STATE OF ALASKA

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DIVISION OF MINES AND GEOLOGY

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GEOLOGIC REPORT NO. 38

Uranium in Alaska

By

Gilbert R. Eakins

College, Alaska

May 1969

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By Gilbert R. Eakins

ABSTRACT

The geology of Alaska is favorable for uranium deposits, and large areas remain untested. This report has been prepared to assist those interested in the search for uranium in the State. All radioactive mineral investigations conducted by Federal and State agencies in Alaska are summarized in a table form. The regions from which the richest and largest numbers of radioactive samples have been collected are southeastern Alaska and the Seward Peninsula. Particular areas discussed are (1) the Bokan Mountain uranium-thorium area, including the Ross-Adams mine, (2) the Hyder mining district, (3) Skagway, (4) Hope Creek in the Fairbanks district, (5) the Brooks Mountain and Ear Mountain areas on the Seward Peninsula, and (6) the Selawik Basin and vicinity in western Alaska. Other areas believed by the writer to warrant investigation are the Ketchikan, Petersburg, and Wrangell districts of southeastern Alaska and the Ogilvie Mountains near the Canadian border north of the Yukon River. Phosphate beds in the northern foothills of the Brooks Range contain low grade uranium.

The report also summarizes recent investigations of Tertiary sandstones by the writer during the summer of 1968. The general areas visited are the Healy coal district, the Eagle area, the Cantwell-Mount McKinley National Park areas and localities near the middle of the Alaska Peninsula. Maximum radioactivity readings of five times background were obtained on the ground. None were sufficiently high to indicate potential ore, but permafrost, meteoric water, and steep dips of many of the Tertiary rocks may have caused near-surface conditions which make uranium detection difficult.

Many of the uranium showings in Alaska have not been tested at depth, and diamond drilling is recommended in some areas. Aerial radiometric surveys and geochemical sampling of stream sediments and soils are methods applicable to uranium prospecting in large parts of the State. The Division of Mines and Geology plans to test geochemical, geobotanical, and aerial survey methods applicable to uranium prospecting during the summer of 1969.

INTRODUCTION

The first uranium rush began shortly after World War II when the U. S. Government offered a discovery bonus and a guaranteed price for uranium production. This boom lasted until 1958 when the Atomic Energy Commission announced that the reserves found up to that time were more than adequate to meet the nation's needs. Exploration came to a standstill, and AEC purchases were then limited to a few "stretch out" contracts, which were extensions granted to assist certain mining operations until 1970. However, all predictions of future uranium requirements had greatly underestimated the rate of growth of the nuclear power industry. The AEC recently stated that in 1965 less than one percent of the electrical generating capacity of the country was nuclear. It estimated that nuclear power plants will supply 23 to 30 percent of our electricity by 1980 and as much as 50 percent by the year 2000. The near-future uranium needs therefore are believed to be far greater than the known supply available at current prices. While the present price of $8.00 per pound of U_3O_8 may prevail for some time, many men within the industry feel that the price will increase so that lower grade ores or higher cost reserves can be used to help satisfy the anticipated demand for more nuclear fuel. The immediate result has been a second uranium boom.

The main difference between the early exploration programs and those being conducted today is in size and sophistication. The easily located deposits, especially in accessible areas, have been mostly found by individual prospectors and small organizations who swarmed over the country in the 1940's and 1950's. Today exploration is, for the most part, in the hands of large companies geared to large scale and expensive programs which are required to locate the deeper and more obscure deposits. Exploration and development drilling for uranium reached a new high of 10.8 million feet during 1967. A total of $500 million probably will be spent on uranium exploration between now and 1980.

Alaska should be considered a potential source of major quantities of uranium. The Ross-Adams mine on Prince of Wales Island already has produced high-grade uranium ore. When the great size and complex geology of the State are considered, it seems inevitable that important concentrations of uranium eventually will be found here. The area involved is equivalent to the combined areas of Arizona, Colorado, Idaho, New Mexico, Utah, and Wyoming. Furthermore, with much of the State relatively unexplored, it is likely that important discoveries still can be made by individual prospectors and small companies, in spite of the activities of larger organizations.

This report has been prepared to encourage and guide uranium explorations within the State. All investigations for radioactive minerals both by the Federal Government and Alaska, as a Territory and as a State, have been located on the accompanying map and referenced. There is no way to include the work done by private companies or individuals, but old assay reports on file at the State Division of Mines and Geology include a number of uranium assays on samples submitted by prospectors which are significantly high to stir interest.

While the number of localities that have been visited and the extent of traverses as shown on the map may suggest that there has been considerable exploration, the actual area covered by radiometric ground surveys is very small in relation to the entire State. During the late 1940's and 1950's, the U. S. Geological Survey conducted a number of radiometric surveys in Alaska for the AEC. These investigations were directed primarily at (1) evaluating known lode mines and prospects for uranium and (2) testing of concentrated stream sediment samples in hopes of locating source rocks which might be abnormally radioactive. These studies revealed a number of radioactive anomalies, but no production has yet resulted The localities investigated and the airborne anomalies detected are indicated on the accompanying map. Additional investigations by the writer during the summer of 1968 are also indicated on the map. These are discussed in a separate section of this report.

GENERAL GEOLOGY OF URANIUM

Hundreds of reports, books, and papers on the various uranium deposits of the world have been published during the last twenty years. Still it is very difficult to make any general statements regarding radioactive ores. Because of the solubility and mobility of uranium, its ores have been found to some extent in all types of rocks and of nearly every geologic age and environment. While uranium is widely dispersed, economic concentrations are rare. The origin, age, geochemistry, and structural controls of known deposits are still subjects of disagreement and speculation. However, certain mineral associations and sedimentary environments occur in a sufficient number of cases to serve as useful guides (but not rules) in prospecting for new deposits. The geology of uranium and prospecting methods will be briefly outlined here, but those who are preparing to explore are also referred to bibliographies published by the AEC and the U. S. Geological Survey.

Uranium may be found either as primary deposits in veins, or as secondary deposits in bedded sedimentary rocks. The principal source of uranium is acidic igneous rocks, such as granite, syenite, pegmatites, or rhyolitic volcanic ash beds. In these rocks may be found uranium minerals, such as uraninite, or trace amounts of uranium contained in the accessory minerals such as zircon, allanite, monazite, xenotime, and sphene. The deposits of primary uranium commonly are associated with silver, copper, thorium, and cobalt and appear most often in zones marginal to base metal ore districts. The most universal gangue minerals of the vein deposits seem to be hematite, purple fluorite, and red jasperoid. These gangue minerals should be particularly useful as "indicators". The basic or dark-colored igneous rocks are very low in uranium content. While the ores are generally believed to be related to nearby granitic rocks, veins or dikes containing uranium may cut any type of country rock.

Even though the richest uranium ores are in a relatively few known vein deposits, over 90 percent of the world's reserves are in sedimentary rocks -- sandstones and conglomerates of continental origin. Essential conditions to the formation of bedded or sedimentary-type uranium deposits are (1) the presence of continental sediments, mainly siltstones, arkosic sandstones, or conglomerates, (2) a granitic or volcanic source which by weathering or leaching has produced uranium-bearing solutions or sediments, (3) a reducing chemical environment to cause precipitation of the uranium from acidic transporting waters, and (4) entrapment so that there will be no further leaching by meteoric waters. Reducing conditions are created by the presence of carbonaceous plant material or hydrogen sulfide. Pyrite is always present in beds containing unoxidized uranium. The most favorable criterion are continental sandstones deposited by ancient streams in foreland regions. Bedded deposits consist of fine-grained uranium minerals that fill pore spaces or replace plant fossils and cementing material in the host rock. Reducing environments are sometimes detected by alteration, or "bleaching", of the enclosing sediments. Bleached sandstones are light colored (gray, green, buff) in comparison with the unbleached (red, brown) oxidized rocks.

The primary uranium minerals, such as uraninite, are generally dark-colored, brown to black, and are found either in veins or pegmaite dikes or dispersed between the grains of sedimentary rocks. When uranium minerals become oxidized by weathering at or near the surface, secondary or oxidized minerals, such as carnotite, are formed. These are frequently bright yellow, green, brown, and reddish brown. However, because of the cold, damp climate in Alaska, the bright colored, soluble, secondary minerals are less likely to be found here than they are in the warm, dry regions.

The greatest part of the known uranium reserves in the United States are in sandstones and conglomerates of Triassic and Jurassic ages in the Colorado Plateau region and in sediments in Tertiary basins in Wyoming. Outside the U. S. most of the free world's uranium reserves are in Precambrian conglomerates as in the Elliot Lake (Blind River) district in Ontario, Canada, and at Witswatersrand, South Africa. The average grade of the ores mined in the United States is 0.20 to 0.25 percent. The grades of the vast Canadian and South African deposits are somewhat lower.

Thorium is a radioactive mineral which is fairly widespread and frequently associated with uranium. At present thorium is not in demand for nuclear fuel, but it may become so. If found in quantity it should be considered potentially important. Radiations from thorium affect a geiger counter or scintillometer in the same manner as uranium. Because of this difficulty, modern multi-channel spectrometer-type scintillometers which can distinguish between uranium and thorium radiation are useful in prospecting.

U R A N I U M I N A L A S K A

The accompanying table and map summarize available data concerning uranium in Alaska. It is not possible at this time to outline uranium provinces as has been done for the Colorado Plateau, but uranium and thorium have been produced from the Bokan Mountain area near Kendrick Bay on the southeastern part of Prince of Wales Island in Southeastern Alaska. This area and others where pronounced radioactive anomalies have been found are circled on the map. In addition to the comments in the table these particular areas are discussed briefly in the following sections. The information in these sections is taken from U. S. Geological Survey reports. Location numbers refer to locations on the map.

BOKAN MOUNTAIN URANIUM-THORIUM AREA

(Location 1)

The original uranium discovery was made in 1955 by Don Ross and Kelly Adams using an airborne geiger counter. The known uranium-thorium mineralization is centered on and around a small, late-stage granite stock believed to be Tertiary in age, which intruded an older Paleozoic pluton composed of quartz monzonite and granodiorite. Numerous small radioactive deposits have been found within a 71-square-mile area. Deposits not directly related to the granite stock have been found in aplite and pegmatite dikes. The dikes are up to 1000 feet long and 10 feet wide and are potentially important because of their uranium, thorium, zirconium, and rare earth contents. The radioactive minerals are principally primary types and consist of uranothorite, uranoan thorianite and uraninite which occur as scattered grains throughout the granite and in numerous thin veinlets. Secondary minerals are rare but some of the ore, possibly autunite, fluoresces brightly under an ultraviolet light. The chief gangue minerals are hematite, calcite, fluorite, and quartz.

The ore at the Ross-Adams mine does not fit into any of the "typical" types or uranium vein deposits, such as those classed as associates of the nickel-cobalt-silver group, the silica-iron-lead group, or the iron-titanium group. The ore body is an irregular concentration roughly 50 x 50 x 400 feet. A large portion of the ore averages over one percent U_3O_8, and pods contain up to three percent U_3O_8. There are no important metallic sulfides associated with the ore, and there is little evidence of structural control. However, there are many copper and gold prospects in the region.

Kendrick Bay Mining Co., a subsidiary of Standard Metals Corp., has stated that the Bokan Mountain property produced approximately 39,000 tons of ore averaging approximately 1.0 percent U_3O_8 between 1957 and 1964. The mine has been inactive since that time, but it was recently announced that the Kendrick Bay Mining Company in a joint venture with the Newmont Mining Company plans to reopen the property. It is possible that new ore will be located at depth.

The Bokan Mountain area and the numerous radioactive anomalies at other localities in Southeastern Alaska make this the most promising part of the State for uranium prospecting.

HYDER MINING DISTRICT, SOUTHEASTERN ALASKA

(Location 16)

The Hyder district is at the head of Portland Canal near the Alaska-British Columbia border. The area is highly mineralized and includes a number of properties containing marginal deposits of gold, silver, copper, lead, zinc, and tungsten. Radioactive material, which apparently is uranium, is widely distributed. Mesozoic Coast Range granodiorite and quartz monzonite are intrusive into Jurassic greenstones, tuffs, graywackes, argillite, and quartzite. Most of the radioactive minerals are associated with sulfides, but some form thin secondary coatings on fracture surfaces. The well-known Premier mine is just across the border in British Columbia.

Uranium investigations have been concentrated on the Mountain View property, about five miles north of Hyder, where assays as much as 0.049 percent equivalent uranium were obtained. A sample of pitchblende, reportedly from the Canyon vein, assayed 0.7 percent equivalent uranium oxide, but this material was not found during a later U. S. Geological Survey examination.

The high radioactivity at several locations and the favorable mineral assemblage may be sufficient basis for more intensive exploration in this district. Of additional interest is the presence of radioactive minerals at 30 or more metallic mineral localities in nearby British Columbia, all of which are west of the Rocky Mountain trench.

SALMON BAY AREA, SOUTHEASTERN ALASKA

(Location 21)

Significant radioactivity extends for eight miles along the northeastern coast of Prince of Wales Island. The radioactive material is in short irregular carbonate-hematite veins which cut graywacke of Silurian age. Many basic dikes also cut the country rock. The highest value obtained was from a grab sample collected by a prospector which assayed 0.13 percent equivalent uranium or 0.64 percent equivalent thorium. Seven channel samples covering 100 feet along one vein averaged 0.034 percent uranium or 0.16 percent equivalent thorium. The veins are generally less than one foot wide and 300 feet long. Some nonradioactive veins contain high-grade rare-earth oxides. It appears that the radioactivity in the area is due mainly to thorium.

The widespread presence of radioactive minerals in the northern part of Prince of Wales Island and the high grade uranium ore at Bokan Mountain on the south end suggest the intervening area is worth close examination.

SKAGWAY, SOUTHEASTERN ALASKA

(Location 42-A)

A uranium prospect was discovered in 1956 almost in the town of Skagway. The deposit is in a bluff about 250 feet directly above railroad tracks and large oil storage tanks. Bedrock consists of altered rhyolite(?), quartz diorite, and andesite dikes. Large faults cut the quartz diorite. Uranium minerals with iron staining are present along a steeply dipping fracture in the rhyolite(?). No other ore minerals or vein material, except purple fluorite, have been reported.

The most radioactive sample analyzed by the U. S. Geological Survey was a small pod of clay, which assayed 0.72 percent equivalent uranium and 1.2 percent uranium. Other samples of the rhyolite contain up to 0.22 percent equivalent uranium. No ore has been produced, but the geology is favorable and additional prospecting is planned.

HOPE CREEK AREA, FAIRBANKS DISTRICT

(Location 81)

The Fairbanks district is not considered particularly favorable for uranium, but a sample of brecciated granite float near a small body of intrusive granite about 10 miles north of the Steese Highway and about 80 miles northeast of Fairbanks contained 0.055 percent equivalent uranium. The sample contained hematite-goethite veinlets. The uranium minerals were not identified. Twenty-one samples of the granite collected by the U. S. Geological Survey contained between 0.001 and 0.004 percent equivalent uranium. Quartz, pyrite, and fluorite have been reported in veins cutting the Birch Creek schist near the granite. The 0.055 percent sample and the associated hematite and purple fluorite may be sufficient justification for uranium prospecting.

BROOKS MOUNTAIN AREA, SEWARD PENINSULA

(Location 156)

The U. S. Geological Survey has conducted rather extensive examinations of a metazeunerite occurrence at Brooks Mountain. Metazeunerite [$Cu(UO_2)_2(AsO_4)$: $8H_2O$] is a hydrous copper-uranium arsenate containing 46.4 percent uranium. The following description of the radioactive deposit is the abstract from U. S. Geological Survey Circular 214, "The Occurrence of Zeunerite at Brooks Mountain, Seward Peninsula, Alaska", by Walter S. West and Max G. White.

> Zeunerite occurs near the surface of a granite stock on the southwest flank of Brooks Mountain, Alaska. The largest deposit is at the Foggy Day prospect. Zeunerite is disseminated in hematite which partially or totally fills openings and vugs in a highly oxidized lens-shaped body of pegmatitic granite and, to a minor extent, in openings and cracks in the weathered granite enclosing the lens. Although a few specimens from the pegmatitic lens contain as high as 2.1 percent equivalent uranium, the average content of the lens rock is between 0.1 and 0.2 percent equivalent uranium and that of both the lens material and the surrounding zeunerite-bearing granite is about 0.07 percent equivalent uranium. A smaller concentration of zeunerite occurs as surface coatings on a few of the quartz-tourmaline veins that occupy joint fractures in the granite on Tourmaline No. 2 claim and in two samples from other sites near the Foggy Day prospect. The zeunerite at these three localities is probably related in source to the Tourmaline No. 2 claim and Foggy Day prospect deposits.
>
> Although no primary uranium minerals were found, it is possible that a primary mineral zone may occur below the zone of oxidation at the Foggy Day prospect.

It has been recommended that further exploration be done by diamond drilling directed at locating a possible primary uranium source at depth below the secondary zeunerite.

EAR MOUNTAIN, SEWARD PENINSULA

(Location 159)

Ear Mountain is located in the northwestern part of the Seward Peninsula about 10 miles inland from the Bering Sea. The core of the mountain is a granite stock two miles in diameter penetrating Ordovician(?) schistose limestone. The area has been much prospected for placer and lode tin. Mafic dikes cut both the granite and limestone. Quartz veins and small pegmatite dikes are common. Small amounts of copper, lead, zinc, tin, fluorite, and traces of gold and silver have been reported from the Winfield mine shaft.

Radioactivity detected in some 600 placer concentrates collected by the U. S. Geological Survey show the presence of radioactive minerals in the area. The highest assay obtained from concentrates was 1.0 percent equivalent uranium. Radioactivity of the bedrock is mostly in the margins of the granite and principally in tourmaline and quartz veins, especially where there is hematite. The most radioactive piece of red ore contained 0.182 percent equivalent uranium. The primary radioactive mineral in the red ore has not been identified, but the secondary minerals metazeunerite and metatorbernite were noted. Thorium is probably present.

Commercial uranium has not been found, but since much of the area is covered, stripping might reveal more extensive deposits.

LOCALITY NEAR RAMPART, ON THE YUKON RIVER

(Location 140)

Tertiary conglomerates have yielded up to 0.014 percent equivalent uranium a few miles upstream from Rampart. This is the highest radioactive assay reported from Tertiary rocks in Alaska and suggests that Tertiary sediments could be a host for uranium ores in this region.

SELAWIK BASIN REGION, WESTERN ALASKA

(Locations 166, 167, 168, 170, 171)

Several radioactive anomalies have been detected on the ground and from the air over a large area which includes the north side of the Kobuk River Valley, the hills south of Selawik Lake, and the Zane Hills. These anomalies suggest that this region could contain ore-grade uranium. Granitic rocks, tuffs, and vein type sulfide ores known in the region could be sources for either lode or sedimentary uranium. In addition to the comments in the table these anomalies are reviewed here.

Location 171 -- A sample containing columbite and tantalite found near Kiana may indicate possible uranium associations. Slight radioactivity of carbonaceous beds in the same area may be significant.

Location 170 -- Radioactivity in the rich copper deposits at Bornite near Kobuk has been noted. Sphalerite associated with the ore has been reported to contain 0.013 percent uranium. Sooty pitchblende has been encountered in drill cores and radioactive minerals recognized on the surface (Runnells, D. D., 1964, p. 69, 78).

Location 168 -- Radioactivity five to ten times background was found in the borders of the Zane Hills pluton in the vicinity of Caribou Mountain. A sample of the quartz monzonite assayed 0.002% uranium.

Location 167 -- Radioactive trachyte containing 0.005% lead and 0.015% zirconium was sampled at a small intrusive body about three miles south of Selawik Lake.

Location 166 -- Airborne radiometric measurements along a northeast flight line from Kiwalik on Eschscholtz Bay to a point a few miles south of Gabolio ranged from 100 to 1600 counts per minute. The highest counts, from 800 to 1600, were detected over granite southeast of Reindeer Station.

OTHER AREAS OF INTEREST

The following regions have not been investigated. They are mentioned because they have mineral assemblages and rock types with a better-than-average possibility for uranium deposits.

1) The Ketchikan, Petersburg, and Wrangell districts of southeastern Alaska contain silver, lead, platinum, molybdenum, fluorite, and other minerals. These areas do not seem to have been adequately prospected for uranium. The geology is favorable.

2) A region north of the Yukon River in the Ogilvie Mountains contains Precambrian, Paleozoic, Mesozoic, and Tertiary rocks. The Precambrian Tindir group contains red beds of hematitic dolomite, shale, flint, tuff, and lava, with a red basal conglomerate. These beds are reported to be similar both in lithologies and age to the rocks at

Great Slave Lake, Northwest Territories, Canada, where samples containing 0.17 percent thorium oxide and 0.006 percent uranium have been obtained. The large reserves of uranium in Canada are mostly in Precambrian conglomerates. A brief investigation by the U. S. Geological Survey in the Eagle-Nation area did not reveal radioactive anomalies, but work was limited to traverses along the Yukon and Tatonduk Rivers.

3) Phosphate rock frequently contains uranium in quantities considerably above the average for sedimentary rocks. Extensive deposits of phosphate rock are present in the foothills north of the Brooks Range. Equivalent uranium assays have been reported up to 0.021 percent, and assays between 0.005 and 0.015 percent are common. The highest uranium assays are obtained where the P_2O_5 content is greatest. Byproduct uranium could be a factor in making these deposits economic at some future date.

4) A sample of uraniferous limestone containing 0.6 percent uranium oxide was submitted to the U. S. Geological Survey in 1951 (TEI 577, p. 78, 79, 86). The radioactive mineral was identified as metatyuyamunite and was disseminated throughout the limestone and on bedding surfaces. The sample was reported to have been found by an Indian somewhere in the vicinity of Nikolai Creek about 17 miles northwest of Tyonek, Tyonek quadrangle, in southwestern Alaska. The location was never verified and the source of the sample remains very uncertain. While many rumored or unverified assays and sample locations have been deliberately omitted from this study, the geology of this area, in conjunction with the reported sample, seems interesting and to warrant investigation. In addition to the one sample submitted, natives in the area have mentioned "similar yellow rocks" from Eocene clastic coal-bearing beds and volcanics known to be present several miles northwest of the reported location of the radioactive limestone.

   A uranium prospect on the north side of Shirley Lake (Location No. 125) about 75 miles northwest of Tyonek Village may or may not be related to the sample mentioned above. At Shirley Lake anomalous radioactivity was found in coatings along small, shallow joints cutting tuff and tuff breccia. The maximum assay obtained by the U. S. Geological Survey was 0.021% uranium, but a prospector reported that one sample from this area assayed 0.29% uranium.

INVESTIGATIONS BY THE DIVISION DURING 1968

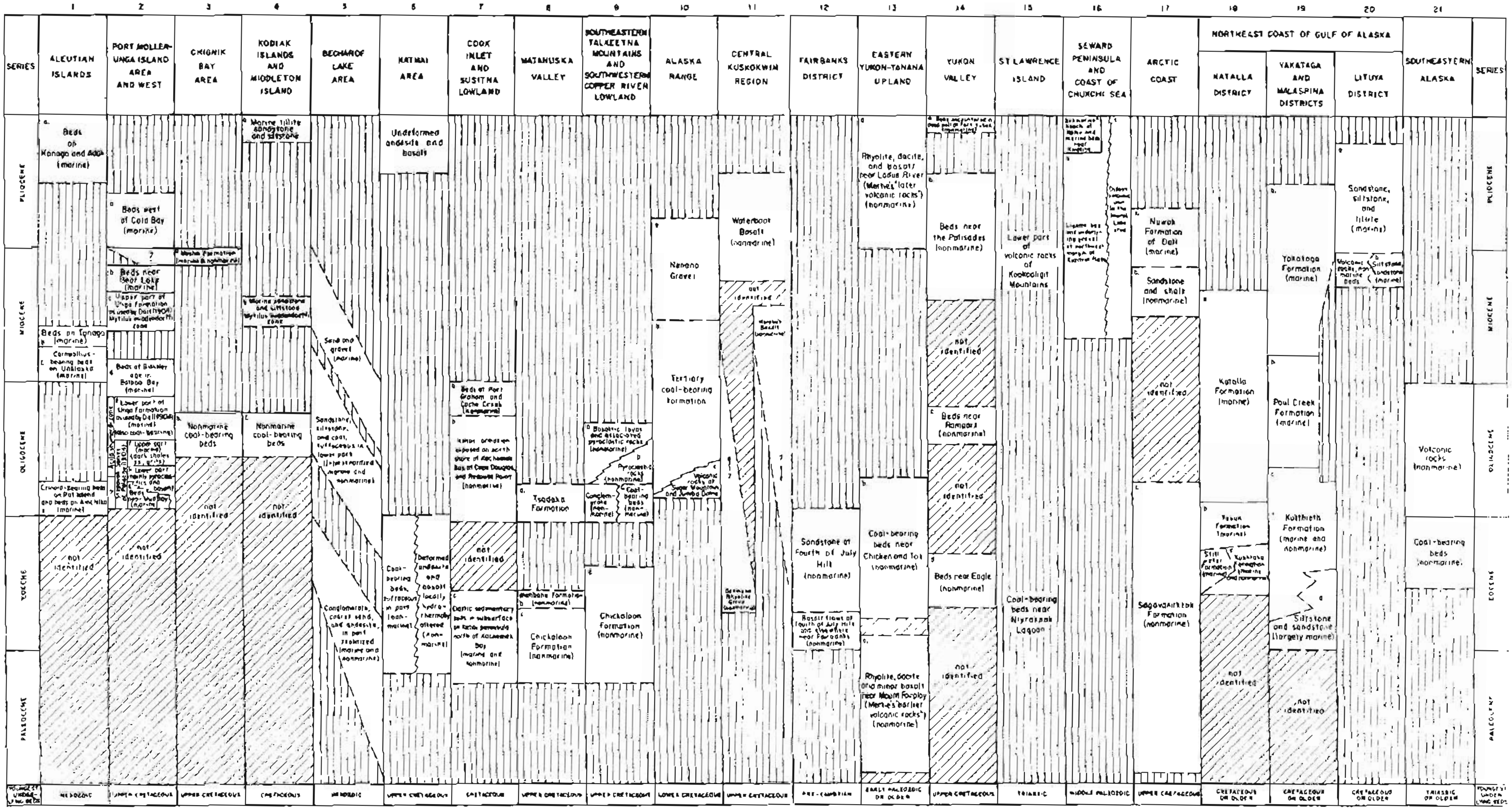
GENERAL STATEMENT

Large uranium reserves have been discovered in the Tertiary sandstones in Wyoming, and many deposits are known to exist in sediments that have accumulated in intermontane basins. These areas are receiving much attention, and ore is still being discovered. Interest, therefore, is directed to Tertiary basins containing continental sands and conglomerates in other regions in the hope of locating similar ores.

A preliminary investigation was undertaken by the State Division of Mines and Geology to ascertain the best approach to the investigation of Alaska's uranium potential. During the summer of 1968 the writer, assisted by Michael Hoge, spent nine weeks examining sediments in Alaska. The primary aim was to determine if continental sandstones and conglomerates of Cretaceous and Tertiary ages contained abnormal radioactivity. In spite of the relatively recent geologic age of the Tertiary Period, late mountain building in Alaska has resulted in intense uplift and much faulting of rocks of this age.

Figure 1

CORRELATION OF TERTIARY ROCKS IN ALASKA



Source: Wolf and Miller, AAPG Bulletin, November, 1961, p 1802-03, "Correlation of Tertiary Formations of Alaska", published with permission of the American Association of Petroleum Geologists

Dips of 20 to 30 degrees are common and occasionally dips up to 70 degrees are observed. Plant fossils give evidence of a temperate to subtropical climate during Tertiary time.

The principal areas examined were (1) the Healy coal mining district in central Alaska, (2) the Eagle area, including traverses along the Yukon River, in east-central Alaska, (3) the Cantwell-McKinley Park area, including the Dunkle coal mine and Silver King mine on the west fork of the Chulitna River in central Alaska, and (4) the Port Moller, Chignik areas and Unga and Popof Islands in the Alaska Peninsula region.

A four-channel spectrometer-type scintillometer ordered by the Division of Mines and Geology for the work was not received until the field season was over. Old Model DR 299 Detectron Nucliometers were used most of the time. These detectors contain a bank of twenty-five small geiger tubes and are sufficiently sensitive for surveys on foot or from a vehicle. A Model 177 B "Scintillator" manufactured by Precision Radiation Instruments, Inc., was available for part of the summer. Frequent failure of all instruments due to excessive moisture was a problem in spite of the special covers used for their protection.

HEALY COAL DISTRICT

(Location 78)

Location

This area lies along Healy River, a tributary of the Nenana River, in the Healy D-4 quadrangle. Healy townsite is opposite the mouth of Healy River on the Nenana River. It is accessible from Fairbanks by Highway 3.

Purpose

The presence of Tertiary arkosic sandstones of continental origin with much carbonaceous material suggests a similarity to the Tertiary rocks containing uranium in the western states. The writer spent one week in the area examining the sediments. Tertiary coal-bearing beds occur in a number of areas along the north flank of the Alaska Range, but those near Healy are well exposed and easily accessible. Incidental examinations of nearby exposures of Birch Creek schist, Totatlanika schist and Nenana gravels were also made.

Geology

A syncline in the foothills along the north flank of the Alaska Range contains Tertiary sediments for a distance of twelve miles along the Healy Creek valley. This area is described by Barnes, Wahrhaftig, Hickcox, Freedman and Hopkins (1951). The valley and the syncline are bounded by ridges of Birch Creek schist. Eocene coal-bearing beds as much as 2,000 feet thick lie unconformably on the schist. They extend along strike approximately east-west for twelve miles and between one and two miles at right angles to the structure. The coal-bearing sequence contains shales, sandstones, claystones, siltstones and a number of subbituminous coal beds. They dip approximately 35 degrees north, but are locally overturned. The sandstones are soft, easily eroded, partly arkosic, and commonly contain stringers of coaly material. Some platy beds of shale and claystone contain abundant leaf imprints. Coarse, unconsolidated Nenana gravels of Tertiary age overlie the coal sequence.

Open pit coal mining is conducted the year around in the valley. Individual coal beds range from a few inches to 40 feet in thickness.

Results

The area was crossed at several points by walking up gulleys so that each bed in the coal-bearing sequence was tested for radioactivity, and foot traverses were made along the entire 12-mile-long area containing the Tertiary outcrops. The maximum radioactivity in sandstones, shales, and Birch Creek schist was about 0.04 Mr/Hr or three times the normal background. At some points, the Birch Creek schist gave slightly higher counts than any of the Tertiary beds. The schist has a high mica content, which may be the source of radioactivity.

While the Tertiary lithology and the abundance of carbonaceous material seem favorable for uranium deposition, the movement of meteoric waters and the disturbed positions of the beds probably make its near-surface retention and detection difficult. Results of the study indicate that the sediments at Healy are not likely to contain significant amounts of uranium or thorium.

EAGLE AREA AND HIGHWAY TRAVERSES, FAIRBANKS TO EAGLE

(Locations 63, 73, 74, 75, 87, 88, 89)

Location

The village of Eagle is on the south bank of the Yukon River in the Eagle D-1 quadrangle, about five miles west of the Canadian border. Localities and outcrops adjacent to the highways between Fairbanks and Eagle and along the Yukon River from the border to a point 20 miles west of Eagle were examined. In addition, Tertiary beds along American and Mission Creeks south and west of Eagle were studied.

Purpose

The primary objective was the examination of the Tertiary sandstones in the Area. The testing of the Pennsylvanian Nation River conglomerate and sandstones and the Mesozoic granites was a secondary purpose.

Geology

Mertie (1942) describes a belt of Tertiary sediments trending northwest along the south side of the Yukon River from the Canadian border almost to Circle Hot Springs, a total distance of almost 100 miles. The belt varies in width from two to ten miles. It is widest south of Nation. A granite batholith parallels the Tertiary rocks a few miles to the south. The granite could be a source of radioactive minerals. Since streams flow north to the Tertiary sediments this may be a favorable condition for their redeposition. A variety of Paleozoic and Mesozoic sediments crop out along the Yukon in the area visited.

Results

Radioactivity measurements between 0.03 and 0.05 Mr/Hr, or two and four times background, were made at a number of outcrops. These locations and some other points of interest are mentioned below.

Location 63 -- Granite exposed in a road cut at Mile Post 1303 on the Alaska Highway just east of the bridge crossing the Tanana River gave a counter reading of 0.04 Mr/Hr, or three times background.

Location 73 -- A broad area of acidic intrusives and flow rocks which gave unusually high background readings extends approximately 15 miles along the Taylor Highway in the vicinity of Mt. Fairplay. Discovery of radioactive rocks on Mt. Fairplay resulted in considerable claim staking several years ago. The writer obtained readings of 0.04 to 0.05 Mr/Hr, or four to five times the usual background, along the highway through the area.

Location 74 -- Tertiary shale, sandstone, and coal beds exposed along Chicken Creek at the town of Chicken and in a gravel pit near Chicken did not yield significant readings. The Silver Queen Lode, just below the highway about four miles north of Chicken and near Mile Post 71 did not show measureable radioactivity. The prospect consists of a 30-foot tunnel following a gouge zone with showings of galena.

Location 87 -- Two feet of gouge in a fault zone in a conspicuous outcrop of marble in a road cut at Mile Post 114 gave three times the background count, or between 0.03 and 0.04 Mr/Hr. Tertiary sandstones and shales exposed in borrow pits along the Taylor Highway from a few miles south of Eagle to Eagle contain sandstone shales, and siltstones. The very fine-grained silty sandstones and siltstones were noticeably higher in radioactivity than the cleaner, coarser sandstones. Counts up to 0.03 Mr/Hr were obtained.

Location 88 -- A foot traverse along American Creek from Eagle south for five miles was made to examine Tertiary sandstones and conglomerates exposed in bluffs along the creek. At three locations localized anomalies were encountered where faults cut these beds. The maximum readings were 0.03 Mr/Hr. Mission Creek enters the Yukon just west of the town of Eagle near the base of Eagle Bluff. The prominent Eagle Bluff stands between Mission Creek and the Yukon. In the 1940's several claims covering showings of gold, copper, nickel, and cobalt were staked along a fault zone on the Mission Creek side of Eagle Bluff. A foot traverse in this area did not produce any radioactive anomalies, but all seven claims were not examined in detail. No mining has been done on the claims.

Location 89 -- Frequent checks with counters along the Yukon River between Eagle and the Canadian border revealed no anomalies in the Paleozoic rocks exposed. The Nation River conglomerate exposed at points between two and eight miles downstream from Eagle produced no anomalous readings. The Mississippian Calico Bluff formation exposed on Calico Bluff about eight miles downriver from Eagle has been reported to contain radioactive black shales. The writer measured readings up to 0.05 Mr/Hr in black shales near the base of the bluff. A climb from the river to the top of the bluff produced lesser readings. Tertiary beds exposed on the south side of the Yukon from two to seven miles west of the mouth of the Seventymile River produced only very low radioactivity. A maximum reading of 0.05 Mr/Hr was obtained from one narrow brecciated zone cutting the beds.

CANTWELL, MOUNT MCKINLEY PARK AREAS AND LOCATIONS ADJACENT TO THE RICHARDSON AND DENALI HIGHWAYS

(Locations 66, 67, 68, 69, 71)

Location

The areas covered under this section include (1) Fairbanks to Mt. McKinley Park along the Alaska, Richardson, and Denali Highways, (2) coal and silver-antimony mines in the west fork of the Chulitna River district, (3) the Cantwell-McKinley Park road, and (4) the road inside the park. Nearby mines, prospects, and accessible outcrops were examined.

Purpose

The rocks of primary interest during this radioactive survey were the Tertiary coal-bearing beds, the Cantwell conglomerate, and the acidic intrusions in the region.

Geology

The areas lie in the east and central parts of the Alaska Range and the foothills on the north and south flanks of the range. The rock units traversed include schist of Precambrian age and metamorphic, volcanic, and granitic rocks of Paleozoic and Mesozoic ages. Tertiary sediments are present in scattered areas at lower elevations. The Cantwell conglomerate of Cretaceous age forms a prominent thick deposit in the Cantwell-McKinley Park area.

Results

A variety of rock types along the routes were checked for radioactivity. Coal mines in Tertiary beds and accessible hard rock mines and prospects were examined. No strong radioactivity was detected, but the more interesting sites visited are described here.

Location 71 -- The Delta coal mine at the head of Ober Creek is eight and one half miles by gravel road southeast from the Richardson Highway in the Mt. Hayes C-4 quadrangle. This is the site of an abandoned open-pit coal mining operation. The principal coal seam is about six feet thick. The exposure reveals about 30 feet of soft shales and sandstones containing some conglomerate beds of quartz and chert pebbles overlying the coal. No radioactive anomalies were detected.

Location 70 -- The traverse along the Richardson and Denali Highways includes the three areas described here.

An abandoned stibnite mine is located about 1/4 mile east of Richardson Highway and opposite the terminus of Black Rapids Glacier. An old tunnel on the east side of a small "hidden" lake is flooded and could not be entered. However, a gouge zone, a two-foot silicified mass with jasperoid and iron staining, and white quartz were present at the mine entrance. No significant radioactivity was noted.

The Rainbow Mountain area is on the east side of Richardson Highway in the Mt. Hayes B-4 quadrangle. This is a mineralized area which contains gold, silver, lead, and copper prospects. Brightly colored flow rocks and dikes, some containing a large amount of disseminated pyrite, are conspicuous in certain locations. No radioactivity was noted.

The Windy Creek-Valdez Creek district is north of the Denali Highway and east of Susitna River. A local prospector, "Tex" Greathouse, living near the Susitna Lodge, allowed the writer to examine a collection of ore samples and rocks from the general area, which is principally a copper district. None of the collection produced anomalous radioactivity.

Location 66 -- Two areas are included under this location.

A crushed zone cutting the undifferentiated Paleozoic-Mesozoic shales exposed in a road cut 2.8 miles north of the junction near Cantwell produced an anomaly of three times background. Abundant iron oxide staining and pyrite were found uphill but no radioactivity. A 10-pound sample of the crushed iron-stained shale retained its radioactivity for several weeks. Later, a test showed none. This indicates the radioactive material was radon gas.

The abandoned Coal Creek coal mine is located between Summit and Broad Pass. A six-foot bed of low grade coal on the west side of Coal Creek is exposed along a gully. No radioactivity in the coal, shales, or gravels was noted. At the old Broad Pass coal mine adjacent to the road at Broad Pass the results were also negative.

Location 67 -- The Dunkle coal mine is on Costello Creek, tributary of the West Fork Chulitna River, in the Healy B-6 quadrangle. The site of this former large mining operation is at an elevation of 2,800 feet on the southern slope of the Alaska Range. The Tertiary coals are similar to those at numerous areas along the flanks of the Alaska Range. The beds dip as much as 20° and faulting is common. Both underground and surface mining has been done. No anomalies were found in Tertiary sediments. Flows and intrusive rocks adjacent to the south limit of the Tertiary beds and near the coal mine contain some scattered pyrite and arsenopyrite. A bluff across the creek behind the abandoned mining camp produced up to 2 1/2 times the background count.

Location 68 -- The Silver King mine is an inactive silver-antimony prospect located on a low hill on the east side of Colorado Creek and about three miles south of the Dunkle coal mine. The location is about a mile north of that shown on the USGS Healy A-6 quadrangle map. Mineralization is associated with a quartz diorite stock which has intruded argillite, limestone, and greenstone. Several trenches have exposed arsenopyrite, chalcopyrite, and stibnite. No radioactivity could be detected.

Location 69 -- This location includes traverses along the Nenana River between Cantwell and Mount McKinley Park Station and areas adjacent to the road through Mount McKinley Park. Tertiary sediments, the Cantwell conglomerate, lavas, and intrusive rocks were checked. No significant radioactivity was located.

ALASKA PENINSULA AREAS

Location

Three areas in the Alaska Peninsula region were visited; Port Moller, Popof and Unga Islands, and Chignik.

Purpose

The presence of nonmarine sandstones and much volcanic material prompted the writer to examine these selected areas for possible radioactivity. It has often been postulated that the source of some uranium is volcanic ash and debris from which the uranium may have been leached and later concentrated in nearby nonmarine sandstones.

Geology

Paleozoic rocks are not exposed in the central part of the Alaska Peninsula visited by the writer. Early Jurassic intrusives make up the backbone of the Alaska Peninsula. These granites and younger sediments were the source of a thick Upper Jurassic and Lower Cretaceous arkosic sequence. Both marine and nonmarine volcanic materials and sediments accumulated during Early Tertiary time. Volcanism and the emplacement of quartz diorite plutons became widespread. The present structures are post Miocene, and uplift is continuing.

Results

Locations 111 & 112 -- Foot traverses were made along the coast around Port Moller Bay and inland on the peninsula between Port Moller Bay and Herderdeen Bay and across Staniukovich Mountain. Sandstones, conglomerates, and volcanics of the Tertiary Bear Lake and Tolstoi formations and the Cretaceous sandstones, conglomerates, coal beds, and limestones of the Chignik and Herderdeen formations were examined. The maximum radioactivity encountered was in a small lens of coal in the Chignik formation on the west coast of Port Moller Bay. This gave 2 1/2 times the normal background count. The Staniukovich sandstone near a mineral spring and cabin, locally known as Hot Spring, gave a slight increase in count.

Locations 108 109 & 110 -- Radioactivity investigations were conducted in the vicinity of the old Apollo and Sitka mines on the southeast part of Unga Island. The two mines are situated within several hundred yards of each other. They were last worked in about 1912. Mineralization includes gold, pyrite, galena, sphalerite, chalcopyrite, and native copper. The gangue is quartz, calcite, and orthoclase. The ore is in reticulated zones cutting andesite and dacite. The zones strike N 20° E and are nearly vertical. No radioactivity was detected. Geochemical soil sampling by the writer failed to indicate extensions of the veins.

Traverses along the north and northwest coasts of Unga Island revealed Tertiary sandstones, shales, and coal beds and an abundance of petrified wood, but no abnormal radioactivity. The lavas along the west coast of Popof were examined with negative results.

Locations 106 & 107 -- Coal has been mined at several points along the coast near Chignik, on Chignik Bay. Sediments examined in this area include the Jurassic Naknek formation sandstones and the Cretaceous Chignik formation sandstones, conglomerates, and coal beds. No anomalous radioactivity was found.

One day was spent investigating an old copper prospect on Warner Bay (Prospect Bay), which is on the coast due south of Chignik. There are two short tunnels in the Tertiary quartz diorite bluff near the shoreline on the north side of Warner Bay. Pyrite, chalcopyrite, galena, and molybdenite were seen on the surface in scattered pockets and on fracture surfaces. Only radioactivity normal for these rocks was encountered.

MATANUSKA VALLEY COAL DISTRICT

Location 52 -- Two days were spent examining the large open pit coal mines at Jonesville and Eska, approximately 50 miles northeast of Anchorage. Only weak (not over twice background) radioactivity counts were noted.

C O N C L U S I O N S

In Alaska the largest numbers of radioactive anomalies have been found on the Seward Peninsula and in Southeastern Alaska. Numerous assays have shown sufficiently radioactive igneous rocks within the State to suggest that new commercial uranium deposits will be found. Large areas are still untested and relatively little work has been directed to the exploration for sedimentary-type deposits. The writer believes that the climate in Alaska and the disturbed positions of the younger sediments are factors which make it difficult to detect ores of Tertiary age. Weathering processes and the widespread presence of tundra make diamond drilling and trenching more necessary in Alaskan prospecting than in more arid regions.

Large free-world reserves have been located in Precambrian conglomerates, and because there is evidence that more radioactive material was available during Precambrian time, it may be wise to search for those rocks and sediments derived from them.

Aerial radiometric surveys and helicopter support are desirable for uranium exploration in remote areas of Alaska. Geochemical and geobotanical prospecting methods may prove to be helpful where tundra and vegetation cover the bedrock, but more experimental work involving their application to uranium minerals is needed. The writer plans to sample in known mineralized areas during 1969 in order to test these procedures.

TABLE SUMMARIZING INVESTIGATIONS FOR URANIUM IN ALASKA

The symbols and abbreviations used in each of the seven columns, from left to right, are explained under the appropriate headings.

<u>Location Numbers</u>: Numbers listed in sequence in the table correspond with locations on the map.

<u>Locality Name</u>: Names of localities generally are those used in the U. S. Geological Survey reports. The locations can be found by use of quadrangle maps and reports listed under references.

<u>Quadrangle</u>: Quadrangle names are those of the U. S. Geological Survey.

<u>References to Radioactivity Investigations</u>: Examples of abbreviations are as follows:

B 1154: U. S. Geological Survey Bulletin 1154.

PP 302-A: U. S. Geological Survey Professional Paper 302-A.

C 196: U. S. Geological Survey Circular 196.

TEM: U. S. Geological Survey Trace Elements Memorandum. These are unpublished reports of limited distribution concerning work done on behalf of the U. S. Atomic Energy Commission. Some have been republished as bulletins or circulars.

TEI: Trace Elements Investigation reports. These are unpublished reports of limited distribution prepared by the U. S. Geological Survey. Some have been republished as bulletins or circulars.

Map I-530: U. S. Geological Survey Miscellaneous Geologic Investigations Map I-530.

IR: Alaska Territorial Department of Mines unpublished Itinerary Report. These are on file at the Alaska State Division of Mines and Geology office at College.

MI: Alaska Territorial Department of Mines unpublished Mineral Investigation. These are on file at the State Division of Mines and Geology office at College.

MR: Alaska Territorial Department of Mines unpublished Miscellaneous Report. These are on file at the State Division of Mines and Geology office at College.

PE: Alaska Territorial Department of Mines unpublished Property Examination. These are on file at the State Division of Mines and Geology office at College.

<u>Country rock</u>: Principal bedrock in the general area.

Mineralization: Includes known minerals and ores of general area. Minerals and elements listed may or may not be of economic importance. Chemical symbols for elements are as follows:

Ag	silver	Cr	chromium	Pt	platinum
As	arsenic	Cu	copper	Sb	antimony
Au	gold	Fe	iron	Sn	tin
Ba	barium	Hg	mercury	Th	thorium
Be	beryllium	Mo	molybdenum	U	uranium
Bi	bismuth	Mn	manganese	W	tungsten
Co	cobalt	Ni	nickel	Zn	zinc
Cd	cadmium	Pb	lead		

Radioactivity Measurements: Geiger counters and scintillometers are frequently used to assay radioactive minerals. The counters used in early investigations could not distinguish between radiation from uranium, thorium, or potassium, so the assays are reported as "equivalent uranium" (eU), which is a measure of the total radioactivity in terms of the amount of uranium which would be required to yield the count obtained. Assays reporting eU generally include radioactivity due, in part, or entirely to thorium and potassium, particularly if no minerals were identified. Assays by other methods may be reported as percentages of U_3O_8, the form in which ore assays are generally given. The compound U_3O_8 contains approximately 85 percent uranium. Chemical assays of course, are the most accurate method of evaluation, and show uranium content in percent or parts per million.

A large portion of the samples collected in Alaska by the Geological Survey were stream sands and gravels. These were washed to concentrate the heavy fractions, which were then assayed. It was believed that this method would locate primary uranium minerals if present in the drainage area. It is difficult, however, to evaluate these assays and relate them to bedrock values unless concentration factors are known. The concentration ratios may be several hundred or even several thousand to one. Unconcentrated samples are the most meaningful. Counters are usually designed with meters that read in milliroentgens per hour (Mr/Hr) and for general reconnaissance work this reading is often all that is reported. This gives a relative value when compared to the background reading.

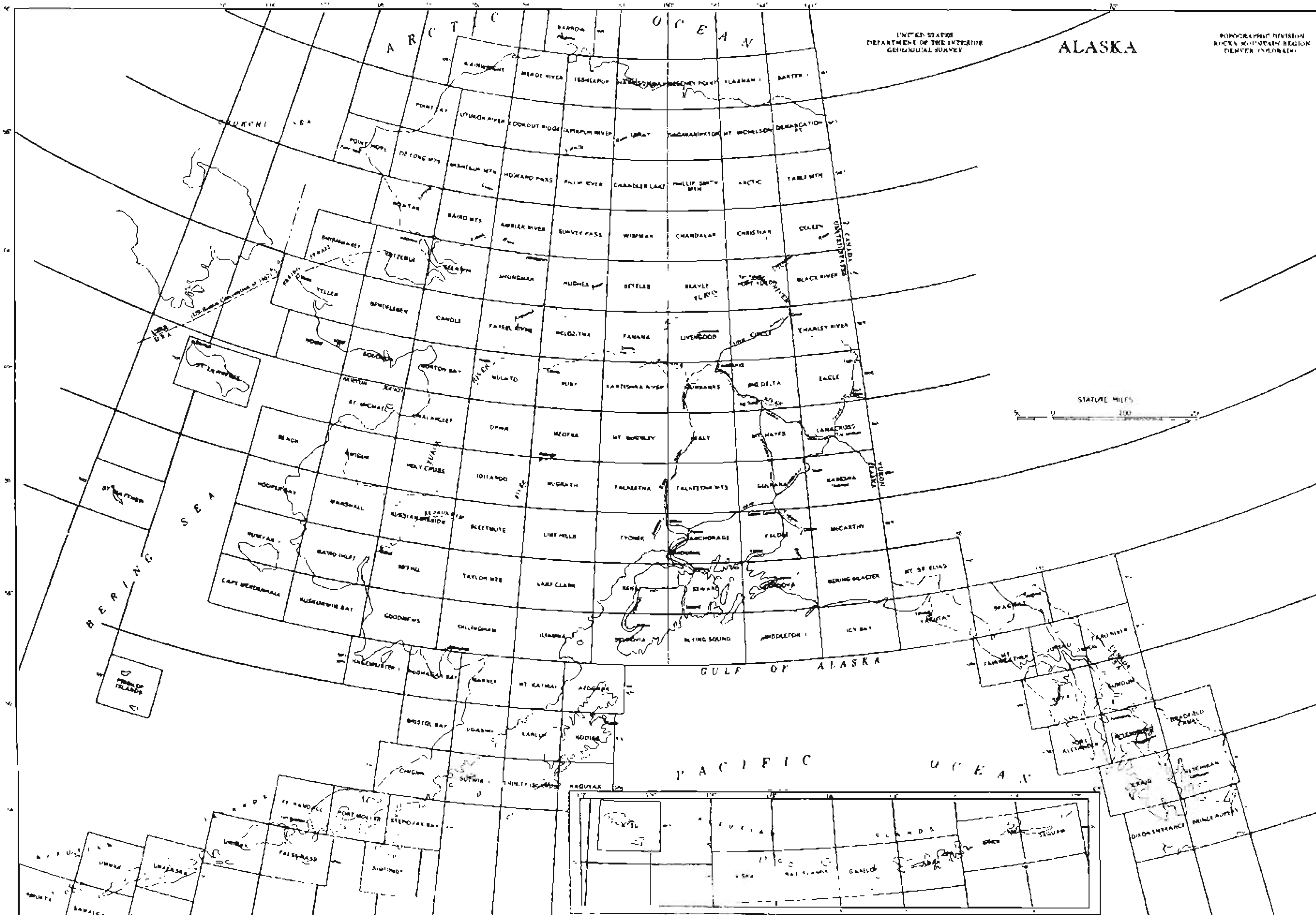


Figure 2

INDEX TO 1:250,000 QUADRANGLE MAPS

Loc. No.	Locality Name	Quadrangle	References to Radioactivity Investigations	Country Rock	Mineralization	Radioactivity Measurement or U Assay
1	Bokan Mountain	Dixon Entrance C-1, D-1	B 1154, B 1155, PE 121-5, PE 121-5, PE 121-6 PE 121-7	Cretaceous intrusives in Devonian metamorphics, uranium and thorium assoc. with peralkaline granite and pegmatite and aplite dikes	Ross-Adams mine has produced 39,000 tons of 1.0% U_3O_8 mostly in veinlets containing uranothorite and uranoanthorianite	Pods contain up to 3% U_3O_8 in Ross-Adams mine and Th up to 5.66%
2	Niblack Anch. Area	Craig A-1	C 196	Greenstone and other metasediments	Fe, Cu in quartz-carbonate veins	eU under 0.001%
3	Dolomi area	Ketchikan A-6	C 196	Argillaceous and siliceous limestone	Fe, Cu, Pb, Zn in mesothermal filling on fault zone	eU under 0.001%
4	Moira Sound (N. Arm) and Dora Lake	Craig A-1	C 196	Argillaceous and siliceous limestone and green schist	Fe, Cu, Au with quartz, carbonate, micas, and clay in mesothermal fillings	eU under 0.001%
5	Cholmondeley Sound Area	Craig A-1	C 196	Argillaceous and siliceous limestone and green schist	Fe, Cu, Zn?, in quartz carbonate clay gangue in mesothermal fillings	eU under 0.001%
6	Gravina Island (South end)	Ketchikan A-6	C 196, Pe 120-14	Metavolcanics	Fe, Cu in shear zones. Poss pitchblende at Black Jack claim in serpentinized rocks	eU to 0.005%; eU of several % reported from the Black Jack No. 7 claim but very scarce
7	Boca de Quadra Inlet area (Wacker claims on Martin Arm)	Ketchikan A-2	IR H.M. Fowler, May-July 1948	Diorite(?)	Reported presence of carnotite by prospector not found	No radioactive material
8	Green Monster Mt.	Craig A-2	B 1058 A	"Graywacke" to limestone	Cu	eU under 0.001%
9	Baker Island	Craig B-5, B-6	B 1058 A		Mo prospect	eU under 0.004%

10	Ketchikan vicinity	Ketchikan B-5	B 1024 B	Metasediments and diorite	Au, Fe, Cu, As, Bi, Sb, in quartz fissure veins	eU under 0.001%
11	Mahoney Mine George Inlet	Ketchikan B-5	PE 120-9 1942	Sandstone, slate cut by quartz diorite	Au, Ag, Cu, Pb, Zn, Cd (Tr) in a vein with quartz and carbonates	Not tested, but favorable mineral ogy
12	Kassan Penn. (?)	Craig B-1 (?)	C 202, TEM 235	Jurassic volcanics	Cu-Fe deposits and Pb-Ag veins	eU in 1 spl. = 0.1% in allanite (TEM 235. p. 63)
13	Kassan Penn.	Craig B-1, C-1, C-2	C 196	Graywacke, slate, limestone and diorite stocks	Fe, Cu, Mo and contact metamorphic minerals at diorite-sediment contacts	eU under 0.001%
14	Helm Bay	Ketchikan C-6 Craig C-1	C 196	Green schist and greenstone	Fe, Cu, Au in quartz, sercite, talc and graphitic material in fracture zones	eU under 0.001%
15	Union Bay	Craig C-1	C 196	Metasediments and mafic to ultramafic rocks	No ore found, but a sample of tyuyamunite in coaly material was reported to be from Union Bay	Tyuyamunite over 1% (?) 1951 investigat ion, eU under 0.001
16	Hyder Mining District	Ketchikan D-1 Brandfield Canal A-1	B 1024 B, TEM 235, B 1058 A, PE 120-11, IR Fowler, 1949	Granodiorite, quartz monzonite, greenstone and metasediments	Mostly near contact of the Texas Creek granodiorite and the Hazelton group of metamorphic rocks. Ag, Au, Pb, Zn, Mo in fissure veins and replacements. Small amount of U associated with hematite and limonite and with the sulfides	eU of 0.049% from Mountain View property and many lesse shows in area. Unverified report of one Mountain View sample assayed 0.7% eU
17	Egg Harbor, Coronation Island	Craig D-7, D-8	B 1058 A		Pb prospect	eU under 0.004%
18	Kosciusko-Shaken and Shipley Bays	Craig D-5	B 1058 A	Graywacke to limestone	Calcite veins; one small galena veinlet	eU under 0.001%

Loc. No.	Locality Name	Quadrangle	References to Radioactivity Investigations	Country Rock	Mineralization	Radioactivity Measurement or U Assay
19	Kosciusko Island, Shaken molybdenite deposit	Petersburg A-5	B 1058 A		Molybdenum prospect	eU under 0.004%
20	Lake Bay, Prince of Wales Is.	Port Alexander A-3	B 1058 A		Cu deposit	eU under 0.001%
21	Salmon Bay, Prince of Wales Is.	Petersburg A-4, B-4	B 1058-A, C 196, C 202, C 248, TEM 356	Paleozoic sediments and volcanics. Radioactive veins found only in graywacke. Many dark dikes present	Many thin radioactive carbonate-hematite veins occur along NE coast of Prince of Wales Is. for about 8 miles. Most of radioactivity due to thorium in thorite and monozite. The largest radioactive vein was found on Pitcher Island	Up to 0.13% eU in narrow carbonate-hematite veins. An average of 7 channe samples from 100' along one vein was 0.034% eU or 0.16% eTh
22	Salmon Bay Area	Petersburg A-4, B-4	C 202	As above	As above	eU = 0.07%
23	Zarembo Is. West side	Petersburg A-3, B-3	C 196	Basalt, andesite, ryolite	Fluorite, pyrite, quartz-carbonate	eU under 0.001% but locally up to 0.005 in felsic volcanics
24	Zarembo Is. N. W. coast	Petersburg B-3, B-4	C 196	As above	As above	As above
25	Round Point Zarembo Is.	Petersburg B-3	B 1058 A	Small granite intrusive	Epidote only	Very low
26	North Shore Prince of Wales Is.	Petersburg B-5	B 1058 A	Graywacke	Epidote-garnet-calcite veinlets at igneous contacts	eU under 0.001%
27	Totem Bay, Kupreanof Is.	Petersburg B-5	B 1058 A	Andesite	None	eU = 0.003%

28	Woewodski Is.	Petersburg B-5	C 196	Andesite, schist, slate, graywacke	Fe, Cu, Pb, Zn in quartz with some carbonate	eU under 0.001%
29	Duncan Canal	Petersburg C-4	C 196	Schistose chert and andesite	Barite and scattered pyrite. Traces of Zn, Pb, Fe in quartz and graphite	eU under 0.001%
30	Groundhog Basin and Glacier Basin	Petersburg B-1	C 196	Schist, gneiss, phyllite cut by dikes and sills	Pb, Zn, Ni, Cu, Mo in high and medium temperature veins with quartz and contact metamorphic minerals	eU under 0.001%
31	Thomas Bay	Petersburg C-3	C 196	Schist and gneiss	Fe, As, Cu, Ni, in vein following a well-defined fault	eU under 0.001%
32	Kuiu Island north end	Port Alexander D-1	C 196	Lavas, graywacke, sandstone, conglomerate, limestone, slate	Ba, Zn, Fe, Pb, Mn, in calcite, quartz, clay in epithermal veins	eU under 0.001% locally up to 0.005%
33	Saginaw Bay and Keku Islets	Port Alexander D-1	C 196	As above	As above	As above
34	Goddard Hot Springs Area, Baranof Is.	Port Alexander C-4	C 202, B 1024-B	Granite, metasediments	Slight radioactivity due to allanite from granite	Sand concentrates yielded up to 0.016% eU. No significant anomalies
35	BBH property Endicott Arm	Sumdum C-3, C-4	PE 115-7	Granodiorite	Uraninite(?) in pegmetities	eU up to 0.04% in large samples
36	Port Astley	Sumdum C-5	B 1058-A	Schist and phyllite intruded by quartz diorite	Fe, Zn, Cu, Pb and trace Ag in quartz-carbonate veins	eU up to 0.006%
37	Chichagof & vicinity, Chichagof Is.	Sitka C-7	B 1024-B	Graywacke, some greenstone cut by light-colored dikes	Fe, As, Pb, Zn, Au in quartz and calcite shear zone fillings	None over 0.002% eU
38	Taku Harbor Port Snettisham area	Taku River A-6, Sumdum D-6	B 1058-A	Schist, diorite	Some pyrite and arsonopyrite in breccia	Maximum eU 0.003%

Loc. No.	Locality Name	Quadrangle	References to Radioactivity Investigations	Country Rock	Mineralization	Radioactivity Measurement or U Assay
39	Juneau & vicinity	Juneau B-1, B-2	B 1024-B	Schist, slates, greenstone intruded by aplite dikes, gabbro and basalt	Fe, Zn, Ni, Pb, Zn, Au, Mo, As, in quartz, mica, carbonate gangue	eU = 0.001%
40	Funter Bay Admiralty Is.	Juneau A-3	B 1024-B	Greenstone, schist, gneiss marble, and a variety of dikes and sills	Ni, Cu, Au, Fe, Pb, Zn, As in quartz veins or sills	eU = 0.001%
41	William Henry Bay area, Lucky Six Claims	Juneau C-4	B 1155	Meta igneous	Traces of thorianite in small red patches in bedrock	eU up to 0.2% (thorium?)
42A	Skagway	Skagway B-1	B 1155	Quartz-diorite, altered rhyolite, andesite dikes	Specks of purple fluorite in iron-stained rhyolite; no sulfides or gangue	eU up to 0.22%, one hand-picked sample = 1.2% eU
42B	Glacier Bay National Monument	Juneau, Mt. Fairweather	OFR 280, p 93	Metamorphosed Paleozoic and Mesoic sediments; Mesozoic and Cenozoic intrusives	Cu, Au, Ag, Ti, Fe, Mo, Ni	Maximum of 0.003% U_3O_8 from Sandy Cove
43	Yakataga Beach	Bering Glacier A-4	C 184, C 202	Tertiary (mostly marine) sandstone, arkose, graywacke, shale, limestone and conglomerate underlie area adjacent to Yakataga Beach	Beach sands examined. Zircon group of minerals found to be radioactive. Gold has been placered from beach sands	9 beach placer concentrated samples averaged 0.044% eU, one of these had 0.320% eU
44	Nizina Dist. (Kennecott - McCarthy Area)	McCarthy B-5 C-5	C 184	Permian, Triassic and Cretaceous greenstone, lavas, limestone, shale and sandstone intruded by quartz diorite dikes and sills	Bonanza copper produced from the Kennecott mines. Principal ore is Cu-Ag and placer Au. Some Mo, Pb, Hg	Panned concentrates eU under 0.002%. No underground examinations reported
45	Bremer River	Bering Glacier	C 184	As above	Placer Au	Placer concentrate = 0.004% eU probably due to zircon and sphene

46	Moose Pass - Hope area	Seward C-6, C-7, D-6, D-7	C 196	Mesozoic metasediments cut by acid dikes	Au, Ag, As, Pb, Zn, Mo in quartz fissure veins	eU = 0.002% or less
47	Girdwood Area	Anchorage A-6, A-7	C 196	Mesozoic argillite and graywacke with quartz diorite dikes and sills	Au, Ag, As, Pb, Zn, Mo in quartz fissure veins	eU under 0.002%
48	Areas adjacent to Richardson Highway - Valdez north to Willow Lake	Valdez A-5, A-6, A-7, B-4 C-4	C 184, B 1155	Predominantly Cretaceous sediments, graywacke; Carboniferous metasediments and volcanics	Placer and lode Au; some Cu	Panned concentrates eU = 0.005% or less
49	Chitina Area	Valdez C-2	C 184	Carboniferous metasediments		eU = 0.000%
50	Locations Adjacent to Glenallen Highway, Anch. to Tahneta Pass	Anchorage	C 184	Mesozoic metasediments and Tertiary shale, sandstone and coal	Coal, Gypsum	eU = 0.002%
51	Willow Creek District	Anchorage C-6 C-7	C 184	Granite, porphery and Birch Creek schist; various dikes	Rich Au veins and placers. Gold lodes in both quartz diorite and schist	Average of 11 sample of pegmatites = 0.004% eU; heavy fractions average 0.032% eU
52	Jonesville-Eska coal District	Anchorage D-5 D-6	C 184 and this report	Tertiary sandstone, shale and coal	Coal	Slight radioactivity count up to three times background in shales
53	Albert Creek and Crooked Creek Area	Talkeetna A-1	C 184	Jurassic sediments and volcanics	Gold placers	eU = 0.000%
54	Iron Creek Area, Talkeetna Dist.	Talkeetna B-5	C 196	Andesite flows, Mesozoic sediments and granodiorite	Cu, hematite in replacements in andesite	eU = 0.002% or less

Loc. No.	Locality Name	Quadrangle	References to Radioactivity Investigations	Country Rock	Mineralization	Radioactivity Measurement or U Assay
55	Orange Hill	Nabesna A-4	C 348	Permian volcanics, limestone and hornfels. Dikes of alaskite, diorite and andesite. Quartz diorite pluton.	Cu, Fe, Zn, Mo in veins and limestone metamorphic deposits	Airborne survey - no anomally
56	Bonanza Creek Chisana Dist.	Nabesna B-2	C 348	Mesozoic sediments and volcanics intruded by granodiorite pluton and andesitic dikes	Pb, Mo, Hg, Cu, Ag, Au, in fissure veins	eU = 0.003 or less
57	Nabesna Mine Nabesna Dist.	Nabesna B-5	C 348	Triassic limestone intruded by quartz diorite; shales, lavas	Veins of auriferous pyrite and calcite; Zn, Pb, Fe, Sb and contact metamorphic minerals	eU = 0.004% or less
58	Rock Creek Molybdenite prospect, Slana Area	Nabesna C-5	C 348	Paleozoic and Mesozoic granites, lavas, gneiss, schist, pegmatite dike	Molybdenite in pegmatite dike	eU = 0.003% (sphene and zircon)
59	Silver Creek Prospect, Slana Area	Gulkana D-1	C 348	Quartz diorite	Fe, Pb, Cu in quartz veins	eU = 0.001% or less
60	Indian Group Prospect, Slana Area	Gulkana D-1	C 348	Quartz diorite	Pb, Ag, Cu in quartz veins	eU = 0.001% or less
61	Highway area between Slana and Tok Jct.	Nabesna C-6, D-5, D-6	C 331	Paleozoic sediments, volcanics, diorite intrusives	One Ag lode; most sampling was stream concentrates	eU average 0.001%. One rock sample = 0.005% eU
62	Alaska Highway, near Northway Jct.	Tanacross	C 202	Granite; two sites sampled	Allanite and zircon in granite produce slight radioactivity	eU ≈ 0.004% in granite

63	Alaska Highway belt, upper Tanana Valley	Tanacross	C 331, this report	Mostly Mesozoic (?) granitic intrusives; Paleozoic schists and gneiss	Slight radioactivity due to accessory minerals zircon and allanite in granite	eU = 0.004% or less, from granite outcrops and stream concentrates
64	Tanana River Traverse	Big Delta, Mt. Hayes, Tanacross	B 1155	Granite, gneiss, schist		Maximum eU = 0.006% in granite at Cathedral Bluffs
65	Maclaren River	Mt. Hayes B-6	B 1155	Triassic diabasic lava	Cu in quartz veins	eU = 0.003% maximum
66	Highway Area Cantwell to McKinley Park	Healy B-4, C-4	This report	Sandstone and conglomerate of Cantwell formation small granitic intrusive. Tertiary sands near Yanert		Maximum reading was 4 times background in crushed zone in shale bank 2.8 mi. N Denali Highway
67	Dunkle Coal Mine, Costello Creek	Healy B-6	B 1155 and this report	Eocene sandstone, shale and coal beds	Coal has been mined	Slight radioactive coal reported but no anomalies found by later investigations
68	Silver King Mine, W. Fork Chulitna River Area	Healy A-6	This report	Cherty limestone, argillite, nearby diorite	Sb, Fe	No anomalies
69	McKinley Park Road, Park Entrance to Wonder Lake	Healy C-5, C-6, Mt. McKinley B-1, B-2	This report	Mostly Triassic and Cretaceous sediments and lavas	Not on road	No anomalies
70	Richardson Highway, Delta Jct.-Paxon	Mt. Hayes A-3 A-4, B-4, C-4 D-4	This report and C 331	Pre-Cambrian or Paleozoic schist, Mesozoic sediments tuffs, dikes, and granitic intrusives	Placer Au, Sb	No significant anomalies. Panned concentrates maximum = 0.011 eU from Ober Creek
71	Delta Coal Mine, Ober Creek	Mt. Hayes C-4	This report	Tertiary sand, gravel, clay, coal	Coal	No anomalies

Loc. No.	Locality Name	Quadrangle	References to Radioactivity Investigations	Country Rock	Mineralization	Radioactivity Measurement or U Assay
72	Ober Creek	Mt. Hayes C-4	C 202	Schist and gneiss	Placer Au	Panned concentrates average 0.006% eU and to 0.011% eU, due to monozite?
73	Taylor Hwy.	Tanacross B-3, B-4, C-3, D-3; Eagle A-1, A-2 B-1, C-1	B 1155; this report	Ryolite, granite, schist; Tertiary sandstone, shale near Eagle	Placer Au; minor Sn, W, Sb, Hg	Maximum eU = 0.015% in granite and aplite near Mt. Fai play. Other dikes and granites up to 0.006% eU
74	Fortymile District, including Chicken	Eagle A-2 A-3, B-1	C 202, C 335, C 348, this report	Pre-Cambrian and Paleozoic metamorphics, Tertiary volcanics, small granitic intrusions	Primarily placer Au; slight radioactive anomalies due to accessory minerals in granite. Fluorite prospect	Maximum eU = 0.005% in felsic igneous rocks and clay. Traces of uranothorianite at Atwater Bar, near Chicken, and placer concentrates eU up to 0.041%
75	Richardson Hwy Area, Fbks. to Richardson	Fairbanks C-1, D-1, D-2; Big Delta B-5, B-6	C 202, C 331, this report	Birch Creek schist, Mesozoic (?) granite	Au in quartz veins	Maximum eU = 0.006% in granitic rock. Anomally in schist near MP 329 = five times background count
76	Bonnifield Dist., Grubstake Creek	Fairbanks A-3	MR 195 - 23	Tertiary sandstone, shales, gravels; nearby Totatlanika schist	Placer Au	Radioactive, black sands reported - no data
77	Liberty Bell Mine & Calif. Creek prospect Nenana Dist.	Fairbanks A-4	C 196	Birch Creek schist, Totatlanika schist	Fe, Cu, Au, Sb, Bi, Ag, As, Pb in quartz	eU = 0.002% or less

78	Healy Coal District	Healy D-4	This report	Tertiary sandstone, shale, coal beds; Birch Creek schist	Coal	No significant anomalies. Maximum radioactivity was three times the background
79	Nenana Hwy, Fbks to Nenana	Fairbanks C-3, C-4, C-5, D-2	This report	Birch Creek schist	Placer Au	No significant anomalies
80	Ester Dome Area, Fbks. District	Fairbanks D-3	C 331	Birch Creek schist with minor granitic intrusions	Au quartz lodes, minor As, Sb, Fe	Maximum eU = 0.007% from stream concentrates
81	Lindgren-Fultz prospect, Fbks Dist; between Fox and Flume Creeks	Livengood A-2 Fairbanks D-2	B 1155 (p 41) C 196 (Table 2)	Weathered granite; Birch Creek schist	Pb, Ag with Fe, quartz and carbonates in veins	eU under 0.01% but weathered pockets up to 0.025% eU
82	Pedro Dome-Gilmore Dome areas, Fbks. District	Fairbanks D-1, Livengood A-1	C 331, C 335	Birch Creek schist, Mesozoic granite and quartz diorite	Au, Bi, W Lodes and placer Au	Panned concentrates to 0.066% eU. Outcrop samples = 0.001% eU
83	Tolovana and Cleary Hill Mines, Fbks. District	Livengood A-1	C 335	Birch Creek schist	Au, Sb, As, in faulted quartz veins	eU = 0.003%
84	Steese Hwy; Bell Creek to North Fork	Livengood A-6 Circle B-4, B-5	C 331	Birch Creek schist; small granitic intrusives nearby	Placer Au	eU 0.001% to 0.005% from outcrops: one concentrate = 0.017% eU
85	Copper Creek Lode prospect, Eagle District	Eagle D-5	C 202, C 335	Mesozoic quartz	Chiefly Cu; minor Pb, Au, Ag, W; in lime silicate rock small amount of uranium in copper minerals	One sample had 0.032% eU. Others = 0.006% or less
86	My Creek area, Fortymile Dist.	Eagle A-5	C 335	Birch Creek schist and granite	Pb, Sb (?), quartz and hematite veins	eU = 0.003% or less

Loc. No.	Locality Name	Quadrangle	References to Radioactivity Investigations	Country Rock	Mineralization	Radioactivity Measurement or U Assay
87	Taylor Hwy, Boundry to Eagle	Eagle A-1, A-2 B-1, C-1, D-1	This report, B 1155	Birch Creek schist, Mesozoic granite and quartz diorite, Tertiary lavas, sandstones and shales, some argillite and greenstone	Primarily placer Au; minor placer Sn, W, Hg; Pb-Ag lode prospect	High background around Mt. Fairplay up to 4 times normal Some Tertiary sands had 3 times background
88	Mission Creek area, Eagle District	Eagle D-1	C 202, C 316, this report	Granite	Co, Au, Ni lode prospect nearby	Average eU for granitic rock = 0.004%, maximum 0.006%. Concentrates to 0.1% eU
89	Yukon River, Canadian Border to Nation	Eagle D-1; Charley River A-1, A-2	C 316; this report	Devonian and Carboniferous sediments; Permian limestone; Tertiary sandstone, shale and conglomerate; greenstone, granite	Placer Au; Au, Cu, Co lode prospect; hematite in the Tindir group	Maximum eU = 0.007% in Mississippian black shale and 0.005% in Mesozoic granite
90	Slate Creek Area (Ben Creek area), Fortymile Dist.	Eagle B-4	C 202, C 335	Ordovician sediments, Mesozoic granite, rhyolite	Placer Au; traces of Pb, Cu	eU up to 0.005% in rhyolite. Placer concentrates = up to 0.096% eU (as gummite)
91	Coal Creek, Charley River Area	Charley River A-5 or B-5	C 202	Granite (?)	Placer Au	Placer concentrates eU up to 0.009% (in monozite sand)
92	Nome Creek & Hope Creek Areas, Fbks. District	Circle B-5, B-6	C 202, C 348	Birch Creek schist, granitic intrusives	Quartz-pyrite-fluorite veins near schist-granite boundry. Radioactive minerals associated with granite not identified in most samples	Placer concentrates = 0.012% eU (Monozite) from Nome Creek; one sample granite talus = 0.055% eU from Hope Creek area. Others = 0.004% eU or less

93	Good Luck Cr. (Lucky Creek) Livengood District	Livengood C-3	C 335, C 331	Chiefly Mississippian chert and silicified limestone	Placer Au; Radioactive euxenite-polycrase series detected in concentrates	An early concentrate yielded 0.048% eU. Later only 0.002% eU found
94	Livengood Dist (See also Map No. 93)	Livengood B-3 C-3	C 331	Paleozoic basic lavas and metasediments; Tertiary acidic intrusives	Primarily placer Au; minor Hg, Fe-As, Pb, Sb, Cr, W, Ag, Ni, in lodes and placers	Maximum eU = 0.005% from weathered granite
95	Bedrock Creek near Miller House, Steese Highway	Circle C-3	B 1155	Birch Creek schist; Mesozoic granite upstream	Fe staining; placer Au in area	eU = 0.005% in Fe-stained schist
96	Miller House-Circle Hot Springs Area	Circle B-2, B-3, C-3	C 202, C 335, C 348, B 1155	Birch Creek schist, Mesozoic granitic intrusive	Uraniferous fluorite, Cu, Sn, and slightly radioactive accessory minerals in granite and placers	eU = 0.007% in granite. Concentrates yielded up to 0.06% eU
97	Connell Prospect, 28 Mile Yukon River	Charley River C-6	PE 51-4	Shale, sandstone	Barite veins	Shale yielded eU slightly under 0.05% estimated from counter reading
98	Yukon River Traverse, Fort Yukon to Stevens Village	Fort Yukon and Beavers	B 1155	Few bedrock exposures		No anomalies detected in stream concentrates
99	O'Keefe Placer Claim, Chandalar Dist. (20 mi SW of Chandalar Lake)	Chandalar	B 1155	Early Paleozoic schist, gneiss, granite	Quartz-pyrite veins	General high background - up to 0.035 Mr/Hr
100	Chandalar Dist. Big Cr. and Lake Cr. Areas	Chandalar 5-10 miles North and East of Chandalar Lake	C 195, C 202, C 348	Precambrian to Cretaceous sediments, Paleozoic and Mesozoic igneous rocks	Fe, W, Au, As, Cu, Sb, Pb, Zn in lodes. Rich Au Dist.	Placer concentrates had 0.002 up to 0.050% eU

Loc. No.	Locality Name	Quadrangle	References To Radioactivity Investigations	Country Rock	Mineralization	Radioactivity Measurement or U Assay
101	Upper Porcupine and Lower Coleen Rivers, NE Alaska	Coleen A-2, A-3, A-4, B-1 (B-4 and C-1, not mapped as such)	C 185	Precambrian and Mesozoic sediments, intrusives, Tertiary sands, shales and lavas	Reports of sulfides of Cu, Pb, Zn, Ag in headwaters of Coleen River. Little data	Highest unconcentrated sample = 0.006% eU from shale. Highly concentrated samples had up to 0.052% eU
102	Mt. Michelson Area, Romanzof Mountains NE Alaska	Mt. Michelson	C 195	Gneissic granite	The presence of fluorite, hematite, zircon, galena, molybdenite and radioactive biotite as accessories in granite are favorable indications of possible U deposits	eU averaged 0.007% in granite; concentrated samples had up to 0.080%
103	Nuka Bay Area, Kenai Peninsula	Seldovia B-2, C-2	C 196, TEM 235	Mesozoic slates and graywackes	Fe, Pb, As, Ag, Cu, in quartz fissure veins	eU = 0.002% or less
104	Jakolof Bay Area, Kenai Peninsula	Seldovia B-4, B-5	C 207	Triassic graywacke, slate and minor limestone and basic intrusions of Triassic age. Many small acid dikes of late Mesozoic age	Chromite at Red Mountain	Concentrates from streams = 0.007% eU or less
105	McNeil Claims Point River Area	Iliamna A-5	C 207	Paleozoic gneiss and schist and granite intrusives	Cu, Ag with calcite and epidote gangue at intrusive contact	eU = 0.002% or less. Concentrates = 0.009% eU
106	Warner Bay (Prospect Bay) Copper Prospect, Chignik Area, Alaska Peninsula	Chignik A-2	This report	Granite, sandstone, conglomerate	Cu, Fe, Mo, Pb, Zn	No significant anomalies - but count in tunnels 3 times background

107	Chignik River Chignik Area, Alaska Peninsula	Chignik B-2, B-3	This report	Cretaceous sandstone, conglomerate, shale, coal. Jurassic sandstone and conglomerate	Coal	No significant anomalies
108	Apollo and Sitka Mines, Unga Island Alaska Peninsula Region	Port Moller A-2	This report	Miocene andesite, dacite	Au, Fe, Pb, Zn, Cu, in reticulated quartz veins	No anomalies on mine dumps. Andesite had up to 3 to 4 times background count near shore
109	Sand Point Area, Popof Island, Alaska Peninsula Region	Port Moller B-2	This report	Andesite, dacite	Beach placer gold	No anomalies
110	Northwest Coast of Unga Island, Alaska Peninsula	Port Moller, B-3 (not mapped on 1:63, 360)	This report	Tertiary sandstone, shale coal, volcanic breccia, chert	Coal	Slight anomalies in chert boulders
111	South Side Port Moller Bay and Staniukovich Mt.	Port Moller D-2 (not mapped on 1:63, 360)	This report	Tertiary sandstone and volcanics; cretaceous sandstone, conglomerate, coal, limestone	Coal	Slight anomalies in Chignik sandstone and coal - up to 3 times background
112	Port Moller Area, Alaska Peninsula	Port Moller D-2 (not mapped 1:63,360)	This report	Tertiary sandstone and volcanics	Black beach sands contain iron, zircon and traces of Au	No anomalies
113	Red Top Mercury Mine, Marsh Mt; Aleknagik Area	Dillingham	This report	Cretaceous graywacke and siltstone	Hg in carbonate veins cutting siltstone	No anomalies
114	Lake Aleknagik	Dillingham	This report	Cretaceous graywacke, argillite, greenstone	Small quartz and calcite veinlets	No anomalies

Loc. No.	Locality Name	Quadrangle	References to Radioactivity Investigations	Country Rock	Mineralization	Radioactivity Measurement or U Assay
115	Lake Iliamna traverse along shoreline and vicinity	Iliamna	C 207, TEI 557, p. 34	Paleozoic gneiss, schist, slate, chert, greenstone. Mesozoic and Tertiary lavas and tuffs, and granitic intrusives	Principally Cu; minor Ag. Mo, Au, hematite, Pb, Zn-various prospects	eU = 0.002% or less. Highly concentrated samples = 0.009% or less. Traces of sooty pitchblende found by USGS in concentrates from beach sands near Current Creek
116	Dutton Claims, Iliamna Lake Area, on Silver Creek	Iliamna C-3	C 207	Limestone and greenstone	Cu, Fe, in limestone - greenstone contact with calcite, epidote and quartz	eU = 0.000%
117	Lake Clark, traverse along shoreline and vicinity	Lake Clark A-4, A-5, B-2, B-4	C 207	Paleozoic gneiss and schist, Mesozoic lavas, tuffs, metamorphics and intrusives	Nearby prospects -- see 115 and 116	eU = 0.002% or less stream concentrates 0.007% eU or less
118	Kasna Creek Claims near Kantrashibuna Lake, Lake Clark Area	Lake Clark A-3	C 207	Limestone, lava, granite	Cu, hematite in limestone	eU = 0.000%
119	Thompson Claims Kijik River, Lake Clark Area	Lake Clark B-3	C 207	Mesozoic granite, lavas, and metamorphics	Ag-Pb prospect; minor As-Fe, calcite, rhodochrosite	eU = 0.002% or less
120	Chisik Island	Kenai A-7, A-8	B 1155	Jurassic shale and conglomerate (Naknek fm.)		Airborne anomaly not found on ground

121	Mount Spurr Area-location indefinite	Tyonek (B-5?)	C 202	Mesozoic granite; Tertiary lavas; Eocene sand and shales, coal	Coal ?	Concentrate in 0.0X% eU range
122	Roundend and Red Hill Bars, Kohiltna River Yentna District	Tyonek D-2	C 202, TEI 6	Pleistocene and Recent gravels	Placer Au and Pt	Placer concentrates had up to 0.083% thorium and up to 0.190% eU. Monzonite present
123	Shalon Bar, Kahiltna River Yentna District	Talkeetna A-2	C 202, TEI 6	Pleistocene and Recent gravels	Placer Au, Monzonite and thorianite in placer concentrates in gravels	Placer concentrates yielded 0.237% eU and 0.14% U and 0.044% Th. (May be extremely concentrated)
124	Petersville area - Cache Creek and Peters Creek drainages, Yentna Dist.	Talkeetna B-2, B-3	C 202, TEI 6, B 1024-A (TEI 26)	Tertiary shale, sandstone, and coal at lower elevations. Mesozoic metasediments exposed in mountain	Au and Pt placers	eU from placer concentrates up to 0.229% eU and U content of 0.090% but later field investigations found a maximum eU of 0.009% in stream concentrates. Highly radioactive samples may be extremely concentrated heavy fractions. Further investigations on Kahiltna River, Poorman and Willow Creek are recommended
125	Shirley Lake 1 mile north Skwentna River	Tyonek D-5	B 1155	Tuff and tuff breccia	Low grade U along joints in tuffs over small areas	eU = up to 0.021%. A prospector reported one sample = 0.29% U

Loc. No.	Locality Name	Quadrangle	Reference to Radioactivity Investigations	Country Rock	Mineralization	Radioactivity Measurement for U Assay
126	Owhat River	Russian Mission C-1	B 1155	Mafic igneous rock and granite rubble		Ground traverses showed 0.009 Mr per Hr.
127	Russian Mountains	Russian Mission C-1	C 328	Felsic stock, mafic dikes, Tertiary basalt, cretaceous sediments	Lodes with As, Cu, hematite Pb, Zn; minor Ag, Au and Sn, Trace of U in metazeunerite found on ore dump	eU up to 0.006%
128	Marshall Area	Marshall D-1	C 328	Carboniferous greenstone, Cretaceous argillite, sandstone, quartzite and conglomerate	Placer Au; trace of Pt. veins with Au, Fe, Pb, Mo, near head of Willow Creek	eU = 0.001%
129	Julian Creek	Iditarod A-3	C 202, C 255, TEI 45, Part I	Cretaceous sandstone, slate cut by granite dikes	Placer Au	concentrates = 0.03% (due to Th in monazite)
130	Flat area	Iditarod B-4 B-5	C 202, C 255, TEI 6	Cretaceous shale and sandstone to quartzite; mafic and monzonite intrusives	Placer Au; lode prospects for Au, W, Sb, Hg	Granite average = 0.004% eU; concentrates up to 0.1% eU but generally in 0.0X% range
131	McLeod Molybdenite prospect, Kaiyuh Mountains	Unalakeet B-1	C 328	Precambrian or early Paleozoic metamorphic rocks; Cretaceous sandstone, shale and conglomerate in SW part, and granite intrusives	Mo in quartz	eU up to 0.003% in rhyolite porphry
132	Nixon Fork	Medfra A-4	C 202, C 279	Paleozoic limestone; Cretaceous sandstone; shale and slate; Tertiary monzonite intrusive	Placer Au; Au, Cu, Bi in lodes at limestone monzonite contact	Limestone boulders at Whalen mine contain allanite and 0.05% eU due probably to Th. Concentrates had up to 0.078%. Uraninite and thorianite identified in concentrates

133 Kantishna District	Mt. McKinley C-2	C 196, TEM 235	Birch Creek schist	Quartz fissure veins with Ag, Pb, Cu, As, Zn, Fe. Many old mines and prospects	eU = 0.001% or less
134 Mt. Eilson Area, Mt. McKinley Park	Mt. McKinley B-1	C 196, TEM 235	Devonian argillite, limestone, schist intruded by granodiorite	Cu, Pb, Zn, Ag, as replacement in calcareous rock	eU less than 0.001%
135 Poorman - Placerville area, Ruby-Poorman Dist.	Ruby A-5, A-6	C 202, TEI 6	Paleozoic schist, greenstone, tuffs; minor Cretaceous sediments, lavas and granite	Placer Au and Sn	eU up to 0.056% and U up to 0.020% from placer concentrates. Th up to 0.044%
136 Flint Creek, Long Area, Ruby-Poorman District	Ruby A-6, B-5, B-6	C 202, TEI 6	Similar to 135	Placer Au and Sn	eU of crushed country rock 0.003 to 0.008%. Concentrates eU up to 1.63%. (3,800:1 concentrated ratio)
137 Birch Creek, Ruby-Poorman District	Ruby B-4	C 279	Similar to 135	Placer Au	Crushed granite had up to 0.006% eU; concentrates had up to 0.36% eU (concentration ratio 2,700:1)
138 Ruby Area, Ruby-Poorman District	Ruby	TEI 6	Similar to 135		eU = 0.00%
139 Melozitna River, near mouth	Ruby D-5, D-6	B 1155 (Yukon River traverse)	Cretaceous sandstone and conglomerate		Cretaceous grit in Melozitna Canyon gave 0.017% eU and a panned concentrate of 0.10% eU

Loc. No.	Locality Name	Quadrangle	Reference to Radioactivity Investigations	Country Rock	Mineralization	Radioactivity Measurement or U Assay
140	Yukon River Traverse, Ft. Yukon to Ruby	Ft. Yukon, Beaver, Livengood, Tanana, Ruby	B 1155	Paleozoic and Mesozoic sediments, greenstone, metamorphic rocks and granite	Pb-Ag on Quartz Creek, Au placers on Grant and Morelack Creeks	Stream concentrates yielded up to 0.015% eU; Cretaceous rocks had up to 0.003% eU; Tertiary conglomerates yielded between 0.014% eU upstream from Rampart. Paleozoic intrusives had up to 0.008% eU
141	Tofty Tin Belt Manley Hot Springs Dist.	Tanana A-2	C 202, C 317 TEI 6	Cretaceous phyllite and graywacke. Tertiary granite nearby	Placer Au and Sn; Chromite reported in area. The 5 following radioactive minerals were identified in placer concentrates: ellsworthite, exchynite, columbite, monazite, zircon	Highly concentrated placer material yielded up to 2.3% eU in one sample; others were 0.035% eU or less
142	Hot Springs Dome, Manley Hot Springs District	Tanana A-2	C 202, C 317	Tertiary granite, Cretaceous metamorphic rocks	Pb-Ag veins	Granite had an average eU of 0.003%
143	Roughtop Mt.-Boulder Creek Area, Manley Hot Springs District	Tanana A-2	C 202, C 317	Tertiary granite, Cretaceous metamorphic rocks	Placer Au	Old report states a local resident found stream pebbles which assayed 0.21% eU but material not found by U.S.G.S. No anomalies located
144	Eureka Area, Manley Hot Springs-Rampart Dist.	Tanana A-1	C 202, C 317	Cretaceous metamorphic rocks, quartz monzonite on Elephant Mountain	Placer Au	eU of quartz monzonite = 0.004%; eU of placer concentrates = 0.004 to 0.042%. Radioactivity due to monazite

145	Rampart Area	Tanana B-1, C-1	C 317	Mississippian volcanics	Placer Au	eU from placer concentrates = 0.001 to 0.010%, probably due to zircon. Bed of lignite has eU of 0.001%
146	Darby Mts. Seward Peninsula	Solomon, west half	C 300, C 202	Mountain core is principally pre-Cretaceous granites and undivided igneous rocks; bordering rocks are schist, greenstone, and various metamorphic rocks, Precambrian to Tertiary in ages	No significant lode deposits but one Ag-Pb prospect was worked. Coal is present. One Au placer mine. Radioactivity found in accessory minerals associated with granite	Many samples of stream concentrates tested. Highest eU in Clear Creek area where concentrates yielded up to 0.104% eU. Most concentrates had eU in 0.0X range
147	Big Hurrah Mine, Seward Peninsula	Solomon C-5	C 196	Carboniferous black slate intruded by quartz vein	Au, Cu, Sb, pyrrhotite	eU under 0.001%
148	Quiggley (Grey Eagle) antimony prospect Seward Peninsula	Soloman C-5	C 196	Quartz veins in Carboniferous slate	Sb	eU under 0.001%
149	Cape Nome Area Seward Peninsula	Nome B-1, C-1 Solomon B-6, C-6	C 202, C 244	Complex of granite, gneiss schist, greenstone of Paleozoic to Mesozoic ages		eU of concentrates of crushed rock = 0.001 to 0.012% and slope wash concentrates had eU from 0.006 to 0.025%
150	Road Traverses Nome Area	Soloman-Nome,	C 196	Schist, granite, gravels, limestone, slate	Sb, pyrite, arsenopyrite	No important anomalies detected
151	Hed and Strand Mine, Nome District	Nome D-1	C 196	Early Paleozoic schist	Quartz veins, Sb, pyrite, arsenopyrite	eU = 0.001%

Loc. No.	Locality Name	Quadrangle	References to Radioactivity Investigations	Country Rock	Mineralization	Radioactivity Measurement or U Assay
152	Charley Cr. Bismuth prospect, Nome District	Nome D-1	C 196	Early Paleozoic schist	Bi with pyrite	eU less than 0.002%
153	Sinuk River Iron Area	Nome D-2	C 196	Early Paleozoic limestone	Veins and stockworks of limonite and hematite; also magnetite, Mn, Pb, Zn, Au	eU less than 0.001%
154	Teller Area Seward Peninsula	Teller A-3	C 244	Schist, limestone, slate and greenstone of probable early Paleozoic age	Placer Au; quartz veins	Maximum eU from stream concentrates = 0.004%
155	Teller Area North side of Grantley Harbor, Seward Peninsula	Teller B-3	C 244	As above	As above	Maximum eU from stream concentrates = 0.004%
156	Brooks Mt. and Lost River Area, York Dist. Seward Peninsula	Teller B-5, C-5	C 196, C 202, C 214, C 319, TEM 235, TEI 6	Early Paleozoic shale and limestone intruded by Mesozoic granite	Sn, W, hematite, purple fluorite, tourmaline. Uranium associated with iron in tin, tungsten, fluorine-bearing rhyolite dikes and in iron rich pockets in limestone	An iron-rich zone ir Lost River Valley ha an average eU of 0.06 to 0.3% in "pockets". Zeunerite was found at 2 places on Brooks Mt. in granite pegmatite Pieces of float contained up to 2.1% eU near granite-limestone contact. No economic deposits located
157	Cape Mt. Area York District Seward Peninsula	Teller C-6	C 202, TEI 6	Granite, limestone, sandstone, slate, basic dike rocks	Sn is important in veins and placer deposits	eU of concentrates up to 0.9%; average 0.03%

158	Potato Mt. Area, York Dist. Seward Peninsula	Teller C-6	C 196	Early Paleozoic black slate intruded by granite porphyry dikes and quartz veins of Mesozoic age	Sn, fluorite, in veins and placers	Less than 0.001% eU
159	Ear Mt., York Dist., Seward Peninsula	Teller C-4	C 202, B 1024-C TEI 6	Schistose limestone, shale slate, quartzite. Granite gabbro, alaskite dikes	Primarily Sn prospects; traces of Cu, Au, Pb, Zn. Most of the radioactivity found was in margins of granite and in quartz-tourmaline veins and with red hematite	Stream concentrates yielded up to 1.0% eU in heavy mineral fraction. Average for all concentrates collected was 0.031% eU. Radioactivity believed due to monazite and zircon. One piece of ore had 0.182% eU
160	Serpentine-Kougarok Area Seward Peninsula	Bendeleben C-6, D-6	C 265, TEI 6	Early Paleozoic limestone slate and schist; Paleozoic greenstone, Mesozoic-Tertiary granite and other felsic intrusives	Placer and lode Au; minor placer Sn; Cu, W, Hg prospect	Average eU of 29 samples of granite = 0.008% and their heavy metals portion average 0.034%. Highest radioactivity was found in vicinity of Hot Springs Cr. Maximum eU of crushed granite = 0.032%
161	Tubutulik River Area, Darby Mt., Seward Peninsula	Solomon D-1	C 202, C 300	Granites, greenstone, schist of pre-Cretaceous ages	Placer Au, Cu, Ag-Pb lode prospects, coal. Radioactivity due to hematite, allanite, zircon, sphene	41 stream concentrate samples had an eU between 0.01 and 0.02% and the maximum eU was 0.01%
162	Sweepstakes Creek and vicinity, eastcentral Seward Peninsula	Candle B-5	C 250	Pre-Cretaceous syenite and lavas; Tertiary basalt	Placer Au; minor placer Pt.	Only noticeable radioactivity in bedrock was in syenite which had eU from 0.001 to 0.013% in crushed samples; stream gravels eU content = 0.0001%

Loc. No.	Locality Name	Quadrangle	References to Radioactivity Investigations	Country Rock	Mineralization	Radioactivity Measurement or U Assay
163	Buckland-Kiwalik District, Northeastern Seward Peninsula	Candle B-5, C-5, C-6, D-5	C 250, PE 45-1, C 202, TEI 45	Pre-Cretaceous basic rocks Cretaceous phyllite; Tertiary granite and basalt	Placer Au and Pt; lode Au, and Cu prospects. A variety of radioactive minerals and presence of metallic sulfides, flourite, bismuth, and silver were found in . stream concentrates but not in bedrock	Placer concentrates on Peace River had eU from 0.2 to 0.8%. Bedrock source not found. Other areas had much less radioactivity
164	Candle Area, ridge at head of Montana Cr.	Bendeleben D-1	MI 44-2	Schist	Earlier reports of samples from same area containing up to 1.3% U_3O_8 were found to be incorrect by later drilling	3 drill holes from 25' to 63' in depths produced eU from 0.002 to 0.01%
165	Candle Creek Area, Northeastern Seward Peninsula	Candle D-6 Bendeleben D-1	C 250, TEI 6	Schist cut by rhyolite dikes and sills and small quartz stringers	Placer Au. Small amounts of radioactive minerals in placers possibly uraninite-thorianite	eU of placer concentrates ranged from 0.001 to 0.025%
166	Selawik Lake airborne radiometric traverse approx. 100 mi. (Map location approximate)	Selawik	Map I-530; PP 450-A p. A52; USGS sketch map of traverse and radiometric measurements (Unpub.)	Granite and syenite intrusives and volcanics of Cretaceous age; Tertiary basalt; Quaternary glacial drift covers much of the area		Airborne radiometric survey produced from 100 to 1600 counts per minute. Highest counts were over or near granite or syenite intrusives in Selawik Hills see anomalies on traverse line
167	Intrusive approximately 4 mi. south of Selawik Lake	Selawik	Map I-530	Cretaceous granite and syenite intrusive		Radioactive trachyte reported

168	Zane Hills, Caribou Mt.	SE part of Shungnak and SW part of Hughes	C 570, B 1155	Granodiorite, quartz monzonite, andesite	Cu-Fe quartz vein; chemical anomalies of Ag, Au, Pb, Bi W found in rock analysis	Border phases of pluton in 2 areas show radioactivity from 5 to 10 times background rate. A sample of quartz monzonite porphyry showed 20 ppm U. Radiometric anomalies in area encountered by airborne instruments
169	Lockwood Hills	Shungnak and Hughes	B 1155	Diorite, tuffs	Quartz veins	No anomalies encountered. eU of diorite = 0.003%
170	Upper Kobuk River, including copper deposit at Bornite on Ruby Creek	Shungnak D-2 D-3, and part of Ambler River Quad.	B 1155; PE 28-1 28-2, 28-3, 28-4; Runnells, D. D.	Gneissic granite, gneiss, serpentine, schist, limestone of Paleozoic age; conglomerate, sandstone, mudstone, and volcanics of Cretaceous age	Rich copper deposit on Ruby Cr. in brecciated limestone includes Ag, Co, Pb, Zn, fluorite; some copper ore is radioactive. Asbestos associated with serpentine at Asbestos Mt. and jade is present at Bismark Mt.	Granite eU = 0.005% near mouth of Kogoluktuk River; eU of ore veins up to 0.02% eU at surface; eU of a copper ore sample from cores = 0.275%. Sooty pitchblende in cores from Bornite
171	Kobuk River Traverse, Kallarichuk River to Kiana	Baird Mts.A-2 Selawik D-3 (not mapped on 1:63,360 scale yet)	B 1155	Cretaceous conglomerate, sandstone, carbonaceous sandstone, shale, coal, tuffs; Paleozoic schist near Kiana	Coal; a sample of columbite and tantalite reported from Kiana; Possible U in carbonaceous beds near Kiana	Carbonaceous shales and sandstones weakly radioactive
172	Hockly Hills, Waring Mt. Area	Selawik D-3 (not mapped on 1:63,360 scale yet)	B 1155	Conglomerate, mudstone, graywacke, black shale of Cretaceous age		Maximum eU = 0.003% in black shale
173	John River, vicinity of Bettles	Bettles	C 195	Cretaceous sediments and volcanics	Cu, Pb found in placer concentrates	eU less than 0.001%

Loc. No.	Locality Name	Quadrangle	References to Radioactivity Investigations	Country Rock	Mineralization	Radioactivity Measurement or U Assay
174	Gold Bench, So. Fork Koyukuk River, Wiseman Dist.	Bettles	C 195, C 202	Mesozoic volcanics	Placer Au, hematite and metallic sulfides in placer concentrates	eU of placer concentrates = 0.027% maximum; probably due to trace of thorianite
175	Wiseman Dist. Middle Fork Koyukuk River, 6-10 miles So. of Wiseman	Wiseman	MI 30-1	Birch Creek schist and nearby granite intrusives		No anomalies detected in stream concentrates or schist bedrock
176	Wiseman Dist. Nolan Creek	Wiseman	C 195	Birch Creek schist and nearby granite intrusives	Placer Au	eU of placer concentrates under 0.001%
177	Wiseman Dist. Rye Creek	Wiseman	C 195	Birch Creek schist	Placer Au	2 placer concentrate samples had eU of 0.014%
178	Tiglukpuk Cr. No. side of Brooks Range	Chandler Lake	PP 302-A	Mississippian Lisburne group consisting of mudstone, limestone, dolomite chert and phosphate rock	Phosphate rock; the highest the P_2O_5 contents contain the highest eU. P_2O_5 assays up to 34.0%	eU up to 0.021% in phosphate rock
179	Upper Kiruktagiak River, No. side of Brooks Range	Chandler Lake	PP 302-A	As above	As above	eU up to 0.022% in phosphate rock

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