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# Geologic Map of Saint Lawrence Island, Alaska

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# Introduction

Saint Lawrence Island is located in the northern Bering Sea, 190 km southwest of the tip of the Seward Peninsula, Alaska, and 75 km southeast of the Chukotsk Peninsula, Russia (see index map, map sheet). It lies on a broad, shallow-water continental shelf that extends from western Alaska to northeastern Russia. The island is situated on a northwest-trending structural uplift exposing rocks as old as Paleozoic above sea level. The submerged shelf between the Seward Peninsula and Saint Lawrence Island is covered mainly with Cenozoic deposits (Dundo and Egiazarov, 1982). Northeast of the island, the shelf is underlain by a large structural depression, the Norton Basin, which contains as much as 6.5 km of Cenozoic strata (Grim and McManus, 1970; Fisher and others, 1982). Sparse test-well data indicate that the Cenozoic strata are underlain by Paleozoic and Proterozoic rocks, similar to those exposed on the Seward Peninsula (Turner and others, 1983).

Saint Lawrence Island is 160 km long in an east-west direction and from 15 km to 55 km wide in a north-south direction. The east end of the island consists largely of a wave-cut platform, which has been elevated as much as 30 m above sea level. Isolated upland areas composed largely of granitic plutons rise as much as 550 m above the wave-cut platform. The central part of the island is dominated by the Kookooligit Mountains, a large Quaternary shield volcano that extends over an area of 850 $km^2$ and rises to an elevation of 630 m. The west end of the island is composed of the Poovoot Range, a group of barren, rubble-covered hills as high as 450 m that extend from Boxer Bay on the southwest coast to Taphook Mountain on the north coast. The Poovoot Range is flanked on the southeast by the Putgut Plateau, a nearly flat, lake-dotted plain that stands 30–60 m above sea level. The west end of the island is marked by uplands underlain by the Sevuokuk pluton (unit Kg), a long narrow granite body that extends from Gambell on the north to near Boxer Bay on the south. Headlands having rugged cliffs or narrow, boulder-strewn beaches characterize the southwest coastline.

The geologic map of Saint Lawrence Island was prepared from published and unpublished field investigations carried out between 1966 and 1971 by W.W. Patton, Jr., Belà Csejtey, Jr., T.P. Miller, J.T. Dutro, Jr., J.M. Hoare, and W.H. Condon (Patton and Csejtey, 1971, 1980) and data from Ormiston and Fehlmann (1969). Fossils collected during these investigations are reported in the Alaska Paleontological Database (www.alaskafossil.org), and mineral resource information is summarized in the online Alaska Resource Data File (Hudson, 1998).

# Geology

The map units are divided into overlap assemblages and lithotectonic terranes. The overlap assemblages are composed of flat-lying to moderately deformed sedimentary, volcanic, and plutonic rocks that range in age from Quaternary to Early Cretaceous. The lithotectonic terranes are strongly deformed and are unconformably overlain and intruded by the overlap assemblage. The lithotectonic terranes are composed of rock units ranging in age from Triassic to Devonian.

## Overlap Assemblage

### Sedimentary Rocks

Large parts of the island are covered by unconsolidated Quaternary deposits (unit Qs) composed chiefly of modern beach and bar deposits that fringe the coastlines and former beach and bar deposits that mantle elevated wave-cut platforms in the eastern and central parts of the island. Glacial drift (unit Qg), which was deposited by an ice sheet that emanated from the Chukotsk Peninsula, Russia, is exposed along the north coast of the island from Akeftapak Bay to Kangee Camp and in the lowlands bordering Niyrakpak Lagoon.

Poorly consolidated, coal-bearing deposits of early Tertiary age (unit Ts) crop out at several scattered localities on the shore of Niyrakpak Lagoon, in the lowlands southwest of the lagoon, and along the Koozata River south of the Kookooligit Mountains.

## Volcanic and Intrusive Rocks

The overlap assemblage includes a compositionally and temporally wide array of volcanic and intrusive rocks that range in age from Quaternary to Early Cretaceous. The most extensive of these is the Quaternary basalt (unit Qb), which forms the Kookooligit Mountains, a large shield volcano in the central part of the island. These Quaternary basalt flows are bordered on the east between the Kookooligit Mountains and the Ongoveyuk River by a broad field of nearly flat-lying felsic flows, tuffs, and breccias of late Eocene age (unit Tr). Two large fields of earliest Tertiary and latest Cretaceous sodium-rich rhyolite, basalt, and andesite lava flows (unit TKsr) border the Kookooligit Mountains basalt flows on the west and south and form smaller fields in the Poovoot Range and on the Putgut Plateau. Scattered outcrops of altered basaltic to rhyolitic flows, tuffs, and shallow intrusive rocks (unit TKv) of uncertain but probable Cretaceous or Tertiary age occur in the eastern part of the island; altered andesitic, basaltic, and rhyolitic flows, volcaniclastic rocks, and hypabyssal intrusive bodies of Cretaceous age (unit Kv) are widely distributed in the western part of the island. Cretaceous granitic rocks (unit Kg) are widely distributed on the island and range in apparent age from Albian to Cenomanian. A small olivine-bearing monzodiorite pluton (unit Ko) is present on the southwest coast of the island at Iwoonut Point. Nepheline syenite (unit Kn) is found as rubble crop on the south-central part of the island and is thought to be part of a more than 1,300-km-long belt of similar ultrapotassic rocks extending from Chukotka, Russia, through Saint Lawrence Island and into west-central Alaska (Miller, 1972, 1989).

# Lithotectonic Terranes

The lithotectonic terranes on Saint Lawrence Island consist of two genetically unrelated rock assemblages. The

Ongoveyuk terrane (units TRs, Ml, and Dd) is chiefly composed of shallow-water carbonate rocks that were deposited along the ancient North American continental margin in Triassic to Devonian time. This assemblage has strong similarities to rocks of the same age presently exposed along the north side of the Brooks Range of mainland Alaska (Moore and others, 1994). The Tomname terrane (units TRPs and TRPg), by contrast, is composed of graywacke, shale, and bedded chert, suggesting deposition in an oceanic environment. The oceanic deposits are closely associated with gabbro and diabase intrusive rocks and ultramafic rocks.

The two lithotectonic terranes are interpreted to be correlative with similar rock assemblages in the Brooks Range and northeastern Asia. The Ongoveyuk terrane units can be correlated with units that are common in Precambrian to early Mesozoic shelf sedimentary rocks of the Arctic Alaska terrane in northern Alaska, whereas the Tomname terrane units bear some similarity to the oceanic igneous and sedimentary rocks of the Angayucham terrane, a subduction complex of Devonian to Jurassic age. These contrasting units are in structural contact on mainland Alaska. On Saint Lawrence Island, as mapped by Patton, they locally appear to be in depositional contact, for example west of Tomname Lagoon. Because the nature of the contact between the terranes has great significance for understanding the tectonics of the region, further examination of the various contacts would be productive.

According to Nokleberg and others (2000), the rocks of these two lithotectonic terranes are interpreted to be part of a complex that extends across the Bering Sea shelf from mainland Alaska to Chukotka in northeastern Russia. The complex, which borders the ancient continental margin of North America and northeastern Asia, formed in the Late Jurassic and Early Cretaceous when collapsed small ocean basins and island arcs were accreted to the continental margin (Nokleberg and others, 2000). The complex in Alaska and Chukotka is composed of a highly disrupted mixture of both oceanic and continental-margin rocks and fragments of volcanic-arc and ophiolite assemblages.

## DESCRIPTION OF MAP UNITS

### OVERLAP ASSEMBLAGE

UNCONSOLIDATED DEPOSITS AND SEDIMENTARY ROCKS

Qs **Beach, bar, and alluvial deposits (Quaternary)**—Gravel and sand eroded from the underlying bedrock platform and silt and sand alluvium eroded from upland areas

*Location and physiographic expression*—Active beach and bar deposits located along the present shoreline and former beach and bar deposits that mantle a broad wave-cut bedrock platform, which stands less than 30 m above sea level in the eastern and central part of the island. Formerly active beach and bar deposits are locally discernible in aerial photographs by their physiographic expression beneath a thin cover of peat and tundra vegetation. Alluvial deposits occur along small streams, mainly in the western part of the island

Qg **Glacial drift (Quaternary)**—Till and outwash gravel of probable late isotope stage 5 or isotope stage 4 (early Wisconsin) age deposited by an ice sheet that extended across the Bering Sea shelf from the Chukotsk Peninsula in northeastern Russia to Saint Lawrence Island (Hopkins and others, 1972; Brigham-Grette and Hopkins, 1995; Brigham-Grette and others, 2001). Small Pleistocene alpine glaciers appear to have been present in the Kookooligit Mountains and in other isolated mountainous areas at elevations above 350 m; however, these deposits are not shown on the map

*Location*—Drift deposits from the Chukotsk Peninsula, Russia, ice sheet are exposed along the northwestern coast of Saint Lawrence Island from Akeftapak Bay to Kangee Camp and at several isolated localities (not shown) in the adjoining coastal lowlands

Ts **Sandstone, coal, and tuff (lower Tertiary)**—Poorly consolidated sandstone, grit, and conglomerate, carbonaceous mudstone, ashy tuff, volcanic breccia, and seams of lignitic coal as much as 60 cm thick. Unit is poorly exposed and outcrops are badly slumped. Total thickness probably does not exceed 25 m. Abundant plant fossils of Oligocene age (J.A. Wolfe, written commun., 1968)

*Location*—Unit exposed in the western part of the island bordering Niyrapak Lagoon and along creeks draining into Aghnaghak Lagoon. Small exposures also have been found south of the Kookooligit Mountains on the Koozata River

VOLCANIC AND INTRUSIVE ROCKS

Qb **Basalt (Quaternary)**—Flat-lying to gently dipping lava flows and interlayered tuffs and breccias composed chiefly of alkali-olivine basalt, olivine-bearing tholeiite, and minor amounts of basanite, hawaiite, and nephelinite (Moll-Stalcup, 1994; Wirth and others, 2002). Numerous small cinder cones and flows are aligned in an east-trending belt along the crest of the Kookooligit Mountains and are chiefly composed of alkali-olivine basalt and basinite. According to Wirth and others (2002), crustally derived xenoliths of granite, granulite, and mafic cumulates and mantle xenoliths of spinel lherzolite, dunite, and wehrlite are abundant in the more alkaline cinder cones and flows. Unit assigned a Pleistocene age based on K-Ar ages ranging from 0.238±0.132 to 1.46±0.13 Ma (Patton and Csejtey, 1980; see table 1, herein)

*Location*—Unit forms the Kookooligit Mountains, a large shield-like volcano that covers approximately 850 km$^2$ in the central part of the island. Two smaller basalt fields cap the uplands near Southwest Cape, and tiny patches of the basalt are scattered across the lowlands south and west of Niyrakpak Lagoon and at Mugum Peak southeast of Apatiki Camp

TKv **Volcanic rocks, undivided (Tertiary and (or) Cretaceous)**—Flows, tuffs, and hypabyssal intrusive rocks that range in composition from basalt to rhyolite and are commonly altered. Age is uncertain but probably no older than Cretaceous

*Location*—Exposures of this unit occur at several widely scattered localities on the eastern part of the island

Tr **Rhyolitic and dacitic tuffs (early Tertiary)**—Pale-reddish-orange to gray welded tuff, ash-fall tuff, tuff breccia, and flows of felsic composition (Patton and Csejtey, 1980). On Fossil River, unit contains a thin sequence of quartzose sandstone, quartz-chert conglomerate, volcanic conglomerate, and ash-fall tuff with abundant plant fossils. Unit is poorly exposed but appears to be generally flat lying or gently dipping. Assigned an early Tertiary age on the basis of a K-Ar age determination of 39.3±1.0 Ma (Patton and Csejtey, 1980; see table 1)

*Location*—Unit crops out along low riverbanks and coastal bluffs in the east-central part of the island between the Kookooligit Mountains and the Ongoveyuk River

TKsr **Sodium-rich rhyolite and basalt (early Tertiary and latest Cretaceous(?))**—Sodium-rich rhyolite flows composed of large phenocrysts of twinned sanidine and reddish-brown hornblende in a fine-grained trachytic groundmass. Unit locally includes basalt, trachyandesite, and andesite lava flows, small hypabyssal bodies of rhyolite, and felsic crystal tuff. Unit poorly exposed but is believed to be only slightly to moderately deformed. Assigned an early Tertiary minimum age on the basis of K-Ar ages of 62.1±1.8 and 64.4±1.9 Ma on the mineral-pair hornblende and sanidine from sodium-rich rhyolite and a whole-rock age of 64.0±2.0 Ma on a sample of trachyte (Patton and Csejtey, 1980; see table 1)

*Location*—Unit crops out at scattered localities on the western half of the island. The two largest bodies lie at the west edge of the Kookooligit Mountains and on the southeast flank of the Poovoot Range. Smaller bodies are scattered along the south coast on Koozata River, Koozata Lagoon, and near Powooiliak Camp

Kv **Andesitic volcanic rocks (Cretaceous)**—Wide variety of flows and hypabyssal intrusive and volcaniclastic rocks. Igneous rocks range from basalt to rhyolite in composition, but chiefly composed of andesite and trachyandesite. Volcaniclastic rocks vary from lithic and crystal tuff and breccia to volcanic conglomerate. All rocks have been altered, in varying degrees, to an aggregate of chlorite, epidote, sericite, clay minerals, calcite, and pyrite and, where intruded by the Sevuokuk pluton, have been metamorphosed to hornblende hornfels or albite-epidote hornfels. Unit is assigned a Cretaceous age but may have a wide age range within the Cretaceous. It is locally intruded by and, therefore, at least in part, older than the Sevuokuk pluton, which yields radiometric ages between 93.5±3.0 and 110.2±0.6 Ma (see table 1). However, near Powooiliak Camp, on the south coast, this unit yielded a K-Ar age of 90.9±3.0 Ma (Patton and Csejtey, 1980; see table 1) and may be, in part, younger than the Sevuokuk pluton

*Location*—Unit exposed on the western part of the island

**Plutonic rock complex (Cretaceous)**—Widely distributed on the island are granitic and more mafic plutons of similar age. These plutons include the very large and possibly multi-phase Sevuokuk pluton on the west end of the island, the small monzodioritic Iwoonut pluton, and an unnamed nepheline syenite pluton near Siknik Cape. Including unexposed (shown in a pale color) but reasonable projections of the extent of the plutons, Cretaceous plutons cover 22 percent of the area of Saint Lawrence Island. Complex subdivided into units Kg, Ko, and Kn

Kg **Granite and granodiorite (Late and Early Cretaceous)**—Granite and subordinate granodiorite, monzonite, syenite, and alaskite. The rocks vary from coarse- to fine-grained and textures vary from granitic to porphyritic and seriate. Three broad categories are recognizable: (1)

granite, granodiorite, and monzonite that contain intermediate amount of quartz and hornblende as the chief mafic mineral; (2) granite, granodiorite, and alaskite that are characterized by a high quartz content and by biotite as the chief mafic mineral; and (3) monzonite and syenite that contain abundant mafic minerals but little or no quartz. Four biotite samples (table 1) from this unit yielded K-Ar cooling ages between 93.5±3.0 Ma and 108.0±3.2 Ma (Patton and Csejtey, 1980), and two biotite samples (table 1) gave $^{40}Ar/^{39}Ar$ ages of 100±0.5 Ma and 110.2±0.6 Ma (Amato and others, 2003). Range in ages suggests either multiple intrusions or variable slow cooling. Of the three age determinations on the Sevuokuk pluton (110.2±0.6, 108.0±3.2, and 100.0±0.5 Ma, map nos. 1, 2, and 6, respectively) on the west coast of the island, the southernmost (map no. 6) yields a significantly younger age, which is similar to the compositionally different Iwoonut pluton (102.3±0.5 Ma, map no. 7; unit Ko), possibly indicating slower cooling to the south. However, the mineralized satellitic stock of the Sevuokuk pluton (93.5±3.0 Ma, map no. 4, table 1) may indicate that the Sevuokuk pluton is the product of a multi-phase event lasting an extended period

*Location*—Unit composed of six, large, named plutonic bodies that are well exposed in the upland areas in the eastern and western parts of the island and numerous small exposures scattered along incised drainages and along the shoreline in the eastern part of the island. From west to east, the large plutons are the Sevuokuk, Taphook, Myghapowit, Kialegak, Soomaghat, and Kinipaghulghat plutons. Some of the isolated exposures may be parts of much larger plutons that are covered or buried beneath the tundra vegetation cover. On the map, we show the possible extent of several of these buried plutons. The location of the exposures is shown by use of a more intense color for that part of the unit

Ko **Olivine-bearing monzodiorite (Early Cretaceous)**—Monzodiorite composed of a medium- to coarse-grained granitic textured rock composed chiefly of plagioclase, K-feldspar, augite, olivine, and biotite. Accessory minerals include apatite, zircon, and magnetite. A biotite sample (table 1) from this unit yielded a $^{40}Ar/^{39}Ar$ age of 102.3±0.5 Ma (Amato and others, 2003)

*Location*—Iwoonut pluton, a small intrusive body bordering the east side of Boxer Bay near Southwest Cape

Kn **Nepheline syenite (Early Cretaceous)**—Medium- to coarse-grained granitic textured nepheline syenite with K-feldspar phenocrysts as much as 4 cm long. Rock-forming minerals are K-feldspar, nepheline, biotite, and melanite garnet and subordinate amounts of sodic andesine and hornblende. Accessory minerals include fluorite, sphene, magnetite, zircon, apatite, allanite, and rare calcite. Closely associated rocks of the granite and granodiorite unit (Kg) appear to intrude the nepheline syenite unit and, therefore, are younger. A sample of the nepheline syenite (table 1) from this complex yielded a $^{40}Ar/^{39}Ar$ age of 113.3±1.1 Ma (Amato and others, 2003). This nepheline syenite is thought to be part of a more than 1,300-km-long belt of similar ultrapotassic rocks extending from Chukotka, Russia, through Saint Lawrence Island and into west-central Alaska (Miller, 1972, 1989)

*Location*—Bedrock exposures of unit occur as rubble crops at three localities on the wave-cut platform north of Siknik Cape in the south-central part of the island. The unit appears to be part of a large plutonic complex composed chiefly of granite and granodiorite (Kg)

## LITHOTECTONIC TERRANES

### ONGOVEYUK TERRANE

Ꞧs **Shale, limestone, and chert (Triassic)**—Unit consists of an upper member, 50 m thick, composed of black shale, dark thin-bedded limestone, and chert and a lower member, 70 m thick, composed of thin-bedded chert and dark siltstone. The upper member contains flat clams Daonella, Halobia, and Monotis, indicating a condensed section ranging in age from Middle (Ladinian) to Late (Carnian and Norian) Triassic (Patton and Dutro, 1969; Alaska Paleontological Database, www.alaskafossil.org). The age of the lower member is uncertain but is presumed to be Middle or Early Triassic on the basis of similarities with rocks of the Otuk Formation (Bodnar and Mull, 1987) in the Brooks Range to the east. Patton and Dutro (1969) originally suggested that the upper part of this unit is correlative with the Shublik Formation of Triassic age and that the lower part of the unit may correlate with either the lower part of the Shublik Formation or the Siksikpuk Formation of Permian age. Since that document was published, the Otuk Formation was defined in the western Brooks Range by

Mull and others (1982), and we suggest that the Otuk is an appropriate correlative unit for the entire map unit

*Location*—Best exposed in the eastern part of the island along small incised streams that drain into Ongoveyuk and Tomname Lagoons. Rubble patches of this unit also have been identified on the Seknak River near Myghapowit Mountain and on the western part of the island on Yaghmelngak Mountain

Ml **Limestone (Upper Mississippian)**—Unit composed of an upper and lower member. Upper member consists chiefly of light- to medium-gray coarsely bioclastic limestone that contains interbedded limey mudstone in upper part. Lower member composed of dark-gray thin-bedded limestone that contains abundant dark chert nodules. Unit metamorphosed to coarse-grained marble near contacts with granitic plutons. Total thickness of unit is estimated to be between 400 and 500 m. Assigned a Late Mississippian age on the basis of an abundant coral, brachiopod, foraminifera, and conodont fauna (Patton and Dutro, 1969; Lane and Ressmeyer, 1985; Alaska Paleontological Database, www.alaskafossil.org). May correlate with the Kogruk Formation of the Lisburne Group

*Location*—Unit is widely exposed along streams draining the wave-cut platform in the eastern part of the island; best outcrops occur along streams that flow into Ongoveyuk and Tomname lagoons. Unit also exposed as scattered rubble patches in the western part of the island

Dd **Dolostone and dolomitic limestone (Devonian)**—Medium-gray to brown, laminated, locally brecciated dolostone and dolomitic limestone. Grades into dark, fine-grained, thin-bedded dolomite in upper part. Unit metamorphosed to sugary textured marble along contacts with granitic plutons. The total thickness of unit estimated to be about 1,300 m. Assigned a probable Late and Middle Devonian age on the basis of an abundant fauna that includes Amphipora(?), tabulate and thamnoporoid corals, and assorted brachiopod species (Patton and Dutro, 1969; Alaska Paleontological Database, www.alaskafossil.org). Conodonts having an age range of Late Silurian through Early Devonian (A.G. Harris, USGS, written commun., 1993) were collected from this unit by J.G. Clough of the Alaska Division of Geological and Geophysical Surveys as reported by Till and Dumoulin (1994). This collection indicates that this unit may contain rocks as old as Silurian. Harris (written commun., 1993) suggested that this unit appears like lithologically similar rocks on the Chukotsk Peninsula of Russia. In addition, the unit is similar to unit Ddm of Till and others (2010) on the Seward Peninsula

*Location*—Unit extensively exposed along streams that drain the wave-cut platform in the eastern part of the island. The best exposures are along the Seknak and Maknek Rivers on the south side of the island. Unit is also exposed locally on the western part of the island, mainly in scattered rubble patches

TOMNAME TERRANE

ꞦPs **Graywacke, grit, and shale (Triassic and Permian(?))**—Dark fine-grained to gritty carbonaceous graywacke, dark carbonaceous shale, and subordinate bedded chert and siliceous mudstone. Clasts in graywacke consist mainly of quartz but also include plagioclase, K-feldspar, shale, chert, granitic rocks, quartzite, schist, and limestone; the matrix is made up of fine-grained siliceous and carbonaceous debris. Highly calcareous graywacke and impure clastic limestone containing abraded echinoderm and coral debris occur in the lower part of the unit. Cone-in-cone structures are common. Unit is intensely deformed and locally altered to hornfels along contacts with granitic plutons. Unit assigned a Permian and Triassic age on the basis of (1) the occurrence of radiolaria of probable Triassic age in chert beds (D.L. Jones, written commun, 1978) and (2) correlation with a lithologically similar assemblage in nearby parts of the Chukotsk Peninsula, Russia, that contains Early Triassic and Permian fossils (Arkavyi and others, 1975)

*Location*—Unit is best exposed along streams draining into Tomname and Ongoveyuk lagoons on the eastern part of the island. Scattered rubble exposures of the unit also occur in the western part of the island

ꞦPg **Gabbro and diabase (Triassic and Permian(?))**—Rusty-weathering altered gabbro and diabase and subordinate amounts of siliceous mudstone, laminated tuff, basalt, fine-grained graywacke, and slate. Gabbro and diabase consist mainly of clinopyroxene, plagioclase, hornblende, and opaque minerals with minor interstitial quartz and K-feldspar. Several tiny bodies of ultramafic rocks, presumably belonging to this unit, were observed on the western part of the island. Offshore dredging of ultramafic rocks (D.M. Hopkins, USGS, oral commun., 1970) and high chromium values in stream sediments on lower Ikoygak Creek (Hudson, 1998) suggest that ultramafic rocks may be present beneath the surficial deposits of Akeftapak Bay. Two K-Ar age determinations on gabbro of this unit yielded 221±7 and 244±7 Ma (Patton and Csejtey, 1980; see table 1)

*Location*—Unit is widely exposed on the western part of the island; on the eastern part of the island, exposures are limited to a few scattered outcrops along the streams draining the wave-cut platform and along the coast

ROCKS OF UNCERTAIN AFFINITY

Pzu **Calc-silicate hornfels (Paleozoic(?))**—Highly crenulated banded rock consisting of 0.5- to 10-cm-thick layers of pale-gray, green, and lavender calc-silicate hornfels alternating with thinner layers of dark argillaceous hornfels. Calc-silicate hornfels composed chiefly of carbonate, scapolite, diopside, tremolite, and biotite. Protolith appears to have been thinly banded marly limestone. Age of unit is uncertain but considered most likely to be Paleozoic, because it is made up chiefly of carbonate rocks and appears to lack the siliciclastic and cherty rocks that characterize younger units

*Location*—Unit is confined to a small area on the eastern part of the island in the vicinity of Sooghmeghat. It is exposed in scattered outcrops around the northern perimeter of the Sooghmaghat pluton and in small roof pendants within the pluton

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**Table 1.** Radiometric age determinations from the Saint Lawrence quadrangle, Alaska (sorted by geologic unit as listed in Description of Map Units; map numbers in sequence from northwest to east end of island).

[Latitude and longitude in degrees and decimal minutes, NAD'27 datum. Methods: K-Ar, conventional potassium-argon analysis; 40/39, $^{40}Ar/^{39}Ar$ analysis. Phases dated: BI, biotite; HO, hornblende; SA, sanidine; WR, whole-rock]

| Map number | Sample number | Map unit | Latitude (N.) | Longitude (W.) | Rock type | Method | Phase dated | Age and analytical error (Ma) | Comments | References |
|---|---|---|---|---|---|---|---|---|---|---|
| 13 | 66AHr136b | Qb | 63° 35.9' | 170° 33.2' | Basalt | K/Ar | WR | 0.364±0.060 | Massive, alkali olivine basalt flow, Kookooligit Mountains | Marvin and Dobson, 1979; Patton and Csejtey, 1979, 1980 |
| 12 | 66AHr217b | Qb | 63° 39.1' | 170° 37.0' | Basalt | K/Ar | WR | 1.46±0.13 | Kookooligit Mountains | Marvin and Dobson, 1979; Patton and Csejtey, 1979, 1980 |
| 11 | 66AHr218a | Qb | 63° 39.5' | 170° 37.0' | Basalt | K/Ar | WR | 0.654±0.183 | Koomlangeelkuk Bay. Reversed magnetization suggests flow is older | Marvin and Dobson, 1979; Patton and Csejtey, 1979, 1980 |
| 14 | 71AHr134a | Qb | 63° 28.0' | 170° 17.3' | Basalt | K/Ar | WR | 0.238±0.132 | Kookooligit Mountains, west of Camp Iveetok | Marvin and Dobson, 1979; Patton and Csejtey, 1979, 1980 |
| 15 | 79APa47a | Tr | 63° 26.6' | 170° 4.4' | Rhyolite | K/Ar | BI | 39.3±1.0 | South of Camp Iveetok | Patton and Csejtey, 1979, 1980 |
| 10 | 69ACy163B | TKsr | 63° 29.8' | 170° 52.2' | Dacite | K/Ar | WR | 64.0±2.0 | South of Kangee Camp | Dalrymple and Lanphere, 1971, 1974; Patton and Csejtey, 1979, 1980 |
| 10 | 69ACy163B | TKsr | 63° 29.8' | 170° 52.2' | Dacite | 40/39 total fusion | WR | 65.5±1.3 | South of Kangee Camp, age recalculated using constants of Steiger and Jäger (1977). Plateau age, 65.6±1.2 Ma; isochron age of plateau steps 65.4±8 Ma | Dalrymple and Lanphere, 1971, 1974 |
| 9 | 66APa242 | TKsr | 63° 30.1' | 170° 54.2' | Rhyolite | K/Ar | SA | 64.4±1.9 | South of Kangee Camp | Patton and Csejtey, 1971, 1979, 1980; Bolm, 1983 |
| 9 | 66APa242a | TKsr | 63° 30.1' | 170° 54.2' | Rhyolite | K/Ar | HO | 62.1±1.8 | South of Kangee Camp | Patton and Csejtey, 1971, 1979, 1980 |
| 8 | 69APa187B | Kv | 63° 22.6' | 171° 17.5' | Tuff | K/Ar | BI | 90.9±3.0 | West side of Powooiliak Bay | Patton and Csejtey, 1971, 1979, 1980 |
| 17 | 70ACy162 | Kg | 62° 59.4' | 169° 35.7' | Quartz monzonite | K/Ar | BI | 104.0±3.0 | Kialegak pluton | Csejtey and others, 1971; Patton and Csejtey, 1979, 1980 |
| 18 | 66AMm245 | Kg | 63° 11.0' | 168° 55.0' | Syenite | K/Ar | HO | 104.0±3.1 | Kinipaghulghat pluton | Csejtey and others, 1971; Patton and Csejtey, 1979, 1980 |
| 6 | 94StL 8a | Kg | 63° 21.31' | 171° 38.4' | Granodiorite | 40/39 plateau | BI | 100.0±0.5 | Sevuokuk pluton. Total fusion age 99.9±0.5 Ma, isochron age 99.8±0.5 Ma | Amato and others, 2003. Corrected sample location provided by J. Amato (written commun., 2009) |
| 4 | 69APa219E | Kg | 63° 28.5' | 171° 31.4' | Quartz monzonite | K/Ar | BI | 93.5±3.0 | Mineralized satellitic stock of Sevuokuk pluton | Csejtey and others, 1971; Patton and Csejtey, 1979, 1980 |
| 2 | 66AMm211 | Kg | 63° 45.9' | 171° 40.6' | Quartz monzonite | K/Ar | BI | 108.0±3.2 | Sevuokuk pluton | Csejtey and others, 1971; Patton and Csejtey, 1971, 1979, 1980 |
| 1 | 94StL 19 | Kg | 63° 46.62' | 171° 42.0' | Granite | 40/39 plateau | BI | 110.2±0.6 | Sevuokuk pluton. Total fusion age 109.7±0.6 Ma, isochron age 110.6±2.4 Ma | Amato and others, 2003. Corrected sample location provided by J.M. Amato (written commun., 2009) |
| 7 | 94StL 1 | Ko | 63° 20.31' | 171° 33.55' | Monzodiorite | 40/39 plateau | BI | 102.3±0.5 | Iwoonut pluton. Total fusion age 102.3±0.5 Ma, isochron age 102.5±0.5 Ma | Amato and others, 2003. Corrected sample location provided by J.M. Amato (written commun., 2009) |

**Table 1—continued.** Radiometric age determinations from the Saint Lawrence quadrangle, Alaska (sorted by geologic unit as listed in Description of Map Units; map numbers in sequence from northwest to east end of island).

[Latitude and longitude in degrees and decimal minutes, NAD’27 datum. Methods: K-Ar, conventional potassium-argon analysis; 40/39, $^{40}Ar/^{39}Ar$ analysis. Phases dated: BI, biotite; HO, hornblende; SA, sanidine; WR, whole-rock]

| Map number | Sample number | Map unit | Latitude (N.) | Longitude (W.) | Rock type | Method | Phase dated | Age and analytical error (Ma) | Comments | References |
|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 71APa 306b | Kn | 63° 16.26' | 170° 12.95' | Nepheline syenite | 40/39 plateau | BI | 113.3±1.1 | Approximate location. Nepheline syenite. Total fusion age 115.46±1.11 Ma, Isochron age 112.68±1.28 Ma | Amato and others, 2003 |
| 5 | 70APa13 | ₮Pg | 63° 28.0' | 171° 31.0' | Gabbro | K/Ar | HO | 221±7 | Poovoot Range | Patton and Csejtey,1979, 1980 |
| 3 | 69APa229A | ₮Pg | 63° 34.4' | 171° 34.8' | Gabbro | K/Ar | HO | 244±7 | North Mamagnak Mountains | Patton and Csejtey, 1971, 1979, 1980 |