DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-291

RECONNAISSANCE GEOLOGIC MAP OF THE NULATO QUADRANGLE, ALASKA

By
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Base map by Topographic Division
U.S. Geological Survey, 1951

Geology compiled in 1955

Scale 1:250000

5 0 5 10 15 20 Miles

Contour intervals 200 and 1000 feet
Dotted lines represent half-interval contours
Datum is mean sea level

1959 magnetic declination varies from 21°30' to 23°30' east

1959

EXPLANATION

Qal — Alluvium
Silt, sand, and gravel of stream beds, flood plains, and terraces

QUATERNARY(?)

TKi — Intrusive rocks
Granite, some diorite. Includes numerous unmapped dikes of varying composition and texture. May include hornfels zones that could not be distinguished from the intrusive rocks on aerial photographs. Probably early Tertiary or Late Cretaceous in age but may be considerably younger (Eakin, 1916, p. 50-51)

CRETACEOUS(?) OR TERTIARY(?)

Ks — Shaktolik group
Graywacke, shale, grit, and conglomerate. Coarse clastic rocks form rubble-covered ridges and hills, shale forms slopes and valleys. Outcrops rare
The rocks of the Shaktolik group have been described by Schrader (1900, pl. 60) along lower Koyukuk River north of Nulato quadrangle; by Smith and Eakin (1911) and by Patton and Bickel (1956a) at the type section on the Shaktolik River west of the Nulato quadrangle; and by Martin (1926) and by Patton and Bickel (1956b) along lower Yukon River in the Nulato quadrangle. Smith and Eakin (1911) placed all rocks of Cretaceous age above the Ungalik conglomerate in the Shaktolik group. Martin (1926, chart opposite p. 474) divided the Upper Cretaceous rocks above the Ungalik conglomerate into the Kaltag, Nulato, and Melozi formations and stated that these three are contemporaneous with the Shaktolik group. Smith (1939) did not accept the three formations of Martin as more than a theoretical subdivision. Before 1902 the Shaktolik group was considered Tertiary in age. These rocks were then shown to be Late Cretaceous in age by Stanton and Knowlton by studies primarily of plant fossils collected by Collier (1902). Imlay and Reeside (1954) reclassified the marine mollusks of the fossil collections of Collier as late Early Cretaceous (Albian) in age. Patton and Bickel (1956b) state that the lower and middle units of the Shaktolik group have been assigned a late Early Cretaceous age, on the basis of identification of marine mollusks by R. W. Imlay, while the upper units of the Shaktolik group, on the basis of plant remains studied by R. W. Brown, are considered Late Cretaceous in age. Detailed stratigraphic information is insufficient to warrant mapping Martin's three formational equivalents of the Shaktolik group within the Nulato quadrangle. Thickness unknown but estimated by Martin (1926) along lower Yukon River to be more than 4,800 feet

CRETACEOUS

Ku — Ungalik conglomerate
Conglomerate, grit, some graywacke. Forms pinnacled ridges where relief is high. Composed of angular to rounded debris derived from older rocks immediately adjacent to conglomerate. Boulders as much as 2 feet in diameter observed. Sorting and bedding poor
Described by Smith and Eakin (1911) from type section on the Ungalik River west of the Nulato quadrangle. Thickness believed to be at least several hundred feet. Described by Eakin (1916) on the Melozitna River northeast of the Nulato quadrangle. Thickness stated as several feet to 60 feet overlain by finer beds laid down contemporaneously with another part of the conglomerate a short distance away. No total thickness estimated. Described along the Yukon River by Martin (1926) and by Patton and Bickel (1956b) as the lower unit of their border facies. Thickness estimated by Martin at 2,000 feet but this thickness may include part of the overlying Shaktolik group. Patton and Bickel estimated a minimum thickness of 1,200 feet

mi — Metamorphosed igneous rocks
Greenstone, and locally some gray to red chert, dark-gray crystalline limestone, greenstone, tuff, and graywacke. Greenstone is altered basalt and diabase of probable extrusive origin and diorite, diabase, gabbro, and pyroxenite of probable intrusive origin. Described by Mertie (1937, p. 160-163) in the Nulato quadrangle; age given as Carboniferous(?). Described by Smith and Eakin (1911) in Nulato quadrangle; age given as post-Carboniferous

PRECAMBRIAN OR CARBONIFEROUS(?) OR POST-CARBONIFEROUS

mc mcl — Metamorphic complex
Quartz-mica schist, quartzite schist, mica schist, albite-chlorite schist, albite-mica schist, sillrelle-mica schist, glaucophane-mica schist, some phyllite, slate, sheared chert, and quartzite. Includes areas of recrystallized limestone, mcl. Described by Mertie (1937) in the Nulato quadrangle. Age given as either late Precambrian or early Paleozoic

PRECAMBRIAN OR PALEOZOIC

vr — Volcanic rocks
Chiefly basalt and andesite. Rarely rhyolite, tuff, chert, agglomerate, and breccia. In some places flat lying or gently dipping and unaltered, elsewhere highly folded, faulted and altered, indicating that the rocks are probably of several different ages

AGE UNKNOWN

Contact
Long dashes where approximately located; short dashes where gradational or inferred

Fault
Long dashes where approximately located; short dashes where inferred; dotted where concealed, arrows show relative movement

High-angle fault
Long dashes where approximately located; short dashes where inferred, dotted where concealed; U, upthrown side; D, downthrown side

Anticline showing crest line and direction of plunge
Long dashes where approximately located; short dashes where inferred; dotted where concealed

Syncline showing trough line and direction of plunge
Long dashes where approximately located; short dashes where inferred; dotted where concealed

Overturned anticline showing crest line and direction of dip of limbs
Dotted where concealed

Overturned syncline showing trough line and direction of dip of limbs
Dashed where approximately located

Strike and dip of beds
Where degree of dip is not indicated it is unknown

Approximate strike and dip of beds based on photointerpretation
Where degree of dip is not indicated it is unknown

Strike and dip of overturned beds

Strike and dip of overturned beds based on photointerpretation
Where degree of dip is not indicated it is unknown

Strike of vertical beds based on photointerpretation

Trace of conspicuous beds

Note: Symbol indicating map unit or direction of dip is questioned if identification of unit or direction of dip is doubtful

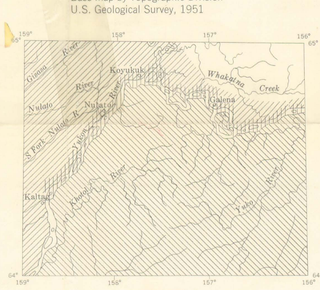

FIGURE 1. INDEX MAP OF THE NULATO QUADRANGLE SHOWING SOURCES OF PUBLISHED INFORMATION

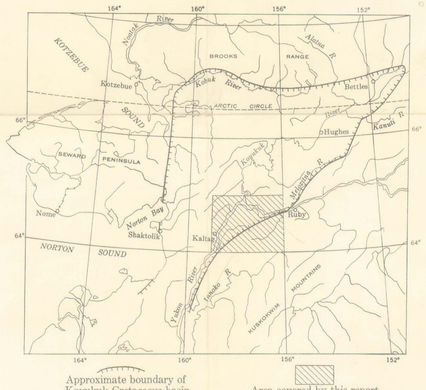

FIGURE 2. INDEX MAP SHOWING POSITION OF THE NULATO QUADRANGLE IN THE KOYUKUK CRETACEOUS BASIN

INTRODUCTION

The Nulato quadrangle is one of a group of maps compiled to make available for public use information from reports on early ground surveys that are mostly out of print and new information obtained by interpretation of aerial photographs that have become available since the ground surveys. Interpretation of the aerial photographs has made possible the extension of formations beyond the limits mapped from ground surveys and has added much new information, especially data on the structure of the rocks. Descriptions of the rocks are taken mainly from reports on the earlier ground surveys and therefore may be valid only within the limits of those surveys (see fig. 1). Although a formation may be recognized on aerial photographs beyond the limits of an earlier ground survey, it is not possible to determine from the photographs whether or not the rocks of the formation in the extended area differ somewhat from the rocks recognized in the ground survey.

The writer is indebted to the U. S. Army 30th Engineer Group for the valuable assistance it gave in helicopter and fixed-wing aircraft transportation, and for the use of the 549th Topographic Engineer Company field camps during the summer of 1954.

SOURCES OF INFORMATION AND METHOD OF COMPILATION

Preliminary photogeologic studies of the southern part of the Koyukuk Cretaceous basin were begun in the spring of 1954. These studies were made on north-south flights of 1:40,000 scale, vertical and 1:40,000 scale, trimetrogon aerial photography. Three months were spent in field checking the photogeology of the basin in the summer of 1954, and approximately one week of this field time was spent in the Nulato quadrangle. Helicopter transportation greatly facilitated the field work. The final compilation, based on photointerpretation, helicopter field checking, published and unpublished data, was completed on the 1:250,000 scale, U. S. Geological Survey Alaska Reconnaissance Topographic Series map of the Nulato quadrangle, during the winter of 1954-1955. Information used to supplement the present study was obtained from sources shown on the index map of the quadrangle (see fig. 1).

STRUCTURE

The Nulato quadrangle lies on the southeastern edge of the Koyukuk Cretaceous basin (see fig. 2). The rocks in the southeastern half of the quadrangle are older than the Cretaceous and probably underlie the Cretaceous rocks through at least part of the basin.

The bedding traces and flow structures of the pre-Cretaceous rocks within the quadrangle are poorly exposed because of low relief and the general absence of resistant units. Highly complex structure is evident in the few exposures present and is indicated by the schistosity that has been produced throughout these rocks. In the older metamorphic complex (mc) the bedding has been almost obliterated by recrystallization and only in the limestone areas (mcl) can attitudes of beds be determined from the aerial photographs.

The dominant structural feature of the rocks of Cretaceous age within the Nulato quadrangle is the northeasterly trend of the fold axes. The beds are tightly folded and commonly overturned. The fold axes plunge steeply and reversals of plunge along the axes occur frequently. Drag folds are common in areas where shale predominates, but are less common in areas where graywacke predominates.

Reverse faults and strike-slip faults with large stratigraphic throw occur throughout the map area. Many of these faults appear to be genetically related to the folding. These faults are both along the trend and across the trend of the fold axes. The thrust movement was generally eastward. Exposures in the stream cuts show that many of the major folds have been faulted along the strike of the beds, but these faults are not apparent on the ridges and hills. Many of these strike faults are reverse faults. Several normal faults with large stratigraphic displacement have been mapped. Numerous smaller normal and reverse faults are present in the quadrangle but could not be shown at the scale of this map. Recent adjustment along normal faults in the quadrangle is indicated by scarps formed in alluvial fans of Quaternary age.

ECONOMIC GEOLOGY

Placer mining in the Nulato quadrangle has been confined to the northwest side of the Kaiyuh Mountains at the abandoned town of Tlatskokot on Bonanza Creek.

Two silver-lead deposits on the headwaters of Bishop Creek, known as the Perseverance lode and the Valley claim, were worked in a small way during 1921-1922 and 1923. At the site of the Perseverance lode the country rock is schist.

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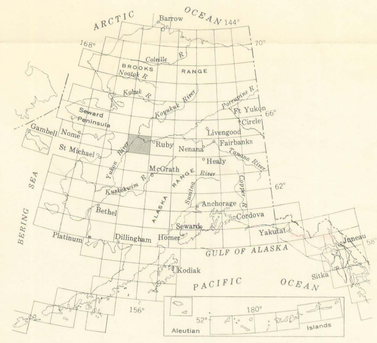

FIGURE 3. INDEX MAP OF ALASKA SHOWING LOCATION OF THE NULATO QUADRANGLE

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MR 6405

For sale by U. S. Geological Survey, price 75 cents