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UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

# RECONNAISSANCE GEOLOGIC MAP OF THE NOME C-3 QUADRANGLE, SEWARD PENINSULA, ALASKA

By C. L. Sainsbury, Travis Hudson,
Rodney Ewing, and William R. Marsh

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CONTENTS

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## INTRODUCTION

The Nome C-3 15- by 30-minute quadrangle adjoins the Bering Sea about 30 miles west of Nome, Alaska, in an area previously unmapped geologically. It lies on the west and south borders of the Nome C-2 and D-3 quadrangles, mapped in 1971 (Sainsbury and others, 1972a, b).

## MAPPING METHODS

The map was prepared with the aid of a helicopter and light aircraft, using methods developed and described by Sainsbury, Curry, and Hamilton (1972). Lithologic control was obtained by landings and spot checks by helicopter, supplemented by foot traverses as much as several miles in length away from the landed aircraft. Geologic units and structures were then extended by light-aircraft traverses using the lithologic control gained on the ground.

## GEOLOGY

The main bedrock units consist of the "York Slate," of Precambrian age, which comprises graphitic and calcareous siltite and chloritic and feldspathic schists, and a large expanse of intricately deformed limestones largely converted to marble. Lesser amounts of Paleozoic limestone and silicified limestone, as well as chloritic-graphitic schists of Precambrian age, are mapped as separate units. Extensive surficial deposits include glacial moraine, glacial outwash gravels, and, along the coastal plain, silts covered completely by tundra. Sledge Island, in the southwest part of the quadrangle, is composed of biotite-hornblende granodiorite or quartz monzonite.

### Stratigraphy

#### *York Slate*

The graphitic rocks are dynamically metamorphosed to slaty rocks that are unusually hard because of the high silica content, which reaches as much as 92 percent. These rocks are intricately drag-folded on microscopic and megascopic scales, and cleavage and fold axes generally dip west or north. White mica in varied amounts developed during the dynamic metamorphism. A thermal metamorphism followed the development of cleavage as a consequence of the intrusion of nearby granitic rocks. Biotite has developed in the thermally metamorphosed rocks, mostly from the white mica.

### *Chloritic and Feldspathic Schists*

The chloritic and feldspathic schists probably represent metamorphosed volcanic or volcaniclastic rocks intercalated in the York Slate. For the most part the rocks are schistose and are somber green in color because of the high chlorite or amphibole content.

A belt of chloritic-graphitic rocks north of the Sinuk (Sinrock) River was mapped separately, for it displays lithologic characteristics intermediate between the graphitic and chloritic units. Because these rocks clearly are part of a thrust plate that overlies carbonate rocks, it is possible that they are tectonically mixed rocks. However, a thin marble bed crops out continuously within these chloritic-graphitic schists. If this marble is a metamorphosed bed, it suggests that the rocks enclosing it were originally volcaniclastic rocks that were intermixed with graphitic siltite.

### *Paleozoic Carbonate Rocks*

A great expanse of intricately deformed marbles and limestones that crops out continuously from the Sinuk River north is bounded on the east by a thrust fault. Known locally as the "Contorted Hills," the name reflects the good exposures of numerous folds that trend northwest, as well as numerous oxidized zones along dikes that intrude the marble. At places, color variations reflect original bedding, and quartz lentils believed to be recrystallized chert are visible. Although no fossils have been found, the carbonate rocks are assigned to the Paleozoic.

Above the thrust fault that forms the east margin of the marble belt, the marble is converted to calcite-mica-graphite schist which probably is the result of the tectonic mixing of the rock types along the thrust fault.

Exposures in cutbanks beneath the moraine along the Sinuk River are sufficient to show that the contorted marbles probably continue unbroken to the coastline. In the northeast part of the quadrangle, dark-gray limestones with the original bedding clearly visible are capped by hard silicified limestone that weathers almost white. This silicified limestone is interpreted as being an erosional remnant of limestone just below a thrust along which silica migrated.

Some of the carbonate rocks outlined on the map cannot definitely be assigned by age.

### *Igneous Rocks*

A granitic stock of medium- to coarse-grained biotite-hornblende quartz monzonite to granodiorite forms Sledge Island. The stock is unfoliated and was intruded after the thrusting. It is correlated with rocks in nearby areas which are of Late Cretaceous age. Within the main belt of carbonate rocks are numerous altered monzonitic(?) dikes, and minerals such as secondary quartz and topaz in some dikes suggest that the alteration is related to a buried granitic rock. The dark dikes in the limestone in the northeast part of the quadrangle are intruded along faults, and are dark lamprophyres.

Metagabbros and related rocks form small plugs throughout the quadrangle; only a few are shown on the geologic map.

### *Surficial Deposits*

Glacial debris composed of rock transported from the Kigluaik Mountains some 20 miles northeast of the Nome C-3 quadrangle forms a terminal moraine in the northeast part of the quadrangle, and mantles the lower slopes along the Sinuk River and its tributaries. Toward the coastal plain, the moraine decreases in thickness and also shows a decrease in the size of its fragmental components. It is clearly truncated by a marine shoreline believed to represent the Sangamon beachline. The old shoreline extends northward from the moraine as a topographic ridge along which sand is exposed at numerous places. Seaward of the Sangamon shoreline, the coastal plain is mantled completely by tundra, but exposures in the thawing banks of numerous thaw lakes show that the tundra overlies silts and muds. The tundra cover is not depicted on the map.

## ECONOMIC GEOLOGY

Placer gold has been mined in small amounts at the head of Quartz Creek in the southeast part of the quadrangle. The gold lies on bedrock covered by glacial moraine, and the deposits appear to be small.

The numerous iron-stained areas along many of the leucocratic dikes that intrude the marbles north of the Sinuk River contrast strikingly with the marble, giving the impression of widespread mineralization. However, several samples of such stained rocks contained only trace amounts of tin, lead, and zinc with larger amounts of boron; these elements are those which might be expected to accompany the introduction of fluorine during the formation of topaz and idocrase found in some of the altered marble near some dikes. A few specimens of altered dike material contain visible pyrite.

The abundant dikes, the alteration of marble to topaz and idocrase, and the complete recrystallization of the marble all suggest that granite may underlie the marble at moderate depth. If so, it is possible that larger amounts of altered marble may be found at depth, and much more tin, along with tungsten and base metals, might be found.

A sample of beach concentrates from the sand bar on the northeast end of Sledge Island contained anomalous tin, the amount being much lower than that found in panned concentrates from streams at many places on the Seward Peninsula. Because lode tin is almost always associated with biotite or biotite-muscovite granite, and is rare near hornblende-bearing quartz monzonites, it is considered unlikely that marine placers containing economic amounts of cassiterite will be found around Sledge Island.

## REFERENCES CITED

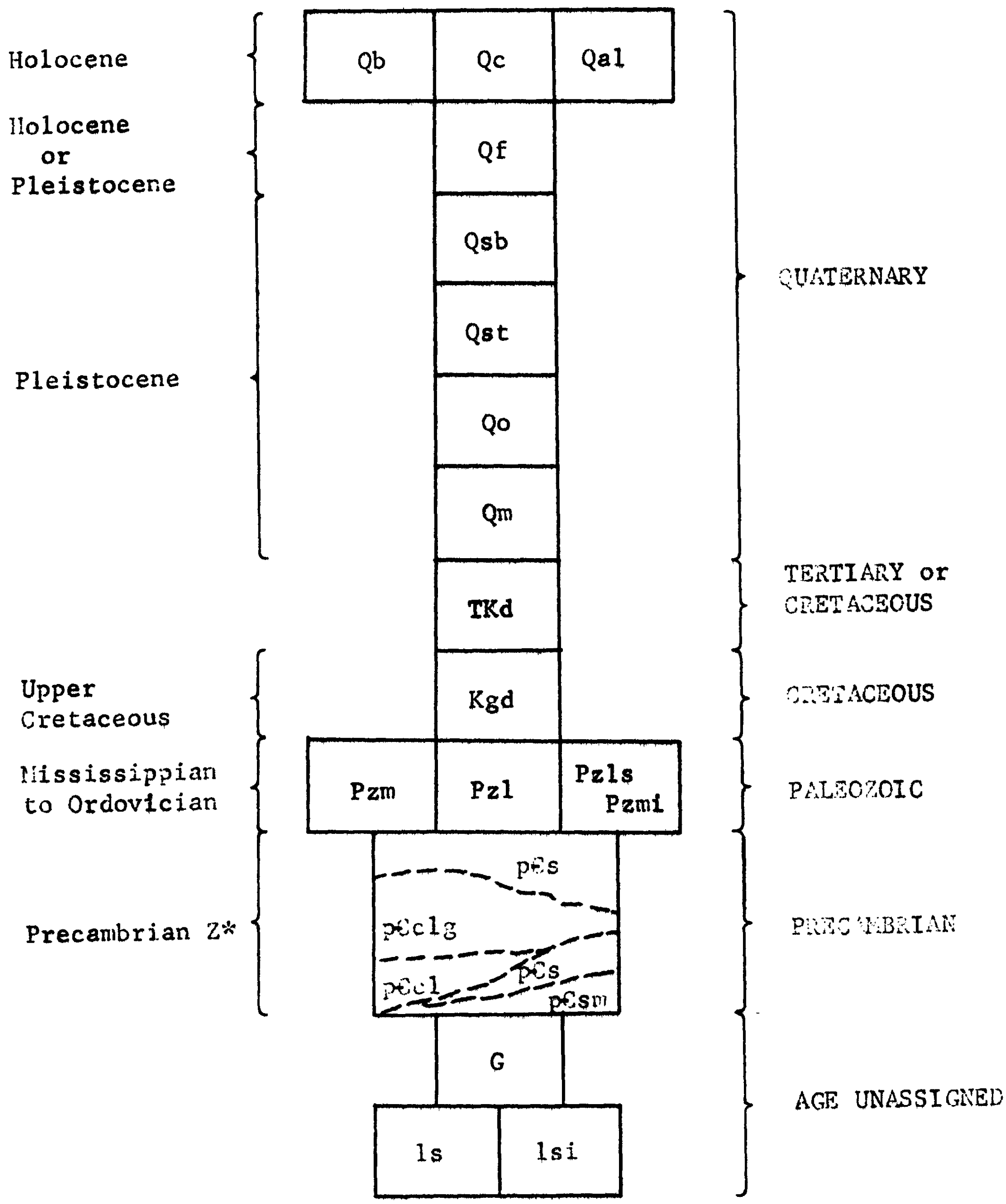
Sainsbury, C. L., Hudson, Travis, Ewing, Rodney, and Marsh, W. R., 1972a, Geologic map of the Nome C-2 quadrangle, Seward Peninsula, Alaska: U.S. Geol. Survey Open-File report.

Sainsbury, C. L., Kachadoorian, Reuben, and Smith, T. E., 1972b, Geologic map of the Nome D-3 quadrangle, Seward Peninsula, Alaska: U.S. Geol. Survey Open-File report.

Sainsbury, C. L., Curry, K. J., and Hamilton, J. C., 1972, An integrated system of airborne geologic mapping and geochemical sampling: U.S. Geol. Survey Bull. 1361 (in press).

EXPLANATION

Correlation of map units




*In accord with an interim scheme for subdivision of Precambrian time recently adopted by the U.S. Geological Survey -- Precambrian Z: base of Cambrian to 800 m.y.; Precambrian Y: 800-1,600 m.y.; Precambrian X: 1,600-2,500 m.y.; Precambrian W: older than 2,500 m.y.

## Description of map units

| | |
|---|---|
| Qb | Beach deposits - modern beach deposits only |
| Qc | Cover - principally tundra over soil, locally frost-riven regolith and colluvium partly covered by tundra |
| Qal | Alluvium - locally includes slightly reworked moraine |
| Qf | Alluvial fan deposits - single large fan along seacliffs |
| Qsb | Beach deposits - sand and gravel of the Sangamon sealevel; may represent spits and offshore bars in part |
| Qst | Silt and sand covered by tundra - deposits covering the coastal plain; mostly silt, but probably includes some reworked moraine and outwash gravels, as well as terrace gravels; overlies a wave-planed platform of Sangamon and pre-Sangamon age (landward of the Sangamon beach) |
| Qo | Glacial outwash - washed sand and gravel with local clay lenses and clay particles |
| Qm | Morainal deposits - principally ground moraine containing igneous and metamorphic rocks from the Kigluaik Mountains; grades upslope to colluvium and downslope to stream gravels, outwash, or beach gravels. Definitely truncated by the Sangamon beachline |
| TKd | Dikes - include diabase, lamprophyre, and altered granitic dikes in the large area of carbonate rock outcrop north of the Sinuk River, where only a few of the numerous dikes are shown on the map |
| Kgd | Granitic rock - biotite-hornblende quartz monzonite to granodiorite |
| | METAMORPHOSED CARBONATE ROCKS |
| Pzm | Marble and minor limestone, white to medium-gray, locally dolomitized, locally schistose; contains relict chert nodules locally |
| Pzl | Limestone and marble with relict bedding or color variations that represent original bedding |
| Pzls | Silicified marble and limestone |
| Pzmi | Impure marble; represents tectonic mixing of rocks along major thrust faults. Shown only where best developed |

YORK SLATE

| | |
|---|---|
| p€s | Faintly to highly foliated graphitic siltite, locally calcareous; all contains phengitic mica |
| p€sm | Metamorphosed graphitic siltite; quartz grains are recrystallized; contains biotite locally; calcareous parts recrystallized to calc-silicate rocks |
| p€cl | Chlorite-albite-epidote-amphibole schists, and feldspathic schists or semi-schists; minor graphite only |
| p€clg | Chloritic and feldspathic schists containing notable amounts of graphite; rocks are of uncertain origin and could represent either a sedimentary mixture of volcanic material with graphitic siltite or tectonically mixed graphitic siltite and chloritic schists |

UNITS OF UNASSIGNED AGE

| | |
|---|---|
| G | Gabbro, metagabbro, and related rocks - irregular bodies most common in chloritic schists, but some intrude thrust sheets of Paleozoic carbonate rocks. Rocks of widely different ages may be included |

Limestone, marble, and impure carbonate rocks

| | |
|---|---|
| ls | Schistose limestone and marble, generally weathers gray |
| lsi | Impure marble and schistose limestone; impurities include chlorite, graphite, and quartz. Rocks may be the result of tectonic mixing of diverse rock types |

NOTE: All the symbols shown below may not appear on this map

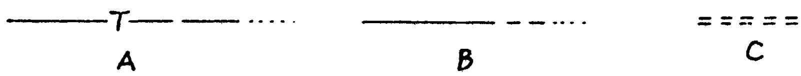

Veins and mineralized areas

A. Mineralized faults with old prospect pits or trenches containing elements as shown

B. Widespread gossans with old prospect pits or trenches; contained elements unknown

C. Placer gold mine extending along stream or beach as shown

D. Placer gold mine of localized extent. On coastal plain symbol represents surface placers as well as old drift mines on buried beaches. Symbols for metals contained in prospects or mines: Au, gold; Ag, silver; Pb, lead; Sb, antimony; Zn, zinc; Cu, copper; $CaF_2$, fluorite




Contacts

A. Transitional over a few feet to hundreds of feet

B. Sharp contact well exposed

C. Open ends indicate that bed continues an unknown distance beyond exposure

All contacts dashed where inferred or approximately located, dotted where concealed


Faults

A. Thrust fault; sawteeth on upper plate. Dashed where approximately located, dotted where concealed, queried where inferred or doubtful

B. High-angle fault, showing dip. U, upthrown side; D, downthrown side. Dashed where approximately located or inferred, dotted where concealed, queried where doubtful


A B C D

Strike and dip of foliation or cleavage

A. Strike and dip estimated by observation from low-flying aircraft
B. Strike and dip direction as determined by observation from low-flying aircraft
C. Strike and dip as measured on the ground
D. Strike and dip direction as determined on the ground


Anticline Syncline Drag folds

Folds

Showing approximate crestline and direction and amount of plunge where known

Prospect pit or trench


Abandoned dredge

Sinkhole

Cold-water spring