and fossil debris.
Stromatoporoid material indicates an age of Dev. or older.
This is an area of faulting as evidenced by stratigraphy and mineralization (qtz veins & copper stn.)
Some Dolo. has residual petroleum product between dolo. xls.
Some dolo. w/ fetid odor
MS rocks occur on top of the carbonate south of the saddle.

RRR 248 Paly

Shale; dk gry., phyllitic, check for palynology.
Just above this shale is a siliceous ss w/ no porosity.

RRR 249
Poly

RRR 250
F

RRR 251
F

brown weathering gray shale (sli. phyllitic) intrbdd. w/ sli. calc. sltst. and vf-f gr. sil. ss.
May be Huntfork For.
Ripples and worm trails on some bddg. planes.
Found a thin bd. w/ brachs, crinoid columnals, & clay pbls.

June 20

Beautiful day - only a few high clouds and no wind.
Joe, Tom, & Keith went to KOTZ early to order some parts for the helicopter.

stop 1 Metased. (Mets) Schist & phyllite w/ abund. bull qtz. Phyllite is gry w/ sheen. Appears as tho the orig. rock was shale, sltst. & ss. Neary Kleary B.M.

stop 2

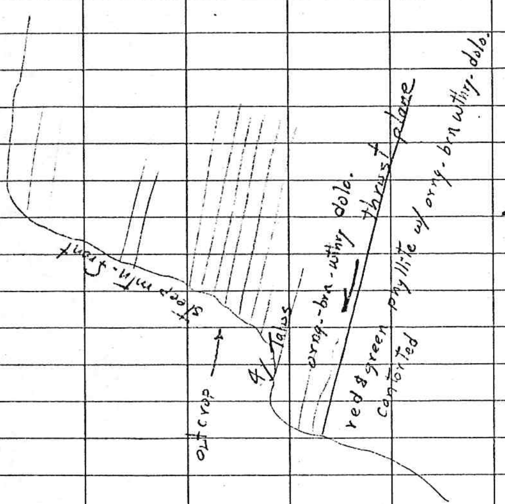
lt. buff brn. rock intrbdd. w/ schist. Dolo., brn. gry (w), med. gry (f), micro xln., good fetid odor on fresh surface, brecciated. Dolo. clasts are cmtd. w/ drussy dolo. xls. and caclite veins. Breccia appears to be Tectonic.
Schist and phyllite (sli. graphitic) surround it. Feeling is there are multiple faults assoc. w/ the carbonate breccia

stop 3

Top of 1970 Pan Am Ains Mtn. section.

The Ains Mtn. carbonates are GiveTian. There are igneous rocks on top of the hill. Looking west we see a thrust that has brought black carbonate over metamorphics. Took Picture.

stop 4



On small knob just above suspected thrust. Possible the thrust is flat & is below the Ains Mtn. Section but not exposed.

The rock forming the steep mountain face is Dolo., intrbdd. med-dkgry (w), dkgry (f), microxln., w/ calcite filled oval voids. Many beds extensively burrowed & many algal mats (w/ intrafor. breccia). Mud cracks in algal mats. Occas. dk. gry. phyllitic intrbds. Contg. sh. laminae. Supratidal-interTidal environment.

stop 5

Ls., f-med. xln., lt brn., w/ schistose features. Metamorphosed.

stop 6

Ls., dk. gry.-blk, microxln.: metamorphosed w/ shaly streaks.

stop 7

Ls., med.-dk gry (f), orng. brn (w), microxln., metamorphosed. Isolated tectonic breccias w/ angular blocks showing algal laminations.

stop 8

Very lt. colored ridge composed of very metamorphosed conglomeratic ss., ss., and shale. w/ abund. qtz. veins. Congl. ss shows very elongate pbls. and ss. matrix turned to shattered qtz.

RRR 252
L

Abundant bear droppings in the area

Congl. is made of pbls & cobbles of wh. qtz. & gry. cht.

stop 9

Qtzite, lt gry (f), f.gr., s&p, w/ scattered pbls. Assoc. qtz veins.

Phyllitic blk. shale as occas. intrbds. Congl. bds. w/elongate pbls. and sandy matrix.

stop 10

Phyllite, red intrbdd w/ metamorphosed schistose gritst.

stop 11

In small saddle — Rocks made of metamorphosed ls., ss (vfgr), and shale.

Above and to the NW of the saddle is the same carbonate seen in stop 4 (on steep mtn. front)

To the south is mostly metamorc. ls. w/ one well developed augen of dk gry. schist. Algal lam. are present in the carb.

stop 12

Green schist and dk gry. phyllite intrbdd.

Hockley Hills

330° az (dip) @ 52° N

RRR 253
f

Sequence of intrbdd. sss, sli. calc. mdst., and highly calc. (limy) mdst or v. arg. ls. This ls. or mdst. has pene contemp. def. and micro x-lam.

RRR 254
Paly

Ss., calc., vf-f gr., grnsh-brn., wacke, thin bdd., x-bddg & scour & fill (both small scale)

RRR 255
mega flora

RRR 256
Mega flora

Hockley Hills Cret.
taken from same place as RRR 218 & 219

June 21

Beautiful weather again – clear in Kiana w/no cumulus in the Bairds

stop 1
Interbdd. schist, qtzite, & crs. x/n metamor. ls. Ls. restricted to 10-15' layers but thin foliated

stop 2
Same rocks as @ stop 1
N 70° E dir. of dip ~ 23°
The Ls. here and above appears to have good porosity due to crs. xls. formed during metamorphism
The dip of the beds is nearly due East here while @ stop 1 it was nearly south. Qtzite made of v.f. qtz grs.

stop 3

N-S dip dir. 17° Taken on metamor. ls. sequence w/ thin brn. schist intrbds. Ls., dkgry, med. crs. xln and appears to be thin bdd (foliation planes)

RRR257 C — These rocks are in the Mets. Picture - Roll 1 frame 20
Some bdd. plane faulting & poss. some normal faulting.

stop 4

Landed on schist (Mets) and walked west up hill into Meta carbonate (ls.) that rests on the Mets. The ls. is lt.-med. gry (w), lt. gry (f), micro to crs. xln., sli. metamorphosed. Check for conodonts. Mostly microxln ls.

RRR258 C

RRR259 C

Possible bioherms scatt. thru out

stop 5

Same carb. sequence - some highly fractured. Sample of dkgry med. xln., w/ qtz grs., arg. Some carb. with wh. cht replacement in massive

RRR260 C

irreg. forms. Cht. maybe replacement after qtz. rich beds.

stop 6

Questionable Mets.

Schistose ls., med. gry., hd.

stop 7

Meta carbonate - Ls. & Dolo. intrbdd. Ls. w/ algal laminae & burrowing. These carbonates lie on top of the Mets. Dolo., micro-vfxln., orng. brn (w), med gry. (f).

Lunch stop too.

Stop 8

Landed on Meta carb. - Dolo. med.-ltgry. (w), Med. gry (f), dnse. Up the hill is contact w/ poss. stratigraphically lower but topo. higher schistose ls., orng. brn to gray (w); med gry (f). Contact appears to be a high angle fault.

RRR 261 c

Qtz. & calcite veins near contact together with brecciated dolo.

RRR 262 F & f
RRR 263 F & f

Dolo., dk. gry., dns., stratigraphically higher than RRR 261. This dolo. contains algal material and very large brachiopods.

8 foss. dolo. pieces are not in bags

stop 9

Same carbonate as seen in the lower strat. position @ stop 8

stop 10

RRR 264 F & C

Contact between orng. brn weathering schistose crs. xln. ls below and med. gry (w), blk. (f), fxln. limy dolo. Near the base is abund. small scale brecciation. Minor thin gry. cht. bands. Thin intrbds of v. lt gry. vf-fxln. dolo.

stop 11

Orng. brn. schistose Ls. & Dolo. below
and Ls., dk gry.-blk., f. xln.,
strong fetid odor, dns., thin bdd.
occas. cht. bds. (discontinuous)
In this mountainous area there
are numerous faults between
the two carbonates.

Pbl. Count #1

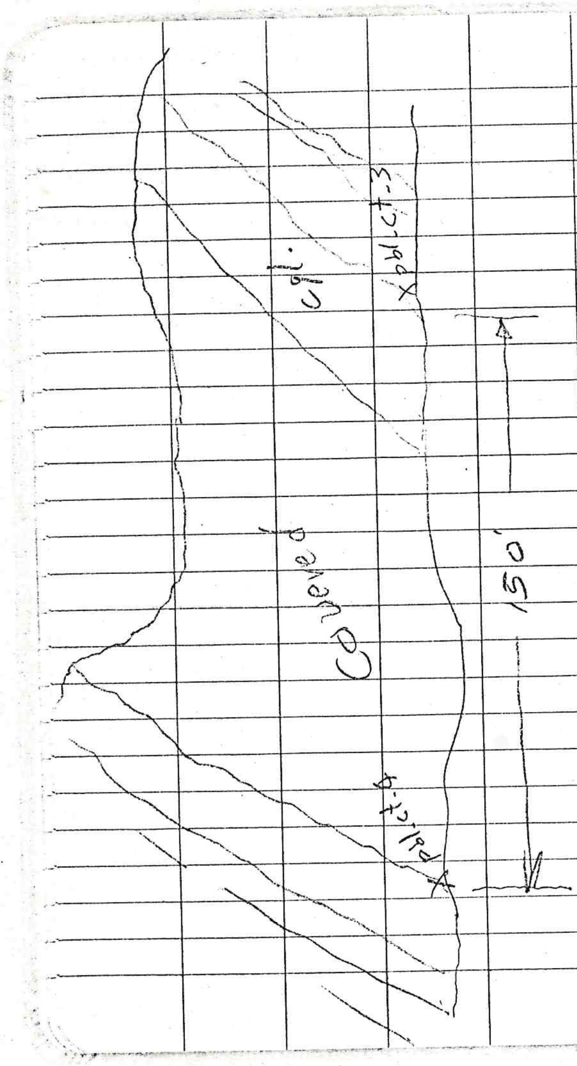
Dk. Gry. Ls.	~~IIII~~ III	8
Dk. volcanic	~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ I	26
Calc. Sltst.	IIII	4
lt. gry ls.	III	3
lt. milky Qtz.	I	1
lt. Grn. Volcanic (chert?)	~~IIII~~	5
lt. Volcanic	III	3

Pebble Count #2

Dk. volcanic	卌 卌 卌 卌 卌 ||||	2[illegible]
Dk. f gr. ss	|||	3
Lt. volcanic	||||	4
Dk. sltst.	|||	3
Dk. chert	|||	3
Vein Qtz. w/volcanic	||||	4
lt. cht.	||	2
Granite	|	
Argillite	|	

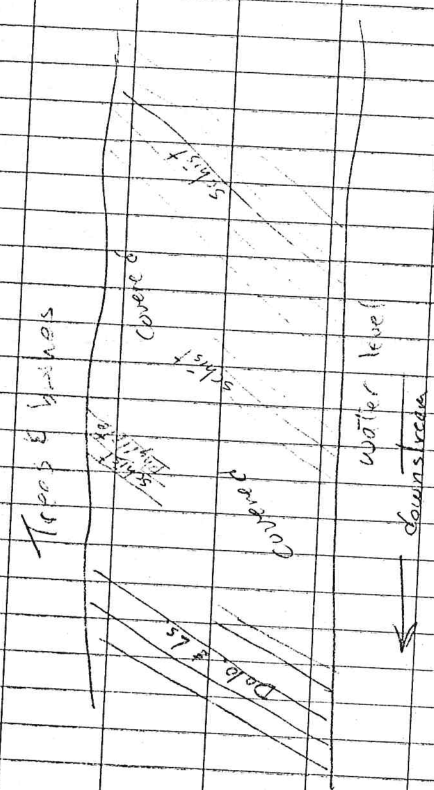
Pebble Count #3

Dk. Volcanic	~~||||~~ ~~||||~~ ~~||||~~ ||	17
Granite or Diorite interned. igneous	~~||||~~ ~~||||~~ ~~||||~~	15
lt. Ls.	|||	3
Dk. Chert	~~||||~~ ||	7
Dk. sltst.	||	2
lt. volcanic	||	2
Dk. Ls.	|||	3
Vein Qtz.	|	1



Pebble Count #4

Dk. Volcanic	𝍸 𝍸 𝍸 𝍸 𝍸 |	26
lt. chert	|	1
Granite (intermed. igneous)	𝍸 𝍸 |	11
Vein Qtz.	|||	3
Lt. Ls.	||	2
Lt. Volcanic	𝍸	5
lt. sltst.	|	1
Argillite	|	1



June 22

Rained early this morning but by 8:00am sun was out. Lloyd & Bob took boat to work river and Barry & Dave flew West by helicopter.

Stop 1

195° Az. dip dir. @ 22° taken on gray & orng.-brn. weathering schist. Schist contains large well developed xls. (pyroxene?). Becomes more phyllitic down stream. Schist down stream is pinkish w/ smaller xl. augens developed.

Dolomite is dns., vfxln - microxln., lt. gry. ; Ls. is gry., vfxln., laminated, dns. (? algal lam.)
182 dip az. @ 42°

Sequence repeats downstream and there is intrbdd. phyllite, schist, ls. & Dolo. There is good gradation

from gry. schist - phyllite - dirty ls. Was originally a sltst.- shale - ls. sequence. Ss. was also a common part of the section and is now crs. schist.
300'± of section exposed

stop 2
290° az. dip dir. @ 15° Taken on gry. schist. Rare garnets in some of the schists. Thin schistose qtzite bd. near the top. About 20' section exposed.

stop 3
Sequence of Mets. consisting of schist. Grades from f-crs. xln. Appears to be jointed and contorted so beddg. not apparent.
175° az. dip dir. @ 20° Taken on schistose plane that could be [illegible]

stop 4 stop to see small hill away from river — Appears to be a river terrace w/ gravels

stop 5

Congl., poorly srtd., framework varies from 8" cobbles to grit size. Matrix is med. to crse gr. sd., sli. calc., iron stained.
Cobbles & pbls. consist of med. gry ls., 40% metamorphics, 15% bull qtz., 40% cht.
1 Picture taken

stop 6

Congl. beds in vertical cliff.
300 az. for strike and vertical dip.
One thin (6"-1') ss. bd. which is scoured by overlying congl.
Matrix is crs. ss, w/ silica cmt & minor iron stn.
Congl. framework about 80-90% milk wh. vein qtz. and ~10% metamor.
Framework is mostly med.-sized pbls. w/ occ. cobbles up to 8" in longest diameter

Pbl. Count from stop 8

Vein Qtz	||||/ ||||/ ||||/ ||||/ ||||/ ||	27	RRR 265 Paly
Schist	||||/ ||||/ ||	12	RRR 206 L
Dk ls.	||||/ ||||/	10	
Rd. Chert	|	1	

stop 7

Sequence of sandy pbl. cgl. w/ thin dirty ss and sandy sltst.
Sequence of channel congls. overlain gradationaly by pbly ss. sandst., and silty ss.
Congl. about 80% vein qtz & 18% metamorphics, & 2% dk. volcanics & others.
silty ss. is orng brn to red
Pebbles average 1/2". No large cobbles. E-W strike 80°N

stop 8

200 az. on dip @ ~15° taken on crs. pbl. congl. w/ sd. lenses. — RRR 207 Paly
Congl., consists of ls., vein qtz., metamor. & dk vol. pbls. Poorly srtd.
Matrix is crs. sd, sli. calc. — RRR 208 mega flora
Pbl. size ave 1", max. 5"
About 20' cgl.
Rd. sltst. above, thin bdd, v. mic.
Grades up into gry. arg-sltst. w/ plant debris. Paly sample from here.

Pble. Count for stop 11

Vein Qtz	||||| ||||| ||||| ||||| ||||| |||	28	
Sideritic sltst.	||||| ||||| ||||| ||	17	RRR 269 paly
dk. Ls.	||	2	RRR 270 mega flora
Schist	||	2	RRR 271 mega flora
Dk Volcanic			1	

Red and gray sltst. are intrbdd.
worm burrows in gray sltst.

stop 9

72° az. dip dir. @ 10° taken on thin ss & cgl. bed (4' thick)
Congl. appears to have less vein qtz pbls.
Scatt. ss. beds appear above the congl. and a coal appears as abund. float @ top of river bank

stop 10

330° az taken on trough x-bddg. Small cliff of cgl. & cgl.-ss.

stop 11

200 az. on dip dir. @ 10° taken on channel x-bdd cgl.
Ave. pbl. size 3/4", max. 4-5"
f-med. gr., good srtd., calc., matrix.
Md. gr., fair-good srtg., v. qtzose, sr-sa
good p&p, friable, sdst. lenses

Pbl. Count of stop 12

Vein Qtz	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ||||
Dk Volcanic	||||
Dk Ls	~~||||~~ ~~||||~~ ||||
Schist	~~||||~~ ||
Sideritic sltst.	|

Pbl. Count from stop 13

Vein Qtz	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ |||
Schist	|||
Dk. ls.	~~||||~~ ||
Sideritic sltst.	~~||||~~ ||

This congl. outcrops semi continuously for several miles along the Kobuk River.

Stop 12

end of continuous outcrop.

175° az. on dip dir. @ 45°

Congl. & ss intrbdd. (60% congl.)

Congl., pbl. size ave. 3/4", max. 4", matrix is med. gr., poorly srtd., sa, v. sli. calc.

Ss. intrbds — crs. gr., sr, poorly srtd., silty, qtz, some cht. as framework, v. calc., trough x-bdd.

Ss. is more abundant down section especially near base of observed outcrops

Stop 13

165° az. dip. dir. @ 43° taken on Cgl. & ss bd.

Cgl. matrix crs. sd., sa-sr, poorly srtd., sli calc., fair p.s.p. Pbls ave 1/2" and max. 3"

Coal float found between prominent

	congl. ledges. Does not outcrop but
RRR 272 paly	float is restricted to one area.
	Stop 14
	250° dip az. @ 17°
RRR 273 paly	intrbdd. cgl., ss & orng. rd. sndy
	sltst. Mostly cgl. down section
	from stopping place. Ss. mostly
	vf gr., silty & carbonaceous

June 26, 1971
Clear, Smoky, + Hot
Rosé, Furer, Abrahamson
worked the Central Waring Mts. and checked the Metamorphics N.E of Kiana. Benny stayed @ Kiana and worked on the photos of the Waring Mts.

Stop #1
Dip Dir. Azi. 152° @ 60°
outcrop appears to be right-side up
Conglomerate + Sandstone interbdd.
Ss; w-brown, f-olive brown, fn gr, qtz framework, sub ang to sub rnd, non-calc, 10% blk fn grs, appears to be a wacke, iron + silica cement, poor ϕ + perm, some x-bdg
Cgl; granules to 10" to 12" boulders, ave. size ≈ 1"; matrix is sandst, fn to med gr; a wacke, fair sorting.

Some small pbl cgl has a silty mdst matrix.

Pebble Count @ Stop #1

Granite	////	4
Basic Igneous	⁄⁄⁄⁄ ⁄⁄⁄⁄ ⁄⁄⁄⁄ ⁄⁄⁄⁄ ////	24
Inter. Igneous	⁄⁄⁄⁄ ⁄⁄⁄⁄ ⁄⁄⁄⁄ ⁄⁄⁄⁄ //	22

Between the more resistant weathering interbdd cgls + ss are swails probably formed by less resistant siltsts + mudsts.

Stop #2

Dip Dir. Azi. 200° @ 20°

Sandstone; w-brown, f- olive gy, fn to med gr, sub ang., fair sorting, minor silt mixed w/ sand, ss is highly x-bdd (dish shaped), non-calc, a wacke, iron + silica? cement, poor perm. + fair Ø.

Appears to have thin interbeds of mdsts + siltsts. Siltsts have carbonaceous debris.

Minor interbeds of f-dk gy, dense, argillaceous Lsts (lime mdsts), vy fnly laminated.

Lime mdsts — RRR 274 Poly

Stop #3

Dip Dir. Azi. 165° @ 40°

Conglomerate; Approx. 200' thick of massive conglomerate w/ indistinct bdg. at this locale This Cgl. body appears be a large lense which pinches out to the East + to the west.

Matrix is ss; med to crs gr, predom. rock grs, other grs are qtz + cht, subrnded, well cemented w/ iron + some silica, fair sorting, poor Ø + perm.

Cgl; small pbls to 8" boulders, ave. pbl size ≈ 1¼".

Note:
Conglomerate @ Stop #3 appears to be a channel deposit.

Pebble Count @ Stop #3

Basic Igneous	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~		31
Inter. Igneous	~~||||~~ ~~||||~~ ||||	14
Dk chert	~~||||~~	5

Stop #4

Grnish gy phyllite w/ wh qtz veins.

Stop #5

Black Phyllite; highly siliceous, vy hard, highly graphitic. Forms resistant Black Knobs.

Appears to be in contact w/ grnish gy schist.

Stop #6

Interlayered dk gy phyllite + brown weathering meta (foliated) Lst; Meta lime is dk gy fresh. Also interlayers of dk gy papery shale?;

Common qtz veins.

May have been a complex of interbdd Lst, shale, + sltst before being metamorphosed.

Stop #7

Strike Azi. 220° appears to be high ∡ of dip.

Conglomerate; pebbles to 12" boulders, abdt wh qtz carb., + meta carb. boulders.

Cgl; w-wh, highly indurated w/ abdt calcite cement,

matrix is crs ss + granules cemented by calcite, sub ang to subrnded, minor amt of iron stain.

Pebble Count @ Stop #7

Wh. vein qtz	////- ////- ////- ////- ////- ////-
Lt. meta. Lime	////- ///
Dk Meta. Lime	////
Dk phyllite	///
Dk Lime	//
Qtzite	//
Qtzose schist	/

Sandstone w/ abdt wh. vein qtz pbls and rare dk lime + phyllite pbls. SS, med gr, subang to subrnded, fair sorting, iron stained, cemented with calcite + iron.

Cgls + Sands are interbdd.

Stop #8

Grnish gy, schistose meta ss? or siltst?

Stop #9

Grnish gy, schistose rock as at Stop #8.

Book #2

Book # 2

Table of Contents

DWA	Photos Roll 2	K II ASA 25 (Set 25)
1 5/16		
2 "		
3 "		
4 "		
5 5/17	Old Cabin + me along Kobuk	
6 5/17	View N. along Walker Lk	
7 5/18	Flower photo	
8 5/21	Interbedded metaCarb. + schist (Kiana Hills)	
9 "	Isoclinal fold in abv. carb.	
10 "	flower picture - lupin	
11 5/22		
12 "		
13 "		
14 5/22	Igneous Body at Mount Bastille	
15 "	Fire N.E. of W. Thompson's Cabin	
16 "	"	
17		
18 5/23	Kobuk Sandunes from W. Mts.	
19		
20		
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Stop #7 –
brownish orange weathering schitose meta limestone.

Stop #8 –
dk gr.gy mafic volcanic; med xln

Stop #9 –
med xln, lt gy w., dolo

Stop #10 –
orange gy w. sheared, foliated meta lime

Stop #11 –
Orangegy w. meta limestone

Stop #12 –
lt gy w., vy lt gy f., crsly rexln Linest.

Stop #13 –
lt.gy w., vy lt.gy f., fnly to med xln dolomite.

Stop #14 —
grgy micaceous slate or argillite; common qtz veins; slightly metamorphosed silty? shale.

Stop #15 —
DWA 280C + 281F (Skagit?)
med lt gy w., med gy f., fn-gr. limestone; common fossil hash (wackestone?). Minor solitary rugose corals, minor small brachs, abdt crinoid hash, + small unidentifiable bugs or frags.
Lime is dense — vy low Ø + perm.

Stop #16 —
Highly silicified fault breccia + highly contorted + brecciated Lst.
DWA 282F — chert in Lst boulder along stream @ stop #16. Abdt megafossil debris

Stop #17-
lt gy, med xln, recrystalized Lst, hd + dense, highly fractured w/ calcite vein fracture fillings. In a highly sheared zone.

Stop #18-
Ss; f-med gy, w. surface dk due to lichen cover; silicous, highly quartzose, w/ common dk grs; fr sorting, fr to med grnd., hard, appears to have poor Ø + perm.

Stop #19- DWA 283C + 284F
Orange brown weathering, dk gy limestone, interbedded w/ calc. black shale layers. Lst is f micrograined w/ abdt fossil debris. fossils are predominantly crinoid stems but a few brachs + corals were seen also. Lith is a wkst interbedded w/ black shale. Lime beds are up to 10" thick shale beds usually less than 2" thick.

DWA 285 Paly

The outcroppings of this unit display well developed fracture cleavage.

(Akayak? Equivalent.)

Has limonite pseudomorphs after pyrite. Unit shows ~~poo~~ no Ø or perm.

Stop #20 -

Kotzebue for fuel, mail, + copter parts.

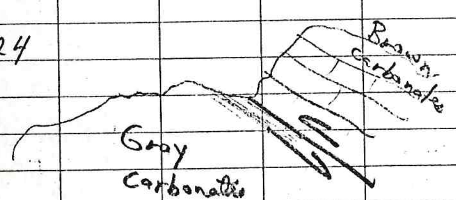
Stop #21 -

dkgrnish gy igneous or volcanic rock. Rock has some banded texture.

Stop #22 -

Grnish black ultramafic igneous body. Has shear zones within surrounded by non-sheared areas. Weathers ~~an~~ orange brown color to dk gy color. Orange brown along shear zones.

Stop #24

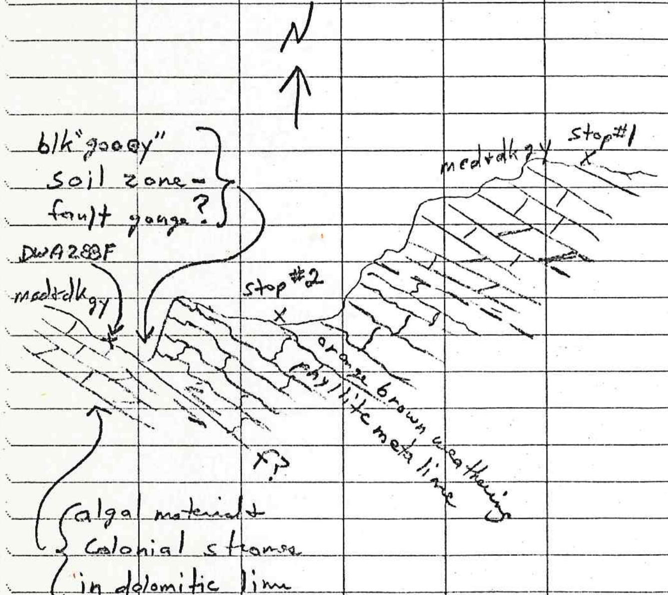


Stop #23 –
Metasandstone + Metashale.
Schists + phyllites

Stop #24 –
Thrust fault ctk between Gray Carbonates underlying Brown Carbonate. Top of Gray Carbonates are highly sheared

Stop #25 –
DWA 286C
Orange Brown weathering Limestone, f-dk gy, abdt burrowed + bioturbated zones interbedded w/ unburrowed zones. No megafossils were seen. Lime is micrograined to med. rexln in places; fm. is Utukok? but no silty or sandy units were seen.
Surrounding mts. appear to be structurally complex including faulting and folding (some infolding) within the gray lime unit + orange brown lime unit (Utukok?).

June 23, 1971
Clear + warm.



Stop #1

Dk gy weathering Carb. (Dolomite+Lst) fresh - med^Hoblkish gy, fn to med xln^(dnd) poor Ø + perm; Unit displays med to dk gy banding (bedding); Some units contain dk gy silicified stromatoporoids? + other small unidentified bugs; Lst beds which contain the fossils are blkish gy + are med to crsly rexln.

DWA 287F

Some units have abdt strome? debris

Silurian? Age.

Some of the Stromes ^are buildups (bio-herms) while some are biostromes.

Stop #2

Brownish orange weathering phyllitic meta. lime; med to crsly rexln w/ mica along foliation planes;

Appears to be stratigraphically lower than Stop #1.

Weathers into "klinkly" plates.

Foliation planes in places display wavy folding.
Calcite vein fillings are common thruout this unit. Minor qtz veins are also present.

DWA 288F

Stop #3

Orange brownish phyllitic meta lime in cth w/ overlying dk grn ~~~~ fnly xln igneous. At ~~~~ top of phyllitic meta lime and at bottom of igneous is a med gy lime w/ abdt slickensides along grnish gy planes. This gy lime zone may have been baked by intrusion of igneous body along a fault zone. This gy lime has also been isoclinally folded in places. Chilled zone overlies the gy carb. + is ≈ 12"-18" thick.

Stop #4

Highly chertified (med to dk gy), fossiliferous Dolo. Lisburne?. Actually highly fossiliferous chert after limestone. Abdt crinoidal debris + other fossil

frags. Small pods of lt gy, med rexln limey Dolomite remain in the chert.
DWA 289C + 290F
Original lith wkst-pkst?
Minor colonial corals!
Minor secondary qtz or vein + vug fillings + linings.

Stop #5
Reddish brown weathering, hackly to pencil fracturing silty clayst; f- grnish gy; in part covered by dk gy lichens; is siliceous + hd; ~~no apparent bedding.~~ Beds are standing vertical + are highly contorted; in part the unit is siliceous, hard shale; this shale weathers brownish greenish + red, f- shale color is grnish gy. Some highly siliceous clayst (almost a chert).
DWA 291 paly

In part has subconchoidal fracture. Blk cht overlies this unit.
Kayak?

Stop #6

~~Highly~~ silicified silty clayst ~~ash~~ sh as at Stop #5. The clayst-shale unit is overlain by a highly chertified carbonate unit (Lisburne?). Is this clayst-shale unit Kayak?

DWA 292 Paly

One shaly bed in this unit has a dk gy to blk color + contains small carbonaceous fragments. This bed was sampled for paly (DWA 292 Paly).

Stop #7

Black cht; common qtz frac. fillings. Some argillaceous "sooty" zones in a few of the chert pieces. A chertified black Shale? Also some black carbonaceous sooty (siliceous in part) shale.

DWA 293 Paly

Lunch —

Stop #8
reddish brown weathering sandstone + dk gy carbonaceous shales. It gy fossiliferous lime pods in the shales. Sandstone has chert granules, crinoid frags and is a dk brn gy. The units are highly contorted. Lst has abdt fossil debris - mostly crinoid frags.
DWA 294 Paly - dk gy to black shale

Stop #9
Gas stop at Igloo Lake

Stop #10
Black cht + yellowish brown siliceous ~~shale~~ limestone. ~~Shale~~ Limestone fresh is dk gy. Limestone is highly siliceous, hard, and dense. Lime has no Ø or perm. Lime displays subchoncodial fracture. Chert has possibly replaced original lith of limestone. Minor crinoid debris
DWA 295 C of siliceous lime

Kayak?

Stop #11

Dk brown weathering mafic igneous body at Mount Bastille. Contains Large pods of lt gy weathering lime. Possibly the lime was ripped up by + incorporated into the igneous ~~bd~~ body during emplacement.

DWA 296C + 297f

DWA 296C of lime pods
DWA 297f of dk olive gy siltstone between igneous layers.

Stop #12

Warren Thompson's Cabin for fuel.

Stop #13

Kiana

End of Field Day

June 24, 1971
Clear + hot (82° @ 8 A.M.)

Stop #1
Pbl Cgl. Pbls are predominantly wh vein quartz (>80%)
Orientation N40E, 70°N
Ave. pbl size about 1" max. ≈ 4"
Minor schist + dk volcanic pbls.
Matrix is crs, subang qtz + vein qtz, iron cement, poorly sorted; some w/ milky qtz as cement.
Has med gr, lt brown ss layer between cgl, siliceous cement, orange limonite specks, subang, qtz grs w/ possibly 10% black grs, also some altered clay minerals in matrix.

Stop #2
Gravel; abdt qtz pbls

Stop #3
Gravel

Stop #4

lt brown weathering ss; f- olive gy, calc., vy fn to crs gr, poor sorting, subrounded, predominance of wh qtz, equal amt of rock frags (volc + meta), grn grs, matrix $CaCO_3$ + iron + probably some clay. Ss is x-bdd.

Interbeds of vy silty mudstones containing scattered grit to small pebbles up to 2"; also contains carbonized plant frags. Mudsts are noncalc.

<u>DWA 298 Paly</u> + <u>299L</u>

Beds appear to be steeply dipping.

Stop #5

Conglomeratic, sandy Mdsts w/ thin ss interbeds. Silt + med gr sand in Mdst is abdt, calc, poorly sorted, boulders up to 12", Pbls + boulders predominantly grnish dk volcanic + felsic igneous.

Appears to be steeply dipping (≈ 70°) to the West (N90W).

Sands are x-bdd.

Pebble Count @ Stop #5

Dk volcanic	~~||||~~ ~~||||~~ ||	12
Granite	~~||||~~ ~~||||~~ ~~||||~~	15
Int. Igneous	~~||||~~ ~~||||~~ ~~||||~~ |||	18
Med gy lime	||	2
flint	|	1
Bull qtz	|	1
Basic Ig	|	1

Stop #6

Lt gy br weathering ss; fn to med grnd interbedded sand, grs are subrnded, qtz + feldspar + abdt black grs (predom.) + rock frags; matrix is silt + clay mixture, med. sorting, appears to have poor ø + perm.

Some interbeds of gy brown, micaceous sandy, argillaceous siltstone; contains carbonized plant fragments.

Note: Ridges are held up by Conglomeratic Units + Sands. Valleys appear to be composed of Silts + mdsts. Carbonaceous debris in silts.

Note:
Dk Volcanic = Aphanitic dk igneous

Stop #7

Conglomeratic sandy siltstone; granules to 10" boulders; breaks down easily; siltst is "matrix", sandy (vy fn to fn gr); non-calc, vy argillaceous, olive gy-f, w-brown; Pb's seem to float in siltstone.

Interbedded conglomeratic sltst + Pbly SS. Ss is w-olive gy, f-olive, fn gr, silty + argillaceous, non-calc, fr sorting, subang to subrnded, qtz + feldspar + rock grs.

Siltst - DWA 300 Paly

Pebble Count @ Stop #7

Dk Igneous	~~||||~~ ~~||||~~	10
Qtzite	|||	3
Dk Chert	||	2
Dk Volcanic	~~||||~~ ~~||||~~		11
Int. Igneous	~~||||~~ ~~||||~~ ~~||||~~ |||	18
Gneissose Granite			1
Silicified Carb.			1
Porphyritic Dk Volcanic	|||	3
Granite			1

Stop #8
Conglomerate; w-brown, outcrop dkgy due to lichen cover; granules to boulders 16" max.
More larger pebbles + boulders than previous stops.
Matrix is SS; med to crs gr; some details as SS @ Stop #7.
Common crsly xln dkgrnish gy Igneous boulders.

Stop #9
Dk gy f, dirty Ss.

Stop #10
Ss; w- lt brown, f- dk olive gy, f gr, v/y argillaceous, non-calc, sub ang to sub rnded, grs not identified. Ss grades into mdst; mdst is dk olive gy.
Ss is fnly laminated.

Stop #11
SS + vy calc fn gr ss; dk gy-f, w-brown. Overlain by sitstones, mdstn, vy small pbly (less than ½") mdsts and ss's; sandstones fn to crs gr. All apparently are intimately interbedded.
Lunch Stop

Stop #12
Brown weathering, med dk gy fresh, vy calc, ss; fn gr, w/scattered crs grs, grs hard to distinguish - not identified, feldspar?, qtz, + black grs., poor Ø + perm.

Stop #13
Fuel Stop @ Ambler

Stop #14
Conglomerate; w- brown but covered by lichens, f- olive brown, indistinct bdg, fairly well cemented, granules to 12" boulders, matrix is a mixture of silt + mud, cemented

Pebble Count @ Stop #15

Granite III 3
Dk Chert 卌 卌 卌 15
Basic Igneous 卌 卌 卌 卌 卌 I 26
Basalt I 1
Lt Chert I 1
Inter. Igneous II 2
Crinoidal Cht I 1
Silicified Shale I 1

by iron + silica.
Appears as though the finer pbls are mixed within the matrix with a framework of large pbls to boulders.

Pebble Count @ Stop #14

Granite 卌 III 8
Inter. Igneous 卌 卌 卌 卌 卌 II 27
Basic Igneous 卌 卌 III 13
Dk gy chert w/qtz veins I 1
purple rhyolite I 1

Stop #15
Massive Conglomerate overlying ss?; Matrix of Cgl is ss, fn to med gr, subang to subrnded, cemented w/ iron + silica, poor ø + perm., Cgl framework varies from granules to 12" boulders.

Pebble Count @ Stop #15
(Left side of page)

Stop #16

Conglomerate; gy lichen covered, average pbl size ≈ 1/2", max. size 3" or 4", poorly sorted med. sand matrix; Conglomerates are thin, planar bedded.

Fault cuts N-S. East of this hill. Beds dip differently from Stop #15.

Beds @ Stop #16 dip azimuth of 300° w/ a dip angle of 16°.

Stop #17

Conglomerate; w- brown but appear dk gy due to lichen cover; abdt qtz pbls (>95%) - wh bull qtz, granules to 3" pbls; qtz pbls weather out littering slope, highly indurated with silica + iron, pbls not qtz are dk gy to black siltstone.

Beds @ Stop #17 appear to be steeply dipping to the North. Strike of beds parallels the ridge top.

Stop #18

Dip Direction Azimuth 270° @ 35°.

Dip taken on interbedded sandy conglomerate + conglomeratic

Sandstone; Pebbles approx. same composition as Stop #15. pbl size ave. ≈ ½", max. size ≈ 3".

Sandstone appears to be x-bdd, is med gr; carbonized plant debris in pebbly SS; cemented by iron + silica.

Sandy Siltst - DWA 301 Paly

Stop #19

Dip Azi. 260° @ 32°

Interbedded Cgl + SS's.

Stop #20

Dip dir. N30W @ 30°

Qtz pbl rich Cgl

Stop #21

Dip Dir. N 10W @ 30°
" " N 0W @ 33°
taken on dk. cgl. that contains abund. basic & inter-med. igneous pbls.

Stop #22
Strike N 90E @ 27° N

Taken on wh pble qtz cgl

Stop #23

Strike N 85W (95E) @ 85° N . Intrbdd. cgl. & ss. Cgl. dk in color (made of dk pbls).

Stop #24

Sandstone; dk gy, fn gr, calc, deeply weathered to a dk br, fair sorting, poor Ø + perm., carbonaceous debris.

Stop #25

Conglomerate w/ ss matrix;

Sand matrix has iron + silica cement, has granules, abdt qtz grs, fn gr, fair sorting, subrnded to subang. Pbls ave. 1" up to 4" max size.

Massive Conglomerate

Pebble Count @ Stop #25

Granite	III	3
Basic Igneous	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 III	33
Rhyolite	I	1
Inter. Igneous	𝍸 𝍸 II	12
Acidic Igneous	I	1

Dip Dir. Azi. 157° @ 43°

June 25, 1971

Notes taken by Lloyd Furer and related to Dave Abrahamson who has here recorded them. 6/25/71

Sta. 1
Meta. dolomitic Lst; vy frac. + sheared

Sta. 2
Schist

Sta. 3
Interbdd grn phyllite + dk blk grn meta. basic igneous

Sta. 4
Meta. dk gy ign. sills; phyllitic; interbdd w/ meta dk Lst. Lst is nearly a marble in places, cut by qtz veins. Two sills vx obvious in mt. side + interlayered w/ Lst. Entire Sequence

has been metamorphosed.

Sta. 5
Dk basic igneous; looks porphyritic

Sta. 6
Intermediate Ign. intrusive; Andesite;
Geochron Spl JDB #1

Has pictures here #1 + 2

→ Basic Ign. sills on meta Lst dipping W. away from intrusive. Left forground is igneous intrusive.

Sta. 7
Dk phyllite overlain by silver grn + maroon phyllite overlain by dk meta. dolo on top of hill. Grn + Maroon phyllite interbdd w/ dk dolo.
Dip is South @ 35°

Sta. 8
Massive Lt gy sugary Lst; fractured + meta?

Conodont Spl JDB #2

Sta. #9
Massive Lst (meta?) w/ interbeds of meta. basic-inter. Igneous

Sta #10
Massive Carb. w/ interbeds of phyllitic rock (meta. Basic Igneous?)

Picture 3 of sills + Carb.

Sta #11
Metamorphics (phyllites?)

dipping nearly vertical.
Very obvious fault gouge.

Spl. JDB #5 (micro fossils)

Check for graptolites? in JDB #4.

Sta. 14
Dk grn meta Igneous.

Sta. 15
Schist

Sta. 16
Meta. Carbonate

Sta. 17

Meta Carbonate w/ Igneous plug on its flank.
possible xenoliths of Carbonate in intrusive.

Plug is intermediate igneous; full of glassy x'ls.

Spl JDB #6 (Geochron)

June 29, 1971
Clear, Cool + Vy windy

~~Stop~~ #1
Dutro's Noatak Type Section

Predom. a vyfn gr, siliceous, qtzose, sandstone; w-rusty brn to gy, f-lt med gy; commonly x-bdd; minor sltst + blk shale thin interbeds.

Blk shale - DW A 302 Paly

Dip Dir Azi. 205° @ ~~27°~~ 35°

Carbonaceous debris on some bedding surfaces in the silty sands. ~~Minor~~ common ripple marks in some sand beds. Minor beds (up to 4" thick) of shale pebble cgl are present. Channels are present in ss units.

Scattered rusty brown-w, (limey ss) qtzose sandy ~~Lst~~ orvy ~~are present~~, abdt iron in this ~~Lst~~ lith, also contains shale pbls.

Blk silty Sh – DWA 303 Paly
Spl. taken ≈ 300' below DWA 302 Paly

Blk Shale – DWA 304 Paly
About 100' stratigraphically below spl. DWA 303 Paly.

Stop #2
Lt gy-w, dk gy-f, Lst; Lime mdst to wackestone; rexln lime mdst; micro-rexln; small indistinguishable fossil frags (crinoid stems?); dense, poor ∅ + perm; in part has argillaceous laminae; strong fetid odor; has siliceous bands in part; undulating beds up to 8" thick; minor dk gy to blk chert nodules; abdt thin calcite filled fractures.
DWA 305 C

Stop #3
Black Shale; silty, hd.
Overlain by massive weathering, brown weathering, fn-d to crsly xln

dk-f, basic Igneous. Contact between the two units is covered but in talus is green chert, baked shale, Limestone w/ abd silicous fracture fillings, and igneous fragments.

blk Sh— DWA 306 Paly

Blk Shale is Hunt Fork?

Stop #4

Subdued topog. probably underlain by dk limestone, + hard chert (Shublik).
Up the hill is outcrop of blk shale w/ hd silt interbeds. At top of hill was thin bedded black chert (Lisburne?). Basic igneous rock apparently intruded between shale + chert.

Orange-brown weathering rock in rounded hills north of the Aniuak River is thought to be Utukok.

Stop #5

Cutbank down river from the previous stop.

Dk gy to blk, silty shale. Shale has common slickensides. Appears to be ~~same~~ similar lith as that below chert at top of hill @ Stop #4.

Dk Shale - DWA 307 Paly

Stop #6

Across Anisak River from stop #5.

Same lith as Stop #5.

silty sh - DWA 308 Paly

Stop #7

Down the Anisak River from Stop #6.

Same lith as stop #5 - blk silty shale.

DWA 309 Paly

Bedded gy chert is interbdd w/ shale at this local. Shales have coatings of white to yellow xls (sulfrous salts?). Rare pyrite or marcasite concretions.

Shublik? Formation

Stop #8

Brown weathering Sandstone; f-grn gy, fn to med gr, ~~vy~~ calc, abdt grn flaky material (chlorite?) a wacke, fair sorting, low Ø + perm., sub ang to subrnded, contains small gy shale pbls., X-bdd; common sltst w/ shale laminae; some mdst.

Mdst - DWA 310 Paly

Stop #9

Brown weathering Basic Igneous w/ large xenoliths of lt gy limestone.

Stop #10

Brownish gy weathering, dk gy fresh siltstone; crinoid, brach + bryozoan debris; common burrows in silts; hd, siliceous, poor Ø + perm.

An equivalent of the Kayak or the Kayak.

DWA 311 F - fossiliferous silt

July 2, 1971
Clear, Warm, + Calm

Stop #1
Helicopter Accident

July 6, 1971
Partly Cloudy, Warm, + Calm

Stop #1
Gnish Gy weathering; phyllitic sandy siltst to schistose silty claystone; sheared.
wh qtz veins common + dk grn igneous dikes present.
Faulting runs approx. E-W + qtz veins along shears.

This is Noatak.
Noatak overlies Hunt Fork.

Stop #2
papery thin parting gy phyllitic shale.
Hunt Fork?

common qtz veins.

Stop #3

Same Lith w/ qtz as Stop #2

Stop #4

schistose silty sand.

Noatak overlying Hunt Fork.

Noatak is sheared.

Stop #5

Gy weathering, papery, phyllitic shale.

Common qtz veins. Highly sheared.

Hunt Fork.

Stop #6

Siliceous, vf fn to med gr, sandstone.

Exposed in a highly sheared zone. Abdt fracture cleavage; common qtz veins.

Noatak? / uppermost Hunt Fork?

Stop #7
Schistone siltstone + vy fngr sandstone.

Noatak.

Stop #8

Interbedded siltstone + limonitic fn to med gr sandstone.

Noatak.

Stop #9
Dk gy chert lenses in between siliceous, slaty siltstones. Also lenses of vy crsly xln igneous, and slickensided dk grnish gy fnly xln igneous. Carbonate nodules in sheared zones.
Highly sheared zone.

Within the metasediments?

Large Faultzone trending ≈ N70E

This large Fault Zone should be followed North and South.

Stop #10

Large Fault Zone as at Stop #9.

Highly contorted, sheared siltsts + cherts; intruded by mafic igneous dikes.

hd silts - DWA 338 Paly+f

Stop #11

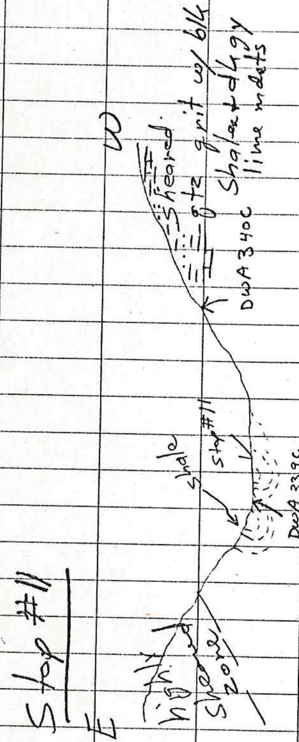
Large Fault Zone

Gray silty shales w/ interbeds of silty + sandy Lst.

DWA 339 C - silty Lime

Unit is highly contorted.

Topog. above the shales are



gritstones to small pebble conglomerates; pebbles + grit are quartz; matrix consists of sheared qtz. The gritstones are sheared; slightly calc; granules + pebbles are subrnded to subang.

gritstones are interbedded w/ black shales and dk gy lime mdsts.

DWA 340C - lime mdst

Interfingering of Kayak and Utukok?

Stop - Fuel

Fuel + lunch on the Kelley R.

Stop #12

Noatak Sandstone

Stop #13

Orange brown weathering limestone and interbedded black shales. Common fossil hash and solitary + colonial corals.

A facies of the Lisburne?

DWA 341 F - Corals

Same 11th and ridge as stop #19 ; June 22, 1971

Stop #14

Stream Cut Bank.

Interbedded shales + siltstones + blk cht. Shales are gy.

Kayak?

Stop #15

Highly fractured chert; gy to rusty brown color.

Book #3

Book # 3

Table of Contents

June 30, 1971

sky is mostly clear w/ less of a wind blowing than yesterday

stop 1

Ss., brn.-gry (f), vf-f grs., qtzose, abund. lim. specks, common dk. grs. Intrbdd. w/ sltst., arg., med-dk gry., rusty brn (w)
May be burrowed.
Thin intrbds. of rusty brn. (w) ls., med. gry (f), common qtz. & dk. grs., rexlzd., foss. (sol. corals, & brachs, micro bugs)
Prob. Utukok

DWA 312
F
DWA 313
C

stop 2 Hummucky Topog. prob. slide of glacial debris

stop 3

DWA 314
paly

Dip az. of 235° @ 28

Seq. of intrbdd. papersh. & ss.
Ss., med. gry (f), vf - f gr., qtz grs.,
abund. small lim. specks, low p & p,
lam., x-bdd, rippled, w/
some bds. w/ bands of ironst. conc.
Sh., dk. gry., sft., papery, thin.
Minor qtz- veins in sands.
Silica cmt. very abund. in sss.

Stop 4

DWA 315
F & C

Sltst., limy, lim. specks, foss. (
Spirifers, crinoid osicles), burrowed,
weathers shaly.
Check sample for conodonts &
mega fossils.
This outcrop prob. [illegible]
Thin ls. intrbds. of crs. xln.,
foss. hash., arg.
Walked to several outcrops

northward along ridge and all
rocks appeared to be Utukok
Crinoid hash and brachs are abund.
in ls. intrbds to the north. One
colonial coral found.

stop 5

Landed briefly. Mainly intrbdd.
vf gr. ss. and arg. sndy sltst.
Thin bdd.

stop 6

Congl. ss. Massive ss.
w/ thin stringers of cgl.
Noatak For.

stop 7

Phyllitic sh. w/ thin slabby
ss. intrbds.

stop 8

Mainly arg. sltst and papery
sh. intrbdd w/ lam. qtzose. qtzitic
vf gr. ss. and random intervals.

stop 9

Mainly slabby weathering. thin bdd. arg. vfgr. ss. that is x-bdd. Thought to be Noatak
↑w/iron specks

stop 10

Top of mountain
slabby ss aa w/ arg. sltst. intrbds. SS. has iron specks
Prob. Noatak

stop 11

Noatak – slabby ss.

stop 12 & 13

Benny & Bob walked down main knob while Lloyd & Dave flew over to small knob (eastward). Sequence mainly intrbdd. ss. & sltst. Ss., vfgr., brn. (w), gry (f), abund. sil. cmt., iron specs, no p&p. Sltst., arg. mic, w/ ripples and worm? Trails. Also assoc. are calc.

ss. w/ brachs, crinoid osicles, and sol. corals(?). This ss. is very scarce. Appears similar to foss. found @ stop 10 on 6-29-71

stop 14

Dip Az. of 275° @ 33° taken on seq. of arg. & mic. sltst. that is burrowed. Occasionally contains tiny crinoid stem parts (osicles).

DWA 316 F

Ss. intrbds. also occur - some w/ fossils. Has iron specs & is calc.

stop 15

Lunch break in small stream. Cutbank contains intrbdd. ss., sltst. & sh. Ss., brn.(w), gry (f), lam., vfgr., dns. Sltst., arg., burrowed, mic. Shale is slty, mic, w/ hackly fract.

6

stop 16

Shale, grn-gry, silty, mic., w/ irreg bedding surface.
Prob. Huntfork.
Interlaminated sh. & sltst. actually.

stop 17

Ss., gry (w), ltgry (f), vf-fgr., abund. sil. cmt, iron specs, lam., w/ clay st. pbls.
Appears to be Noatak

stop 18

DWA 317
F

Dolo., med.-dkgry, brecciated, foss., f.xln., dkgry (f).
Has brachs. & colonial organisms (stroms or coelenterates)
Outcrop is isolated knob

stop 19

DWA 318
paly

Shale, blk, fissile, carbonaceous.
Probably Huntfork.

stop 20

Intrbdd. red, grn, and blk. phyllitic shale. May be metamor. Want fork. by nearby igneous intrusion

stop 21

DWA 319
F&C

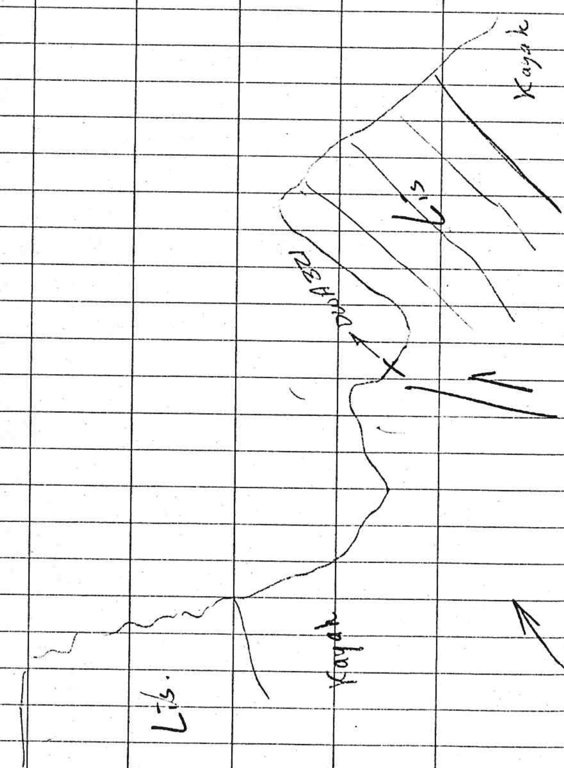
Landed on lt. weathering carbonate unit that lies in partial contact w/ igneous.
Ls., dk. gry., f xln., brecciated, foss., dns., fetid odor
A small patch of blk. fissile sh. & blk cht. occurs on top of the carb.

stop 22

Basalt, vesicular w/ calcite in vesicules.

stop 23

500'-600' lt. brn., lt gry, creamy cht.



stop 24

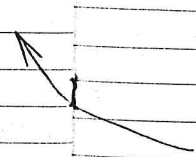
Igloo Lake for gas
4 full drums + 3-4 gal.

Stop 25

DWA 320
Paly & foram

Seq. of f ss., lt. brn (w), grn.-brn. (f), vf-crs. gr. w/ gr. sizes intrbdd. Frmwk made of qtz & rock grs. w/ abund. matrix, poor p&p. Often mixed w/ clay st. blebs. laminated

stop 26



landed on contact between Lisburne and younger rocks (Shublik & Jur.) Highangle reverse faulting @ contact.

Stop 27

DWA 321
SR

On saddle of Kayak sh. Faulting brings repeated Lis. below saddle.

July 1

Beautiful day - only a few clouds and slight wind.

stop 1

Landed in center of basic igneous plug

stop 2

DWA 322
F

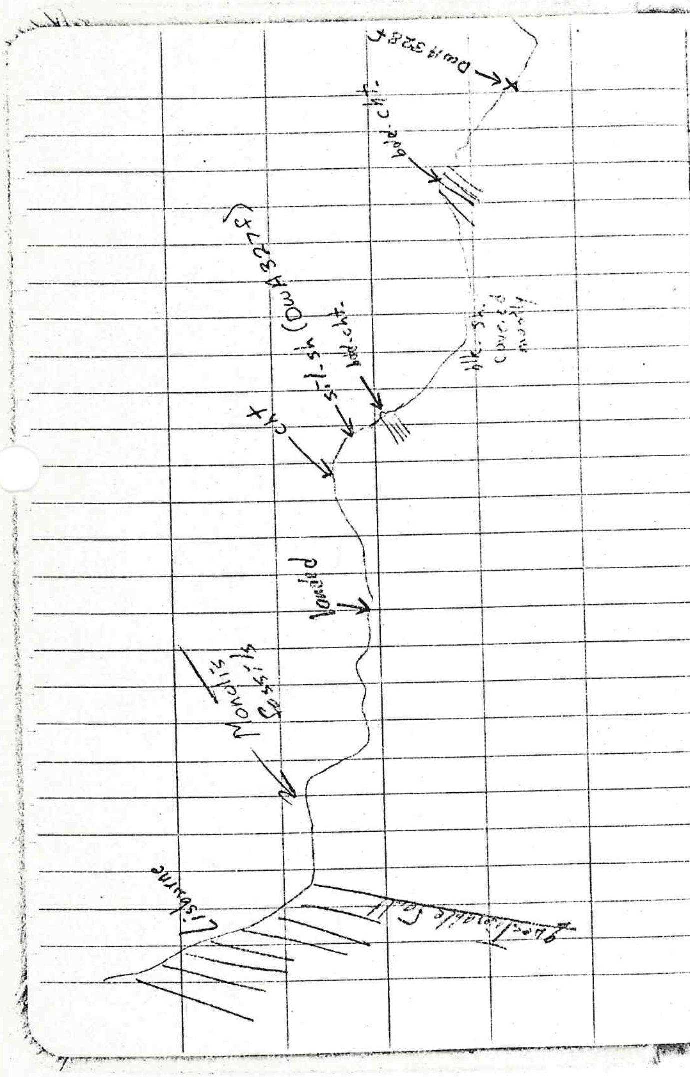
DWA 323
C

DWA 324
F&C

Fossils commonly silicified

Rafenesquinid Types mostly

Sequence of foss. gry. ls. and dns. dk. gry. calc. & sil. sltst. and arg. ls.
Fossils abund. (brachs & crinoid osicles) Blk. cht. also present in thin beds. This sequence weathers brown and gray (mott.) on mtn. slopes.
Just south of this stop @ end of mountain ridge is a cap of gray Lisburne.
This brown seq. is Utukok



DWA 325
F

This sample came from beds To south of landing area and considered to be Lisburne?

stop 3

DWA 326
f

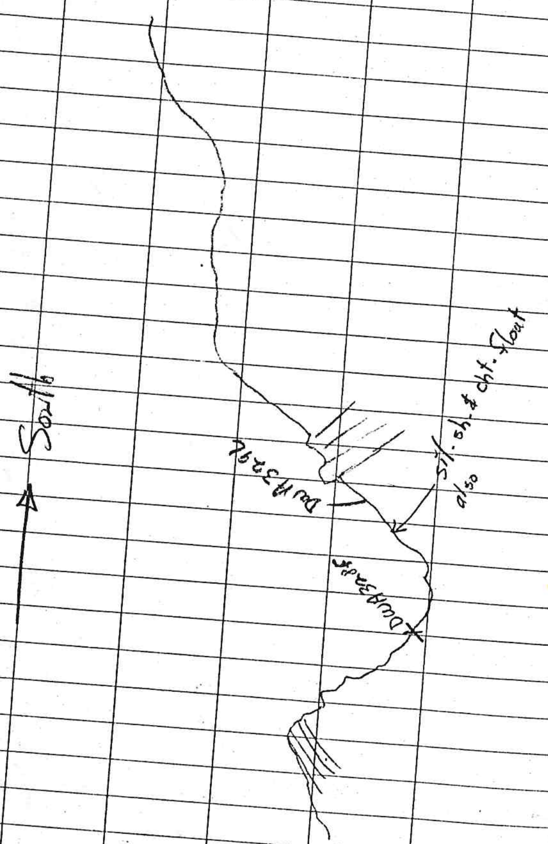
In suspected fault valley - landed on subdued hill w/ dk cht. and sil. sh. float. Red & lt gry-grn. cht. locally present Possible Shublik

stop 4

DWA 327
f

Outcrop of bedded olive-gry and black chert. Shows signs of movement and shearing (fract.) A fault may run through very close to this stop.

The bedded cht. is on top of knob and overlies grnsh-gry sil. sh. that has a pencil fract. Weathers red and grn-gry. Contains thin cht bds. Sh. has sub-conchoidal fract.



DWA 328
F

taken from small stream draining to the south. Rock is Clyst., subconch. fract, w/ lim. specs, prob. sil.

To the south, up the hill, from DWA 328 is sil. sh., cht. and common blk. ss. This ss. is made of round (spherical) grs., crs., well srtd., cmtd. by H. olive gry. material. May have orig. been an oolitic phosphorite. This seq. prob. Shublik

DWA 329
L

stop 5

Landed on ridge of siliceous sh. and cht. Prob. Shublik

stop 6

Landed on sil. ch. & bdd. ch. as @ stop 5. Walked up hill to blk. weathering and brown weathering rocks. Sampled blk. material which is sil. sh. and limy cht. of the Kayak(?). The

DWA 330
f & paly

12

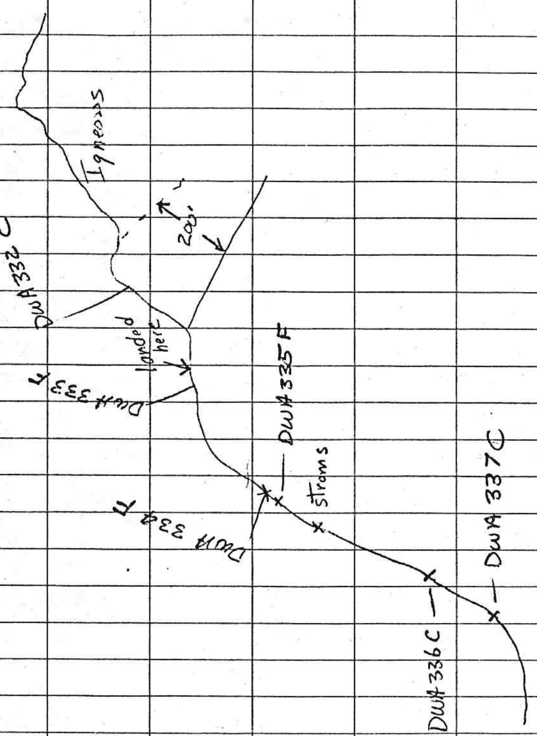
brown weathering rock is ls., blk.(f), dns., f xln., foss. (horn & brachs) and may be Wahoo(?)
Lisburne caps large E-W Trending ridge above sample area

stop 7

DWA 331
f & Paly

Seq. of intrbdd. v. arg. sltst. and Ss. Ss., brn. (w), dk. gry (f) w/ tinge of grn., f gr., fair srtg., frmwk. of rk. frag. (grn. & black color), sa-sr, poor p & p, scatt. carb. debris, calc., rare ch. dk. cht. granules., lam., clay pbls.
Sltst., dk. gry, v. arg., mic., sli. calc., lam., micro x-lam.

This seq. lies upon the Lisburne
1 picture of contact (Roll 2 frame 2)



stop 8

landed on high saddle just north of high Lisburne ridge. Up hill to the south is intrbdd. red & grn. sil. sh. w/ cht nod. Sh. is splintery, hd., & v. siliceous. Possibly Siksikpuk Fm. These beds are part of an overturned syncline that involves the Lisburne and Cret-Jur.

stop 9

Jur.-Cret. granular to f.gr. sss. & sltst.

stop 10

Landed on top of carbonate hill. Will walk down carb. section while Joe goes for gas. Carbonate in contact w/ igneous rocks. At the top is Ls., gry-brn (F),

DWA 333 F → f-med xln. w/ foss. (brachs & crinoids)

DWA 332 C → Taken in thin dns., blk., ls. bds. between lam. blk. cht. This unit is different than the carbonate landed upon.

DWA 334 F — Foss. ls. w/ abund. brachs. of the rnychonelid Type.

DWA 335 F — taken just below DWA 334 where stroms are abund. A coral found here too along w/ algal laminations. Coral had dead oil! Algal lam. in dolo., fxln., v. lt. gry, dns.

Sequence is highly foss. in upper half but grades downward into dolomite and algal mat environ.

DWA 336 C — Ls., brn. (f), microxln., mdst. from lower 1/3 of section.

DWA 337 C — From base of Section Ls., gry (f), microxln., dns. also some med.-crs. (grainst.) well rounded frmwk.

stop 11
Landedon saddle w/ lt gry. carb. as in last stop assoc. w/ yellow brn. silty ls. Blk. bdd. cht. occurs @ top of ridge

Tuesday July 6
First day of work since chopper went down on 2nd.

(1) Nootok. Mstly gry-grn sl sndy shistose sltst w/sm minor intrusions & qtz veins.

(2) Gray papery phyllitic sh Hunt Fork?

(3) Same as (2)

(4) Nootok similar to (1). Sl more ferrug, mic.

(5) Gray phyllitic papery sh fract & sheared, qtz. Ht. Fork.

(6) Gray f/m gr ss, ferrug.
Fract & sheared Nootak? or
of Hunt Fork??

(7) Sh & sndy sltst. phyllitic,
schistose. Similar to (1)

(8) Nootak as @ (7)

(9) Meta limestones, shales, chert,
Prob. pre Hunt Fork basement?
Sm highly sheared ign? dikes, serpentinized.
Large Fault zone. (N70°E)

DWA 338 p+f (10) Mets as @ (9) w/ fault
contact w/ sh & sltst.

DWA 339-C (11) Gray silty v.r. fissle/splintery
shales. Interbedded silty? Ls.
Sm m/c gr congl ss.

DWA 340-C — Dk gry ls (micrite?).

(12) Nootak (No stop)

DWA 341-F (13) LISBORNE - CORALS

(14) Shales, sltst, shly sltst.
Poss. Kayok??

(15) Cherts, ls. & sltst Monotis
SHUBLIK.

(16) SHUBLIK Phosp.

(17) SHUB BLK CHT

(18) SHUBLIK. TOP OF PEAK TO NORTH
SAME.

(19) Sltst (shly) & shale - hackly fract,

(20) CHERT (SHUBLIK)

DWA 342 Paly & f (21) SHUBLIK?

(22) Gray cht (Shublik?)

July 8

Stop 1 Lt gry phyllite - qtz veins (Metaseds)

Stop 2 Grn-gry phyllite - popery talc, mica (vfgr). Qtz veins (Metaseds)

Stop 3 Med gry/gry phyllite few qtz vns (Metaseds) Sm sndy layers.

Stop 4. Fgr Lt gry-tn limonitic sl silic w/interbedded sh Noatak Slightly meta Poss X-bedded. Sm mgr ss. Fairly abdt qtz veins.

Stop 5 Lt gry/purple sndy phyllitic shale Sm ss as @ (4) Meta of sh more intense than ss. (Lower Noatak - Hunt Fork ?)

DWA 348 F **Stop 6** Gray sl phyllitic sh & shly sltst Interbeds of vfgr limonitic ss. Sm

DWA 349-F earthy red sndy foss Ls. (Brachs, gast.) Noatak

Stop 7 Purp-gray sltst to vfgr ss. Sl mic, sl sheared. Argill limonitic

DWA 350-F

351-F,C Noatak Weathers into fairly large plates Foss packstone w/ silt & sd grns.

DWA 352-F,C **Stop 8** Gray/grn-gry chloritic phyllitic

353-F sity sh & sltst. Pyrite molds. Sandstone higher in outcrop. Sm brn fl/vfgr Poss Sm x-bedded ss. Hunt Fork?

Stop 9 Lt gry vfgr silic ss Gry/lt gry brn weathering Chl grns, qtz grns limonitic, sheared, Sh interbeds, qtz veins.

S

DWA 354-F **Stop 10** LISBURNE

355-F

356-F

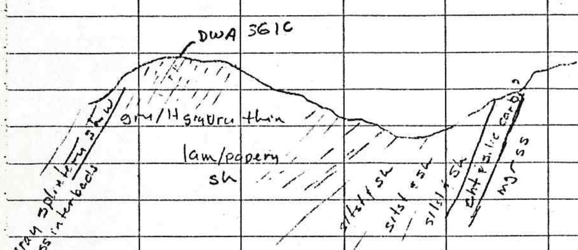
357-F (Kayak sh below Lisburne, 50' above sd)

358-F

Stop11 SS: Gry f/mgr clean qtz, siliceous, limonitic, well sorted to fair. Qtz veins
Weathers blocky to platy
Nootok Sm X-bedding. Fairly massive. Much ss ⇒ qtzite

DWA 359 Poly Stop12 Gray vfgr vry ferrug ss. Dk gry vry fissle almost papery shale. SS is X-bedded
Nootok (bottom?)

DWA 361C Stop13 Gray-grn mgr sheared ss. Gray silty sh & sltst.



DWA 360-F Stop 14
Rd-brn sh. Gray cht (frac).
Shublik) Grn-gry/grn thin lam sh. Gry vfgr silty ss
Monotis

Stop15 Gray vry silty ls. worm trails Interbedded silic ss. Utukok.

July 9, Friday

DA 362-L,F Stop 1 Dk gray f/m gr. Ls Foss?, weathers
363-C or-brn Gry/dk gry f-gr Ls. fract
364-Poly,sl algal mats, gray weathering, cherty
Sm gry silty sh. worm trails.

DWA 365 P,sl Stop 2 Gry/dk gry/gry-tn frac. cht. Thin
366 Poly,sl bedded, interbedded w/shales
367 Poly,sl Black silty sh & mudstone ~~sm~~
368 F,L weathers brn. granular Limy mdst conc.

365 Lower sh
366 Middle
367 Upper
368 Chert

Sunday, July 11

Stop 1 Dull red-brn silic sltst
& chert. Sm tn/gry-tn cht
SHUBLIK? Grn-gry mxln basic
intrusive. Sm grn-gry silic
sltst or mdst. Sm gry/dk
gry sl frac cht.

DWA 369 L,F Paly
370 F
371 Paly SR

Stop 2 Cherts & sltst as @ ①.
Beds of vfgr cross-lam orange-
brn weathering (pr calc) ss. Grn-gry mxln
basic intrusives. Sm blk cht,
Sm dk gry shly sltst.
Gray mstly fgr ls w/regular
thin bedded chert. Fossiliferous.
Entire sequence probably is Utukok.

DWA 372 L+C.
(Marble)

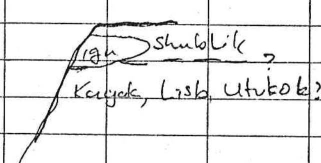
Stop 3 Gray calc silty sh. Sm
gray fl/vfgr dns calc ss.
Sm wh gray weathering marble
interbedded cht. Intrusions as
① & ② Gry-grn c/vcgr cht
& qtz pebble congl up
hillside

DWA 373, Paly, C
374 Lith.

Stop 4 U dull earthy red silic
siltstones & chert. Gry/dk gry/
tn fract. cht. Sm grn/vari color
cht. Grn-gry vf/m/c gr congl?
ss w/thin gray silty shale interbeds.
Ss is sl. calc, wacke, poorly sort
grns sub rd/ang. No p/p, laminated
Dip Az. 10°, 30. Ss may have
shale pbbls. Thick to thin bedded
Jr-K

DWA 375 - C

Stop 5 Large saddle north of ④. Abdt
gray/blk cht w/sheared pencil
silty sh. & unsheared gray sh w/
plant frags & worm trails. Common
basic ign float from top of hill
to north.



Stop 6 Gray, tn & blk chert
SHUBLIK. Abdt grn cht

DWA 376-F
DWA 377 C,F

Stop 7 Lt gry-tn qtz vf/cgr vry calc w/gran & pbbls
Dull earthy rd/gry metallic silic sltst Abdt Jasper & rd-or cht, sm w/ congl. pbbls. Ss ⇒ sndy Ls in places, brachs, crinoids, vry foss in places
Sm gray vfgr sandy limonitic shaley Ls. Finely lamin.
Sm mgr wh qtz ss w/ sl calc silic cement

DWA 378-F
379-F,C

Stop 8 NUKA RIDGE
Limestone, mostly thin to med bedded Vari. colored, mstly vry foss (Brachs, crinoids, bryz, corals) Sm ⇒ coquina SS, vf/m/cgr congl. Vari-colored, mstly gry, grn, purp-gry. Often ss is glauc. Worm burrows common in most of the ss.

Gry-grn f/mgr vry calc, vry glauc foss (brachs, worm burrows) ss.

Stop 9 ss; Lt tn-gry f/mgr congl. Med/cgr granite, white.

Stop 10 Blk/gry-tn cht, Sm dk gry silic silty sh. Grn mgr [illegible] w/ grn cht.

Stop 11 Gray vfgr calc ss. Abdt dk grns. Dk gry silty Ls, clays, crypto-xln. Gry/dk gry sltst. Sm crser grained sd & congl sd. Sm dk gry/blk cht.
Dk gry brn-gry silty foss shor sh sltst.

DWA 380-F (float)
381-C
382-Lf Paly
383-F (Shale pbbly w/ls nodules) Peleč.
384-F (Limestone, coral, bryz, crino.)

No outcrop, downslope from saddle (Nanl Fork)

DWA 380-384 from float.

July 14 (Wednesday)

BRR 275-L Geo. (Grn pyrit sh)

Stop 1 Gray/blk silic sh and/or cht. pyritic. Hunt Fork? shales upstream. Sharp fault? contact w/gry pyritic silic thin bdd. Ls & shales & cherts. Entire seq. along cutbank exhibits faulting & near convolute folding. Downstream - Grn pyritic (cobr?) silic sh. Poss sl meta. = H. Fork.

Attempted to go west to Mishegik Mt. but terminated because of low ceiling. Return to camp for fuel & proceeded NE to vicinity of Siniktanneyak Mtn Snow on peaks nw Brooks R.

Stop 2 W end of Siniktanneyak Mtn. Basic Ign. (Gabbro?)

Stop 3 - Nootok Lt tn gry vfgr ss.

Stop 4 Lt tn gry vfgr ss. Nootok

BRR 276-L

Stop 5 Hunt Fork? shale

Stop 6 Gray fgr limonitic ss no pkp, silic cement FRR

Stop 7 Lt tn-gry fgr ss, silic cement < 5% dk grns. Sm congl w/ pbbls. (blk cht, wh qtz). Kanayut.

Stop 8 Carbonate Gray marb. Ls.

July 15, 1971 Thur.

Clouds have lifted some from yesterday. Patches of blue here & there.

RRR 277-C,F
278-F

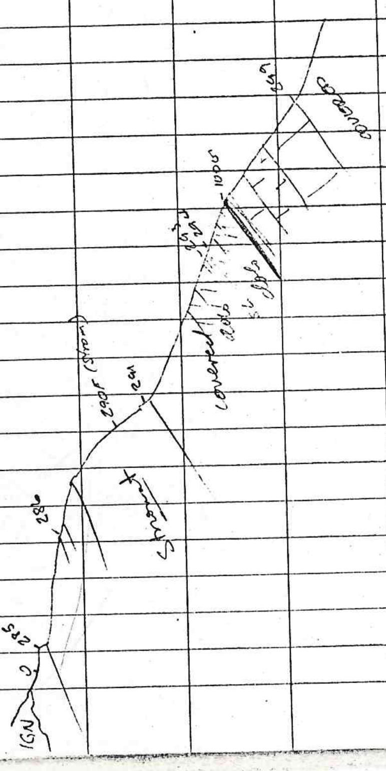
Stop 1 Lisburne; Dk gray packstone (crinoids) sl fetid odor Corals brachs. Interbedded w/ thin black shales Abdt black chert. Entire area tectonically screwed up

RRR 279-f,C
280-F

Stop 2 Gray limonitic sm foss sndy Ls. Weathers tn/gry Utukok Abdt worm borrows

Stop 3 Gray meta shale, sm rd/grn silic sh Gray/ lt gray recryst silic Ls Sh weathers mottly orange-tn, splintery.

Stop 4 Tn-gry dns vfxln Ls.
RRR 281-C,F Brachs corals Tcd.
282-F comp Underlain? by Hunt
283-F Fork? ? sh & sltst.
284-Daly, sl. w H.F? shale.



TRAIL CREEK CARBONATE SECTION

TOP

0-15. Dk gray silic/cherty Ls. Calcite
RRR 285-C,F veins

15-70 Ls, thin bedded, shaly, weathers
RRR 286-F,C grey to yellow-tn. Crinoids
packstone.

70-100 Ls. Gry/lt gry mstly fxln, brecciated
RRR 287-F,C Fetid odor, sl cut w/HCL

100-200 Ls A.A. except less fractured, ~~dns~~,
RRR 288 L,C vfxln /wackestone

200-300 Ls. A.A. frac'd, shatters rather easily,
RRR 289-L,C No vis. foss., calcite veins along
frac'd.

RRR 290 F Stromatop. @ 340'

300-400 Ls A.A., poss foss. No apparent
RRR 291-C,F bedding. All massive Ls may
be stromatop. buildups.

400-470 Ls. A.A.
Intraformational congl w/stromat.
~ float. RRR 292-F

470—800 no spl. Covered (May be dolo as @ 800')
Gray vfxln succ. dolo. Dns, no P&P
Thinly bedded

870 RRR 293-P,SR Brn-grn shale, sm black
RRR 294-L,C - Dolo. below shales

800-900 Gry vfxln fract dolo w/ dolo veins;

930 RRR 295-F Ls: gry vfxln fract
RRR 296-F

940 Ls w/dolo interbeds

900-1000 Gry/dk gry vfxh Ls. Thin bedded
to shaly @ top, becs massive
lower on outcrop. Sl fetid odor.

1000-1100 Very thin/massive bdded Ls A.A.
RRR 297-L,C Lt tn-gry in color. Pac

1100-1200 Ls. Packstone, healed fract.
RRR 298-L,C

1200-1300 Gry-brn vfxln packstone
RRR 299-L,C

1300-1500 Covered; Ls rubble

1500 Ls Lt brn-gry vfxln foss (brachs)
RRR 300-F,C packstone

1500-1600 Covered; Ls rubble Base
of hill & section.

July 16, 1971 Friday

Weather cleared during the night. Scattered clouds this morning. Snow on many mountain peaks. C. Bitgood to leave today and D. Abrahamson to replace him.

stop 1

RRR 301
f-F-C

Dolo., blk., f-med. xln. forming large elongate rounded hill. Corals found + abund. Resembles dk. carb. found in Baird Mtns. that was either Dev. or Sil.

stop 2

RRR 802
paly

landed on saddle of Huntfork - a siliceous splintery shale. Some sil. ss. float found. Igneous float common on top of hills above saddle. Black shale put in sample. Some float is limy (Lutukok?)

stop 3

Intermediate igneous rock

stop 4

RRR 303
L & F

Primarily shale, gry (f), gry. to gry-brn (w), banded, sli. metamor. Ss. as intrbds. — gry (f), brn. (w) vf gr., abund. iron blebs w/ limy cmt. Shaly ls. also present

RRR 304
Paly & SP

RRR 305
C-F-L

This may be Kayak - Utukok

stop 5

RRR 306
F & C

RRR 307
F

Ls., lt. gry. (w), m-dk. gry (f), crs. xln., brecciated w/ calcite blebs & veins. Weathers to slabs
Acid gives a brown "cut".
Possible reefs

stop 6

RRR 308
F & F

Saddle between carb. and dk. clastics. The dk. rocks are a sequence of intrbdd. calc. vufgr. ss, calc. slty. ss, and sndy. ls. Sample

308 is from these rocks.
Dip az. of 160° @ 40°. Some lss. are made of foss. hash (crin.) and are red in color. Intrbdd. sh. is grn. & rd., silty, noncalc. and has worm trails.
Fossil hash ls. is x-bdd. (small scale)

RRR309
C

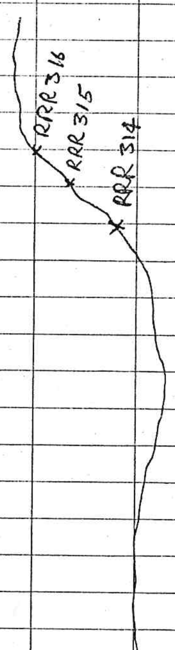
Taken on H. carb. apparently same as at stop 5

stop 7

RRR 310
L

Noatak ss & cg.

Ss., f-crs. gr., gry (f), A-sr gr., sli. calc., cly. cmt. Grs. of dk. cht., qtz., & rk. grs. Minor py.
Cg., gry olive brn., w/ angular cht. pbls. Some ls. pbls.
Cannonball concretions present.
At this loc. it appears as though the Noatak overlies the Lisburne which may be overturned



stop 8

RRR 311
f & C

Landed atop elongate Mtn. made of thin intrbds. of banded cht., cherty ls., sil. shale, and sndy ls.

RRR 312
poly & SR

An igneous sill occurs about half way up this mountain.

RRR 313
L & C

stop 9

RRR 314
poly

Clastic seq. Vf gr. sil. & calc. sss. @ base w/ intrbdd. shale. Above this is dk gry cht and sh. intrbd's w/occas. arg. ls. At Top is abund. sh.

RRR 315
f & C

RRR 316
poly & plant frags.

Each sample is higher strat. than the first.

This is an interfingering of HF & Nba. Nearly flat dip

stop 10
eastern edge of Kingaviksak Mountain

RRR 317
F & F

RRR 318
F

Lisburne Ls. - lt.gry (w), grybrn. (f), dolo., fxln., and foss. (colonial and solitary corals, brachs, & crinoids) Lt. and med. gry cht. in bands and irreg. lenses.
Beds are standing @ high angle.
In some places the ls. contains abund. dolo. (brn-color)

stop 11

RRR 319
F
including one slab

On carbonate hill. Ls., md. to dk. gry brn., gry. w/ fetid odor.
Abund. corals (sol. & colonial), few crinoids & rare brachs.
Prob. Lisburne.

stop 12
Ss. of the Noatak.
Ss., lt gry., Fgr (w/ med & gran sleprs), v. sli. calc., abund. sil. cmt., hd., dns.
no p & p.

stop 13

Landed on Cretaceous

RRR 320 hills. Marine(?) dk. gray shale
f & paly w/ ss. intrbds. Ss., brn(w), gry-
brn(f), f+vf gr., clay matrix,
calcite cmt. Lam. to thin bdd.
plant frags. present on bdd.
planes. Graded beds present -
going from med. to vf gr. upwards.
sharp basal contact.
Rocks are folded

stop 14

Landed on rocks considered
RRR 321 to be Okpikruak by USGS.
f & paly Intrbdd. ss., sltst. & sh. as @
stop 13

stop 15

Cretaceous outcrop along
RRR 322 river (in cutbanks)
f & paly Seq. of dk. gry-blk shale w/
intbdd. vf gr., silty, mic., & calc. ss.
RRR 323 Sample 322 from shale. Ss. is lam.
L This is overlain abruptly by

granule cgl. and cgl. ss. & ss. The cgl. directly overlies the sh. w/ sharp contact. RRR 323 is of the crs. clastics.

Intrbdd. sh. and ss. occurs again above the cgl. & ss.

July 17, 1971

Cleared off last night.
Weather moving in from SE but clear to the NW.

Stop #1
Lt gy-w, med gy-f, Lst.
vy fn to crs gr grainstone, abdt
RRR 324 rnded frags (crinoids) and abdt
f+C pellets or oolites, poor Ø+perm;
RRR 325C no apparent bedding, minor
RRR 326F dk gy cht nodules; minor small
brachs + solitary corals
Note: These Lt gy carbonate exposures have a rolling, hummucky topography.

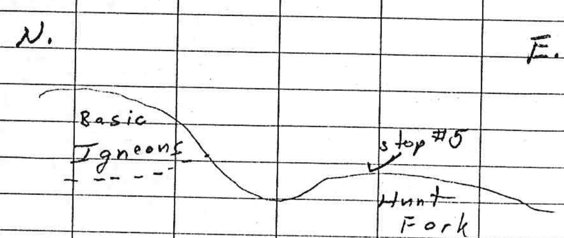
Some vy crs sand layers have good Ø+perm and common dead oil between the well rnded fossil frags (crinoidal debris).

Lisburne?

Stop #2
N. Across small swale from Stop #1.
Lith as Stop #1.
RRR 327 C+F?

Stop #3
Combination of basic igneous and black chert with floats of Shublik?

Stop #4
Same as stop #3 with minor amounts of black siliceous Limestone.



Stop #5
Vy fn, highly siliceous sand with interbeds of silty shale + siltstone. Sand is dk gy, contains common qtz fracture fillings, no Ø+perm. Sands + shales have a "baked" appearance.
Hunt Fork

Stop #6
Basic igneous with sediments undiff.
Sediments include:
black chert
med gy Lst
siltstone
shale

Sediments + igneous are "jumbled" together.

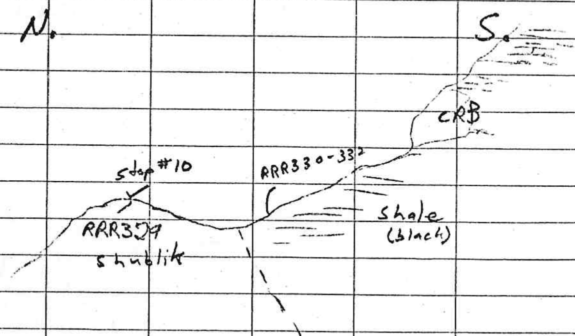
Stop #7
Basic igneous with sediments undiff.

Stop #8
dk grnish gy sandsts with interbedded dk gy siltsts + shales. Sands vy fn gred, abdt black "blebs", "blebs" appear to be aligned, highly siliceous, no Ø + perm, thin bdd w/ thin x-lam's.
J-K? or Noatak??

RRR 328 f+Paly – shaly siltst

Stop #9
Sand as at Stop #8 but calcareous cement.

Stop #10
Dkgy to black, highly frac cht. with some tan to orangeish weathering surfaces.
Shublik? – monotis
RRR 329 F – monotis. Coquina



RRR 330 P+SR
RRR 331 P+SR
RRR 332 P+SR

Stop #11
Sandstone w/ cgl.
grnish gy sand as at stop #8 but less siliceous.
J – K?

RRR 333 L

Stop #12

Med gy chert; fnly laminated, parts into large blocks, appears to be over 200'.

Lisburne? or Shublik?

Stop #13

RRR 334F - brachs

Yel br, sandy (qtz) limestone, abdt X-lams, silt to vyfn sand, poor Ø & perm, calcite cement, minor brachs.

Tupik (Utukok?) Fm.

Stop #14

Various shades of gy chert; highly fractured; common grngy siltst.

Shublik?

Stop #15
grnish gy, fn gred sands to silty shales. Common silty grnish gy Lst.
J-K?

RRR 335 f+Paly - silty shale

Sands: vy fn to fn gred, great variety of grain types (wacke), silty, subang to subrnded, poor Ø + perm silica cement.

RRR 336 L+Paly - silty Lst or calc siltst

Stop #16
Sandstone; w-orange brn, f-grnish gy, fn to med gred, subang to subrnded, a wacke, poor Ø + perm., silica + calc. cement; abdt black grs.
minor shale interbeds: dk gy.

RRR 337 f+Paly - Dk gy shale
RRR 338 Paly+SR - "
Minor gritstone float present

Stop #17
Lith as stop #16

Entire mountain is composed interbedded sands and shales.

RRR 339 f+Paly - dk gy shale

J-K?

July 19, 1971
High Scattered Overcast, warm,
light wind

Stop #1
Lst; dk gy, argillaceous,
minor limonite blebs, thinnly planed
(≈ 1/4"), fn to med rexln; isoclinally
folded, phyllitic; some vy crsly
rexln; Unit totally rexln;

This Carbonate appears to be
within the metasediments.

RRR 340 C - dk gy + lt gy Lst

Overlying the dk gy Lst is a
lt gy totally crsly rexln metaLst.

Stop #2
Lt grnish gy phyllite

Stop #3
Dk gy phyllite; slightly
graphitic; abdt bull qtz veins.

Qtz veins contained weathered sulfides + leached cavaties.

Stop #4

Lt orange gy-w, lt gy-f Dolomite; noncalc, microxln, hd, dense, no ø + perm; minor mica on some parting planes; Common dolomite breccia cemented with crsly rexln calcite.

Also layers of med gy, crsly rexln, sheared calcite.

Meta Carbonate
(within the Meta seds?)

Minor schist interlayers - Carbonate within the metasediments.
minor qtz veins.

RRR 341 L }
RRR 342 F } med gy, calc dolo.
RRR 343 C } oolites?, pisolites?
corals?,
thinly lam. algal mats?

Oolite + Pisolite layers are well sorted and interbedded with algal mats and wavy algal stromatolites.

RRR 344 C — med gy, crsly rexln Lst

Stop #5
gy, shiny, graphitic phyllite with minor qtz veins.

Stop #6
Gy phyllitic schist; highly limonitic.
Originally a sand?

Metasediments

Stop #7
med gy, vy crsly rexln Lst; strong unidirectional orientation of calcite crystals

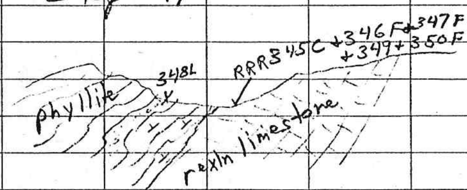
Stop #8
Lt gy, crsly xln Lst;
common limonite blebs.

meta Lst. but appears
to be above the "Metasediments".

Stop #9
Gy-w, grnish gy-f, med to
vy crs sand with common scattered
grit sized grains, grit is made
up of vein qtz & various gy shades
of chert, slightly calc; pebbles
& grit have been "stretched"; is
slightly calc.; some carbonate
clasts; matrix consists of silt
to med sand. Unit has been
metamorphosed.
Metasediments

Stop #10
Lt gy-w, lt to med gy-f, crsly
rexln Lst; minor fnly to med rexln
Lst;
within the Metasediments?

Stop #11



Stop #11

Gryish grn phyllite w/ qtz veins; phyllite is vy calc. meta lime?

phyllite contains pyrite cubes; minor calcite veins present. Phyllite also contains some small pebbles (chert?); phyllite appears to have grains in it.

RRR345C - dk gy rexln lime

Stratigraphically below the phyllite is a dk gy lime; lime is fnly rexln and contains common crinoid debris and other small fossil debris, also brachs. Some med to crsly rexln lime, also common qtz+calcite veins

RRR346F - mega bugs (crinoids, brachs, bryozoans, corals?, stromatoporoids?)

Fossil debris is commonly silicified

RRR347F - mega bugs

RRR349F - "

RRR350F - " corals

RRR 348L - Cgl + Ss

Cgl + Ss. ; ltgrn-f+w, fn to med gr ss, vy calc, grades from slightly pebbly to conglomeratic, some clasts cobble size, abdt carb. pebbles;
These cgls + ss have been metamorphosed; pebbles are in places stretched.
These cgls + ss similar to Lith at stop #9.

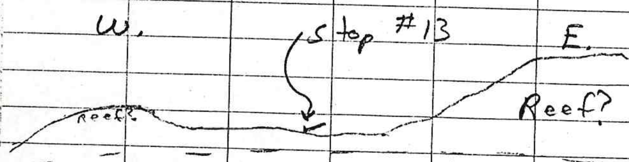
Stop #12
w-Lt gy Lst, f-dkgy, fnly rexln, highly fractured + healed with calcite, dense, hard, no Ø + perm;
Abdt intraformational cgl, clasts range from small pebbles to cobbles, clasts are well rnded, some clasts are spherical.
Minor large productids?; pisolites? were seen.
RRR 351F - brach + corals?

RRR 352 F+C. - gy lime

Some pebbles and clasts have been stretched.

This unit is a metalime.

This unit probably equivalent to (but a diff. facies than) the carbonate at step #11.



This unit may be one or a series of reefs.

Stop #13

Lt gy-w, Lst., f-lt to med gy, rexln (fnly to crsly); may be a rexln organic buildup (reef?)

Note: Hill exposed to east of this stop appears to be a massive, rexlized reef by topographic expression.

Unit has a massive appearance.

Unit is within the meta-sediments?

Unit probably equivalent to(but a diff. facies than) the last two stops (stops #11+#12).

RRR 353 f+C - mottled gybrn lime

Stop #14

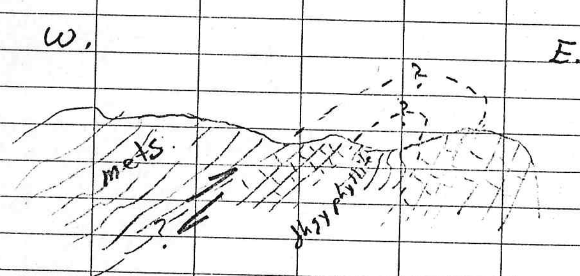
Lt to med gy-w Lst., f-medgy, med to crsly rexln, in part friable due to extreme recrystalization, strong sulfrous to fetid odor, excellent ø+perm., weathers into sugary crystals.

within the metasediments?

Stop #15

Dkgy phyllite boardered by lt gy carbonate, an anticlinal feature?

Stop #14



Tuesday July 20, 1971

Fair weather in Ambler again. Fehlmann, Rose, Abrahamson & Berry working eastern half of Ambler Quad.

stop 1

Ls., lt gry (w), lt-med. gry. (F), finely rexln., friable, v-good p&p, sacc., sheared.

RRR 354
L

Landed in valley w/ Ls. to the south and mets to the north

stop 2

Ls., dk - ltgry. banded, md. rexln., extensively sheared. These carbonates are within the Mets.

stop 3

RRR 355
C

Ls., lt. tan to dk gry banded to splotchy (sep. during metamor.), v.f. rexln, sheared, dns., no p&p

stop 4

RRR 356 C

Ls., lt-md. gry (f), micro-vf rexln, poor p&p, dns., parts into plates & parts along shearing planes. Massive character from a distance.

stop 5

RRR 357 Paly
RRR 358C
RRR 359L

Landed on high saddle between two prominent knobs of Konyust congl.. The cgl. and assoc. sil. ss. rest on blk. sh., shly sltst., and limy sh. of the Huntfork. RRR 358 taken from gry. ls. in the Huntfork.

The above sequence is in fault contact w/ carbonates (poss. metacrb.)

The dom. clasts of the cgl. are wh. qtz. pbls and cobbles. Dk-lt gry cht pbls are also present.

Several pictures taken.

July 22, 1971

High overcast (broken) ~~warm~~ cool, and light wind.

Stop #1

Metamorphic Limestone; phyllite, highly foliated and folded, micro-rexl'n, dk gy, abdt calcite veins, large augen structures up to 50" in size.

RRR 360C - lt + dk gy phyllitic lime

Stop #2

Black to dk gy phyllite + schistose lith; graphitic; original lith a shale.

RRR 361 P+SR

Stop #3

reddish to grnish gy weathering phyllite; thinly foliated; common limonite specks, common qtz

veins; grnish gy-f; original lith a silty shale to sandy sltst + vy fn gr qtz sand.
Hunt Fork?

RRR 362 Paly + SR - dk phyllite

Stop #4
reddish gy-w, f-reddish gy, interbdd siltsts + vy fn to fn gr qtz ss with abdt limonite blebs, silica cement, minor clay in sand, minor black grs (10%), no Ø + perm, common qtz veins.

Upper Hunt Fork or Noatak?

Saddle is Hunt Fork and peaks are Noatak?

RRR 363 Paly - gy shaly siltst

silty shales are commonly burrowed. One crinoid stem seen. minor ripples in vy fn sands.

Stop #5

Ltgy-f, orangegy-w, crsly xln
Lime w/ breccias. Highly rexln.
Picture - Roll 4 exp. 20 from this stop
across the valley to the ~~sou~~ east.

stop 6

Top of Mtn. - landed on blk.,
RRR 364 Paly — graphitic phyllite (RRR 364) which is
intrbdd. w/ ls. & dolo.
RRR 365 L & f — → ls., lt-dk gry, breccia. Clasts are
vf-f xln in size. Poor p & p. Sli. dolo.
RRR 366 L & f — Ls., vf rexln., lam. dk. & lt. gry. H. cobred
sil. layers & nod. (metamor. seg. or sedimen.)
Abund. ls. w/ off-wh. silica bands, some
of which may be algal.
Ls., dk gry., vf-microxln., w/ augen
structures, arg., sheared.

Stop #7

RRR 367 Paly + SR — Black, phyllitic shale;

highly graphitic in places.

Stop #8
Gneissic Granite;

Uy close by seems to be ~~grade into~~ overlain by the metasediments.

RRR 368 Geochron - gneissic gran.

July 23, 1971
Overcast, cool, slightly windy.

Stop #1

Noatak Canyon in Fault Zone.

Hunt Fork that has been silicified by basic intrusives?

Stop #2

Med gy-w Lst.; Common dk gy chert lenses + beds + nodules; lime mdst or whst, poor Ø + perm, hd, dense, siliceous, abdt fossil debis in parts
Lisburne

RRR 369 F+C - med gy limest
bryozoan, col. corals
sol. coral
RRR 370 C - med gy limest
RRR 371 F - chert + corals
RRR 372 F - col. corals

Stop #3
Creek W. of mt. Bastille.

Vy thinly laminated, dkgy Lst; phosphatic?, in part sooty, in part highly brecciated, microxln or micrograined; Lime mdst, highly argillaceous, fetid odor.

RRR 373C – blk lam. lime
RRR 374 Paly – " " "
RRR 375 C – " " "

July 24, 1971
High Overcast, cool, minor wind

Step #1
Igneous

Step #2
Sandstone; w-reddish brown, f-olive gy, fn grained sand to pebble cgl + sedimentary breccia, poor ø+perm; cgl clasts are composed of abdt rock fragments (chert, igneous mets? feldspar, qtz), clasts are rnded to angular, occasional red chert granules; fn grained sand matrix, cement is iron + silica.

RRR 376 L - sand + cgl
RRR 377 Poly + f - olive sltst

Step #3
Sandstone: w-red brn, f-dk grn, poor ø+perm, common granules, vy fn grained to med grained w/ floating granules, common black grs, chert

common, ~~minor~~ common red clayst clasts + grs, poorly sorted, a wacke, highly cemented.
RRR 378L - granular sandstone

Sands appear to have abdt igneous looking grains.

Stop #4
Sandstone, siltst, + silty clayst interbedded.
Ss: vy fngr, gy brn - f, w - brn, siliceous, ~~possible~~ thin laminations poor Ø + perm.
Siltsts + silty claysts; med dk gy - f, w - red brn, siliceous, subconcoidial fracture.

RRR 379L - Ss
RRR 380 Paly + f - clayst
RRR 381 SR - clayst

Stop #5
Sandstone; w - red brn, f - grnish gy, fngr, common blk elongate angular

grs (hornblende or pyroxene), abdt dk grn grs (not glauconite) ≈ 2% red to pink grs, minor qtz + feldspar, poor Ø + perm, well indurated, minor sand w/ granules (feldspars).

RRR 382 L – SS

Sand has medium sorting, angular to subrnded grs.

Step #6

Cgl; hoodoo weathering, appear to be large lenses (possibly channel fill).

Cgl framework varies from granules to cobbles up to 7", poorly sorted frame work.

Matrix is sandst, fn to med gr, iron + silica cement, matrix well cemented, poor Ø + perm, grs are rock frags, subang to rnded, medium sorting.

RRR 383 L – Cgl

Pebble Count @ Step #6

Inter. Igneous	𝍸𝍸𝍸 |||	17
Acidic "	||	2
Basic "	𝍸𝍸𝍸𝍸𝍸 |||	28
Dkgy silic. clayst	||	2
Qtz	|	1

Several of the hills in this area have exposures of hoodoo weathering cgls.

Flying east of Stop #6 the dominant lithology appears to be sandst with common lenses of channel cgl. Dip is uniformly to the South @ approx. 20°.

Stop #7

Sandst; w- red brn, f- grnish gy, fn to crs gr, common granules to small pebbles, med to poor sorting, abdt qtz grs, many blk grs (pyroxene? or hornblende?), no Ø + perm, well cemented, common feldspar grs.

RRR 384L - sandst

Flying east of Stop #7 the dominant lithology appears to be sandst and finer sediments; only minor cgl lenses; No apparent Dip Direction.

Notes for July 24, 1971 are continued in Field Book #4.

Book #4

Book #4

Table of Contents

1

July 24, 1971 (Continued)

Continued from Field Book #3.

Stop #8

Sandstones; crs to fn gr; similar to stop #7.

Silty mdsts w/ pebble lenses interbedded with the sandsts. minor plant frags in mdst.

RRR 385 Paly – mdst

Stop #9

Porphyritic Acidic-Intermediate Igneous and Aphinitic Basic Igneous w/ phenocrysts and amygdules.

RRR 386 L + Geochron

Note:
On the S.W. side of the mt. at stop #9 is a brilliant orange spot. A mineralized zone?

Note:
On the south flank of ridge to the north of stop #10 is another orange spot. A mineralized zone?

common qtz veins associated with epidote?

This igneous body appears to be ~~made~~ composed of liths vy similar to those found in the cgls southwest of this spot.

Is this igneous mass a source for the cgls in the near vicinity?

Stop #10

Basic igneous mass; dk grn w/ white zoned feldspars. Also some grnish gy igneous w/ large feldspar phenocrysts.

Pebble Count @ Stop #11

phyllite	𝍸𝍸𝍸	15
wh. vein qtz	𝍸𝍸𝍸𝍸𝍸 I	26
basic ign	𝍸 II	7
meta. dolo	I	1
gneiss	I	1

Note:
Below Cgl ledges at stop #11 there appears to be interbedded sandst and siltst. and then more cgl lenses

Stop #11

Cgl; Cobble to Boulder framework, common sandstone lenses. Cgls are imbricated. Imbrication indicates current direction in the direction of dip.

Dip Direction 125° Azi @ 15°.

Sands are cross bedded.

Cgl; small pebbles to boulders upto at least 16" in dia, ave. size approx. 5", vy poorly sorted, well rnded.

Matrix has the appearance of a weathered igneous rock.

matrix is a med to crs sand, grs are abdt igneous rock frags and qtz, salt + pepper look, abdt iron cement, fair ø + perm.

Sandst; w-brn, f-brn.

Minor brn red sltst lenses.

RRR 387 L - ss + cgl

Two pictures on Roll 4 taken of cgls at Stop #11.

Stop #12

Meta limestone; vy crsly rexln limestone, friable, excellent Ø + perm, segregated dkgy + medgy thin crystal layers; some orangy weathering white crslyrexln lime.

Stop #13

Black, graphitic, highly folded phyllite. Common qtz veins

Stop #14

Meta lime overlying black phyllite.

Lst; crsly rexln, segregated into dk + lt gy laminae, hard + dense, no Ø + perm.

RRR 388L - rexln limest

Stop #15

Dk gy phyllite w/ thinly interlayered qtzite. Quartzite is vy fn grained.

Stop #16

Cgl; Poorly sorted; outcrops in ledges; Abdt wh. qtz pebbles, cobbles, and boulders up to 12" in dia. Minor metamorphic pebbles and cobbles.

RRR 389L - Cgl + Ss

July 25, 1971 Sunday 6

Scattered clouds - good weather. Fehlmann, Rost, Abrahamson & Webster to fly south and east to look @ Cretaceous (?).

Stop 1

Dk igneous, basic, dk. grn., porphoritic, olivine bearing abund. grn. phena too., olivine filling amygdules, red "clasts" in groundmass.

PRR 390 geochron

This rock type was observed as clasts in cgls. yesterday early in the day.

stop 2

Difficult to tell rock type.
Believed to be igneous cgl. & ss from
such a close source of basic igneous
rocks that definition between igneous
and sed. rock is hard.

RR 391
LHh

stop 3

A mixture of igneous and
sed. rock (maybe an igneous rock w/ sed.
clasts) No pillows observed. Chill
zones apparent throughout the area.
The basic rock here is apparently
igneous with & without sed. clasts.
Abund. qtz. veining in some areas

RR 392
L

stop 4

Olivine rich basic gabbros &
basalts. Some w/ amygdules
and zeolites.

stop 5

Basic Igneous rock.
Porphyritic basalt w/ phenocrysts of
basic feldspar in blk. groundmass

stop 6

Dk. basic igneous rock (porphyritic
basalt). Phenocrysts of feldspar &
olivine.

stop 7

Ss., brn. (w), gry grn. (f), med-
RRR 393 L f gr., med. srtg., sa-sr, < 2%
red grains, < 5% wh. grs., abund.
grnsh. grs (pyrox.), common blk. grs.,
hd., well indurated, sli. calc., poor
p & p. Minor assoc. qtz. veins

Source prob. Angutikada Peaks
and assoc. peaks about 1/2 mi. away.

stop 8

Predom. ss. w/ assoc. cgl., sltst. and slty. mdst.

RRR 394 poly

Ss., brn (w), brnsh grn. (f), vf-med. grs., poorly srtd., sa-sr, fairly hd., poor p & p. Grains + minor rd. grs., common feld's., common blk. & dk. grn. grs.

RRR 395 L

Cgl., framework of granules to pbls. (up to 2") Basic ig. pbls abund., cmtd. w/ iron and matrix of slt. to vf gr. ss. coarser sd. grs. in matrix. Badly weathered. some zeolites

RRR 394 taken from slty. mdst. & muddy sltst.

Ss. grades from just ss. to granule ss + pbly ss., to cgl. ss. Cgl. occurs as lenses in ss.

Stop 9

Ss., sltst. and slty mdst.
Ss., like before, some of it looks to be very close to the source.
RRR 396 from dk. gry slty mdst.

RRR 396
poly

Stop 10

Interbdd. ss and sltst. - slty md-st. Ss., brn. (w), grnsh gry (f), f-crs. gr., w/ scatt. crs. grs., sa-sr, dns., poor p&p, common felds., abund grn grs (pyrox.?), common blk. grs, some w/ salt & pepper look. Well cmtd. Commonly laminated.
Large to small clyst. frag. in ss.
Mdst. & sltst. often mixed w/ ss.

RRR 397
L

RRR 398
poly

stop 11

phyllite w/ assoc. qtz. veins. Mets

stop 12

Meta Qtzite and meta sltst. w/ assoc. qtz veins. Prob. Mets

stop 13

Cgl. and intrbdd. ss.

PPR 399 L

Ss., orng. brn. (w), f-med gr. w/ scatt pbls, fair p$\frac{s}{t}$ p, limonite, grains of qtz. & metamorc. rk frag. (phyllite) Very thinly bdd.

Cgl. made of phyllite & qtz fromenck, med. srtg., granules to pbls. $\frac{3}{4}$" in dia., limonite cmt.

Prob. a fault down Alatna river valley.

stop 14

RRR400 plly

RRR401 L

Rockybottom Creek cutbank
190° dip az. @ 45°
Seq. of repeated ss., sltst. and minor shale. Many graded units starting w/ crs. ss. @ base and slty sh. @ top. Plant frags. common. Occas. graded ls.
Cgls. ~~appear~~ occur in the tops of surrounding mountains but is intrbdd. w/ it.

stop 15

RRR 402 L

Ss., crs., dk grn., dns., framework of dk. cht., felds., & rk. frags.
Congl., pbl. to cobble, size from granules to 6" in dia. Consists of mostly basic igneous clasts w/

some dk. cht., and lt. cht., minor qtz pbls.

The cgls. and sss of these mountains at a distance appear to be moderately folded.

stop 16

DDR 403
L

Ss. and cgl. Mostly ss. which grades into cgl. ss and sandy cgl. Rocks made of metamor. qtz & phyllite pcs. and pbls.

Contact between sediments and metamorphics apparently lies to the north.

stop 17

Intrbdd. cgl., ss., and sltst.
Cgl., small pbl. to small cobble
sizes w/ med. srtg., poor p & p.
Clasts apparrently both ig. &
metamorp rocks.
Ss., brn.(w), dk.grn., f-med.,
sa-sr, fair p & p, common fslds.
and blk grs., rock frag., some iron
cmt.

July 26, 1971 Monday

Rain and low clouds all day - did not work. Benny departed to Anchorage via Kotzebue. Move all fuel from Noatak strip to Harold Lie's cabin site.

July 27, 1971 Tuesday

Rose, Abrahamson, Fehlmann, and Webster and Joe flew to Noatak camp. Deheaded all barrels that were empty near the cabin and across river @ fuel cache. Rolled remaining barrels into willows and tied them down w/ wire to willows. 22 barrels are stacked w/ some not completely full.

July 28, 1971

Moved from Ambler to Fairbanks — no unusual incidents.

July 29, 1971

Moved from Fairbanks to Sagwon. Due to mechanical problems, Interior did not leave Fairbanks until after 5 pm therby eliminating any field work @ Sagwon. Some heavy snow on tops of mtns. in central Brooks Range

July 30, 1971 Friday

Rose, Abrahamson, Fehlmann, Webster and Petit to look @ Cret. South and SW of Sparwood.

Stop #1

Dk brownish gy shale.

RRR 405 Paly +SR - brn gy shale
RRR 406 f - " " "

RRR 405 + 406 appear to be the stratigraphically lowest samples at this stop.

RRR 407 Paly - coal + underclay

RRR 407 appears to approx. 30' stratigraphically above RRR 405 + 406.

RRR 408 Poly + SR - dk gy shale

RRR 408 appears to be approx. 20' above RRR 407.
Sample RRR 408 taken in interval of interbedded shales and concretions. Concretions contain large megaflora fragments (trunks + large broad leafs).

Beds of exposure are dipping due South. Dips are gentle and variable.

Stop #2
Core of Kuparuk Anticline.
Siltstone; lt brn gy, siliceous, abdt carbonaceous fragments, volcanic glass shards?, minor vy fn sand?, thinnly laminated.
Does not appear to be Okpikruak.

RRR 409 Paly - siltstone

Stop #3

Sandstone; w-brngy, f-gy, vy fn to med, well sorted, good Ø + perm, subang to rnded, common grn mineral (chlorite?) common blk grs (chert?) abdt quartz, minor clay, slightly calc, clay + calcite + silica cement, common pelecypods of various kinds, minor gastropods, abdt wood frags on parting surfaces some w/ pelecypods, common granules and small pebbles, minor ripple marks (interference + current) laminated to cross laminated.

Strandline Deposit.

RRR 410 F + L - Pelecypods

RRR 411 Paly - Bentonitic underclay

Sandstone; fn to med gr, laminated, x-laminated, minor clay, calcite cement (vy calc), salt + pepper appearance, abdt dk grs (chert), quartz abdt, abdt iron blebs, good Ø + perm, local scours filled w/small to large pbls,

RRR 413L - sandst w/iron blebs + sand w/ pbls

pebbles also occur isolated in laminated sand, pebbles are predom. dk gy to blk chert, minor wh. qtz pbls, laminated appearance due to iron bleb weathering.

RRR 414L - sandstone

RRR 414 stratigraphically below RRR 413.

The interval sample 413 + 414 is highly bentonitic med gr sandst.

RRR 412L - dk gy siliceous tuff

RRR 412 is stratigraphically between 410 + 411. RRR 411 is stratigraphically above 413. RRR 412L contains scattered plant frags. Stratigraphic order of samples is from highest to lowest:

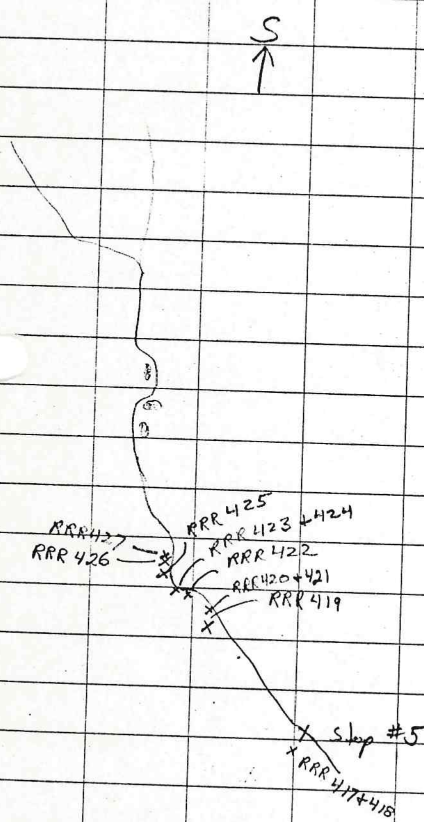
RRR 410
" 412
" 411
" 413
" 414

Stop #4

Interbedded siltsts, shales, + sandsts.

RRR 415 Paly + f - gy brn shale

Sandstone; w - brn, f - gy, fn-gr (vy fn)



vy calc, abdt iron, common black grs (coaly?), abdt quartz, poor Ø + perm, laminated, abdt plant frags on parting laminae, plant frags are carbonized, slump structures common in sandstone; sands appear to be lenticular and contain current ripples at the base of the sand.

RRR 416 L - sand

Stop #5

Core of Aufeis Anticline.

Interbedded sandstone + shale.

RRR 417 Paly + f - clayst w/ plant frags

Sandstone; w-brn, f-gy, salt + pepper, fn to med gr, abdt qtz, common blk grs covered with a few sandstone talus covered ridges which cause topographic breaks. The dip direction appears to be to the north.

Sandstone is gy, contains minor clay, is fn grained on the average, and predominantly quartzose. Sands contain large ripples, flute casts, and load? casts.

RRR 420 Paly+f - clayey gy siltst

RRR 421L - brn weathering ss.

Ss; w- brn, f- gy brn, vy fn grs, common orange blebs + dk grs, abdt quartz, silty, fair Ø + perm, flute casts, worm tubes?, possible shale pebbles

RRR 422 Paly+f - dk gy silty shale

RRR 422 taken a sequence of interbedded sandsts, shales, + siltsts. Sands contain common flute casts, vy fn gr, common iron blebs + blk grs, abdt qtz, laminated to thin bedded, beds vary from 6" to 3', common silty concretions, good Ø + perm. shale; silty, fractured, plant frags

RRR 423 Paly+f - dkgy shale

Between RRR 422 and RRR 423 is a sequence of sands with minor shale interbeds. At the local of RRR 423 is shale between sands. Sands contain large clay clasts ranging from small pbls to boulders and have flute cast bottom markings (large bulbous lobate to small elongate flattened lobate).

Exposures are steeply dipping predominantly to the south.

RRR 424L - ss + siltst

RRR 424 taken at same spot as RRR 423.

sandst; w-gy brn, lt gy-f, vy fn gr, fair sorting, silty, >10% clay matrix, fair Ø, clay pbls, flute casts, carbonaceous debris

RRR 425 Paly + f + SR-614 shale, silty shale; black, silty, brittle

This exposure is shale and highly folded.

RRR 426L - silicified tuff

Stratigraphically above RRR 425 is a siliceous tuff unit w/ bentonitic interbeds.

RRR 427 Paly +f - bentonitic shale

RRR 427 approx. 50' strat. above RRR 426.

Dips are to the south - Azi 185° @ 50°

RRR 427 is in a sequence of volcanic sands, siltsts, + shales.

RRR 428 Paly +f - dk gy shale

RRR 428 approx. 60' strat. above RRR 427.

The sequence of samples taken at this locale is through the axis of the Aufeis Anticline.

Stop #6

Siltst; w-medgy, f-dkgy, abdt clay, laminated

RRR 429 Paly+f -dkgy siltst

Stop #7

Core of Kuparuk Anticline just South of the axis.

Interbedded siltsts + vy fn ss.
siltst; f-gy, w-gy, laminated, hard, minor carbonaceous debris, clayey

RRR 430 Paly+f - siltst
RRR 431L - vy fn ss
sandstone; w-gy brn, f-med gy, vy fn gr, hard+dense, poor Ø+perm, sideritic?, silty, burrowed?, carbonaceous, flute casts?

RRR 431 approx. 100' stratigraphically above RRR 430. Dip is to the south.
Some sands are fn-to med gr, have floating pebbles up to 1½" in dia (gy cht), abdt plant frags, minor unidentified fossil debris, weathers lt pinkish gy, poorly sorted, abdt burrows, grs are wh. qtz w/ overgrowths, abdt orange blebs (huelandite?)

RRR 432 Paly + f - dk gy clayey siltst
RRR 432 approx. 100' strat. above RRR 431.

4:5

July 31, 1971 Saturday 30

Low clouds, cold, snow + rain

Rose, Fohlmann, Webster, Abrahamson, and Petit to look at Cretaceous in Kemik Anticline east of Sagwon.

Stop #1

Close to core of Kemik Anticline.

RRR 433 Paly + f — blk to dk gy siltst

No outcrop found took talus

Stop #2

tundra cover + shale talus

RRR 434 Paly + f — dk gy shale

RRR 435 L — lt. gy sandstone

Sandstone; w-brn, f-lt brngy, vy
fn gr, siliceous, dense, poor øt
perm., ≈5% blkgrs, abdt milkwhite
grs (volcanic?), oil stain?, minor
iron blebs

Returned to Sagwon due
to poor weather.

August 1, 1971 Sunday 33

High Overcast, cool

Rosé, Fehlmann, Webster, Petit, and Abrahamson to look at Cretaceous in Kemik Anticline and possibly White Hills (Tertiary).

Stop #1

Close to core of Kemik Anticline.

RRR 436 Paly +f - black shale
RRR 437 Paly +f - " "
black shale; brittle, iron stone concretions, thin bentonitic layers common
RRR 438 Paly +f - black shale
RRR 439 Paly +f - " "
438 + 439 are vy close.

stratigraphically to 436+437.

RRR440L - sandstone
440 taken at same location
as 438+439.
Some thin sandstone stringers
thruout shale unit.

RRR441 Paly+f - gy siltst

siltstone; med gy, vy argillaceous,
appears to be burrowed

Stop #2
Blackshale; ironstone concretions
with buchia?
Okpikruak Fm.?

RRR442F - buchia?

RRR 443 Paly+f – dk gy to blk silty shale

RRR 444 Paly+f – dk gy silty shale
RRR 444 taken approx 100' strat. below RRR 443.
Exposure dips steeply to the South. Buchia? is common as impressions + ~~has~~ have commonly been replaced by pyrite.

RRR 445 Paly+SR – blk silty shale
RRR 446 Paly+f – " " "
445 + 446 taken approx. 200' stratigraphically below 444.

This exposure gives off an oily slick when dumped into the stream. A good source rock?

Stop #3 Note:
Entire sequence walked appears to be Tertiary.

Stop #3
North side of Shaviovik Anticline.
Thick sandstone units w/ interbedded shale? units (shales are tundra covered). One coal bed exposed approx. 8' thick.

RRR 447 Paly - coal
coal is in part silty and contains abd't plant frags; is argillaceous.

RRR 448 L - cglomeratic SS

Sandstone; salt + pepper, med to crs gr, qtz + dk gy grs predom., minor clay matrix, excellent Ø + perm, friable, fair sorting,

subang to subrnd; common pebbles are
mod. to dk gy chert w/ some milk
white qtz, occasional brown +
grnish gy chert pebbles, some
chert pebbles have fossils (Lisburne?),
some cobbles in sands also.