PRELIMINARY REPORT ON THE STRATIGRAPHY AND STRUCTURE OF THE KURUPA, COLVILLE, AND COLAMNAGAVIK RIVERS, ALASKA.

U. S. Geological Survey Party No. 4

By

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INTRODUCTION

U. S. Geological Survey Party No. 4 covered the area between 68°30' and 69°08' N. latitude and between 154° and 155°20' W. longitude during the period May 18 to September 2. Traverses were confined mainly to the valleys of the Kurupa, Colville, and Colamnagavik Rivers inasmuch as very little rock is exposed in the interstream areas. This report is limited to the Colville River valley area between the Kurupa and Killik Rivers, and to a stratigraphic section exposed on the Kurupa 7-12 miles south of the Colville.

A final report will be prepared by April 1, 1947, on the total area and will include discussions of the stratigraphy and structure of Upper Cretaceous Formations A through D on the Colamnagavik and Kurupa, the stratigraphy of Formation D on the Colville, and the Lower Cretaceous and Triassic rocks. Separation and identification of heavy minerals from the sandstones and conglomerates, binocular and petrographic microscope examinations of specimens, identification of megafossils, and separation and identification of microfossils, if any, will be undertaken. Detailed examination of all aerial photos will be made to trace out structures and formations in the adjacent areas to the east, north, and west. It seems probable that close correlation between this area, the Killik River

area, and Maybe Creek area will be possible by extrapolating field and aerial photo data. It is possible also to trace structures and some formations westward from the Kurupa River.

STRATIGRAPHY

Although a number of sections in Formation D were measured along the Colville, further work will be necessary before they can be correlated, and therefore the section of Formation D on the Kurupa 7 to 12 miles south of the Colville is used in this report. This section, which is almost continuously exposed over a distance of 4 airline miles along the Kurupa, is representative of all the Formation D encountered in the Colville valley, but it is probable, however, that due to monotonous recurrence of sandstone, silt shale, clay shale, and coal, and to the irregularities of cross-bedding and lensing, only generalized correlations will be possible.

The Kurupa River section is 4,888 feet thick (see Fig. 2) and is tentatively believed to be entirely in Formation D. It is underlain by Formation C, and where the highest bed was seen is covered by overburden 30-35 feet thick. The thickness of Formation D in the Killik-Chandler-Anaktuvuk area is approximately 2,000 feet. Therefore, either a westward thickening of D or a lateral change to a more terrestrial facies in Formation E is implied. On the basis of field examination, no faunal evidence of the existence of E was seen in this section.

The beds that crop out comprise about 17% of the total section. About 52% is medium to fine-grained, pale greenish-yellow to light gray, thin-layered (2-8 inches) to shaly, cross-bedded sandstone containing carbonized plant fragments and occasional beds and lenses of coarse-

grained sandstone and quartz-chert-pebble conglomerate. About 16% is medium gray to pale yellow-green-yellow silt shale, and about 16% is a similar fissile clayshale. Thin-layered, pale yellow to light gray siltstone makes up 9% of the outcrops. About 6% is bituminous coal and bony coal in beds 3 inches to several feet in thickness. The remaining 1% is mainly argillaceous limestone, marlstone, and tuff all of which occur in very thin beds. Clay ironstone is prominent throughout the section in nodules, lenses, and thin beds. In the covered intervals, which are uniformly distributed throughout the section, the rock types are inferred from float to be silt shale, clay shale, coal, bone, and minor amounts of siltstone and fine- to very fine-grained sandstone.

Plant fossils and imprints are very common throughout the section, but no invertebrate remains were found.

Formations C, B, and the top of A are exposed on the Kurupa River conformably underlying the section of D. The lithologic and faunal characteristics of these formations are very similar to those described in the Killik-Chandler-Anaktuvuk area, but the thicknesses vary notably. In the Killik area Formation B is believed to be 2,800 feet thick and Formation C 2,200 feet thick 1/. In the Kurupa River area there is a total of about 2,600 feet

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1/ Stratigraphy and structure of the area of the Killik-Chandler-Anaktuvuk and Colville Rivers, Alaska Geol. Investigations, N.P.R. No. 4, Alaska, Report No. 1, 1946.

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of section exposed below Formation D, of which approximately 930 feet are in Formation A and the remaining 1,670 feet are believed to comprise both

Formations B and C. Sufficient information is not yet available to delimit the contact between B and C. The thickness of these formations underlying the Colville Valley between the Kurupa and the Oolamnagavik Rivers is probably very similar to that measured along the Kurupa.

All the outcrops adjacent to the Colville River appear to be Formation D, except for the bluffs ½-1½ miles above and 1 mile below the mouth of the Oolamnagavik. A transitional facies or interfingering between the upper part of Formation C and basal part of D may be present in these outcrops. Formation C is characterized by a dominance of greenish yellow to medium gray, fine to very fine-grained, platy, thin-layered to shaly, moderately cross-bedded sandstone with numerous Inoceramus and several other small pelecypods. Medium gray siltstone with interbedded ironstone and carbonized plant fragments and siltshale with ironstone occur in minor amounts. Two large coal beds 5 and 7 feet thick and several traces of coal occur in this otherwise marine type of section. The overlying Formation D is similar to the section (see Fig. 2) on the Kurupa River, except for the presence of a thick sandstone bed bearing a few Inoceramus and several mudshale layers with abundant small pelecypods. Formation C in this area seems to have a much higher percentage of sandstone and lower percentage of silt shale than D. This, together with the difference in color, abundance of marine faunal remains, and absence of significant coal beds, gives sufficient criteria for distinguishing Formation C from D within the area covered by this report.

In general, Formation B on the Kurupa River is composed of massive to layered light yellow to greenish yellow, poorly sorted, coarse to fine-grained sandstone, pebble-granule conglomerate, and minor amounts of silt

shale and shaly sandstone. Carbonized plant fragments and petrified wood are abundant. Coaly shale and thin layers of low grade bituminous coal are common. Most of the rocks weather reddish yellow.

Formation A on the Kurupa is predominantly layered and cross-bedded, fine to very fine-grained, well cemented, medium to greenish yellow sandstone. Ripple markings, clay galls, carbonized plant fragments, and interbedded shaly layers are not uncommon. Siltstone and silt shale form a relatively small proportion of the exposed section. A marine fauna, consisting of several pelecypod genera, a cephatopod, and Dentalium, is well preserved and fairly common in the sandstone.

STRUCTURES ALONG THE COLVILLE RIVER

The anticlinal folds in the Colville Valley are broad with sharply folded crests. The dips on the flanks all seem to be uniform and rarely exceed 15°. The crests seem to be characterized by a series of minor, tight folds parallel to the axis of the major fold, minor cross folds, and minor faults with displacements of several feet. No major synclines are exposed in the Colville valley, although a minor one north of the Colville River in the vicinity of the mouth of the Kurupa River is inferred from aerial photography. The major syncline 4-10 miles south of the Colville is a broad fold which is believed to be continuous across this area and to extend considerably farther both eastward and westward.

Two anticlinal structures roughly parallel the course of the Colville River between the Kurupa and Killik Rivers (see Fig. 1). Between the Kurupa and Aupuk Creek an anticlinal axis is believed to parallel the course of the Colville River and probably continues north of the Colville to the east and west. A saddle separating 2 small domes is inferred about 4 miles

east of the mouth of the Kurupa, and closures on these highs to the east and west seem probable. Due to the distribution of outcrops, the amount of closure cannot be determined, but it is thought to be small. The dips on this structure are mostly 3 to 10° with a few 15 to 25°. The center of the fold is completely exposed in a bluff on the southeast side of the Colville about 15 miles east of the Kurupa.

Between Aupuk Creek and the mouth of the Killik River a northwest trending axis lies just south of the Colville River above the Oolamnagavik, curves sharply east along the Colville and then northeast to the mouth of the Killik. A low plunge to the northwest seems quite certain, but the fold cannot be traced more than half the distance from the Oolamnagavik to the Aupuk. Formation C is exposed in the center of this anticline where it is cut by the Colville River at the mouth of the Oolamnagavik. Minor thrust faults and many tight folds causing dips of 40 to 80°, close to the axis, whereas farther out on the flanks dips range from 5° to 15° with a few as high as 25°. Between the Oolamnagavik and the Killik Formation C disappears, and it seems likely that there is closure on the eastern end of this structure. This anticline is an extension of the one which was mapped at the mouth of the Killik by the U.S.G.S. Killik River party in 1945.

GAS SEEP NEAR MOUTH OF AUPUK CREEK

The gas seep, which was mapped by Navy Geological Party No. 3 in 1945, was visited in August, 1946. The gas is bubbling rapidly in a small lake about 1-3/4 miles above the mouth of Aupuk Creek. Bubbles rise from the

lake bottom at the rate of about one per second in at least 20 spots within an area of 150 square feet. A sample of the gas was analyzed by the National Bureau of Standards, and the report was submitted to Commodore W. C. Greenman and referred to the Geological Survey. The analysis by Mass Spectrometer on a dry, air-free basis shows the following:

Methane	98.(8)
Ethane	0.07
Nitrogen	0.7
Oxygen	---
Argon	0.06
Carbon dioxide	0.4
	100.03 %

Calculated heating value 986.7 B.T.U./cu. ft.

Calculated specific gravity 0.5622

ACCESSIBILITY AND TERRAIN INFORMATION

(From terrain information pertaining to geophysical exploration. Prepared at the request of J. A. Legge, Jr., October, 1946.)

Landings can be made on skis by a Bellanca, Norseman, or similar airplane at most places in the area any time during the season of snow. These planes can make wheel landings on numerous gravel bars along the Colville River from June through September. Pontoon landings can be made at most places on the Colville River and at certain places on the Kurupa River, depending upon the stage of water level and the skill of the pilot. No bars suitable for wheel-plane landings are found in the Kurupa River valley, and neither wheel nor pontoon landing places can be found on the Oolamnagavik River. It is practical to travel in this area by floating down the three main rivers in light

weight boats or by moving overland in weasels.

The area is one of low-rolling tundra ridges and broad, shallow valleys. The average relief is 100 to 300 feet, and the maximum is about 700 feet. The area is covered predominantly by bunch grass (niggerheads) which makes foot travel difficult. There is little or no brush outside the creek valleys, and willows are limited to the gravel flats adjacent to the larger streams. Except during the spring breakup, only the Colville, Kurupa, and Oolamnagavik Rivers are difficult to cross, although the smaller creeks are sharply incised in the tundra and cannot be crossed at random by tracked vehicles.

The Colville, Kurupa, and Oolamnagavik Rivers meander considerably and swing from one valley wall to the other within a distance of 1 to 5 miles. Gradients measured along the rivers are 4 feet per mile on the Colville, 14 feet per mile on the Kurupa, and 20 feet per mile on the Oolamnagavik. The river channels are a series of slower-flowing relatively deep stretches separated by shallow, swifter-flowing "riffles." The water depth varies considerably with each rainy period. The Colville River has a minimum depth of 3 to 4 feet over the "riffles" at low water. The Kurupa River in the lower 20 miles averages roughly 4 to 7 feet in depth and has a minimum depth of 16 inches over the "riffles." The Oolamnagavik River in the lower 20 miles averages 3 to 6 feet in depth and has a minimum depth of 1 foot over the "riffles."

Drainage is good on most of the low hills, and the ground is wet but not swampy. Swampy lake-covered flats and low terraces similar to those surrounding Umiat camp are common along the three main rivers and extend

back ¼ to 1 mile from the rivers. They are not a serious hindrance to travel as the bad parts can be by-passed, but sites for roads, camps, or landing fields on this terrain should be chosen carefully.

Bedrock exposures are almost entirely limited to cutbanks and steep hillslopes on the three main rivers. A few small outcroppings are found along the smaller streams, but few, if any, exposures are found on the interstream ridge tops. Upper Cretaceous Formations A, B, C, and D, consisting of fine-grained sandstone, siltstone, silt shale, and minor amounts of medium- to coarse-grained sandstone, conglomerate, coal, and ironstone, have been identified within this area. In general, these strata are folded into broad east-west trending anticlines and synclines with minor folding, fracturing, and doming on some of the anticlinal crests.

Post-Cretaceous terrace gravels and valley floor gravel, silt, and muck are common along the three major rivers. The terraces are of two types: (1) high-level terrace remnants perched on bedrock hills and bluffs 100 to 300 feet above the rivers, and (2) low-level terraces that rise 10 to 50 feet at the edge of the valley floors.

The gravel in the high-level terraces is a poorly sorted mixture, ranging from sand to cobble size, of chert, quartz, quartzite, conglomerate, etc., which is similar to the gravel in the river beds. The thickness of gravel is usually only a few feet and rarely exceeds 20 feet. The distribution of these gravels could not be determined but appears to be sporadic. They are not continuous enough to be suitable for landing field sites or for a supply of filling material. The low-level

terraces also are irregularly distributed along the edges of the valley floors and are composed of the same type of gravel as the higher terraces. Some of these gravels are a veneer 5 to 30 feet thick on a bedrock bench, and it is not known whether they are all underlain by bedrock benches. In general, the terraces, although nearly flat, are slightly higher at the edge. Small lakes and swamps are common on these terraces, although the ground is usually solid and well drained close to the edge. Many of the terraces would be suitable for landing fields and camp sites.

The river flats of the three major valleys range from several hundred feet to a mile in width. Most of the area of the flats is near the river level and subject to possible flooding in the spring breakup and to invasion by shifting river channels. The flats are composed of cobbles as much as 12 inches in diameter, pebbles, and sand, which are covered in part by 1 to 6 feet of silt and/or muck. Small brush and willows cover about 75 percent of the gravel flats. No data are available on thickness of the gravels in the river flats. On the Colville River many of the gravel bars are long and smooth enough for landing single-engine planes, and, with little work, landing strips suitable for larger planes could be cleared. Movement of equipment along the river flats could be done best by tractor train during the winter. Due to the meandering of the rivers from side to side in the valley, the continuity of the flats is broken at 3 to 10 mile intervals by steep cutbanks with the river flowing at the base. When the rivers are not frozen, long-distance travel by tracked vehicles could be done more easily

by following the low divides.

As in the vicinity of Umiat, permafrost seems to underlie the entire area. Very little specific information was obtained on depth of seasonal thaw. A few observations showed that thawing extended to a depth of 12 to 18 inches in the tundra and "niggerhead" areas and to 2 feet or more in the gravel terraces and river flats.