DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN FILE MAP

INTRODUCTION

This is a preliminary report of geologic investigations in the lower Yukon-Norton Sound region, Alaska. Stratigraphic and structural information were obtained on a boat traverse of the lower Yukon River made by J. M. Hoare, W. W. Patton, Jr., A. R. Tagg, geologists of the U. S. Geological Survey, and R. W. White, temporary field assistant, during the summer of 1960.

Information presented in this report supersedes that published in an earlier report on the geology of the Russian Mission quadrangle (Hoare and Coonrad, 1959).

Fossil identifications are by Ralph W. Imlay, David L. Jones, and Jack A. Wolfe of the U. S. Geological Survey.

BEDDED ROCKS

Bedded rocks ranging in age from Paleozoic to late Cenozoic and intrusive rocks of Late Cretaceous or Tertiary age crop out at intervals on the north and west bank of the Yukon from north of the mapped area downstream to the vicinity of Mountain Village. For mapping purposes the bedrock strata are divided into five units. These units are primarily lithologic rather than stratigraphic because, at the present stage of investigation, it is not possible to correlate between exposures of the strata with much assurance. However, the probable age of most of the strata, based partly on fossil evidence and partly on previous experience of the writer, is indicated where known.

UNIT f

Unit f includes metamorphic rocks that crop out along the river in the vicinity of Marshall. The rocks consist of light- and dark-green chlorite schist, gray quartz-mica schist, dark-gray quartzite, and pebble conglomerate. Some of the quartzite is calcareous. Pebbles in the conglomerate are well-rounded and are mostly quartzite and fine-grained volcanic rocks. The relationship of the conglomerate to the schistose rocks is unknown because the contact is covered. However, the fact that the conglomerate is less metamorphosed than the schists suggests that it may be a remnant of a younger group of rocks. No volcanic rocks were noted along the river, but greenstone formed by the alteration of mafic volcanic rocks is said to crop out in the mountains east of the river (Harrington, 1918, pl. IV).

No fossils were found in these rocks and their age is unknown. They were mapped as Carboniferous by Harrington (1918, p. 23-26, pl. III) who correlated them with less metamorphosed rocks of Permian age which crop out farther up-river. The writer thinks that Harrington's basis for correlation is rather weak and pending further field work has chosen to map the metamorphic rocks as a separate unit.

UNIT e

Unit e consists of light- to dark-gray and green siliceous siltstone, and fine-grained quartzite, conglomeratic quartzite (made up chiefly of pebbles of white, gray, and black chert), chert, coarse-grained calcareous sandstone, crystalline gray limestone, and volcanic breccia and tuff.

A few fragments of crinoid columnals were found in crystalline limestone about 5 miles below Russian Mission. Crinoid columnals, fragments of bryozoa, brachiopods, and plants occur in a small exposure of coarse-grained sandstone and volcanic tuff or breccia on Tuckers Slough. Small brachiopods and crinoid columnals were collected from thin-bedded dark-gray limestone which crops out on Tuckers Slough.

These rocks and fossils are thought to be of Permian age because they are similar to rocks and fossils of Permian age which crop out on the Kuskokwim River below the village of Aniak (Smith, 1939, p 33; Hoare and Coonrad, 1959).

UNIT d

Unit d is made up mostly of volcanic rocks but includes some sedimentary strata. The volcanic rocks consist of basalt, andesite, and dacite lava flows, tuffs, and breccias. Locally minor amounts of sandstone, siltstone, and limestone are interbedded with the volcanic rocks.

The dip of the strata varies from near-horizontal to vertical but at most places the dip is 30° to 60°. Locally the flows and breccias are so massive that their attitude can not easily be determined.

At least 10,000 feet of thin-bedded gray and green tuff, massive breccia, basalt flows, and a small amount of limestone and siltstone crop out above and below Ohagamut village. Four small collections of fossils of Jurassic and Early Cretaceous age were obtained from these strata below Ohagamut. The fossils consist of belemnites (Cylindroteuthis), ammonite fragments (cf. Olcostephanus and Polyptychites), pelecypods (Buchia crassicollis or B. sublaevis), and some unidentifiable organic markings. Locally the tuffs contain fragments of carbonized wood. The fossils were examined by Ralph W. Imlay and David L. Jones. Imlay reports that the belemnites are almost certainly Jurassic and the ammonites probably Jurassic but may be Early Cretaceous in age. Jones reports that the pelecypods are Early Cretaceous.

Similar volcanic rocks crop out at intervals farther upstream, from the vicinity of Paimiut to a point about 10 miles above Grayling Creek. Most of these rocks have previously been mapped and described as greenstone of Carboniferous age, andesite and dacite flows of Tertiary or late Late Cretaceous age, and basalt flows and tuffs of Quaternary or late Tertiary age (Harrington, 1918, p. 48-50, pl. III). A few poorly preserved fossil leaves were obtained from a thin layer of soft tuff about 10 miles above the mouth of Grayling Creek. The tuff is interbedded with coal and appears to be conformable with fresh-looking basalt which overlies it. The leaves were identified by Jack A. Wolfe as Metasequoia glyptostroboides Hu and Cheng, a species that occurs throughout the Cenozoic Era.

The fossil evidence is not definite because the specimens examined by Wolfe are fragmentary and poorly preserved. Also pelecypods, Buchia crassicollis, of Early Cretaceous age were found in similar volcanic rocks 40 to 50 miles farther up the Yukon by Patton and Bickel (W. W. Patton, Jr., oral communication, 1960). Although there is a possibility that some of the volcanic rocks are of Cenozoic age, present information indicates that they are probably of Mesozoic age.

UNIT c

Unit c includes sedimentary rocks of Jurassic and Cretaceous age which consist of medium- to dark-gray sandstone, greenish-gray sandstone, conglomerate, and siltstone. Some of the rocks are tuffaceous. Much of the sandstone is moderately calcareous; the siltstone is rarely calcareous.

Locally the beds are graywacke-type sandstone consisting of mixtures of angular and partly rounded fragments which range in size from silt-sized particles to small pebbles. However much of the sandstone appears to be fairly well sorted. It commonly contains much carbonized plant trash and locally shows faint ripple marks and other evidence of near-shore, shallow water deposition. All of the rocks are well-indurated. Massive beds of both fine- and coarse-grained rocks commonly show spheroidal weathering.

Most of the large cutbank exposures are chiefly sandstone and conglomerate in beds 1 to 6 feet thick with intercalated siltstone in somewhat thinner beds. Locally massive beds of sandstone and cobble conglomerate 20 to 30 feet thick crop out. At a few places, there are large exposures made up chiefly of siltstone and shale. It is probable that fine-grained and relatively thin-bedded rocks underlie many of the covered intervals and that fine-grained rocks are at least as abundant as sandstone and conglomerate.

Four collections of fossils which range in age from Middle Jurassic to Cretaceous were obtained from these rocks. A few specimens of a small species of pelecypod were found about 4 miles below Horse Island. The fossils were identified by David L. Jones as Cardium or Isocardia with an age range of Jurassic through Cretaceous. Impressions of large deciduous leaves were obtained from massive beds of sandstone about a mile below Pilot Station. They were identified by Jack A. Wolfe as Aralia wellingtoniana of Hollick and Gredneria grewiopsoides Hollick who states they are of early Late Cretaceous age. Two collections of pelecypods were obtained near the mouth of the Andreafsky River. One of the collections, made a few hundred feet below the mouth of the Andreafsky River, was studied by David L. Jones who reports that it consists of Inoceramus of probable Cretaceous age. The second collection, made on Andreafsky River about 2 miles above its mouth, was studied by Ralph W. Imlay who reports that it consists of Inoceramus (cf. I. lucifer Eichwald) of Middle Jurassic age.

The Inoceramus of Middle Jurassic age obtained from this unit of sedimentary rocks (Unit c) appear to be about the same age as some of the fossils obtained from the sequence of volcanic rocks (Unit d) which has been described above. Fossil evidence that these two groups of rocks are partly equivalent in age is borne out by the fact that Unit c includes layers of tuffaceous sandstone.

UNIT b

Unit b consists of horizontal and near-horizontal flows of vesicular olivine basalt which crop out near Russian Mission and about 12 miles above Marshall. Individual flows are 5 to 15 feet thick and marked by 2 to 3 feet of scoria near their tops. Scattered vesicles occur throughout the flows.

The flows are thought to be of Quaternary age because they are undeformed and fresh-appearing.

INTRUSIVE ROCKS

UNIT gr

Intrusive igneous rocks along the lower Yukon are chiefly granitic but include a few dikes and sills of mafic rocks less than 20 feet thick. The intrusive mafic rocks and two or three small bodies of granitic rocks have been omitted from the geologic map owing to their small size.

The granitic rocks are light- to dark-gray, fine- to medium-grained granitic-textured rocks that range in composition from granite to diorite. They form dikes, sills and small stocks.

The granitic rocks are intrusive into strata ranging in age from late Paleozoic to late Mesozoic; so some of them, at least, are as young as Late Cretaceous or Tertiary. The fact that granite pebbles are common in conglomerate of Cretaceous age suggests that some of the granite bodies may be of pre-Cretaceous age.

SURFICIAL DEPOSITS

UNIT a1

The surficial deposits comprise unconsolidated deposits of silt, sand, and gravel of Quaternary age. They include Recent flood-plain alluvium and older terrace gravels and silt of Pleistocene age.

Unconsolidated deposits are most extensively developed east and south of the Yukon River. From the vicinity of Blackburn south to Paimiut they form a belt at least 20 miles wide east of the river. Below Paimiut the belt widens abruptly and merges with the Yukon-Kuskokwim delta. West and north of the Yukon the deposits are best developed near the mouths of large tributary streams, such as the Aniak, Chulinak, and Andreafsky Rivers.

The deposits contain quantities of brown peat in layers that are commonly several feet thick. Much of the peat and most of the older silt deposits are permanently frozen. The older silt deposits of Pleistocene age mantle the lower slopes of hills and ridges and in places form near-vertical bluffs along the river that are 40 to 60 feet high. Such bluffs form the west bank of the Yukon for several miles below the mouth of Grayling Creek.

REFERENCES

Harrington, G. L., 1918, The Anvik-Andreafsky region, Alaska: U.S. Geol. Survey Bull. 683, 70 p.

Hoare, J. M., and Coonrad, W. L., 1959, Geology of the Russian Mission Quadrangle, Alaska: U.S. Geol. Survey Miscellaneous Geologic Investigations, Map I-292.

Smith, P. S., 1939, Areal geology of Alaska: U.S. Geol. Survey Prof. Paper 192, 100 p.

EXPLANATION

Surficial deposits

a1 — Floodplain deposits and silt

Bedded rocks

Undeformed basalt flows

Younger sedimentary rocks

d — Deformed volcanic rocks

e — Older sedimentary and volcanic rocks

Metamorphic rocks

Intrusive rocks

gr — Granitic rocks

MAP UNITS NOT ARRANGED IN CHRONOLOGIC ORDER

Contact, dashed where approximately located

Inferred fault

Syncline

Strike and dip of beds

Fossil locality

Interbedded dark-gray siltstone and fine- to coarse-grained gray sandstone. Few beds of pebble and cobble conglomerate. Coal blebs and carbonized plant fragments common, locally crossbedding and ripple marks.
Age: probably late Early Cretaceous or early Late Cretaceous

Plant fossils
Metasequoia glyptostroboides Hu and Cheng

Gray tuff with carbonized plants; one 6-foot bed of coal; overlain by vesicular basalt.
Age: possibly Cenozoic

Volcanic breccia

Fairly soft gray and buff sandstone with carbonized plant material. Appears to overlie volcanic rocks.
Age: unknown

Massive red and green volcanic breccia interbedded with black basalt flows.
Age: unknown

Basalt

Light-gray and lavender rhyolite flow(?)

Massive basalt flows and volcanic breccia, some flows vesicular and amygdaloidal, some black obsidian

Gently dipping thin-bedded to massive gray and lavender cherty tuff; some petrified wood.
Age: Cretaceous or Tertiary

Gently dipping light- and dark- colored tuff and breccia, interbedded with dark lavender flows. Tuff contains large fragments of black obsidian.
Age: Cretaceous or Tertiary

Massive, black, porphyritic basalt flows interbedded with thick layers of massive breccia.
Age: probably Jurassic or Cretaceous

Massive dark-gray, porphyritic basalt flows, somewhat vesicular and amygdaloidal.
Age: probably Jurassic or Cretaceous

Hard, dark-gray sandstone, conglomerate, and slaty siltstone. Most beds thick or massive, conglomerate forms beds up to 30 feet thick, some layers show graded bedding. Mafic lava flow or sill 5 to 10 feet thick in upstream exposure.
Age: probably late Early Cretaceous or early Late Cretaceous

Very hard, fine-grained, bluish-gray, fossiliferous limestone associated with massive cobble conglomerate and calcareous grit, and breccia containing fragments of crinoids, bryozoans, brachiopods, and plants.
Age: probably Permian

Small Pelecypods
Cardium or Isocardia

Thick- to massive-bedded gray sandstone and conglomerate with interbedded dark-gray siltstone and shale; some sandstone greenish gray, cross-bedded, contains carbonized plant fragments. Near Paimiut strata generally darker color, includes much coarse-grained, low-rank graywacke and graywacke conglomerate.
Age: probably late Early Cretaceous or early Late Cretaceous

Massive, fine-grained, bluish-gray tuff or cherty siltstone interbedded with very hard grit or fine-grained breccia. These rocks harder, more indurated than rocks above Paimiut. Upstream from head of Tuckers Slough are massive basalt flows, fine to coarse volcanic breccia and agglomerate.
Age: probably Jurassic or Early Cretaceous

Hard, fine-grained tuff or gray cherty siltstone interbedded with fine- to medium-grained quartzite.
Age: probably Permian

Green and gray-green cherty rocks interbedded with light- to dark-green, fine- and medium-grained tuffs.
Age: possibly Jurassic or Cretaceous

Horizontal, highly vesicular, black basalt flows.
Age: Quaternary

Fine- to coarse-grained quartzite and conglomeratic quartzite, gray crystalline limestone, mafic lava flows, and tuff.
Age: probably Permian

Gray sandstone interbedded with gray and green siltstone; carbonized plant fragments.
Age: probably Jurassic or Cretaceous

Thin-bedded, gray and green cherty tuff interbedded with thick- to massive-bedded, coarse-grained tuff and breccia; a few massive basalt flows near Akahamiut; much carbonized plant material in coarse-grained tuff near Ohogamut. At least 10,000 feet of strata exposed between Ohogamut and Toklik.
Age: Jurassic and Early Cretaceous

Light- and dark-green chlorite schist, fine- to coarse-grained dark-gray quartzite and pebble conglomerate, and gray quartz-mica schist.
Age: possibly pre-Permian

Horizontal, highly vesicular, black basalt flows.
Age: Quaternary

Ammonite fragments, cf. Olcostephanus and Polyptychites

Belemnites, Cylindroteuthis

Buchia Crassicolis or sublaevis

Thin- to massive-bedded green and gray cherty tuff interbedded with medium- to coarse-grained, gray and green tuffs and breccias and a small amount of fine-grained sedimentary rock. Section sparsely fossiliferous.
Age: Jurassic and Early Cretaceous

Inoceramus, cf. I. lucifer Eichwad

Inoceramus; a few leaf impressions

Plant fossils
Aralia wellingtoniana of Hollick
Gredneria grewiopsoides Hollick

Near Pitkas Point chiefly thick-bedded, medium- to light-gray sandstone with ripple marks and crossbedding; much carbonized plant material and a few pelecypods. Sandstone medium to coarse grained, interbedded with shale-pebble conglomerate and siltstone. Below Pitkas Point rocks mostly thin-bedded siltstone and shale with a few thick sandstone layers.
Age: Jurassic and Cretaceous

Mostly light-gray and medium-gray sandstone interbedded with dark-gray siltstone and shale. Near Pilot Station thick beds of gray sandstone interbedded with olive green sandstone containing large leaf impressions, ripple marks, worm tracks, and shattered quartz pebbles.
Age: late Early or early Late Cretaceous

This map is preliminary and has not been edited or reviewed for conformity with U.S. Geological Survey standards.

PRELIMINARY GEOLOGY ALONG THE LOWER YUKON RIVER, ALASKA

By
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SCALE 1: 500 000

10 0 10 20 30 MILES

1961 MAGNETIC DECLINATION AT SOUTH EDGE OF SHEET RANGES FROM 18°00' to 20°30' EAST