STATE OF ALASKA

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GEOLOGICAL REPORT NO. 41

# An Experiment in Geobotanical Prospecting for Uranium, Bokan Mountain Area, Southeastern Alaska

By

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August 1970

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# AN EXPERIMENT IN GEOBOTANICAL PROSPECTING FOR URANIUM, BOKAN MOUNTAIN AREA, SOUTHEASTERN ALASKA

By

Gilbert R. Eakins

## A B S T R A C T

A project was conducted at the Ross-Adams uranium mine to determine the usefulness of various sample types in uranium exploration in Alaska, where conditions present unusual difficulties. A total of 421 samples were collected, including several varieties of plants, mulch, algae, and stream sediments. The Ross-Adams ore deposit is a uranium-thorium concentration in a small stock of peralkaline granite. The area was selected for testing various types of sampling because the mine has produced high-grade ore and the geology is known.

Highly anomalous uranium values were obtained from the ashed plants and other materials. The highest value of 2396 parts per million uranium was obtained from lodgepole pine. Eleven assay maps illustrate the results of sampling different plants, mulch, and stream sediments. Other maps show a fracture pattern, mine workings, and radiometric surveys. The analyses indicate that the lodgepole pine is the most suitable plant for geobotanical prospecting in the area. Some evidence suggest that mulch and stream sediments may be useful for uranium prospecting.

## I N T R O D U C T I O N

### OBJECTIVES

This report is the second by the Division of Mines and Geology directed toward assisting those prospecting for uranium in Alaska (Eakins, 1969). Difficulties in radiometric prospecting for uranium over large parts of Alaska, besides the usual ones of remoteness and rugged terrain, are: the presence of tundra cover, dense vegetation, humid climatic conditions, permafrost, complex geologic structure, and widespread metamorphism of both igneous and sedimentary rocks. These conditions prompted the writer to undertake a biogeochemical prospecting project in an effort to learn if the method would be useful within this state.

The area selected for sampling was the Bokan Mountain uranium-thorium district near the southern end of Prince of Wales Island. High-grade uranium ore has been produced from an alkali granite stock at the Ross-Adams mine, and radioactivity has been found at numerous sites within the surrounding area. The writer spent the month of August, 1969, collecting samples and examining the geology of the mine and nearby prospects.

Evaluation of the properties and general exploration programs by private companies are currently in progress. Competition is very keen, and therefore it would not be appropriate for the writer to attempt a discussion of ore reserves or the economic possibilities of mining properties at this time.

## LOCATION AND ACCESS

The Bokan Mountain uranium-thorium area, as defined by MacKevett (1963), includes a northwest trending tract of roughly 70 square miles located on the east side of the southern part of Prince of Wales Island (*fig 1*). Except for a small strip along the eastern shoreline of the island which falls in the Prince Rupert D-6 quadrangle, the area is in the Dixon Entrance D-1 quadrangle. The most important deposit of uranium found so far is at the Ross-Adams mine on the southeast side of Bokan Mountain at an elevation of 950 feet (*fig 2 & 3*). It is about one and three-fourths miles by road from the head of the West Arm of Kendrick Bay, where Newmont Exploration Limited has a camp and dock. The camp is approximately 40 miles southwest of Ketchikan. It is served by chartered boats and float planes, both of which are available in Ketchikan.

Except for the short road between the bay and the Ross-Adams mine, land travel is by foot and generally very difficult. A few trails leading to some claims are not maintained and not easily followed. Helicopters being used by exploration groups can be landed at rather widely-spaced clearings at the higher elevations.

## CLIMATE AND VEGETATION

The climate of southern Prince of Wales Island is not severe, but precipitation is heavy, especially during the spring and summer. Strong wind storms are always a possibility. The U. S. Department of Commerce (1968, p 10) recorded an average annual precipitation of 118 inches during the last 10 years at the Annette Island airport, twenty miles northeast of Kendrick Bay. Temperature extremes at the same location were a low of 1° F and a high of 90° F.

Vegetation varies from very dense in rain forests at the lower elevations to nearly absent along rocky slopes, which range up to 2500 feet at Bokan Mountain. Many of the middle and higher areas where soil is thin support only stunted trees and scrub brush. Swamps and muskeg exist where drainage is poor. Forests contain large spruce, cedar, and hemlock, which often have trunks up to four or five feet in diameter. Fallen trees and dense brush consisting of berry bushes, devils club, and other low-growing varieties make some places nearly impenetrable. Thick mosses cover everything in the well-shaded forests (*fig 4*).

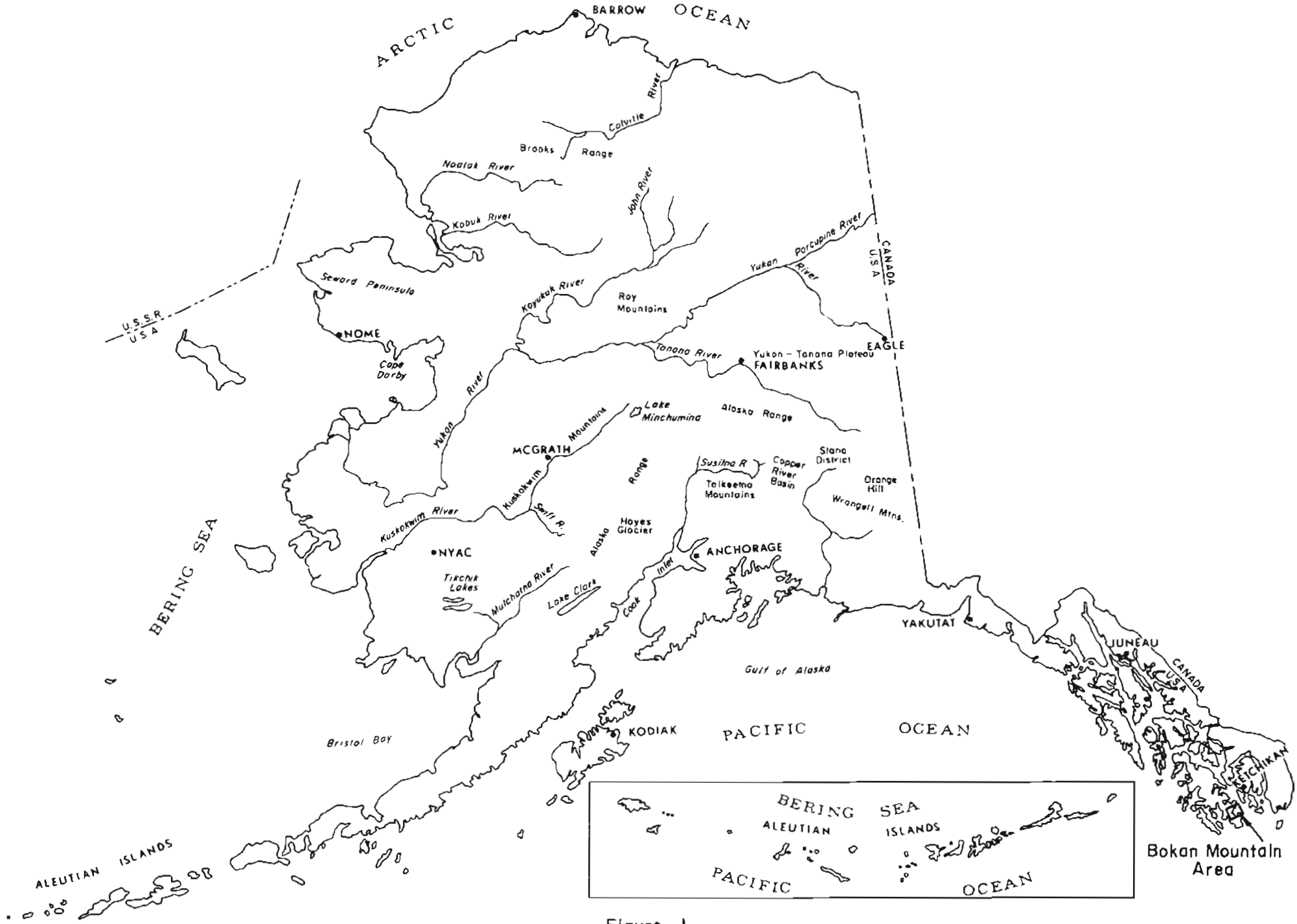



Figure 1

**Location Map - Bokan Mountain Area, Alaska**

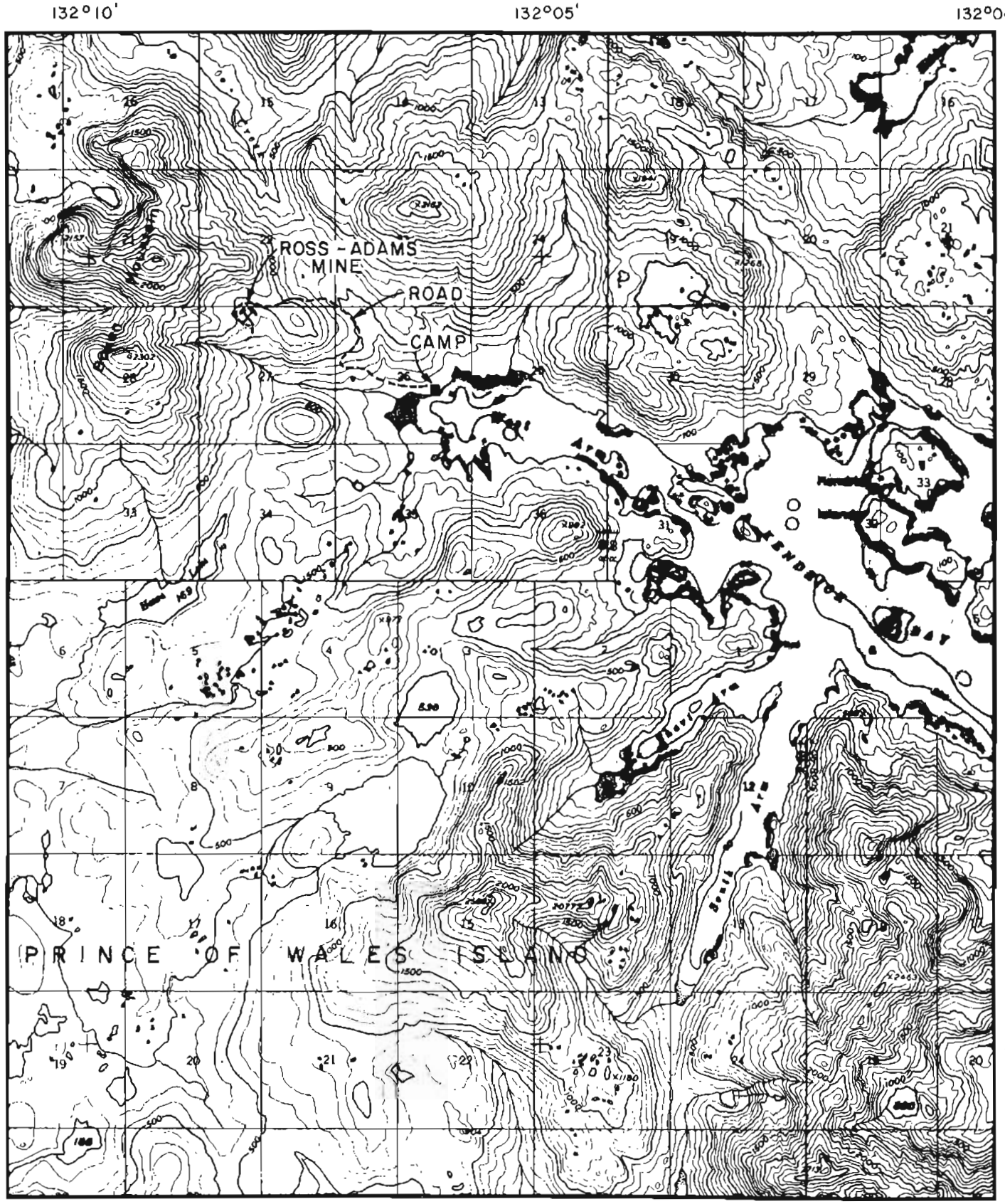



Figure 2

# Bokan Mountain Uranium - Thorium Area

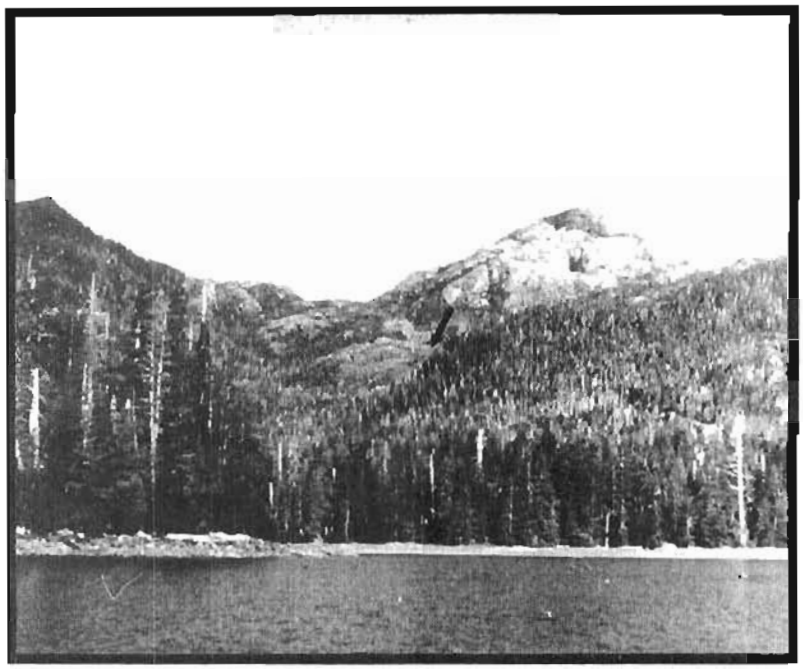


Figure 3-- Bokan Mountain from Kendrick Bay, facing west. Arrow marks the location of the Ross-Adams mine.

## PREVIOUS WORK

Early regional geological reconnaissance was done by Wright and Wright (1908) and Buddington and Chapin (1929). Other publications containing historical information on mining and the geological setting are listed under REFERENCES.

The most complete published report on the Bokan Mountain uranium-thorium area is by MacKevett (1963). It is accompanied by a geological map with a scale of 1:24,000. Much of the following description of geology and mineralogy of the Bokan Mountain area have been drawn from this report. Field work by MacKevett was done during the summers of 1956, 1957, and 1958. Mining at the Ross-Adams mine up through that time had been limited to the shipping of 15,000 tons of ore produced from a trench approximately 400 feet long, 30 to 70 feet wide, and 30 feet deep. Later a 500-foot tunnel was driven at the 700-foot level toward the ore body, and a raise connected the tunnel with the open pit at the 925-foot elevation (*figs 5 & 6*).

Biogeochemical methods used for uranium prospecting in the western states have been developed by the U. S. Geological Survey (Cannon, H. L., 1956, 1957, 1960, 1964, and others). While the writer is not aware of any previous plant analyses for uranium in Alaska, a report on lead and zinc in plants in Southeastern Alaska (Shacklette, 1960) compares metal contents of seven species. Another paper (Chapman and Shacklette, 1960) summarizes the average lead, zinc, copper, nickel, iron, and molybdenum content of several Alaskan plants. Shacklette (1965) has discussed the association of bryophytes with mineral deposits in Alaska. Outside of Alaska, private companies have done extensive work in this field and a number routinely make botanical analyses for uranium in their own laboratories,

Figure 4-- Typical vegetation of the Ross-Adams mine. View west of mine.

Figure 5-- The Ross-Adams mine. View looking south to open pit.

## ACKNOWLEDGEMENTS

The writer wishes to express his gratitude to Newmont Exploration Limited for permission to conduct the biogeochemical test project on their property. He is indebted to Mr. Bill Mounts and Mr. Vivian Vellet of Newmont for their generous assistance and hospitality at the Kendrick Bay camp. Appreciation is due Mr. R. L. Dotson, who holds claims in the area, for his cooperation during the study.

Samples were analyzed by Union Carbide Corporation at their Grand Junction, Colorado laboratory. This service was a great contribution to the project. Thanks are extended to Mr. P. E. Galli, Union Carbide geologist, for his assistance in handling samples and arranging for analyses.

## GENERAL GEOLOGIC SETTING

Southeastern Alaska is a subprovince of the Western Cordillera tectonic belt. The principal features of the province are the Coast Range Batholith and the outlying subsidiary intrusives. The batholite is complex, consisting of a variety of igneous rocks of various ages.

Marine sediments and volcanics deposited in Paleozoic and Mesozoic euogeosynclines on the western side of the orogenic belt formed thick sequences, totaling possibly 50,000 feet. The oldest dated rocks are Ordovician and Early Silurian (Brew, Loney, and Muffler, 1966).

Deformation and plutonic activity during the Nevadian orogeny have regionally metamorphosed the rocks and created many large-scale faults with lateral movements to more than 50 miles. A conspicuous north-trending linear fault pattern can be seen in many fiords and straits. A number of fault zones contain mineral deposits (Twenhoffel and Sainsbury, 1958). A large vertical fault apparently has controlled the development of the South Arm of Kendrick Bay. Both primary and secondary joints are common. Primary joints, interpreted as being the result of rapid cooling, have localized many of the pegmatite dikes in granite.

Metamorphism on the west side of the Coast Range Batholith has created gneisses which grade westward into the schists, phyllites, and less metamorphosed rocks on the islands of Southeastern Alaska. The strike of most of the bedded rocks and the general grain of the major structures is northeastward.

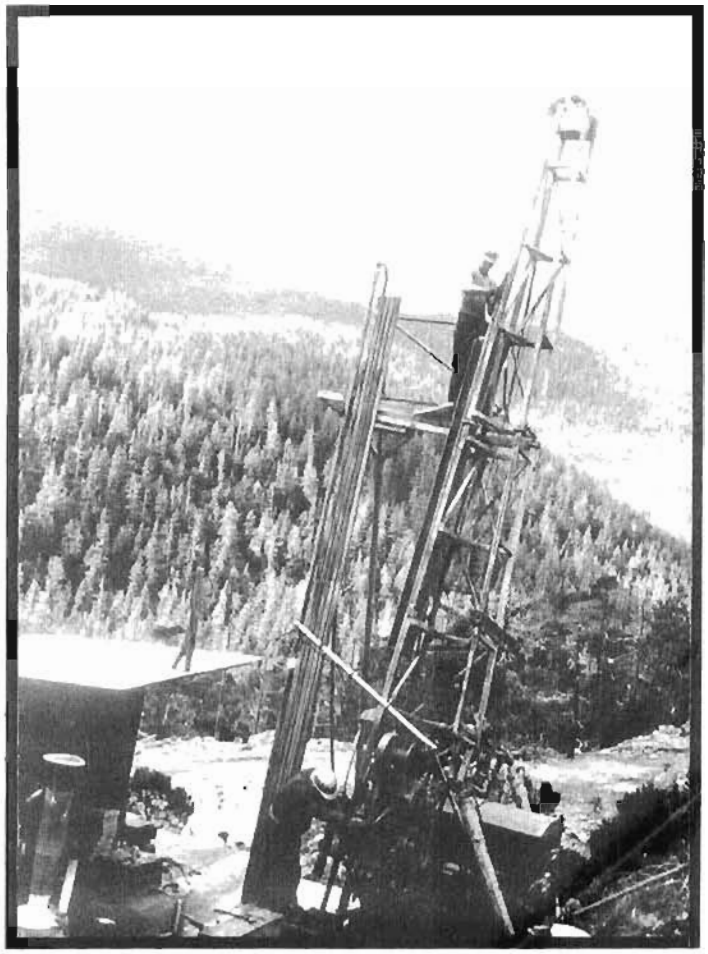


Figure 6--Core drilling at the Ross-Adams mine. View southwest of mine.

## MINING OF NONRADIOACTIVE MATERIALS

The history of mining in Southeastern Alaska goes back to 1867 when a Russian first mined copper on Prince of Wales Island near new Kasaan. The region contains many old mines and prospects and a wide variety of minerals. The most important deposits are closely related to plutons and structural features of early Mesozoic and early Tertiary age. So far, very few large mineral deposits have been found in the main Coast Range intrusions.

Southeastern Alaska's lode mining has yielded 6.2 million ounces of gold, 3.3 million ounces of silver, 37 million pounds of copper, 48.3 million pounds of lead, 111 thousand pounds of zinc, and 14 thousand pounds of platinum group metals, mainly palladium (Kaufman, Alvin, 1961). Other ores and potential ores are antimony, barite, garnet, iron, molybdenum, titanium, nickel, and tungsten.

In the Bokan Mountain area, copper and gold deposits were staked during the early 1900's at several localities between McLean Arm and Mallard Bay. The Polson and Ichis copper and gold prospects are just south of McLean Arm, nine miles southeast of the Ross-Adams mine. Ores there are localized in quartz-calcite-barite veins in a series of fault zones. Pyrite, chalcopyrite, hematite, chrysocolla, and traces of bornite and gold have been found. Gold was once produced from auriferous pyrite at the Nelson and Tift mine, a mile west of the mouth of McLean Arm. The ore formed a small lens in calcareous rock that has since been mined out.

Iron claims have been staked in the southern part of Prince of Wales Island where magnetite occurs with hornblende concentrations in diorite and pyroxenite.

## GEOLOGY OF THE BOKAN MOUNTAIN URANIUM-THORIUM AREA

### BEDROCK

Radioactive minerals of the Bokan Mountain district are associated with a small peralkaline granite stock of Mesozoic age which has intruded an older monzonite pluton. According to the Shand classification, peralkaline granite is an igneous rock division in which the molecular proportion of alumina is less than that of soda and potash combined. Potassium-argon and lead-alpha measurements indicate the Bokan Mountain granite to be late Jurassic or early Tertiary in age and the older pluton to be early Paleozoic, probably Ordovician (Lanphere, M. A., MacKevett, E. M., and Stern, I. W., 1964). The peralkaline granite stock is roughly circular and about two miles in diameter. This rock is well exposed on the steep slopes of Bokan Mountain.

Slate of Devonian age extends around three sides of the central stock and along the contact between granite and monzonite. At other places the slate is separated from the granite by a strip of monzonite. Paleozoic gneiss, schist, amphibolite, marble, and calcic hornfels lie north and west of the slate. South and east of Bokan Mountain the rocks are predominantly quartz monzonite and quartz diorite, but other plutonic rocks in the area are pyroxenite, gabbro, and syenite. A variety of dikes, largely aplite, pegmatite, and andesite, are widespread. Radioactivity is frequently encountered in the aplite and pegmatite dikes.

Peralkaline Bokan Mountain granite is the rock of primary interest. It is the host for most of the uranium-thorium deposits, and underlies most of the material sampled for this project.

This granite is unusual and has not been reported from any other locality in Southeastern Alaska. It is characteristically high in quartz and sodium-bearing mafic minerals. Many different textures have been noted and grain size varies from fine to coarse. It is generally light gray to white and speckled with about 10 percent dark minerals. Acmite and riebeckite are characteristic, and each is present in amounts from one to twelve percent. Accessory minerals are chiefly zircon, uranothorite, pyrite, xenotime, fluorite, cordierite, and magnetite. Unusual amounts of the minor elements, uranium, thorium, yttrium, lanthanum, niobium, cerium, and other rare earths are present.

Some of the dikes within the area, especially aplite and pegmatite, genetically related to the Bokan Mountain granite are interesting because they contain uranium, thorium, zirconium, and niobium. These dikes are believed to have crystallized from a volatile-rich fluid during a late intrusive stage. Quartz-rich aplite dikes are up to 1000 feet long and 10 feet wide. Pegmatites are less than 4 feet thick, but are traceable for as much as 3000 feet. They are poorly zoned and contain scattered dark uranium or thorium minerals. Other dikes in the area range in composition from diabase to rhyolite and form a complex assemblage.

## URANIUM-THORIUM DEPOSITS

Most of the uranium and thorium minerals in the Bokan Mountain district are primary types and are believed to have formed by hydrothermal solutions during Tertiary time. The principal radioactive minerals there are uranothorite, uranoan thorianite, and uraninite. Phosphates, niobates, and complex silicates are present in minor amounts and carry some uranium or thorium.

Four types of deposits in the Bokan Mountain area have been described by MacKevett:

1. Primary segregation of uranium-thorium minerals in a late stage of the peralkaline granite magma and subsequent hydrothermal deposition. This type occurs at the Ross-Adams mine.

2. Syngenetic deposits in pegmatite and aplite dikes.

3. Epigenetic hydrothermal deposits, chiefly open-space filling, but includes some replacement.

4. A deposit formed in clastic sedimentary rock by filling of the interstices at the Cheri No. 1 prospect.

## ROSS-ADAMS MINE

The initial uranium discovery in the Bokan Mountain area was made in 1955 by Don Ross and Kelly Adams using an airborne geiger counter. A total of 60,000 tons of ore averaging almost one-percent of both $U_3O_8$ and thorium has been produced by various operators. The mine was closed in 1964 after fulfilling a contract with the Atomic Energy Commission. An effort to reopen it is pending results of core drilling and ownership negotiations. Newmont Exploration, under an agreement with Standard Metals, is currently evaluating the property, which covers approximately 500 acres. Drilling has proven the extension of ore beyond previously known limits. The internal structure of granite at the mine has been found to be much more complicated than was suspected before Newmont's work.

The ore body is irregular, but plunges generally southward. The percentage of uranium minerals decreases gradually outward from a high-grade zone, and ore limits are indefinite. Two steep intersecting faults striking N70W and N80E are exposed at the south end of the open pit. These faults cut the ore and displace it to the south. On the largest fault, the writer observed slickensides, which indicate a few feet of recent lateral movement. In addition, many smaller faults and joints are present throughout the mine.

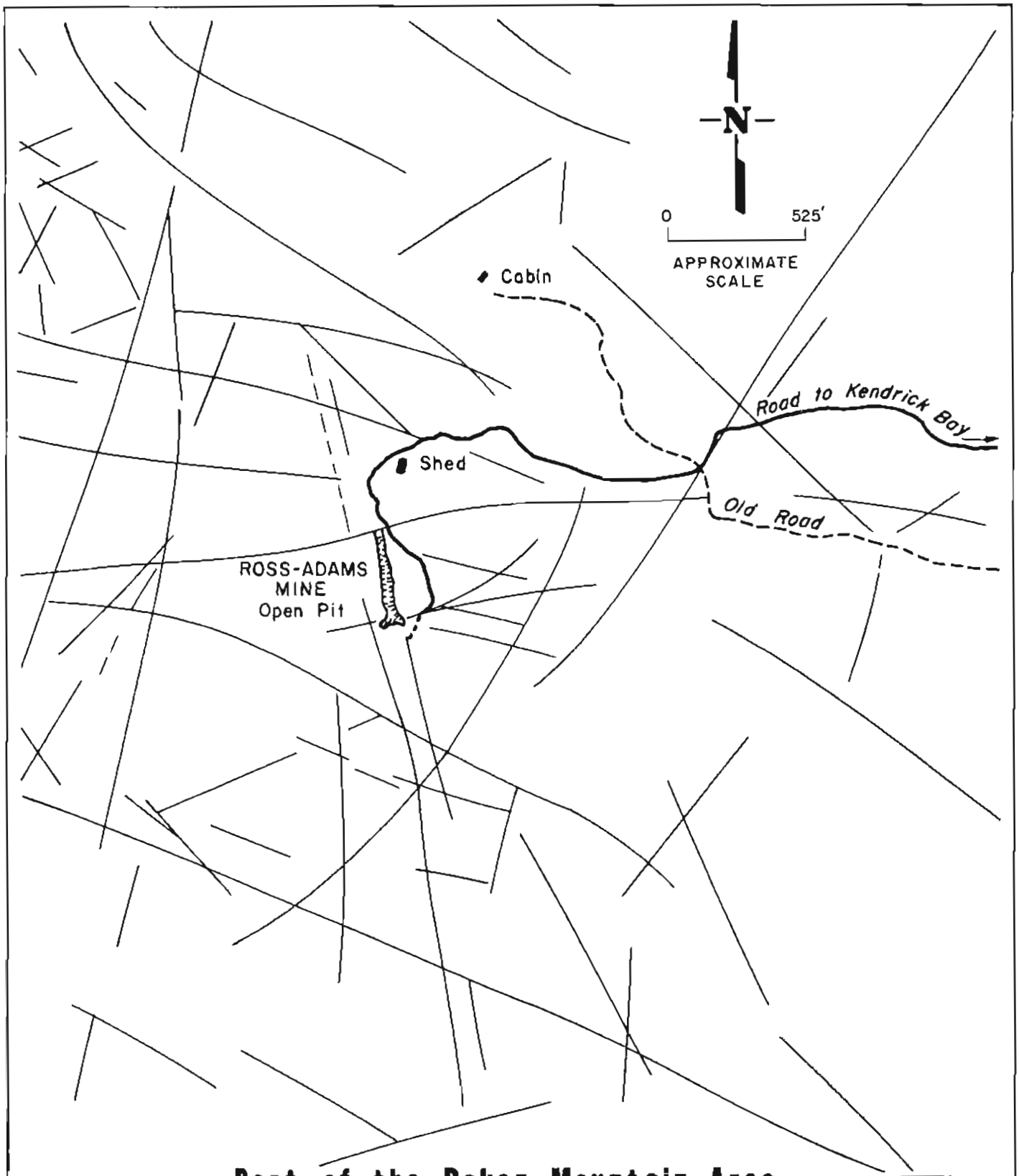
Figure 7 shows lineations evident on aerial photos in the Ross-Adams mine area. These probably represent high-angle joints and faults. Intersections occur that might be loci of crushed zones favorable for mineral deposits. Under the microscope iron-stained fractures can be seen radiating from the ore minerals and from reticulating veinlets along cleavage planes in the feldspars.

The ore body mined in the open pit originally contained a "core" of high-grade ore which averaged over 0.5% $U_3O_8$. A large portion contained ore running 1% $U_3O_8$, and pods contained up to 3% $U_3O_8$. Twelve samples analyzed by the U.S.G.S. yielded from 0.18 to 3.2% chemical uranium. High-grade ore can be distinguished by its dark color due to the presence of associated hematite in the granite. The "core" was enveloped by a zone of lower-grade ore between 2 and 20 feet thick that averaged less than 0.5% $U_3O_8$. Information is not available on the ore mined later by underground methods.

Two radiometric surveys by the writer shown in figures 8 & 9 give readings in milliroentgens per hour obtained with a scintillometer in the main open pit and in the short tunnel at the upper level of the mine. Figure 8 shows readings recorded with a geiger counter, both in the main open pit and in the lower tunnel. The geiger counter readings are considerably lower overall than the scintillometer readings, due to differences in instrument sensitivities. The background in both cases averaged about 0.02 milliroentgens per hour at the surface. The highest radioactivity in the entire area, based on geiger counter readings, was at the widest part of the lower tunnel where the short crosscuts connect. This zone is highly broken and sheared.

### Mineralogy

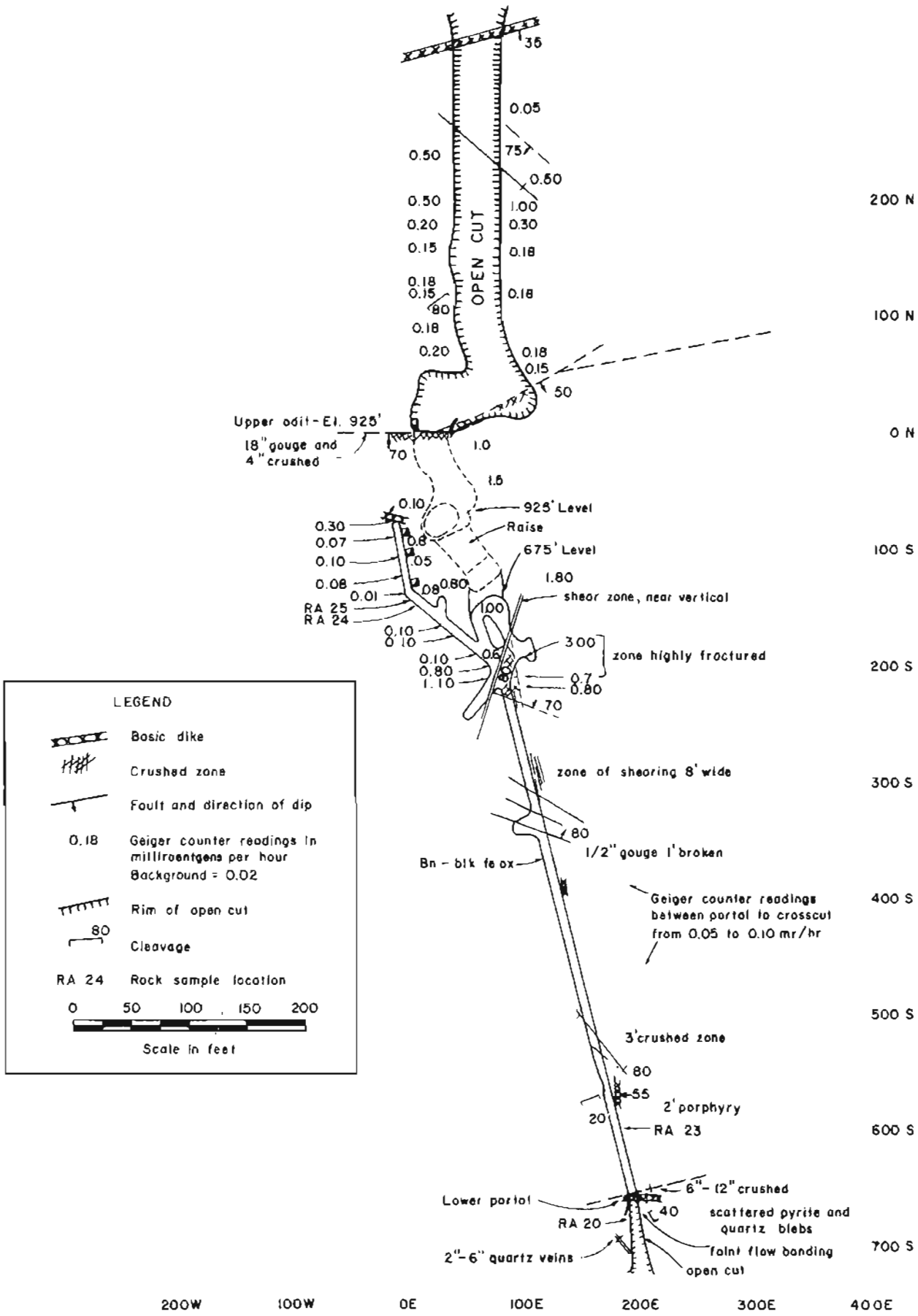
The ore minerals are difficult to identify but almost all are primary. They occur both as scattered grains throughout the peralkaline granite and in numerous thin (0.1 to 0.8 mm) veinlets. Anhedral to euhedral grains up to 2 mm wide are typical. The dominant ore minerals are uranothorite (uranium-bearing thorite) and uranoan thorianite (uranium-bearing thorianite). Coffinite ($U(SiO_4)(OH)_4$) is found in minor amounts. Other vein minerals accompanying the ore minerals are abundant hematite and calcite, and lesser amounts of fluorite, pyrite, hydrous iron sesquidoxides, galena, quartz, clay minerals, and chlorite.




**Part of the Bokan Mountain Area Showing Fracture Pattern**

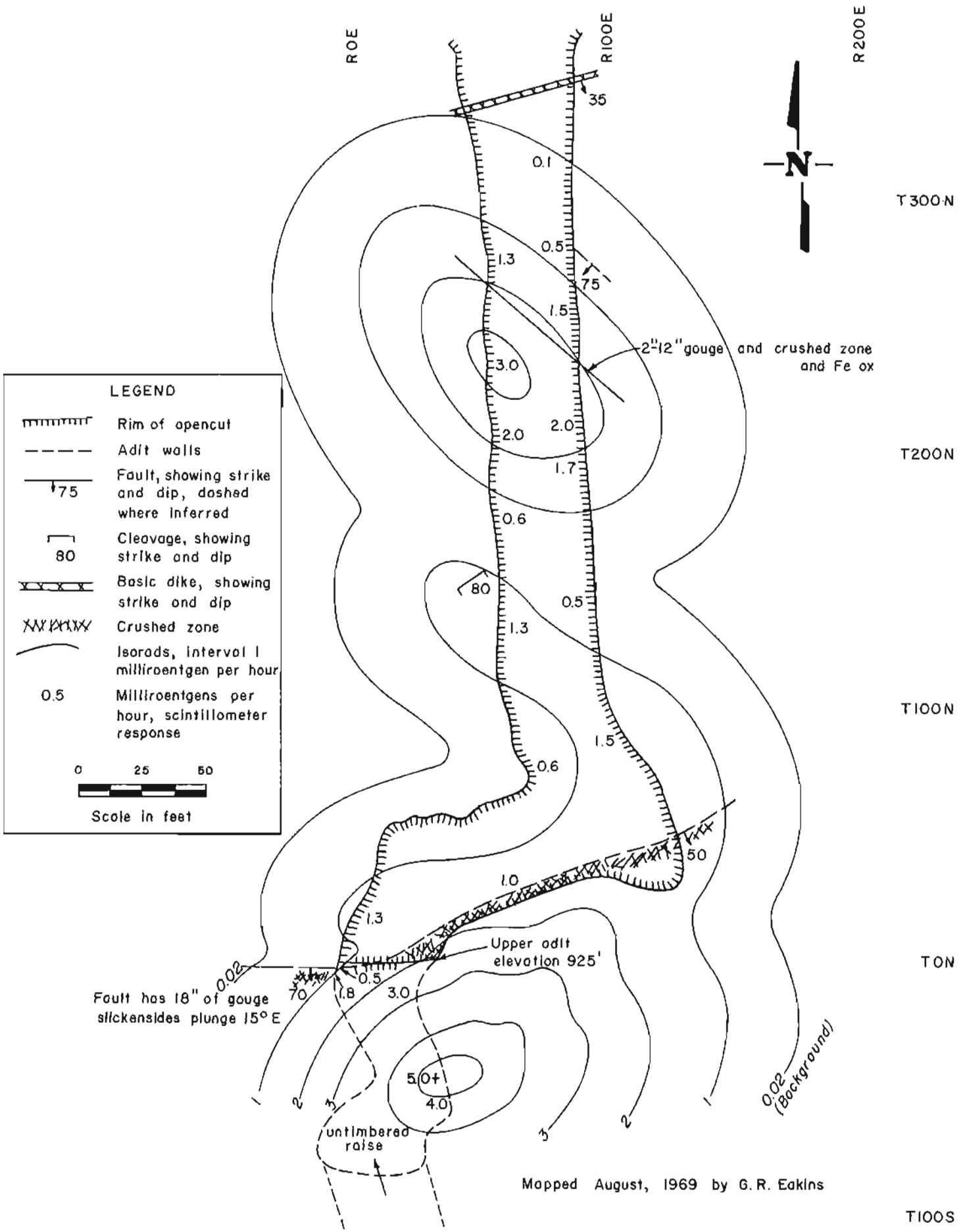
G. R. Eakins 1969
Data from photo FJB 5-19 (5-10-61)

Figure 7




# SKETCH MAP
# ROSS-ADAMS MINE
## Geology and Radiometric Survey by G. R. Eakins

Figure 8




# ROSS-ADAMS MINE

## Radiometric Survey of Main Opencut & Upper Adit

Figure 9

While there is no sharp boundary between the ore and the host granite, the ore contains slightly more iron, lead, aluminum, zirconium, titanium, magnesium, calcium, manganese, and arsenic, but less quartz and potassium, than the surrounding rock. Most of the ore is out of radioactive equilibrium, but the thorium combines with the uranium in such a way to give the effect of apparent equilibrium.

Other uranium-thorium minerals have been found in small amounts at some other prospects in the area. These include uraninite, uranophane, allanite, possibly davidite or brannerite, and ellsworthite. Only minor amounts of secondary uranium minerals have been reported from the Ross-Adams property. These are gummite, sklodowskite, beta-uranophane, bassetite, and novacekite. The scarcity of secondary uranium minerals is undoubtedly due to their solubility and the heavy rainfall in the area.

### Ore Genesis

Uranium-thorium mineralization at the Ross-Adams mine is believed to be hydrothermal in origin. It apparently occurred subsequent to the crystallization of the peralkaline granite, and probably was facilitated by a complex fracture system. Tuttle and Bowen (1958) theorized that vapor pressure in crystallizing granite could exceed the overburden limit causing fracturing of the roof with a resulting sudden drop in pressure and rapid crystallization. Such a process might have aided in creating a system of micro-fractures into which the late stage ore at the Ross-Adams mine was emplaced. Later movements offset the ore body slightly.

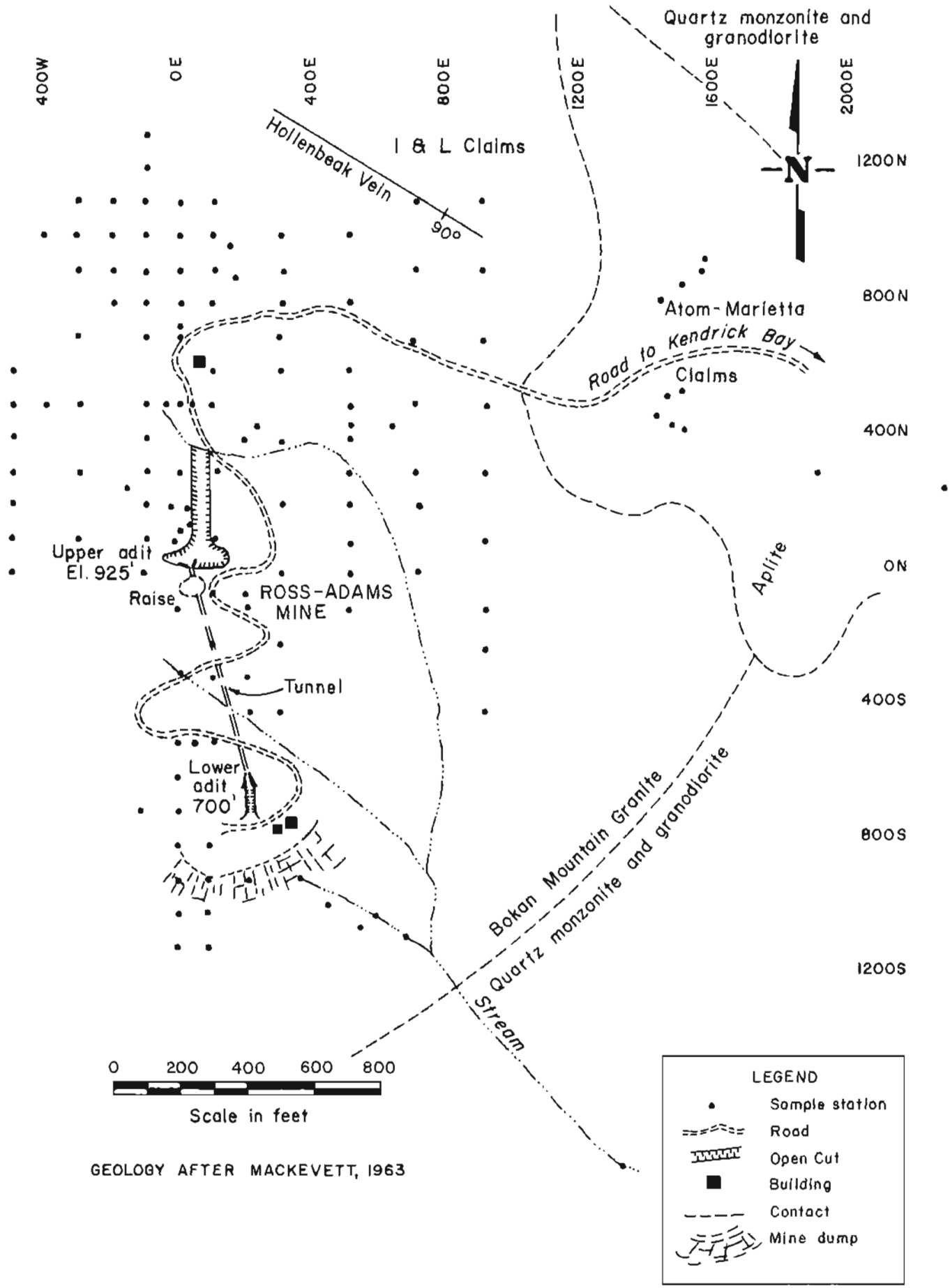
## OTHER CLAIMS AND PROSPECTS

Claims and prospects in the area are numerous near altered dacite dikes in albitized zones along the margin of the peralkaline granite. Others are on small pegmatite dikes within the granite. Most claims are only slightly explored. One prospect was located with the intent of mining fluorite.

The Atom-Marietta claims are about 1600 feet east of the Ross-Adams mine (*fig 10*). Shallow pits there have exposed radioactive material in shear zones in the older sedimentary and metamorphic rocks near the contact with the Bokan Mountain Granite. Sample locations 27-30, 59, 60, 61, 65, and 66 are on the Atom-Marietta claims.

Other claims cover weakly radioactive zones scattered in the Bokan Mountain Granite. The "I and L" group of claims adjoin the Ross-Adams mine property. These claims are about 1000 feet north of the Ross-Adams mine at a slightly higher elevation (*fig 10*). Most of the soil and vegetation there has been stripped by bulldozer work and natural erosion. Here radioactive minerals occur in pegmatites and along the northwest trending Hollenbeak vein.

Outside the peralkaline granite stock, weak anomalies occur on prospects near Gardner Bay about eight miles southeast of Bokan Mountain. The anomalies are in pegmatites. Rather weak anomalies have been found in altered andesite dikes cutting syenite near Stone Rock Bay about three miles farther south from Gardner Bay.




# Sketch Map of Mine Area Showing Sample Locations

Figure 10

## BIOGEOCHEMICAL PROSPECTING METHODS

Two different botanical prospecting methods have proven effective in locating uranium ores in covered areas where radiometric instruments have failed.

The indicator-plant method of botanical prospecting is based on the principle that certain plant species indicate the presence of abnormal amounts of radioactive elements in soil or ground water associated with weathering mineral deposits. For example, the selenium indicator plants of the Astragalas genus have been used successfully to locate uranium in the Colorado Plateau (Cannon, H. L., 1960). R. L. Dotson, who has been prospecting on Bokan Mountain, has pointed out that the blue flower, lupine, appears to favor the uranium-rich soil in this area. Plant assemblages, or sometimes the lack of them, over known ore deposits compared with assemblages over nonmineralized areas is required for the systematic use of the method.

The biogeochemical method of botanical prospecting involves the chemical analysis of ashed plant material. Deposits of uranium, zinc, tungsten, tin, arsenic, copper, and vanadium have been discovered in this manner. Preliminary plant inventories and analyses are needed to determine which species will best serve to locate particular elements and to establish their normal or background values. The usefulness of plant analyses depends upon finding certain plants of wide distribution which during growth accumulate anomalous amounts of indicator metals. Plant analyses in Grand County, Utah, showed that sulfur, selenium, arsenic, and molybdenum are concentrated with uranium in that area (Cannon, H. L., 1964). A variety of plants, ranging from small bushes and flowers to trees of both conifer and broadleaf types, may be used with varying degrees of success (Cannon, 1960). Lichen and algae also have been found to accumulate uranium in anomalous amounts. A uranium content of 1 part per million or more is frequently considered to be anomalous in the Colorado Plateau region (Froelich, Albert J. and Kleinhampl, 1960, p 59).

Reliable comparison of absolute analytical values can be made only if the samples are collected in a consistent manner and are collected from identical parts of the same plant species. In general, plants with deep roots will serve better than those with shallow roots. Leaves may show greater metal concentrations than the twigs, but both parts can be used. Dead branches of trees in the La Ventana Mesa uranium area, New Mexico, yield more uranium in ash than do live branches (Cannon, H. L. and Starrett, W. H. 1956). Depth of root penetration, amount of moisture in the soil, and depth of the mineral deposit are variables which influence the effectiveness of the method. Fracture patterns, ground water movement, and topography should also be considered when interpreting the results of a botanical sampling program.

Geochemical prospecting for uranium by stream sediment analyses has not been considered very useful because of the high mobility of the $U_6$ ion (Cohen, Brooks, and Reeves, 1969). However, limited stream sediment sampling by this writer at Bokan Mountain appeared to be effective.

## SAMPLING PROCEDURE

Plants selected for sampling depended largely on their availability. The choice over much of the area was limited to small, stunted evergreens. The species most prevalent were lodgepole pine, western cedar, western hemlock, and common juniper. Trees are larger and denser away from the mine.

Sampling was conducted principally over the Ross-Adams mine property, where the presence of uranium ore is known. Samples were taken mainly on a grid with spacings of 100 or 200 feet (*figs 10 & 12*). Samples of the various plants selected were collected within a radius of 30 feet of the sample station. Spot sampling was done at some of the outlying prospects.

The principal sample area and grid system extend approximately 2500 feet from north to south and 1600 feet from east to west. Bare bedrock is exposed over much of the area and soil is generally only a few inches thick. In the more heavily wooded parts around the margins of the sampling area, the soil was as much as two to four feet thick. The surface around the mine is hummocky and the slopes fairly gentle. Slopes steepen to 20° in marginal areas. Runoff is rapid during periods of rain, and small temporary streams abound (*fig 11*).

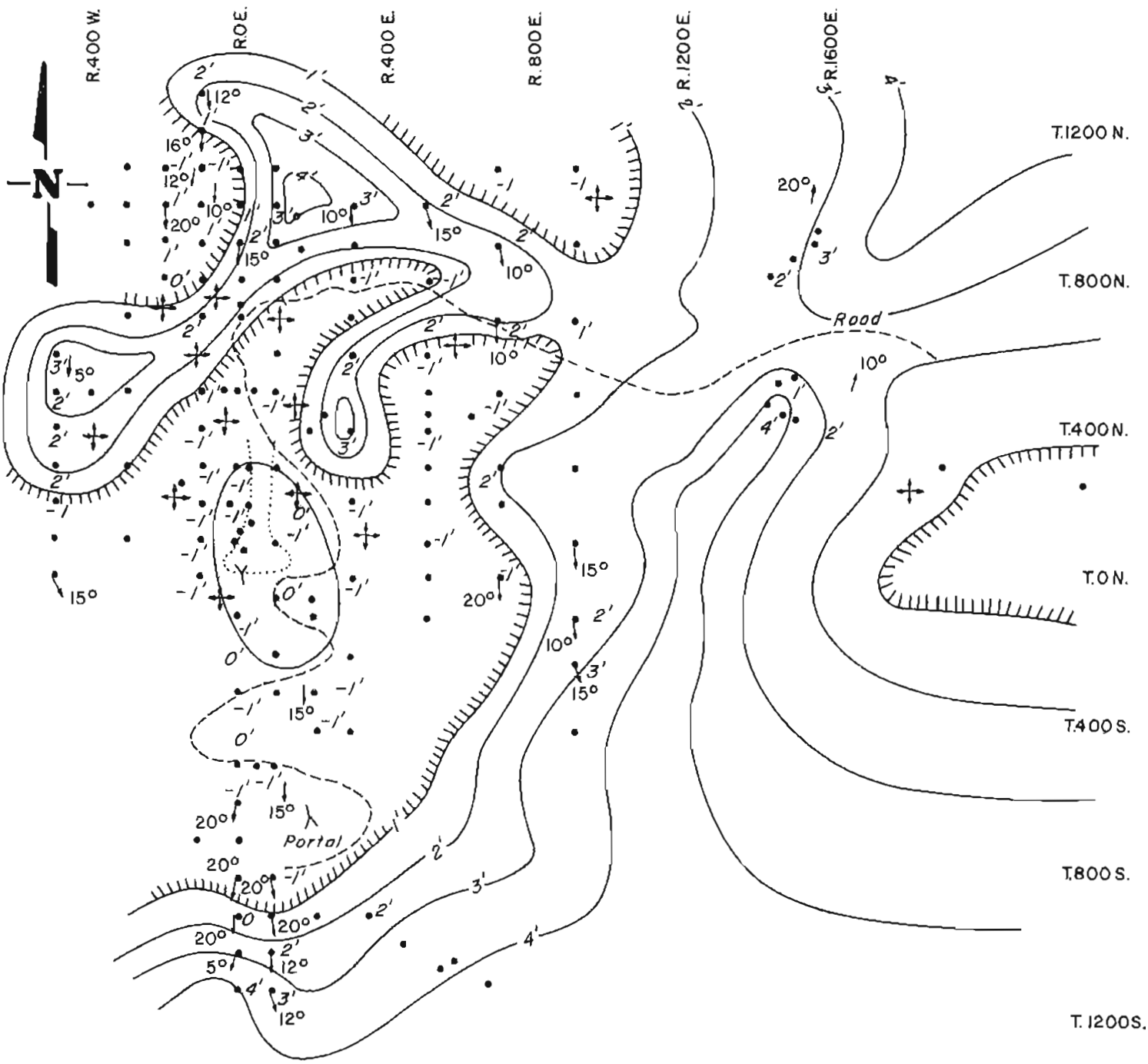
Conditions which make the area less than ideal for test sampling are variable but are generally (1) small thickness of the soil, (2) the shallow root systems of the plants resulting from thin soil and heavy rainfall, (3) the highly variable distribution of the plants, and (4) the possibility of contamination from surface mining operations. However, the choice of areas containing a uranium deposit and known geology was very limited.

The numbers of samples of all types were as follows:

| | |
|---|---|
| Algae | 13 |
| Blueberry | 19 |
| Juniper | 19 |
| Living lodgepole pine | 88 |
| Dead lodgepole pine and burls | 22 |
| Miscellaneous plants | 13 |
| Mulch and soil | 41 |
| Spruce | 41 |
| Stream sediment | 9 |
| Western cedar | 108 |
| Western hemlock | 48 |
| TOTAL SAMPLES | 421 |

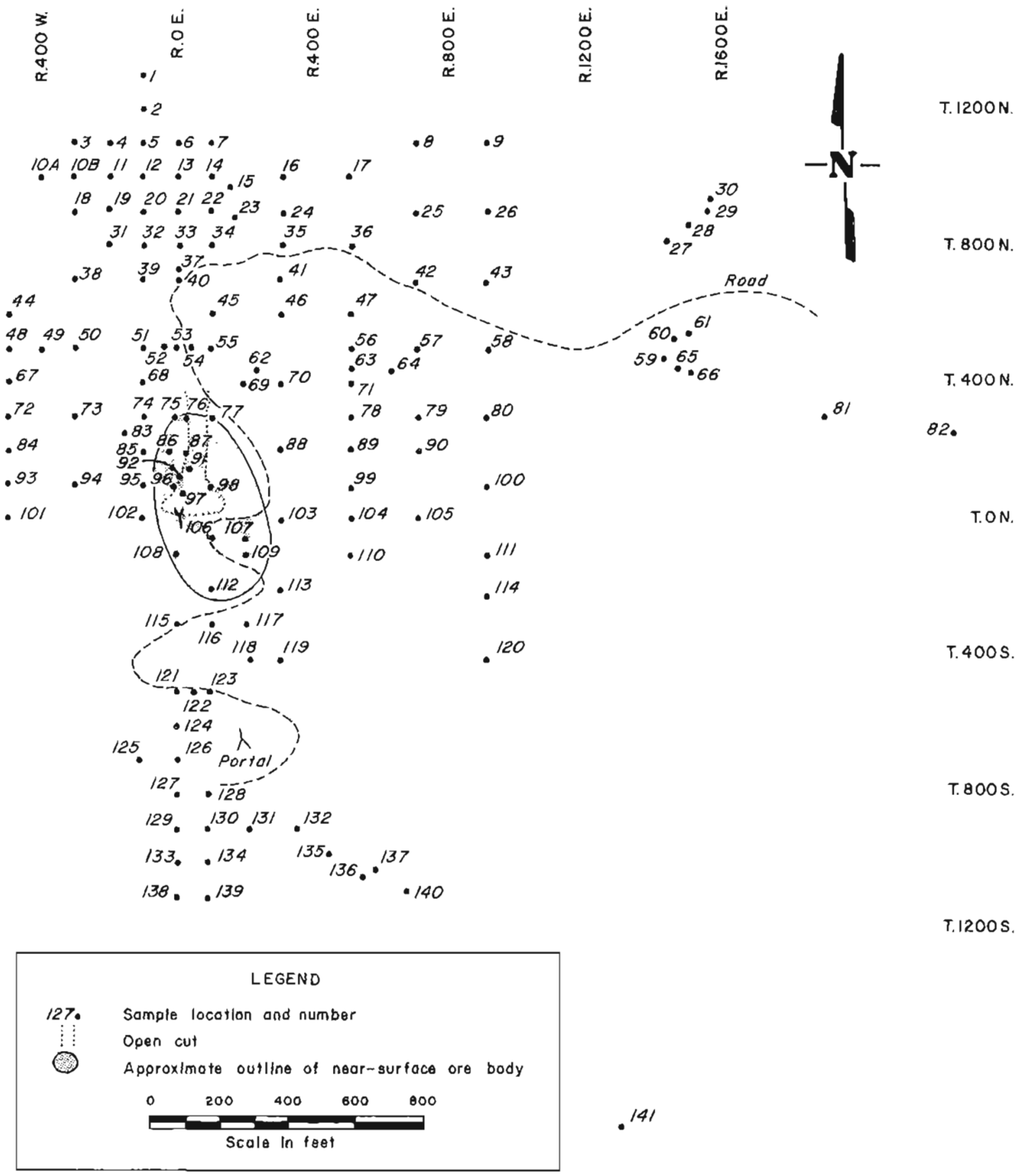
Plant samples were taken by cutting 6 to 10 inches of the branch tips, including leaves, needles and cones, and placing the material in No. 8 paper grocery bags. Because of almost constant rain during the sampling, tearing of bags was a major problem. However, porous bags are required so that samples eventually can dry. Plastic bags are not recommended because plant material will rot if stored in air-tight containers. The weight of the samples ranged from four to eight ounces. Eight ounces or more are preferred in order to have plenty of ash for analyses.

Mulch or humus, which includes accumulated plant material on the ground in various stages of decomposition, has been known to show anomalous metal content over mineralized areas (Ginzburg, 1960, p 233). Therefore, mulch was included in the sampling program. Material was taken from near the surface, just beneath the moss cover. These samples unavoidably contained live moss, grass roots, and soil.




# Ross - Adams Mine Area
# SOIL THICKNESS & SURFACE - SLOPE

Figure 11




# INDEX MAP

## SHOWING ALL SAMPLE LOCATIONS AND NUMBERS

Figure 12

Common blue-green algae can accumulate uranium in flowing streams. Several samples of algae of unidentified types were collected at Bokan Mountain. This plant is difficult to sample, because it is seldom abundant enough to provide an adequate-size sample. It is almost impossible to collect algae without including a certain amount of sediment.

A few moss samples were included to determine to what extent they accumulate metals. While having very shallow roots, mosses are widespread throughout Alaska. Huckleberry, one of the most common bushes in the wooded areas on Bokan Mountain, also was sampled wherever it occurred at a sample station.

A stream crossing the Ross-Adams mine property and flowing to Kendrick Bay was sampled at several points between its mouth and the mine to see how well stream sediment fines would serve for geochemical prospecting for uranium. Stream sediment analysis is not a biogeochemical method.

## ANALYTICAL METHODS

Analyses of all the samples collected for this project were made by Union Carbide Exploration Corporation at their laboratory in Grand Junction, Colorado. A summary of the methods used follows:

| | |
|---|---|
| Uranium: | assayed by the fluorimetric procedure using a flux of sodium and lithium fluoride. Accuracy to 1 ppm* uranium. |
| Vanadium: | assayed by the hydrogen-peroxide colorimetric procedure. Sensitivity to 1 ppm vanadium. |
| Molybdenum: | assayed by atomic absorption. Sensitivity to 2 ppm molybdenum. |
| Arsenic: | assayed by the silver diethyldithiocarbonate colorimetric procedure. Sensitivity to 1 ppm arsenic. |
| Copper: | assayed by atomic absorption. Sensitivity to 2 ppm. |
| Manganese and zinc: | assayed by atomic absorption. Because of the high concentrations both were reported in percentages. |

* ppm means parts per million

## SAMPLING RESULTS

Analyses of the various plants, mulch, and stream sediment samples are listed in tables 1 through 12. Maps showing the sample locations and analyses for each type of plant and material are included. Extremely high uranium values were obtained from many of the samples collected near the ore body. Average background values cannot be calculated because the laboratory reported that the sample size in many cases was too small for exact determination of uranium below a certain level, generally 3 to 20 ppm. The range of uranium assays, including all samples, is from less than 1 to 2396 ppm. The higher values correspond well with the known near-surface distribution of uranium mineralization. The few scattered samples collected from the Atom-Marietta claims gave rather poor and inconsistent results.

Background or normal uranium content for most of the materials and plants sampled, based on the lower values reported, apparently is less than 3 ppm. The small number of stream sediment samples prevents estimating a background value for this material, but the lowest was 7 ppm.

There is little or no correlation between uranium content and vanadium, molybdenum, arsenic, copper, manganese, and zinc content. These accessory metals are more characteristic of sedimentary-type uranium deposits rather than vein-type or those associated with granitic rocks.

It was not possible to standardize the sampling, because of the variable surface conditions and unequal distribution of plant types. Therefore, it is difficult to accurately compare the relative merits of using one or another plant for geobotanical prospecting in the area. However, lodgepole pine is the most useful of the plants sampled in the area.

All the plant types sampled, with the possible exception of blueberry and alder, evidently can accumulate anomalous amounts of uranium. Also, uranium in the test area is concentrated in humus. Radiometric measurements showed that mulch or humus generally contains more radioactive matter than underlying granite.

Comments on each of the types of materials sampled follow:

Living lodgepole pine (*table 1 and fig 13*) Lodgepole pine was sampled at 88 locations and produced uranium assays ranging from less than 1 to 2396 ppm. This plant is one of the most abundant and widely distributed in the area, and appears to be the most useful in geobotanical prospecting for uranium there. The better root system no doubt helps account for its relatively high sensitivity to uranium in soil. The pattern of analyses reflects the near-surface mineralization very well.

Dead lodgepole pine (*table 2 and fig 14*) The 22 samples of twigs and burls from dead lodgepole pine had assays ranging from 7 to 1230 ppm uranium. The average uranium concentration appears to be higher in the dead material than in the living plants, especially those from locations north and up slope from the Ross-Adams mine.

Spruce (*table 3 and fig 15*) Spruce trees were sampled at 41 locations, and yielded values from less than 2 to 315 ppm. Spruce is less abundant than lodgepole pine and cedar, and does not appear to accumulate uranium as well. However, relatively high values were obtained from the vicinity of the old mine workings.

Western cedar (*table 4 and fig 16*) Western cedar grows abundantly in the area and was sampled at 108 locations. Uranium assays ranged from less than 1 to 2127 ppm. Background appears to be less than 3 ppm. Cedar assays generally are lower than for lodgepole pine at the same locations and do not define the mineralized areas as well as the pine assays.

Western hemlock (*table 5 and fig 17*) Western hemlock is not as abundant in the area as cedar and lodgepole pine and was found at only 48 of the sample sites. The assays ranged from less than 2 to 901 ppm. The distribution of significantly high assays corresponds well with the known mineralization, but the number of assays is too small to compare the merits of hemlock with other plants.

Juniper (*table 6 and fig 18*) Nineteen samples of juniper had uranium values ranging from less than 2 to 159 ppm. While the higher assays from over the ore zone seem to indicate that juniper can serve as an accumulator plant, its shallower root system probably makes it less efficient than larger trees.

Blueberry (*table 7 and fig 19*) Nineteen samples of blueberry bushes had uranium values ranging from less than 20 to 30 ppm. Compared with other plants, blueberry showed only low uranium values. Though the samples collected were the same size as those of other plants, they proved to be insufficient for accurate ash analyses. All but two samples were simply reported as less than 20 ppm or less than 30 ppm.

Algae (*table 8 and fig 20*) Thirteen algae samples have uranium values ranging from 2 to 1833 ppm. The highest values were from small streams and pools a few hundred feet north of the open cut, suggesting that this material can accumulate large amounts of uranium even in areas with relatively low uranium in the bedrock. It appears that the algae north of the mine are accumulating uranium derived from the granite upslope rather than an ore body. However, sampling of algae in routine prospecting is not practical because they usually are not available in adequate quantities and carbonaceous or silty material cannot be separated completely from such samples.

Miscellaneous plants (*table 9 and fig 21*) This group of samples includes the following: 5 alder, 2 club moss, 1 luketkea pectinata, 3 crowberry, and 2 unidentified shrubs. The range in uranium assays was from less than 3 to 923 ppm. These plants were too sparsely distributed to be useful. The uranium content of such low-growing, shallow-root plants seems unusually high, but the high values were from immediately over mineralized ground.

Mulch and soil (*table 10 and fig 22*) The 41 mulch and soil samples yielded uranium assays from 1 to 441 ppm and show that uranium is concentrated in the humus here. The material sampled was the humic layer just below the moss cover. While it is called mulch, the material unavoidably contained some silt and live moss roots. The ease and convenience of sampling mulch rather than plants seems to make it preferable where conditions are similar to those at Bokan Mountain. Mulch sample coverage of the test area is poor, partly because of the lack of sufficient mulch around the mine. However, analyses show high values which indicate that there has been a buildup of uranium at the surface by the accumulation of decomposed plant material.

Stream sediments (*table 11 and fig 23*) Nine stream sediment samples were collected from a stream beginning above the Ross-Adams open cut to a point near its entrance into Kendrick Bay, a distance of slightly more than one mile. Uranium values ranged between 7 and 554 ppm and produce a nearly ideal assay profile. Three samples near the upper end of the open cut had values of 7, 8, and 33 ppm. Starting at a point just below the lower tunnel the values in sequence downstream were 554, 253, 291, 198, and 77 ppm. Surface mining and the mine dump have probably caused a considerable increase in the uranium in the sediments above what it would be if the area had not been disturbed. Many more stream samples should be collected and analyzed for uranium to determine their value for uranium prospecting in the region. While stream sediment sampling has generally been considered unsuitable for uranium prospecting because of its solubility, it is much more convenient and rapid than geobotanical prospecting.

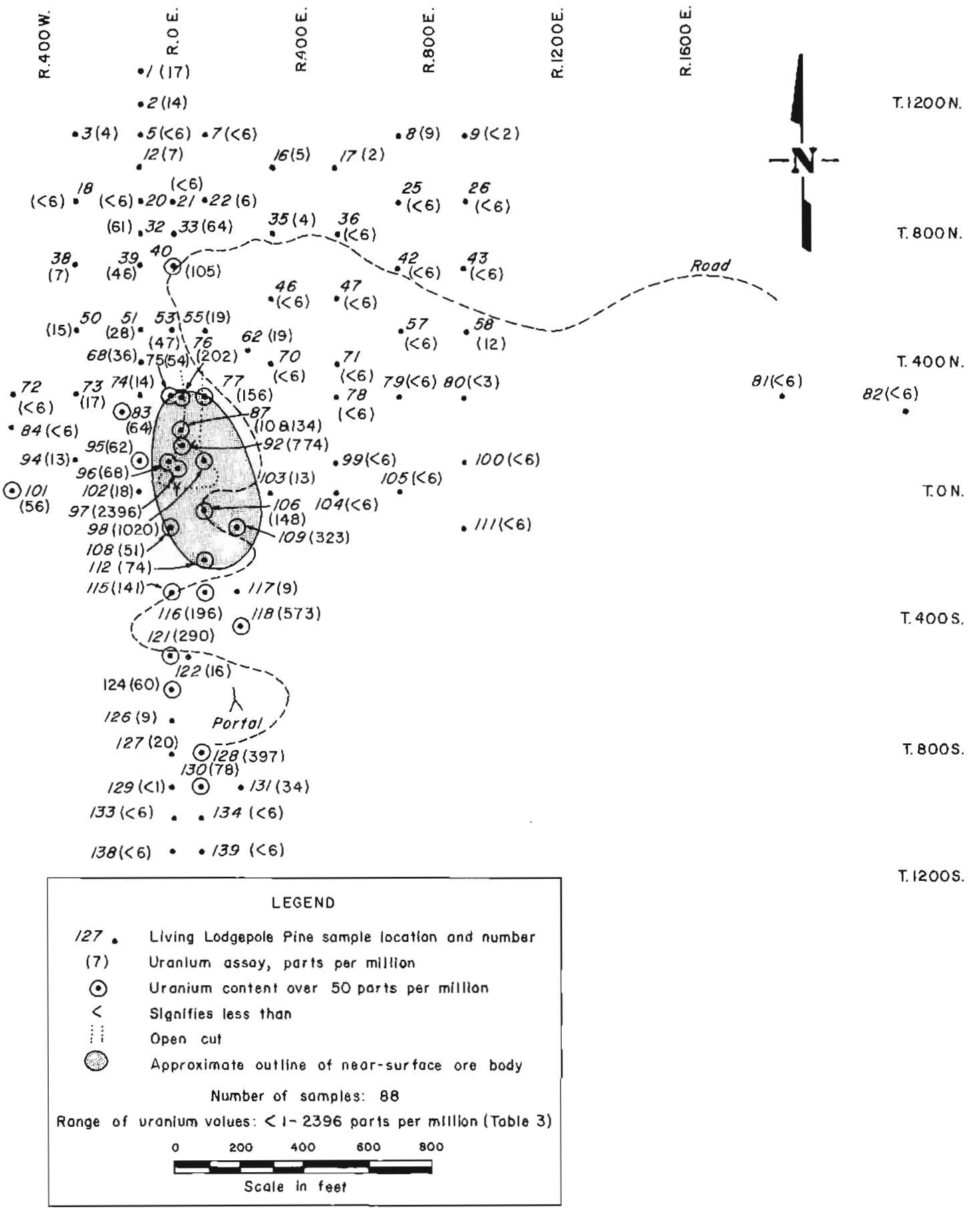
Lichen On the west side of the saddle on the south side of Bokan Mountain at an elevation of about 1600 feet, the writer noted a bright orange lichen growing on granite outcrops. This lichen evidently has acted as a uranium accumulator. Repeated checking with a scintillometer showed the lichen-coated portions of the granite to have two to four times as much radioactivity as the other nearby rock.

The lichen, identified by Dr. Leslie A. Viereck, U. S. Forest Service, as a species of Lecidea (possibly Lecidea Lapicida) may serve as a good indicator plant for uranium. This lichen is known to have the ability to extract iron from rock, and the concentration of uranium by it at Bokan Mountain may illustrate an ability to extract certain ions. The single area where this plant was noted was perhaps 100 feet wide. This limited observation does not permit one to say whether lichen grows preferentially upon high uranium-bearing rock or not, but only that it at least has a tolerance for uranium and can concentrate the metal under proper conditions.

## CONCLUSIONS

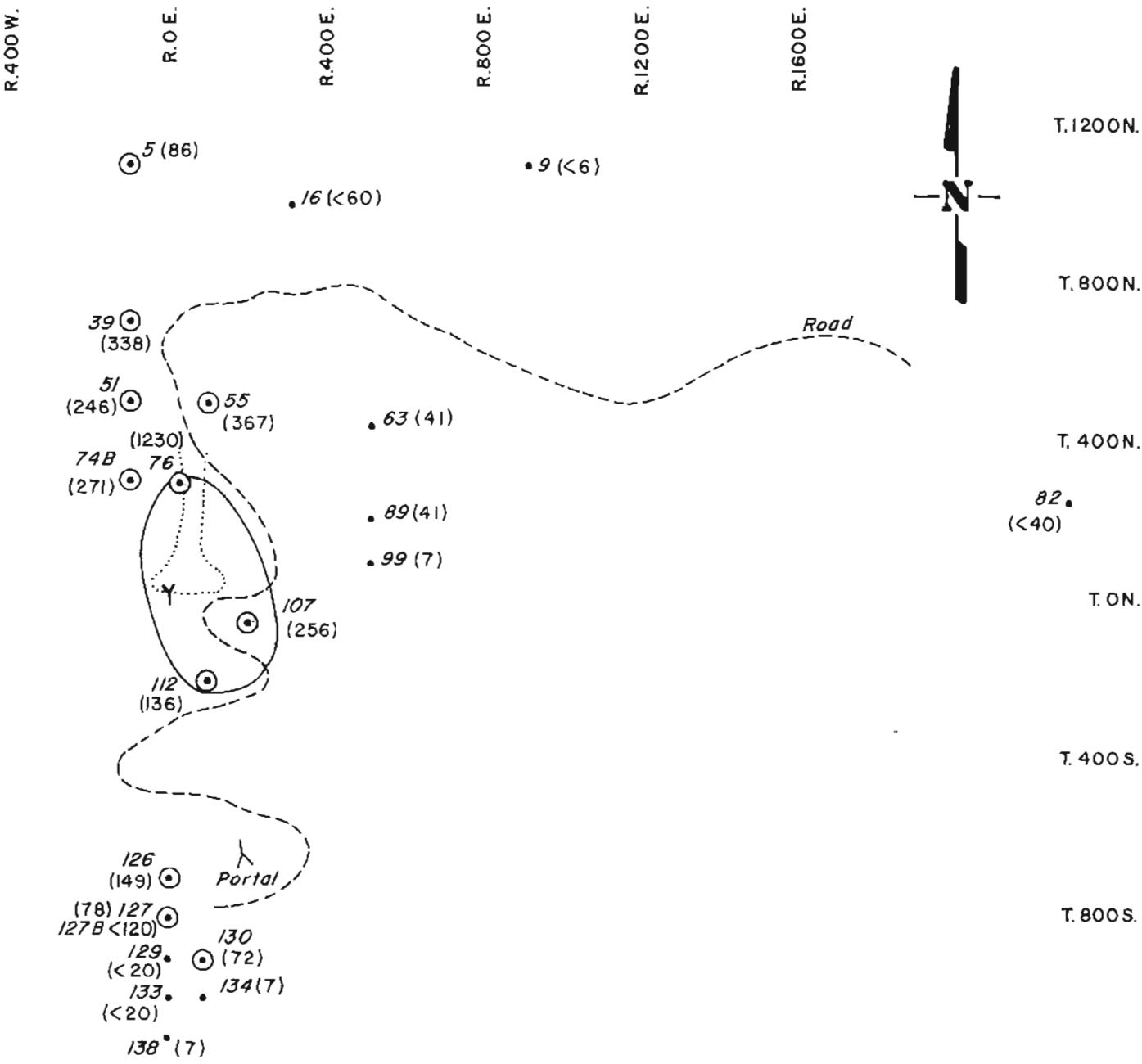
Sampling at the Ross-Adams mine shows that a variety of plants and materials may produce highly anomalous uranium in a uranium mining district, but in varying degrees. Of the plants sampled, the lodgepole pine proved the most useful because of its wide distribution, the relative ease of obtaining an adequate sample, and the plant's sensitivity to uranium in the soil. Mulch overlying the Bokan Mountain granite showed definite uranium concentrations. Measurements with a scintillometer frequently failed to indicate radioactivity. Geobotanical sampling may be especially helpful in defining the outlines and limits of uranium deposits once they have been detected.

While stream sediment sampling produced an almost ideal assay pattern along a stream draining from the mineralized area, the number of samples collected and the area sampled were too limited to determine their value for prospecting. The effects that mining has had on the sample results are not known. The Division plans to continue testing stream sediment sampling and other prospecting techniques to aid in locating the most favorable geologic settings for possible vein-type and sedimentary-type uranium deposits in Alaska.




# Sample Locations
# LIVING LODGEPOLE PINE

Figure 13




LEGEND

| | |
|---|---|
| 127 • | Dead Lodgepole Pine sample location and number |
| 127B• | Burl sample location and number |
| (7) | Uranium assay, parts per million |
| ⊙ | Uranium content over 50 parts per million |
| < | Signifies less than |
| ⋮ | Open cut |
| ◯ | Approximate outline of near-surface ore body |

Number of samples: 22

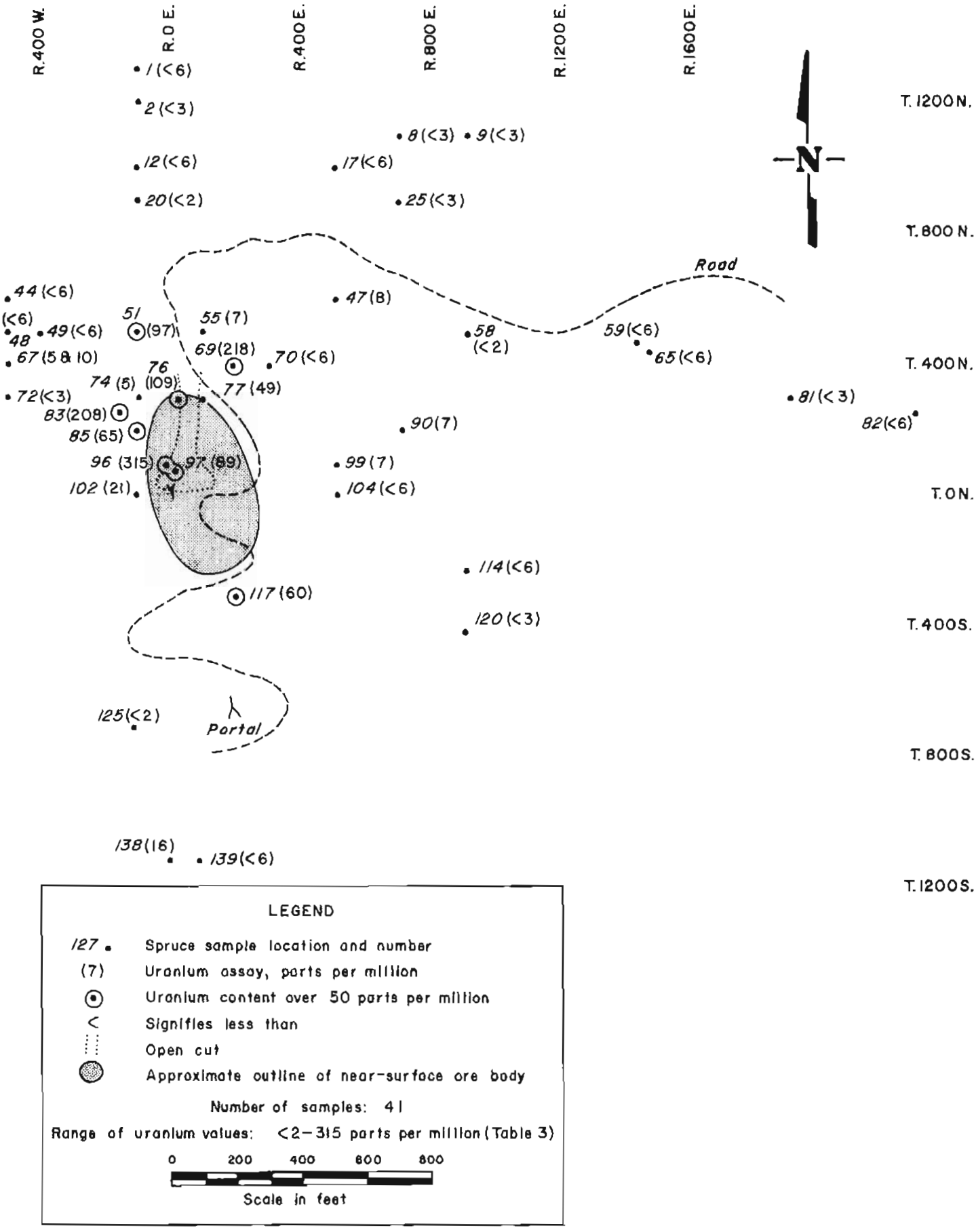
Range of uranium values: 7 - 1230 parts per million (Table 1)

0 200 400 600 800

Scale in feet

# Sample Locations
# DEAD LODGEPOLE PINE & BURLS

Figure 14




LEGEND

| | |
|---|---|
| 127 • | Spruce sample location and number |
| (7) | Uranium assay, parts per million |
| ⊙ | Uranium content over 50 parts per million |
| < | Signifies less than |
| ⋮ | Open cut |
| ◯ | Approximate outline of near-surface ore body |

Number of samples: 41

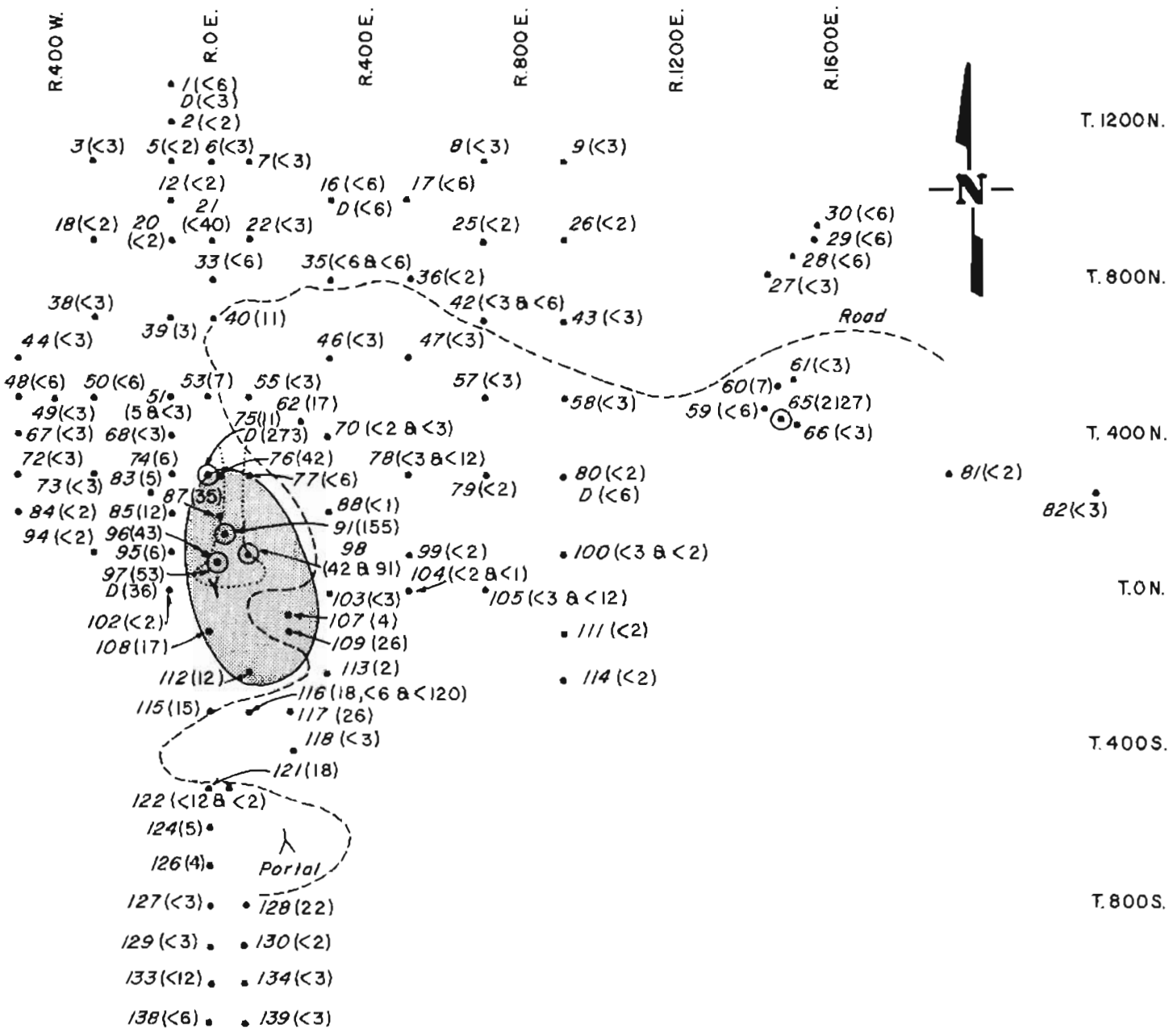
Range of uranium values: <2–315 parts per million (Table 3)

0 200 400 600 800

Scale in feet

# Sample Locations
# SPRUCE

Figure 15




LEGEND

| | |
|---|---|
| 127 • | Live Western Cedar sample location and number |
| 127D• | Dead Western Cedar sample location and number |
| (7) | Uranium assay, parts per million |
| ⊙ | Uranium content over 50 parts per million |
| < | Signifies less than |
| ⋮⋮ | Open cut |
| ◯ | Approximate outline of near-surface ore body |

Number of samples: 108

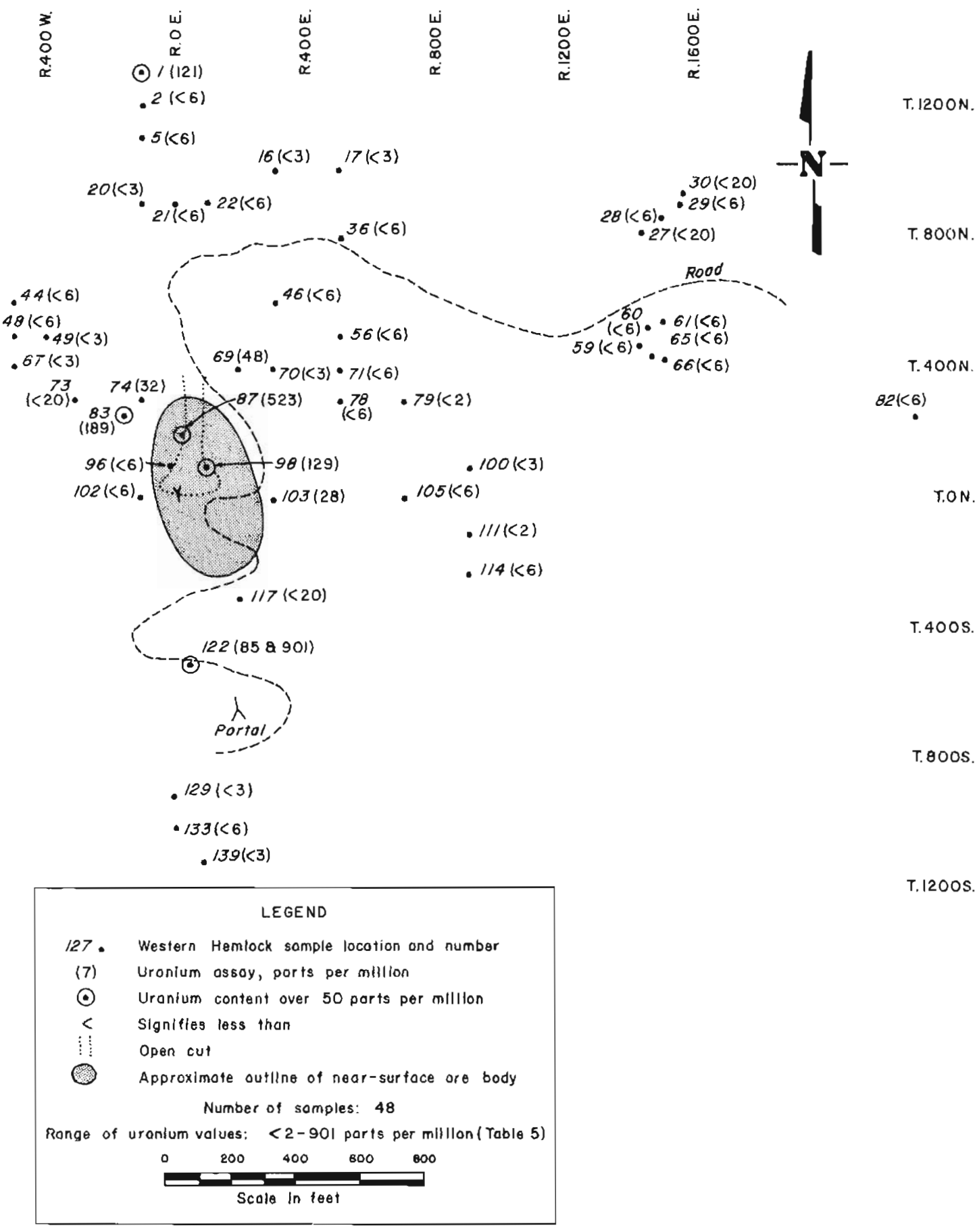
Range of uranium values: <1 - 2127 parts per million (Table 4)

0 200 400 600 800

Scale in feet

# Sample Locations
# WESTERN CEDAR

Figure 16




LEGEND

| | |
|---|---|
| 127 • | Western Hemlock sample location and number |
| (7) | Uranium assay, parts per million |
| ⊙ | Uranium content over 50 parts per million |
| < | Signifies less than |
| ⋮⋮ | Open cut |
| ⬭ | Approximate outline of near-surface ore body |

Number of samples: 48

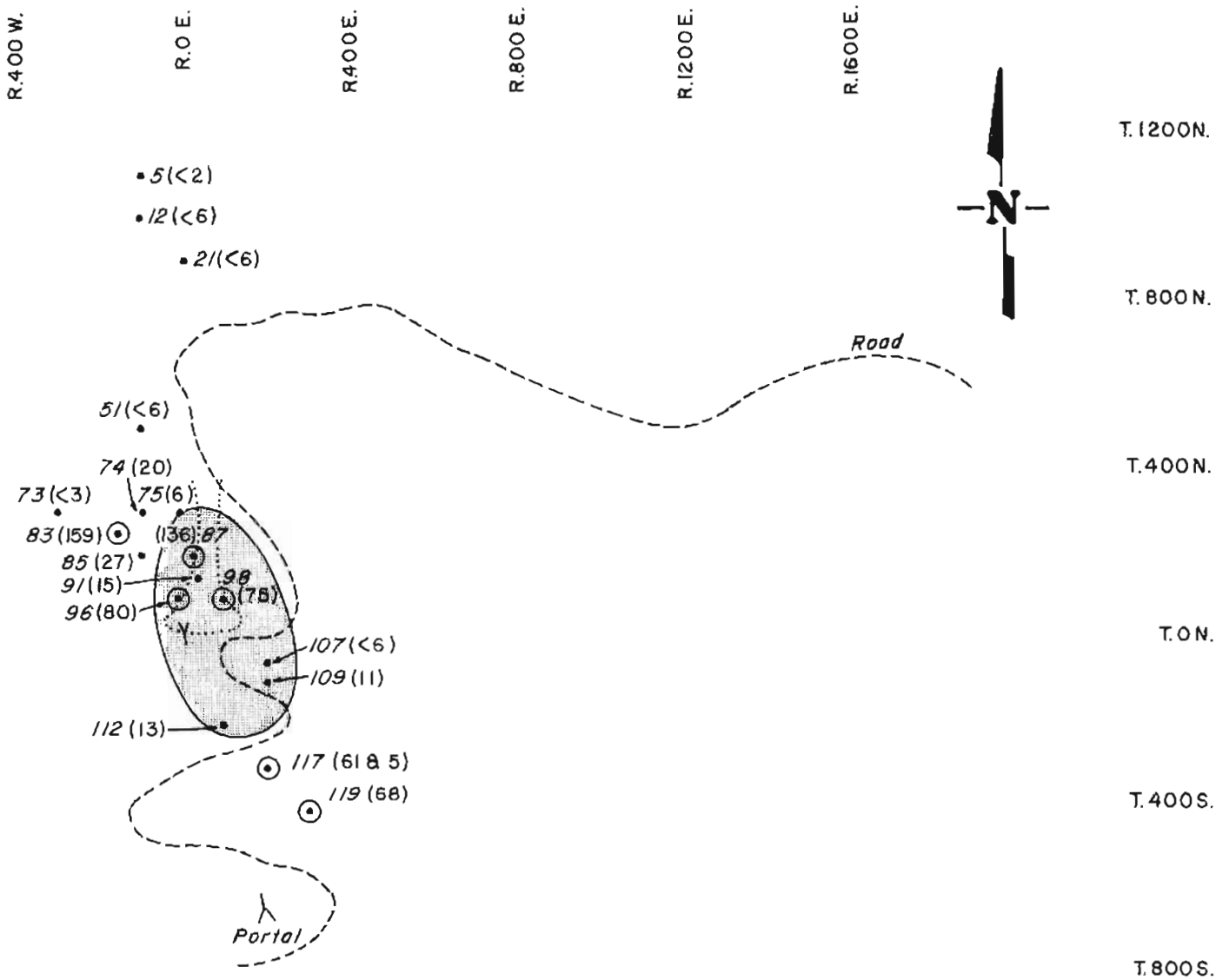
Range of uranium values: <2-901 parts per million (Table 5)

0 200 400 600 800

Scale in feet

# Sample Locations
# WESTERN HEMLOCK

Figure 17




LEGEND

| | |
|---|---|
| 127 • | Juniper sample location and number |
| (7) | Uranium assay, parts per million |
| ⊙ | Uranium content over 50 parts per million |
| < | Signifies less than |
| ⋮ | Open cut |
| ◎ | Approximate outline of near-surface ore body |

Number of samples: 19

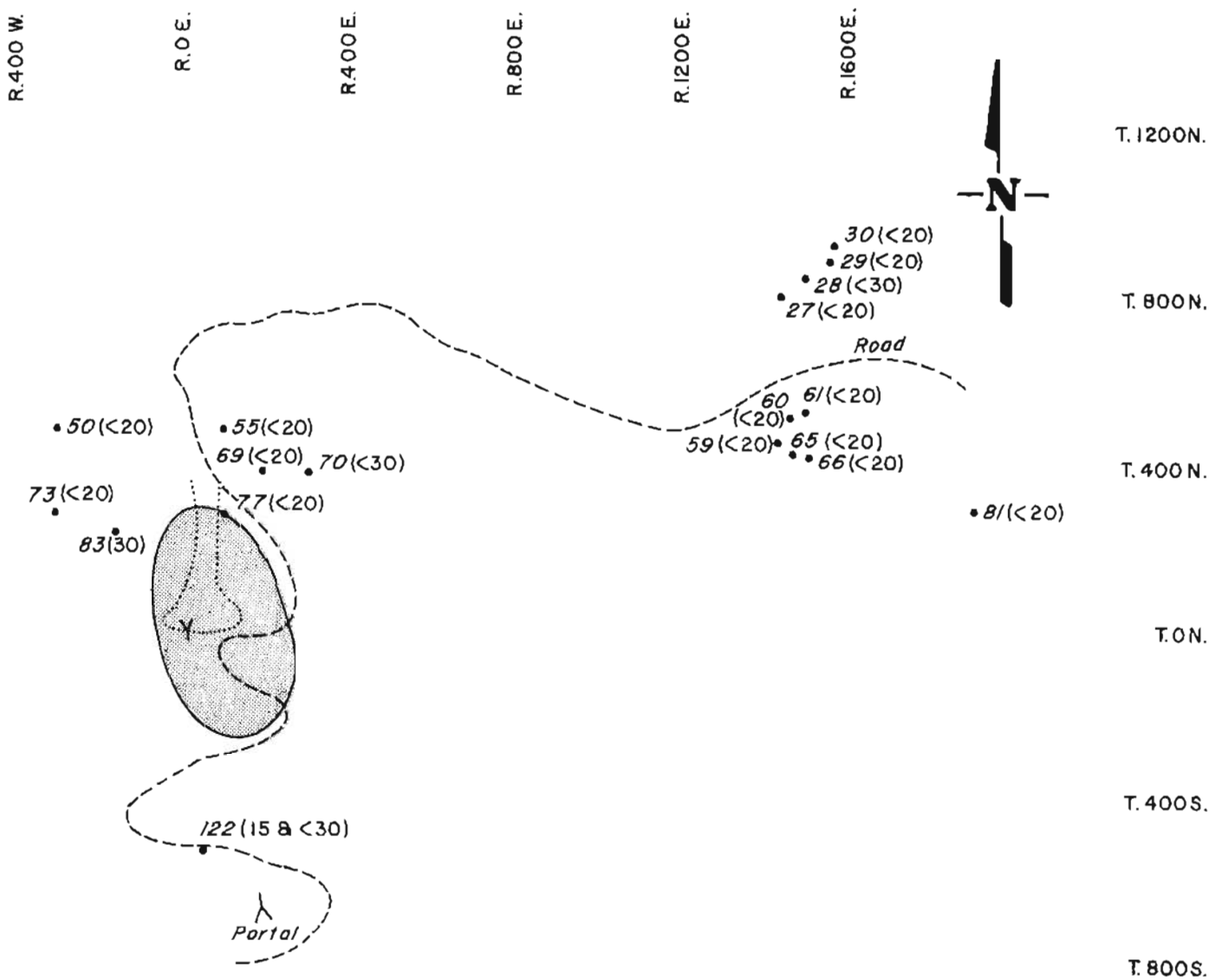
Range of uranium values: <2 - 159 parts per million (Table 6)

0 200 400 600 800

Scale in feet

# Sample Locations
# JUNIPER

Figure 18




LEGEND

| | |
|---|---|
| 127 • | Blueberry sample location and number |
| (7) | Uranium assay, parts per million |
| ⊙ | Uranium content over 50 parts per million |
| < | Signifies less than |
| ⋮⋮ | Open cut |
| ▒ | Approximate outline of near-surface ore body |

Number of samples: 19

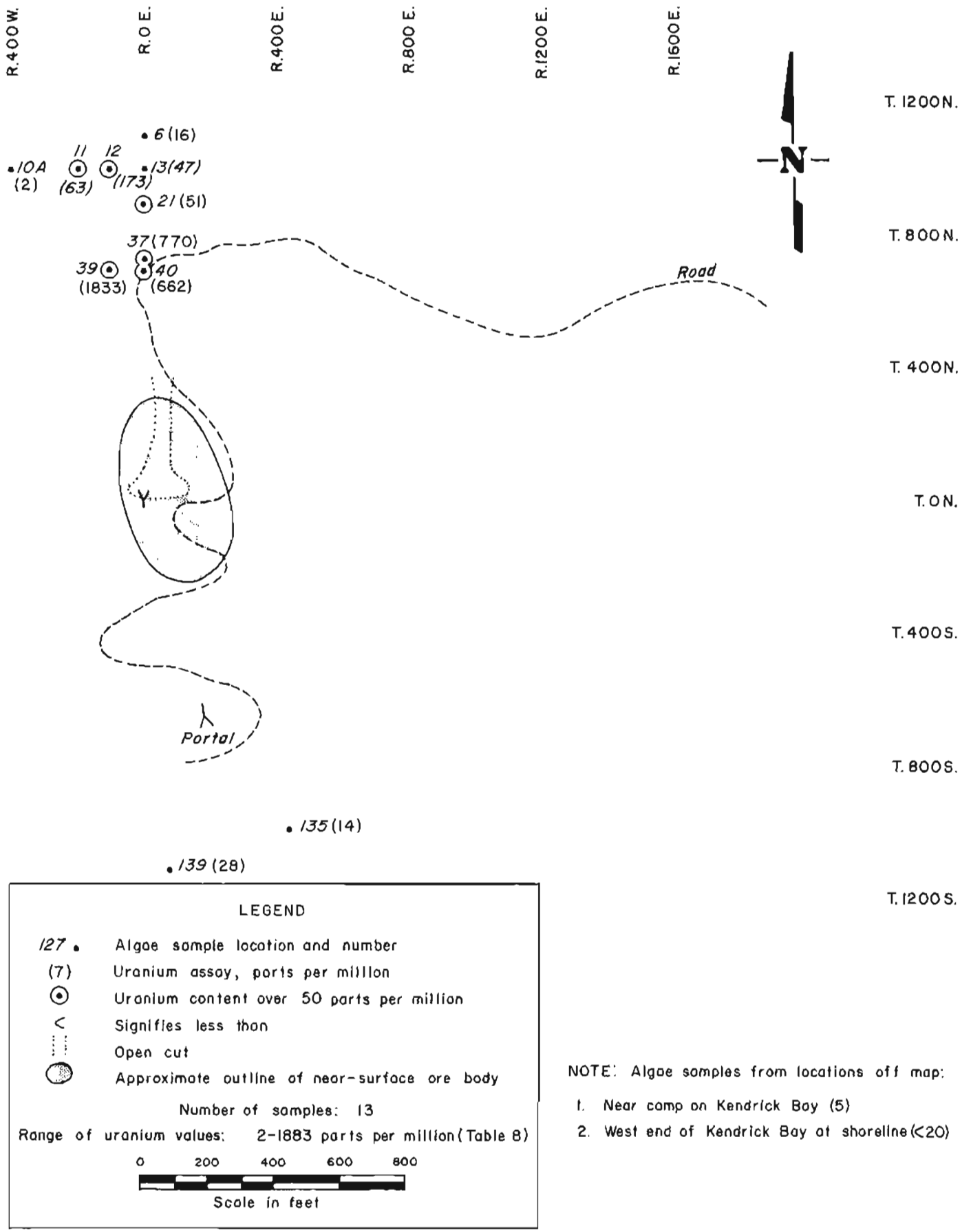
Range of uranium values: <20 – 30 parts per million (Table 7)

0 200 400 600 800

Scale in feet

# Sample Locations
# BLUEBERRY

Figure 19

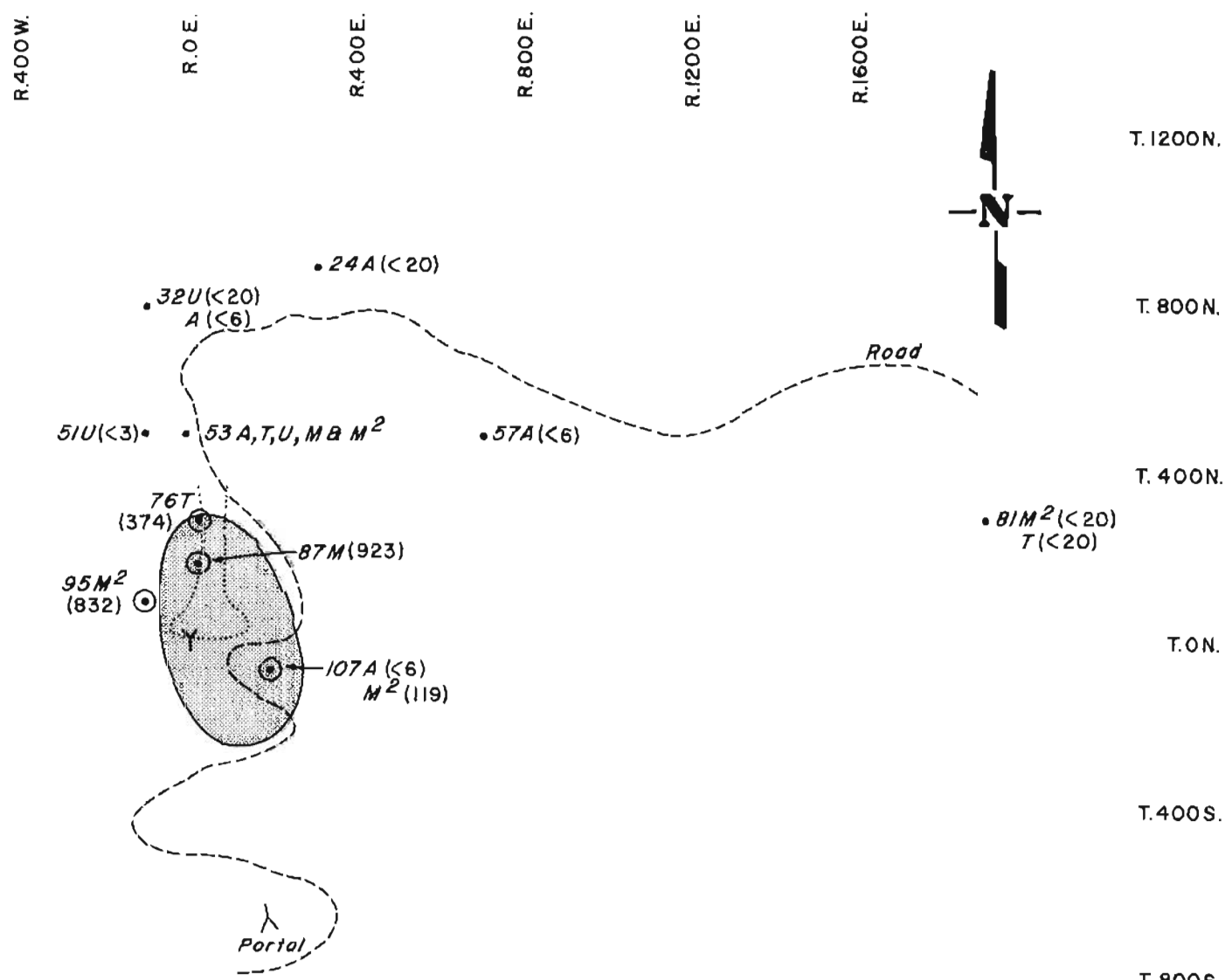



NOTE: Algae samples from locations off map:

1. Near camp on Kendrick Bay (5)
2. West end of Kendrick Bay at shoreline (<20)

# Sample Locations
# ALGAE

Figure 20




LEGEND

| | |
|---|---|
| 32A • | Alder sample location and number |
| 32T • | Club Moss (Lycopodium clovtum L.) sample location and number |
| 32M • | Luketkea pectincto sample location and number |
| 32M2• | Crowberry (Empetrum nigrim L.) sample location and number |
| 32U • | Unidentifled shrub sample locotion and number |
| (7) | Uranium assay, parts per million |
| ⊙ | Uranium content over 50 parts per million |
| < | Signifies less than |
| ⋮⋮ | Open cut |
| ▒ | Approximate outline of near-surface ore body |

Number of samples: 13

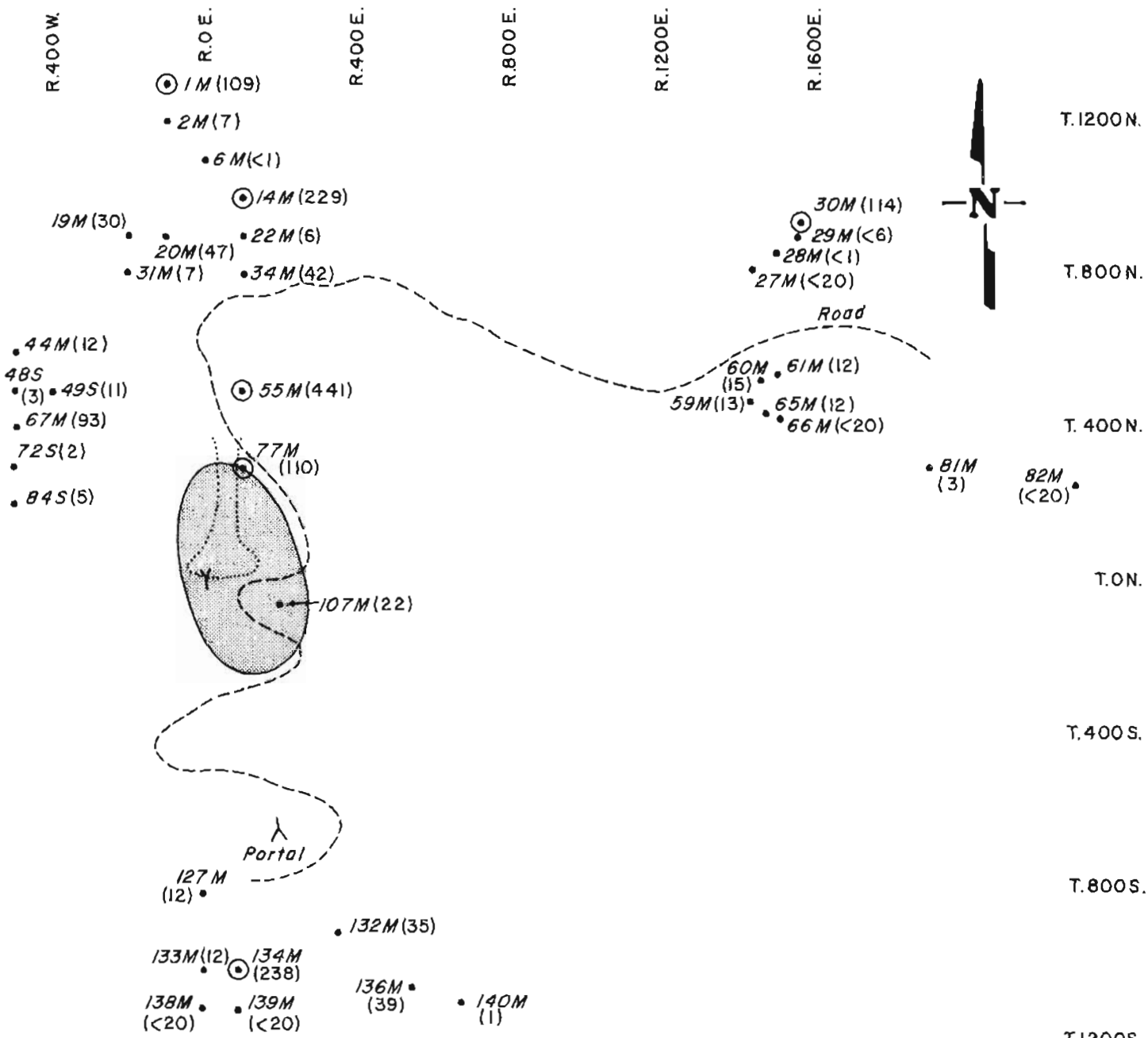
Range of uranium values: <3-923 parts per million (Table 9)

0 200 400 600 800

Scale in feet

# Sample Locations
# MISCELLANEOUS PLANTS

Figure 21




LEGEND

| | |
|---|---|
| 127M• | Mulch sample location and number |
| 127S• | Soil sample location and number |
| (7) | Uranium assay, parts per million |
| ⊙ | Uranium content over 50 parts per million |
| < | Signifies less than |
| ⋮ | Open cut |
| ◯ | Approximate outline of near-surface ore body |

Number of samples: 41

Range of uranium values: 1 – 441 parts per million (Table 10)

0 200 400 600 800

Scale in feet

NOTE: Mulch samples from locations off map:

1. (1)
2. (8)
3. (<3)

# Sample Locations
# MULCH AND SOIL

Figure 22

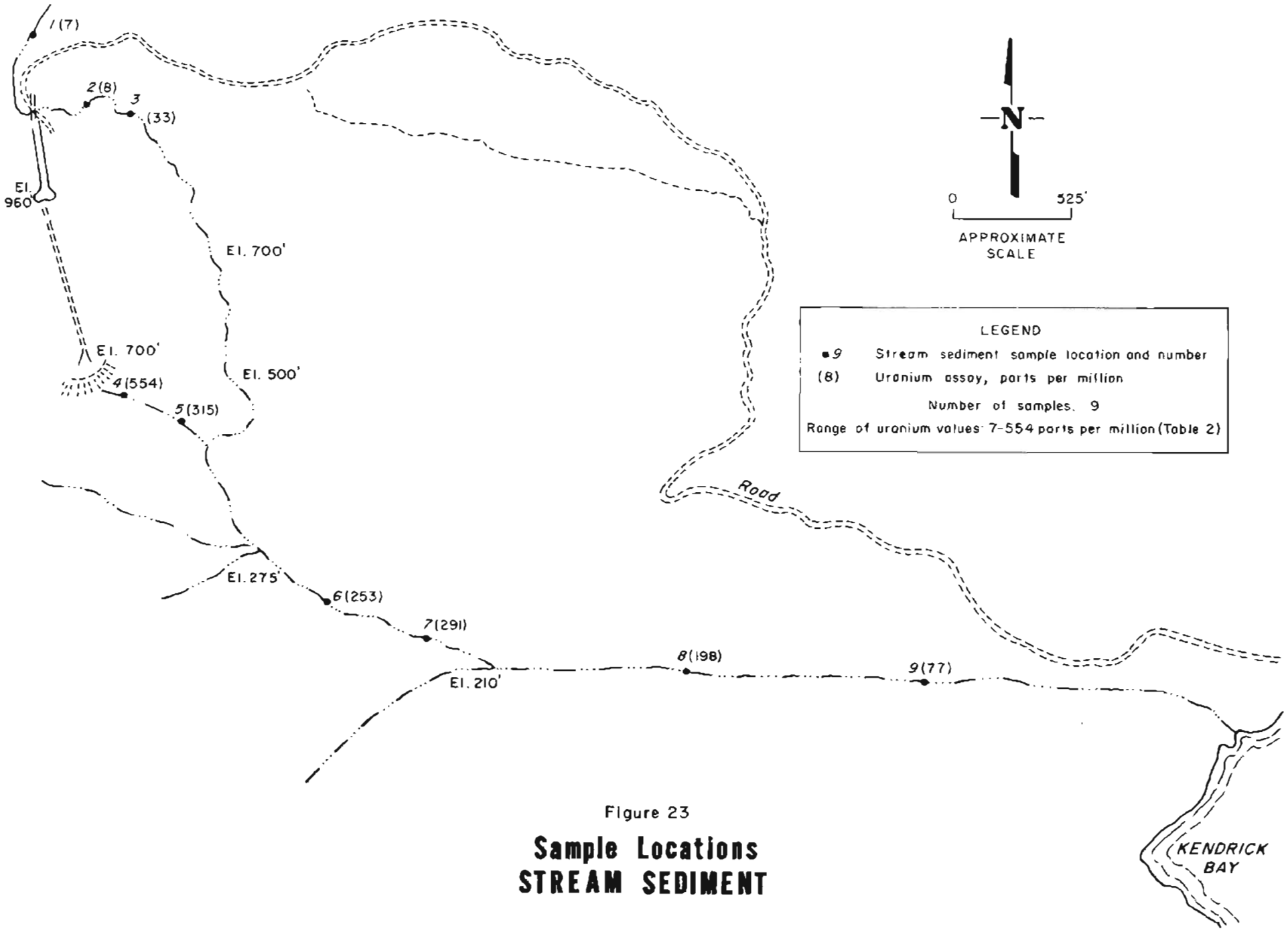



Figure 23

**Sample Locations**
**STREAM SEDIMENT**

## EXPLANATION OF THE TABLES

\- indicates "less than"

I.S. indicates insufficient sample for analysis

U = Uranium
V = Vanadium
Mo = Molybdenum
As = Arsenic
Cu = Copper
Mn = Manganese
Zn = Zinc

### Table 1

### Living Lodgepole Pine

### Ash Analyses

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 100W-1300N | 43323 | 17 | -150 | 20 | 49 | -10 | 5.00 | .28 |
| 2 | 100W-1200N | 43322 | 14 | -150 | 10 | 3 | 20 | 4.10 | .22 |
| 3 | U300W-1100N | 43330 | 4 | - 75 | -10 | 5 | 35 | 3.40 | .27 |
| 5 | 100W-1100N | 43378 | -6 | -150 | 60 | 4 | 20 | 3.10 | .44 |
| 7 | 100E-1100N | 43394 | -6 | -150 | 10 | 1 | 10 | 5.30 | .22 |
| 8 | 700E-1100N | 43337 | 9 | -150 | -10 | 32 | 10 | 1.20 | .16 |
| 9 | 900E-1100N | 43334 | -2 | - 50 | -10 | 1 | 10 | 0.73 | .09 |
| 12 | 100W-1000N | 43321 | 7 | -150 | 40 | 7 | -10 | 2.80 | .260 |
| 16 | 300E-1000N | 43325 | 5 | -150 | 10 | 34 | -10 | 4.10 | .19 |
| 17 | U500E-1000N | 43324 | 2 | - 75 | 15 | 3 | 20 | 1.50 | .19 |
| 18 | 300W-900N | 43348 | -6 | -150 | -10 | 10 | 2 | 1.30 | .25 |
| 20 | 100W-900N | 43376 | -6 | -150 | -10 | 4 | -10 | 4.20 | .14 |
| 21 | U00W-900N | 43361 | -6 | -150 | 40 | 20 | 15 | 2.10 | .22 |
| 22 | U100E-900N | 43342 | 6 | -150 | 20 | -10 | 11 | 2.70 | .30 |
| 25 | 700E-900N | 43360 | -6 | -150 | -10 | -10 | 19 | 2.20 | .20 |
| 26 | 900E-900N | 43347 | -6 | -150 | -10 | -10 | 3 | 1.30 | .35 |
| 32 | 100W-800N | 43370 | 61 | -150 | -10 | 4 | -10 | 3.20 | .23 |
| 33 | 0W-800N | 43379 | 64 | -150 | 50 | 1 | 30 | 4.70 | .54 |
| 35 | U300E-800N | 43326 | 4 | - 75 | 10 | 6 | 30 | 1.55 | .15 |
| 36 | U500E-800N | 43372 | -6 | -150 | -10 | 4 | -10 | 2.60 | .19 |
| 38 | U300W-700N | 43332 | 7 | -150 | -10 | 30 | 10 | 1.60 | .24 |
| 39 | 100W-700N | 43381 | 46 | -150 | 60 | 9 | 20 | 5.00 | .35 |
| 40 | 00W-700N | 43335 | 105 | - 75 | -10 | 13 | 30 | 1.75 | .21 |
| 42 | 700E-700N | 43345 | -6 | -150 | 10 | -10 | 5 | 1.00 | .35 |
| 43 | 900E-700N | 43404 | -6 | -150 | -10 | 3 | 10 | 1.40 | .23 |
| 46 | U300E-600N | 43385 | -6 | -150 | -10 | 2 | 20 | 2.60 | .25 |
| 47 | 500E-600N | 43386 | -6 | -150 | -10 | 8 | 30 | 4.20 | .22 |
| 50 | U300W-500N | 43338 | 15 | -150 | 60 | 23 | 10 | 2.70 | .23 |
| 51 | 100W-500N | 43390 | 28 | - 75 | -10 | 3 | 85 | 5.01 | .21 |
| 53 | 0W-500N | 43685 | 47 | I.S. | -20 | 3 | 100 | 2.8 | .099 |

Table 1 (Contd)

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 53 | 0W-500N | 43333 | 47 | - 75 | 60 | 11 | 55 | 0.95 | .25 |
| 55 | 100E-500N | 43393 | 19 | -150 | -10 | 3 | -10 | 6.40 | .27 |
| 57 | 700E-500N | 43373 | -6 | -150 | 10 | 4 | -10 | 2.30 | .11 |
| 58 | 900E-500N | 43340 | 12 | -150 | 10 | 26 | 60 | 1.60 | .38 |
| 62 | 200E-450N | 43403 | 19 | -150 | 10 | 3 | 60 | 1.60 | .180 |
| 68 | 100W-400N | 43357 | 36 | -150 | -10 | -10 | 17 | 1.70 | .19 |
| 70 | U300E-400N | 43344 | -6 | -150 | -10 | -10 | 4 | 4.00 | .16 |
| 71 | 500E-400N | 43377 | -6 | -150 | 40 | 1 | -10 | 2.60 | .26 |
| 72 | 500W-300N | 43354 | -6 | -150 | -10 | 10 | 14 | 2.80 | .21 |
| 73 | U300W-300N | 43329 | 17 | -150 | -10 | 4 | -10 | 3.10 | .20 |
| 74 | 100W-300N | 43405 | 14 | -150 | -10 | 2 | 30 | 3.70 | .15 |
| 75 | 0W-300N | 43355 | 54 | -150 | -10 | -10 | 1 | 2.00 | .20 |
| 76 | 25E-300N | 43387 | 202 | -150 | 60 | 7 | 10 | 3.50 | .20 |
| 77 | 100E-300N | 43362 | 156 | -150 | -10 | 20 | 21 | 2.80 | .22 |
| 78 | 500E-300N | 43365 | -6 | -150 | -10 | 19 | -10 | 1.50 | .18 |
| 79 | U700E-300N | 43375 | -6 | -150 | 10 | 3 | -10 | 4.30 | .17 |
| 80 | 900E-300N | 43358 | -3 | - 75 | 35 | 25 | 6 | 2.80 | .12 |
| 81 | AT-9 | 43396 | -6 | -150 | -10 | 3 | 10 | 0.40 | .15 |
| 82 | AT-10 | 43395 | -6 | -150 | 20 | 2 | 30 | 2.70 | .24 |
| 83 | 150W-250N | 43380 | 64 | -150 | 50 | 6 | 50 | 2.10 | .30 |
| 84 | 500W-200N | 43397 | -6 | -150 | -10 | 5 | -10 | 2.00 | .16 |
| 87 | 35E-200N | 43383 | 10 | -150 | 40 | 14 | 30 | 3.20 | .24 |
| 87 | 0W-200N | 43369 | 134 | -150 | 10 | 1 | 20 | 1.50 | .19 |
| 92 | 50E-150N | 43389 | 774 | -150 | -10 | 17 | 40 | 3.20 | .26 |
| 94 | U300W-100N | 43339 | 13 | -150 | 60 | 34 | 10 | 4.00 | .18 |
| 95 | 100W-100N | 43320 | 62 | - 75 | 20 | 6 | 40 | 3.57 | .215 |
| 96 | 0E-100N | 43363 | 68 | -150 | -10 | 15 | 20 | 2.30 | .170 |
| 97 | 0W-100N | 43428 | 2396 | -100 | 15 | 7 | 15 | 1.90 | .33 |
| 98 | U100E-100N | 43341 | 1020 | -150 | -10 | 30 | 41 | 2.10 | .19 |
| 99 | 500E-100N | 43366 | -6 | -150 | 50 | 15 | -10 | 2.20 | .20 |
| 100 | 900E-100N | 43374 | -6 | -150 | -10 | 2 | -10 | 4.20 | .16 |
| 101 | 500W-0N | 43356 | 56 | -150 | 30 | -10 | 15 | 1.80 | .15 |
| 102 | 100W-0N | 43319 | 18 | - 75 | 10 | 6 | 15 | 3.20 | .185 |
| 103 | U300E-0N | 43331 | 13 | -150 | 20 | 11 | -10 | 2.40 | .28 |
| 104 | 500E-0N | 43359 | -6 | -150 | -10 | -10 | 15 | 1.20 | .11 |
| 105 | 700E-0N | 43343 | -6 | -150 | -10 | -10 | 9 | 3.60 | .26 |
| 106 | 100E-50S | 43353 | 148 | -150 | 10 | -10 | 2 | 3.90 | .23 |
| 108 | 0E-100S | 43346 | 51 | -150 | -10 | -10 | 4 | 2.20 | .23 |
| 109 | 200E-100S | 43400 | 323 | - 75 | 5 | 2 | 30 | 2.95 | .20 |
| 111 | 900E-100S | 43350 | -6 | -150 | -10 | -10 | 11 | 3.60 | .17 |

Table 1 (Contd)

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 112 | 100E-200S | 43401 | 74 | - 75 | -10 | 1 | 45 | 1.40 | .115 |
| 115 | 0E-300S | 43368 | 141 | -150 | 40 | 21 | 10 | 2.70 | .25 |
| 116 | ID100E-300S | 43336 | 196 | - 50 | -10 | 11 | 33 | 1.63 | .13 |
| 117 | 200E-300S | 43398 | 9 | - 50 | -10 | 1 | 20 | 1.43 | .10 |
| 118 | 200E-400S | 43382 | 573 | -150 | 70 | 15 | 50 | 2.30 | .29 |
| 121 | 0E-500S | 43399 | 290 | - 75 | -10 | 2 | 30 | 4.00 | .26 |
| 122 | 50E-500S | 43327 | 16 | - 75 | -10 | 4 | -10 | 2.65 | .15 |
| 122 | ID50-500S | 43328 | I N S U F F I C I E N T | | | S A M P L E | | | |
| 124 | 0E-600S | 43391 | 60 | -150 | -10 | 5 | 40 | 2.60 | .23 |
| 126 | 0E-700S | 43367 | 9 | -150 | 20 | 6 | 10 | 1.80 | .21 |
| 127 | 0E-800S | 43392 | 20 | -150 | -10 | 4 | 50 | 1.80 | .24 |
| 128 | 100E-800S | 43388 | 397 | -150 | 10 | 11 | 40 | 4.10 | .35 |
| 129 | 0E-900S | 43384 | -1 | -150 | 50 | 6 | 30 | 5.10 | .28 |
| 130 | 100E-900S | 43364 | 78 | -150 | -10 | 14 | 10 | 2.60 | .18 |
| 131 | 300E-900S | 43406 | 34 | -150 | -10 | 5 | 10 | 1.50 | .28 |
| 133 | 0E-1000S | 43352 | -6 | -150 | -10 | -10 | 2 | 5.40 | .21 |
| 134 | 100E-1000S | 43349 | -6 | -150 | -10 | -10 | 4 | 4.30 | .30 |
| 138 | 0E-1100S | 43371 | -6 | -150 | -10 | 3 | -10 | 3.10 | .19 |
| 139 | 100E-1100S | 43351 | -6 | -150 | -10 | -10 | 6 | 5.40 | .18 |

Table 2

Dead Lodgepole Pine and Burls

Ash Analyses

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 100W-1100N | 43421 | 86 | I.S. | -20 | 2 | -20 | -.20 | .04 |
| 9 | 900E-1100N | 43427 | -6 | I.S. | -20 | 2 | -20 | .20 | .07 |
| 16 | 300E-1000N | 43420 | -60 | I.S. | -50 | 5 | -50 | -.50 | .16 |
| 39 | 100W-700N | 43412 | 338 | I.S. | -50 | 7 | -50 | -.30 | .10 |
| 51 | 100W-500N | 43416 | 246 | -150 | -10 | 6 | -10 | .10 | .04 |
| 55 | 100E-500N | 43413 | 367 | I.S. | -20 | 9 | -20 | .40 | .07 |
| 63 | 500E-450N | 43426 | 41 | I.S. | -10 | 2 | 80 | .60 | .10 |
| 74 | 100W-300N | 43408 | 271 | I.S. | -50 | 4 | 30 | .40 | .17 |
| 76 | 25E-300N | 43418 | 1230 | -150 | -10 | 2 | -10 | -.10 | .02 |
| 82 | AT10 | 43423 | -40 | I.S. | -30 | 3 | -30 | .30 | .11 |
| 89 | 500W-300N | 43411 | 41 | I.S. | -20 | 7 | -20 | .80 | .09 |
| 99 | 500E-100N | 43410 | 7 | -150 | -10 | 2 | -10 | .10 | .04 |
| 107 | 200E-50S | 43414 | 256 | -150 | -10 | 8 | 80 | .40 | .06 |
| 112 | 100E-200S | 43422 | 136 | - 50 | -10 | 1 | 10 | -.10 | .01 |
| 126 | 0E-700S | 43419 | 149 | -150 | -10 | 1 | -10 | .10 | .03 |
| 127 | 0E-800S | 43407 | -120 | I.S. | -100 | 14 | -100 | -1.0 | .21 |
| 127 | 0E-800S | 43415 | 78 | I.S. | -20 | 13 | -20 | -.20 | .06 |
| 129 | 0E-900S | 43686 | -20 | -150 | -15 | 11 | 60 | 2.33 | .077 |
| 130 | 100E-900S | 43424 | 72 | I.S. | 25 | 2 | 10 | .30 | .06 |
| 133 | 0E-1000S | 43409 | -20 | -275 | -20 | 2 | -20 | .13 | .06 |
| 134 | 100E-1000S | 43425 | 7 | -100 | -10 | 1 | -10 | -.10 | .03 |
| 138 | 0E-1100S | 43417 | 7 | I.S. | -20 | 11 | -20 | .266 | .07 |

Table 3

Spruce

Ash Analyses

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 100W-1300N | 43537 | -6 | -150 | -10 | 14 | -10 | 9.7 | .02 |
| 2 | 100W-1200N | 43536 | -3 | - 75 | - 5 | 7 | - 5 | 7.8 | .01 |
| 8 | 700E-1100N | 43545 | -3 | - 75 | 20 | 9 | 10 | 3.55 | .40 |
| 9 | 900E-1100N | 43569 | -3 | - 75 | 5 | 1 | - 5 | 1.20 | .01 |
| 12 | 100W-1000N | 43544 | -6 | -150 | 10 | 24 | -10 | 7.00 | .04 |
| 17 | U500E-1000N | 43538 | -6 | -150 | -10 | 10 | -10 | 5.8 | .03 |
| 20 | 100W-900N | 43553 | -2 | - 50 | 7 | -1 | - 3 | 1.77 | .01 |
| 25 | 700E-900N | 43566 | -3 | - 75 | 20 | 3 | - 5 | 3.00 | .02 |
| 44 | 500W-600N | 43562 | -6 | -150 | -10 | -1 | -10 | 4.30 | .04 |
| 47 | 500E-600N | 43539 | 8 | - 75 | 30 | 8 | - 5 | 7.65 | .03 |
| 48 | 500W-500N | 43559 | -6 | -150 | -10 | -1 | -10 | 4.30 | .03 |
| 49 | 400W-500N | 43546 | -6 | -150 | -10 | 2 | -10 | 3.60 | .04 |
| 51 | 100W-500N | 43568 | 97 | I.S. | -12 | 9 | -12 | 4.22 | .04 |
| 55 | 100E-500N | 43564 | 7 | - 50 | 17 | 4 | - 3 | 1.50 | .008 |
| 58 | 900E-500N | 43552 | -2 | - 50 | 10 | 1 | 10 | 2.63 | .30 |
| 59 | AT-4 | 43570 | -6 | -150 | -10 | 6 | -10 | 4.80 | .03 |
| 65 | AT-1 | 43560 | -6 | -150 | -10 | 7 | -10 | 2.40 | .03 |
| 67 | 500W-400N | 43561 | 5 | - 75 | 15 | 8 | - 5 | 6.10 | .03 |
| 67 | 500W-400N | 43573 | 10 | I.S. | -20 | 16 | -20 | 1.35 | .11 |
| 69 | 200E-400N | 43557 | 218 | I.S. | -12 | 6 | -12 | 4.78 | .04 |
| 70 | U300E-400N | 43549 | -6 | -150 | -10 | 7 | -10 | 4.90 | .04 |
| 72 | 500W-300N | 43548 | -3 | - 75 | - 5 | 12 | 10 | 4.90 | .35 |
| 74 | 100W-300N | 43551 | 5 | - 75 | 25 | 5 | 5 | 6.85 | .02 |
| 76 | 25E-300N | 43563 | 109 | I.S. | -15 | 42 | -15. | 2.25 | .10 |
| 77 | 100E-300N | 43535 | 49 | -150 | -10 | 13 | -10 | 4.9 | .03 |
| 81 | AT-9 | 43541 | -3 | - 75 | 40 | 7 | 15 | 1.65 | .02 |
| 82 | AT-10 | 43571 | -6 | -150 | 10 | 13 | -10 | 6.00 | .04 |
| 83 | 150W-250N | 43543 | 208 | -150 | -10 | 12 | -10 | 4.10 | .04 |
| 85 | 100W-200N | 43567 | 65 | -150 | -10 | 5 | -10 | 5.30 | .05 |
| 90 | 700E-200N | 43534 | 7 | -150 | -10 | 17 | -10 | 2.5 | .03 |
| 96 | 0W-100N | 43572 | 315 | -150 | -10 | 2 | -10 | 7.30 | .60 |
| 97 | 0W-100N | 43558 | 89 | - 50 | 16 | 10 | 3 | 1.57 | .30 |
| 99 | U500E-100N | 43542 | 7 | - 75 | 15 | 7 | 10 | 4.65 | .06 |
| 102 | 100W-0N | 43533 | 21 | -150 | -10 | 14 | -10 | 7.9 | .04 |
| 104 | 500E-0N | 43547 | -6 | -150 | 10 | 18 | -10 | 4.50 | .05 |
| 114 | 900E-200S | 43554 | -6 | -150 | -10 | 60 | -10 | 10.30 | .02 |
| 117 | 200E-300S | 43550 | 60 | I.S. | -15 | 8 | -15 | 8.25 | .07 |
| 120 | 900E-400S | 43565 | -3 | -150 | -10 | -1 | -10 | 7.40 | .02 |
| 125 | 100W-700S | 43556 | -2 | - 50 | - 3 | -1 | - 3 | 3.23 | .27 |
| 138 | 0E-1100S | 43555 | 16 | -150 | 10 | 7 | -10 | 4.40 | .04 |
| 139 | 100E-1100S | 43540 | -6 | -150 | -10 | 12 | -10 | 7.50 | .04 |

Table 4

Western Cedar

Ash Analyses

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 100W-1300N | 43479 | -6 | -150 | -10 | 4 | -10 | 1.4 | .03 |
| 1 | 100W-1300N | 43530 | -3 | - 75 | - 5 | 5 | - 5 | -.1 | .01 |
| 2 | 100W-1200N | 43463 | -2 | - 50 | - 3 | 2 | - 3 | -.1 | .01 |
| 3 | 300W-1100N | 43467 | -3 | - 75 | 5 | 7 | - 5 | -.1 | .01 |
| 5 | 100W-1100N | 43480 | -2 | - 50 | 3 | 1 | - 3 | -.1 | .008 |
| 6 | U0W-1100N | 43474 | -3 | - 75 | - 5 | 1 | - 5 | -.1 | .01 |
| 7 | 100E-1100N | 43518 | -3 | - 75 | 5 | 2 | - 5 | -.1 | .02 |
| 8 | 700E-1100N | 43477 | -3 | - 75 | 5 | - 1 | - 5 | -.1 | .01 |
| 9 | 900E-1100N | 43486 | -3 | - 75 | 5 | 5 | - 5 | -.1 | .01 |
| 12 | 100W-1000N | 43461 | -2 | - 37 | - 3 | 2 | 5 | -.1 | .008 |
| 16 | U300E-1000N | 43529 | -6 | -150 | -10 | 13 | -10 | -.1 | .02 |
| 16 | U300E-1000N | 43437 | -6 | -150 | -10 | 5 | -10 | .223 | .0400 |
| 17 | U500E-1000N | 43491 | -6 | -150 | -10 | 10 | -10 | -.1 | .02 |
| 18 | U300W-900N | 43441 | -2 | - 50 | 20 | - 1 | - 3 | -.1 | .01 |
| 20 | 100W-900N | 43465 | -2 | - 37 | - 3 | 1 | - 3 | -.1 | .01 |
| 21 | U00W-900N | 43501 | -40 | I.S. | -50 | 9 | -50 | -.4 | .03 |
| 22 | 100E-900N | 43502 | -3 | - 75 | - 5 | 9 | - 5 | -.1 | .01 |
| 25 | 700E-900N | 43513 | -2 | - 50 | - 3 | 2 | - 3 | -.1 | .01 |
| 26 | 900E-900N | 43466 | -2 | - 50 | - 3 | 1 | - 3 | -.1 | .009 |
| 27 | AT-8 | 43498 | -3 | - 75 | 5 | 10 | - 5 | 0.3 | .01 |
| 28 | AT-7 | 43520 | -6 | -150 | -10 | 3 | -10 | 0.5 | .04 |
| 29 | AT-6 | 43499 | -6 | -150 | 10 | 17 | -10 | 0.2 | .02 |
| 30 | AT-6 | 43526 | -6 | -150 | -10 | 13 | -10 | -.1 | .03 |
| 33 | 0W-800N | 43500 | -6 | -150 | -10 | 32 | -10 | -.1 | .02 |
| 35 | U300E-800N | 43528 | -6 | -150 | -10 | 14 | -10 | -.1 | .02 |
| 35 | 300E-800N | 43483 | -3 | - 75 | - 5 | 6 | - 5 | -.1 | .02 |
| 36 | U500E-800N | 43489 | -2 | - 50 | 10 | 3 | - 3 | -.1 | .009 |
| 38 | 300W-700N | 43485 | -3 | - 75 | 20 | 8 | - 5 | -.1 | .01 |
| 39 | 100W-700N | 43492 | 3 | - 75 | - 5 | 4 | - 5 | -.1 | .01 |
| 40 | 0W-700N | 43682 | 11 | - 75 | 75 | 3 | - 5 | -.1 | .02 |
| 42 | 700E-700N | 43472 | -3 | - 75 | 5 | 5 | - 3 | 0.2 | .02 |
| 42 | 700E-700N | 43673 | -6 | -150 | 80 | 7 | -10 | 0.50 | .04 |
| 43 | 900E-700N | 43454 | -3 | - 75 | 5 | 5 | - 5 | -.1 | 0.12 |
| 44 | 500W-600N | 43456 | -3 | - 75 | 10 | 8 | 5 | 0.3 | .02 |
| 46 | U300E-600N | 43523 | -3 | - 75 | 20 | 3 | - 5 | -.1 | .02 |
| 47 | U500E-600N | 43490 | -3 | - 75 | 5 | 5 | - 5 | -.1 | .01 |
| 48 | 500W-500N | 43475 | -6 | -150 | - 5 | 3 | - 5 | -.1 | .03 |
| 49 | 400W-500N | 43444 | -3 | - 75 | 20 | 1 | 20 | .45 | .02 |
| 50 | U300W-500N | 43484 | -6 | I.S. | -10 | 1 | -10 | 0.6 | .03 |
| 51 | 100W-500N | 43430 | 5 | - 75 | 5 | 1 | - 5 | -.1 | .02 |

Table 4 (Contd)

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 51 | 100W-500N | 43508 | -3 | - 75 | 5 | 1 | - 5 | -.1 | .02 |
| 53 | 0W-500N | 43450 | 7 | - 75 | 20 | 1 | 10 | -.1 | .02 |
| 55 | 100E-500N | 43674 | -3 | - 75 | 25 | 5 | 5 | -.1 | .02 |
| 57 | 700E-500N | 43482 | -3 | - 75 | 5 | 7 | - 5 | -.1 | .02 |
| 57 | 700E-500N | 43476 | -3 | - 75 | -10 | 2 | -10 | -.1 | .01 |
| 58 | 900E-500N | 43469 | -3 | - 75 | - 5 | 5 | - 5 | -.1 | .01 |
| 59 | AT-4 | 43515 | -6 | -150 | -10 | 5 | -10 | 0.2 | .03 |
| 60 | AT-5 | 43521 | 7 | -150 | -10 | 16 | -10 | 0.4 | .02 |
| 61 | AT-2 | 43435 | -3 | - 75 | - 5 | 3 | - 5 | -.1 | .02 |
| 62 | 200E-450N | 43519 | 17 | -150 | 10 | 3 | -10 | 0.9 | .03 |
| 65 | AT-1 | 43683 | 2127 | I.S. | -15 | 18 | 13 | .005 | .06 |
| 66 | AT-3 | 43448 | -3 | - 75 | 15 | 2 | - 5 | .80 | .01 |
| 67 | 500W-400N | 43429 | -3 | - 75 | - 5 | 2 | - 5 | -.1 | .02 |
| 68 | 100W-400N | 43507 | -3 | - 75 | 5 | 2 | - 5 | -.1 | .01 |
| 70 | U300E-400N | 43436 | -2 | - 50 | 4 | 1 | - 3 | -.1 | .01 |
| 70 | 300E-400N | 43497 | -3 | - 75 | - 5 | 10 | - 5 | -.1 | .01 |
| 72 | 500W-300N | 43431 | -3 | - 75 | 5 | 2 | - 5 | -.1 | .01 |
| 73 | 300W-300N | 43522 | -3 | - 75 | 5 | 8 | - 5 | -.1 | .01 |
| 74 | 100W-300N | 43488 | 6 | - 75 | 10 | 4 | - 5 | -.1 | .02 |
| 75 | 0W-300N | 43438 | 11 | - 50 | 10 | 1 | - 3 | .0160 | .0233 |
| 75 | 0W-300N | 43532 | 273 | I.S. | -15 | 5 | -15 | -.2 | .03 |
| 76 | 25E-300N | 43459 | 42 | - 75 | 20 | 5 | 5 | 0.1 | .02 |
| 77 | 100E-300N | 43666 | -6 | I.S. | 80 | 9 | -10 | -.1 | .02 |
| 78 | U500E-300N | 43681 | -3 | - 75 | 25 | 4 | 10 | -.1 | .02 |
| 78 | 500E-0N | 43667 | -12 | I.S. | 70 | 8 | -10 | 0.3 | .02 |
| 79 | 700E-300N | 43670 | -3 | - 75 | 35 | 6 | - 5 | 0.3 | .007 |
| 80 | 900E-300N | 43503 | -2 | - 50 | - 3 | 8 | - 3 | -.1 | .009 |
| 80 | 900E-300N | 43531 | -6 | -150 | -10 | 10 | -10 | -.1 | .03 |
| 81 | AT-9 | 43517 | -2 | - 50 | 13 | 1 | 7 | -.1 | .01 |
| 82 | AT-10 | 43495 | -3 | - 75 | 20 | 5 | - 5 | 0.3 | .02 |
| 83 | 150W-250N | 43512 | 5 | - 75 | 10 | 3 | - 5 | -.1 | .02 |
| 84 | 500W-200N | 43453 | -2 | - 37 | - 3 | 1 | - 3 | -.1 | .006 |
| 85 | 100W-200N | 43493 | 12 | - 75 | 10 | 5 | - 5 | -.1 | .02 |
| 87 | 35E-200N | 43457 | 35 | - 50 | 3 | 3 | - 3 | -.1 | .01 |
| 88 | U300E-200N | 43433 | -1 | - 30 | 13 | - 1 | - 3 | .0140 | .0266 |
| 91 | 50E-150N | 43458 | 155 | - 50 | 16 | 3 | 3 | -.1 | .01 |
| 94 | U300W-100N | 43470 | -2 | - 37 | - 3 | 1 | - 3 | -.1 | .005 |
| 95 | 100W-100N | 43487 | 6 | -150 | 50 | 13 | -10 | -.1 | .04 |
| 96 | 0W-100N | 43527 | 43 | - 75 | 20 | 6 | 5 | -.1 | .06 |
| 97 | 0E-100N | 43442 | 53 | - 50 | 16 | 3 | 7 | .17 | .02 |

Table 4 (Contd)

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 97 | 0E-100N | 43684 | 36 | I.S. | 45 | 15 | 95 | 1.07 | .11 |
| 98 | 100E-100N | 43671 | 42 | - 75 | 40 | 7 | - 5 | -.10 | .01 |
| 98 | 100E-100N | 43473 | 91 | - 75 | 5 | 5 | - 5 | -.1 | .02 |
| 99 | U500E-100N | 43524 | -2 | - 50 | - 3 | 5 | - 3 | -.1 | .006 |
| 100 | 900E-100N | 43672 | -3 | - 75 | 40 | 3 | - 5 | 0.35 | .006 |
| 100 | 900E-100N | 43464 | -2 | - 50 | 4 | 1 | - 3 | -.1 | .01 |
| 102 | 100W-0N | 43449 | -2 | - 50 | 10 | - 1 | - 3 | -.1 | -.01 |
| 103 | U300E-0N | 43455 | -3 | - 75 | - 5 | 7 | - 5 | -.1 | .01 |
| 104 | 500E-0N | 43504 | -2 | - 37 | - 3 | 5 | - 3 | -.1 | .007 |
| 104 | 500E-0N | 43516 | -1 | - 30 | 6 | 10 | - 2 | -.1 | .006 |
| 105 | U700E-0N | 43525 | -3 | - 75 | 10 | 7 | - 5 | -.1 | .02 |
| 105 | 700E-0N | 43669 | -12 | -150 | 20 | 12 | -10 | 0.5 | .02 |
| 107 | 200E-50S | 43514 | 4 | - 75 | 20 | - 1 | - 5 | -.1 | .01 |
| 108 | 0E-100S | 43439 | 17 | - 75 | - 5 | 2 | - 5 | .021 | .0250 |
| 109 | 200E-100S | 43511 | 26 | - 75 | 10 | - 1 | - 5 | -.1 | .01 |
| 111 | 900E-100S | 43446 | -2 | - 50 | 10 | - 1 | - 3 | -.1 | .01 |
| 112 | 100E-200S | 43468 | 12 | - 50 | 7 | 1 | 3 | -.1 | .01 |
| 113 | 300E-200S | 43494 | 2 | - 50 | 3 | 3 | - 3 | -.1 | .01 |
| 114 | 900E-200S | 43471 | -2 | - 50 | 7 | 1 | - 3 | -.1 | .01 |
| 115 | 0E-300S | 43462 | 15 | - 50 | 7 | 1 | - 3 | -.1 | .01 |
| 116 | 100E-300S | 43434 | 18 | - 75 | 15 | 3 | - 5 | .0240 | .0500 |
| 116 | 100E-300S | 43665 | -6 | I.S. | 40 | 17 | -10 | 0.40 | .04 |
| 116 | ID100E-300S | 43668 | -120 | I.S. | 95 | 40 | -15 | -.7 | .02 |
| 117 | 200E-300S | 43496 | 26 | - 75 | 5 | 9 | - 5 | -.1 | .02 |
| 118 | 200E-400S | 43509 | -3 | - 75 | - 5 | 2 | - 5 | -.1 | .02 |
| 121 | 0E-500S | 43478 | 18 | - 75 | 10 | 2 | - 5 | -.1 | .02 |
| 122 | 50E-500S | 43481 | -12 | I.S. | -20 | 2 | -20 | -.1 | .05 |
| 122 | U50E-500S | 43505 | -2 | - 50 | 13 | 2 | - 3 | -.1 | .008 |
| 124 | 0E-600S | 43443 | 5 | - 50 | 10 | 2 | 7 | -.10 | .01 |
| 126 | 0E-700S | 43506 | 4 | - 75 | 5 | 2 | - 5 | -.1 | .01 |
| 127 | 0E-800S | 43432 | -3 | - 50 | 10 | - 1 | - 3 | .0103 | .0233 |
| 128 | 100E-800S | 43452 | 22 | - 50 | 7 | - 1 | - 3 | -.1 | .007 |
| 129 | 0E-900S | 43440 | -3 | - 75 | 5 | 6 | - 5 | -.1 | .01 |
| 130 | 100E-900S | 43451 | -2 | - 37 | 5 | 1 | - 3 | -.1 | .006 |
| 133 | 0E-1000S | 43510 | -12 | I.S. | - 5 | 1 | - 5 | -.1 | .03 |
| 134 | 100E-1000S | 43447 | -3 | - 75 | 35 | 1 | - 5 | -.1 | .01 |
| 138 | 0E-1100S | 43445 | -6 | -150 | -10 | 2 | -10 | .50 | .01 |
| 139 | 100E-1100S | 43460 | -3 | - 75 | 10 | 5 | - 5 | 0.7 | .02 |

Table 5

Western Hemlock

Ash Analyses

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 100W-1300N | 43605 | 121 | -150 | -10 | - 1 | -10 | 8.20 | .04 |
| 2 | 100W-1200N | 43583 | -6 | -150 | -10 | 4 | -10 | 10.90 | .03 |
| 5 | 100W-1100N | 43585 | -6 | -150 | -10 | 8 | -10 | 9.10 | .03 |
| 16 | U300E-1000N | 43587 | -3 | - 75 | - 5 | 7 | - 5 | 7.15 | .01 |
| 17 | U500E-1000N | 43581 | -3 | - 75 | 20 | 5 | - 5 | 4.10 | .01 |
| 20 | 100W-900N | 43593 | -3 | - 75 | 35 | 4 | - 5 | 6.45 | .007 |
| 21 | 0W-900N | 43575 | -6 | -150 | -10 | 7 | -10 | 1.70 | .02 |
| 22 | 100E-900N | 43602 | -6 | -150 | -10 | - 1 | 10 | 5.70 | .04 |
| 27 | AT-8 | 43582 | -20 | I.S. | -13 | 14 | -13 | 7.67 | .03 |
| 28 | AT-7 | 43578 | -6 | -150 | 20 | 117 | -10 | 3.90 | .02 |
| 29 | AT-6 | 43601 | -6 | -150 | 10 | - 1 | 40 | 3.20 | .02 |
| 30 | AT-6 | 43621 | -20 | I.S. | 13 | 9 | 35 | 4.00 | .03 |
| 36 | U500E-800N | 43600 | -6 | -150 | 10 | - 1 | 30 | 3.20 | .06 |
| 44 | 500W-600N | 43577 | -6 | -150 | 10 | - 1 | -10 | 5.40 | .02 |
| 46 | U300E-600N | 43615 | -6 | -150 | 10 | 3 | -10 | 6.40 | .05 |
| 48 | 500W-500N | 43616 | -6 | -150 | -10 | - 1 | 10 | 8.60 | .03 |
| 49 | 400W-500N | 43592 | -3 | - 75 | - 5 | 1 | - 5 | 6.40 | .01 |
| 56 | 500E-600N | 43607 | -6 | -150 | -10 | - 1 | -10 | 4.10 | .02 |
| 59 | AT-4 | 43597 | -6 | - 15 | 40 | - 1 | -10 | 3.50 | .02 |
| 60 | AT-5 | 43589 | -6 | -150 | 10 | - 1 | -10 | 5.20 | .02 |
| 61 | AT-2 | 43590 | -6 | -150 | -10 | - 1 | -10 | 6.00 | .02 |
| 65 | At-1 | 43599 | -6 | - 50 | 40 | - 1 | 10 | 5.60 | .02 |
| 66 | AT-3 | 43611 | -6 | -150 | 50 | 10 | -10 | 6.80 | .02 |
| 67 | 500W-400N | 43613 | -3 | - 75 | - 5 | 3 | - 5 | 3.85 | .01 |
| 69 | 200E-400N | 43594 | 48 | -150 | 90 | 4 | 35 | 9.00 | .04 |
| 70 | U300E-400N | 43595 | -3 | - 75 | - 5 | - 1 | 5 | 8.35 | .006 |
| 71 | 500E-400N | 43574 | -6 | -150 | -10 | 113 | -10 | 3.90 | .02 |
| 73 | U300W-300N | 43619 | -20 | I.S. | 25 | 11 | 45 | 8.25 | .06 |
| 74 | 100W-300N | 43603 | 32 | -150 | -10 | - 1 | 10 | 3.70 | .05 |
| 78 | U500E-300N | 43580 | -6 | -150 | 40 | 5 | -10 | 5.00 | .02 |
| 79 | U700E-300N | 43606 | -2 | - 50 | - 3 | - 1 | 13 | 5.00 | .02 |
| 82 | AT-10 | 43579 | -6 | -150 | -10 | 7 | -10 | 6.90 | .02 |
| 83 | 150W-250N | 43620 | 189 | -150 | 23 | 8 | 55 | 4.56 | .05 |
| 87 | 35E-200N | 43614 | 523 | -150 | 10 | 125 | 40 | 8.40 | .04 |
| 96 | 0E-100N | 43604 | -6 | -150 | -10 | - 1 | -10 | 6.80 | .02 |
| 98 | 100E-100N | 43576 | 129 | -150 | -10 | 7 | -10 | 7.90 | .03 |
| 100 | 900E-100N | 43586 | -3 | - 75 | 20 | 9 | 10 | 7.05 | .02 |
| 102 | 100W-0N | 43588 | -6 | -150 | -10 | - 1 | -10 | 6.70 | .60 |
| 103 | U300E-0N | 43617 | 28 | -150 | -10 | 2 | 10 | 4.20 | .08 |
| 105 | U700E-0N | 43610 | -6 | -150 | 30 | 10 | -10 | 8.10 | .02 |

Table 5 (Contd)

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 111 | 900E-100S | 43598 | -2 | - 50 | 10 | - 1 | 3 | 5.97 | .008 |
| 114 | 900E-200S | 43596 | -6 | - 15 | 40 | - 1 | 10 | 9.80 | .02 |
| 117 | 200E-300S | 43591 | -20 | I.S. | -20 | - 1 | -20 | 7.83 | .06 |
| 122 | U50E-500S | 43618 | 85 | I.S. | -50 | 30 | -50 | 6.00 | .08 |
| 122 | ID50E-500S | 43612 | 901 | -150 | -10 | 9 | 20 | 4.70 | .04 |
| 129 | OE-900S | 43609 | -3 | 75 | 15 | - 1 | 20 | 6.25 | .02 |
| 133 | OE-1000S | 43584 | -6 | -150 | 30 | 5 | -10 | 13.80 | .04 |
| 139 | 100E-1100S | 43608 | -3 | 75 | - 5 | - 1 | 5 | 6.10 | .01 |

Table 6

Juniper

Ash Analyses

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 100W-1100N | 43637 | -2 | - 50 | 7 | 1 | 10 | 0.27 | .01 |
| 12 | 100W-1000N | 43636 | -6 | -150 | 10 | 14 | -10 | 0.30 | .02 |
| 21 | 0W-900N | 43627 | -6 | -150 | -100 | 9 | -100 | 1.3 | .03 |
| 51 | 100W-500N | 43635 | -6 | -150 | 30 | 27 | -10 | 1.60 | .02 |
| 73 | 100W-300N | 43633 | -3 | - 75 | 15 | 6 | 15 | 0.50 | .02 |
| 74 | 100W-100N | 43626 | 20 | - 75 | 5 | 3 | 15 | 0.05 | .02 |
| 75 | 25E-300N | 43622 | 6 | - 75 | 10 | - 1 | - 5 | 0.80 | .01 |
| 83 | 150W-250N | 43634 | 159 | -150 | 10 | 17 | -10 | 1.20 | .02 |
| 85 | 100W-200N | 43624 | 27 | -150 | -10 | 18 | -10 | 0.60 | .02 |
| 87 | 35E-200N | 43625 | 136 | -150 | -10 | 11 | 10 | 1.80 | .02 |
| 91 | 50E-150N | 43628 | 15 | - 75 | 10 | 4 | 10 | 0.65 | .03 |
| 96 | 0W-100N | 43631 | 80 | - 75 | 35 | 9 | 25 | 0.95 | .03 |
| 98 | 100E-100N | 43640 | 75 | -150 | 20 | 13 | -10 | 1.70 | .02 |
| 107 | 200E-50S | 43632 | -6 | -150 | -10 | 12 | -10 | 1.10 | .02 |
| 109 | 200E-100S | 43639 | 11 | - 75 | 35 | 8 | 5 | 0.70 | .02 |
| 112 | 100E-200S | 43630 | 13 | - 75 | 10 | 3 | 10 | 1.00 | .02 |
| 117 | 200E-300S | 43638 | 61 | - 75 | 15 | 8 | 15 | 1.00 | .04 |
| 117 | 300E-200S | 43629 | 5 | - 75 | - 5 | 2 | 5 | 0.45 | .02 |
| 119 | 300E-400S | 43623 | 68 | - 75 | 5 | 7 | 25 | 1.25 | .04 |

Table 7

Blueberry

Ash Analyses

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 27 | AT8 | 43655 | -20 | I.S. | -20 | 4 | 60 | 8.20 | .05 |
| 28 | AT7 | 43657 | -30 | I.S. | -20 | 13 | 20 | 6.75 | .06 |
| 29 | AT6 | 43656 | -20 | I.S. | 80 | 6 | 40 | 5.00 | .03 |
| 30 | AT6-B2 | 43659 | -20 | I.S. | -20 | 6 | 40 | 2.40 | .05 |
| 50 | U300W-500N | 43647 | -20 | I.S. | 14 | 3 | 40 | 4.14 | .05 |
| 55 | 100E-500N | 43658 | -20 | I.S. | 25 | 3 | -15 | 9.00 | .04 |
| 59 | AT4 | 43649 | -20 | I.S. | -20 | 2 | 80 | 3.60 | .06 |
| 60 | AT5 | 43645 | -20 | -150 | -10 | 6 | 140 | 5.89 | .06 |
| 61 | AT2 | 43648 | -20 | -150 | 24 | 2 | 125 | 5.78 | .05 |
| 65 | AT-1 | 43642 | -20 | I.S. | 33 | 6 | 80 | 1.13 | .04 |
| 66 | AT3 | 43652 | -20 | I.S. | 35 | 8 | 55 | 7.50 | .04 |
| 69 | 200E-400N | 43651 | -20 | I.S. | -20 | 21 | 60 | 6.17 | .04 |
| 70 | U300E-400N | 43654 | -30 | I.S. | 98 | 19 | -25 | 7.25 | .05 |
| 73 | U300W-300N | 43646 | -20 | -150 | 55 | 5 | 35 | 5.44 | .04 |
| 77 | U100E-300N | 43644 | -20 | I.S. | -12 | 4 | 12 | 5.38 | .04 |
| 81 | AT9 | 43643 | -20 | I.S. | 14 | 7 | 90 | 3.33 | .06 |
| 83 | 150W-250N | 43641 | 30 | I.S. | -12 | 11 | 85 | 8.67 | .05 |
| 122 | 50E-500S | 43653 | 15 | I.S. | 95 | 9 | 75 | 5.75 | .06 |
| 122 | U50E-500S | 43650 | -30 | I.S. | -30 | 12 | -30 | 1.50 | .03 |

Table 8

Algae

Ash Analyses

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 6 | AOW-11N | 43746 | 16 | - 75 | -50 | 3 | -50 | 0.50 | -.001 |
| 10 | A4W-10N | 43752 | 2 | - 30 | - 2 | - 1 | - 2 | -.1 | -.001 |
| 11 | A2W-10N | 43751 | 63 | 60 | - 2 | 3 | 2 | -.1 | -.001 |
| 12 | A1W-10N | 43748 | 173 | I.S. | -30 | 3 | -30 | 1.00 | .02 |
| 13 | AOW-10N | 43745 | 47 | - 30 | 14 | - 1 | 4 | 0.84 | .003 |
| 21 | AOW-9N | 43744 | 51 | - 75 | 10 | - 1 | - 5 | 3.95 | .24 |
| 37 | AOW-7N-2 | 43743 | 770 | - 30 | 8 | 4 | - 2 | -.1 | .001 |
| 39 | A1W-7N | 43747 | 1833 | - 30 | 14 | 2 | - 2 | 1.74 | .09 |
| 40 | AOW-7N-1 | 43742 | 662 | - 50 | 13 | . 7 | 3 | .2 | .02 |

Table 8 (Contd)

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 135 | A1 | 43740 | 14 | I.S. | -20 | 37 | -20 | -.2 | .006 |
| 139 | A1E-11S | 43750 | 28 | -150 | -10 | 1 | -10 | 0.50 | .009 |
| * | A2 | 43741 | 5 | - 50 | - 3 | 24 | - 3 | -.1 | .01 |
| ** | AKB-2 | 43749 | -20 | I.S. | -15 | 1 | -15 | -.2 | .007 |

- - - - - - - -

* Sample location -- near Kendrick Bay Camp -- not shown on map
** Sample location -- west end of Kendrick Bay -- not shown on map

Table 9

Miscellaneous Plants

Ash Analyses

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 24 | 300E-900N A | 43660 | -20 | -150 | 75 | 8 | 45 | 0.33 | .03 |
| 32 | 100W-800N U | 43687 | -20 | -150 | 45 | 7 | 35 | 2.44 | .057 |
| 32 | 100W-800N A | 43663 | - 6 | -150 | 70 | 15 | 20 | 1.70 | .09 |
| 51 | 100W-500N U | 43688 | - 3 | - 75 | 35 | 4 | 5 | -.1 | .02 |
| 53 | 0W-500N A | 43664 | - 6 | -150 | 120 | 9 | 40 | 0.70 | .06 |
| 57 | 700E-500N A | 43662 | - 6 | -150 | 130 | 5 | 90 | 0.80 | .09 |
| 76 | 25E-300N T | 43679 | 374 | -150 | 80 | 5 | 10 | 0.80 | .04 |
| 81 | AT9 M2 | 43676 | -20 | I.S. | -15 | 5 | 65 | 2.01 | .04 |
| 81 | AT9 T | 43680 | -20 | I.S. | -20 | 25 | 13 | 1.67 | .05 |
| 87 | 35E-200N M | 43675 | 923 | -150 | 70 | 19 | 60 | 1.60 | .08 |
| 95 | 100W-100N M2 | 43677 | 832 | I.S. | -20 | 2 | 140 | 4.00 | .05 |
| 107 | 200E-50S M2 | 43678 | 119 | I.S. | -15 | 4 | 130 | 4.25 | .06 |
| 117 | 300E-300S A | 43661 | - 6 | -150 | 80 | 5 | 30 | 0.70 | .07 |

A = Alder U = Unidentified Shrub T = Club Moss M2 = Crowberry M = Luketkea Pectinata

Table 10

Mulch and Soil Analyses

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 1 | M1W-13N | M 43693 | 109 | I.S. | 23 | 27 | 35 | 0.57 | |
| 2 | M1W-12N | M 43694 | 7 | - 37 | 20 | 5 | 15 | -.1 | |
| 6 | COE-11N | M 43716 | - 1 | - 30 | 10 | 4 | - 2 | -.1 | .004 |
| 14 | M1E-10N | M 43692 | 229 | - 75 | 40 | 11 | 20 | 2.05 | .03 |
| 19 | M2W-9N | M 43695 | 30 | - 30 | 60 | 6 | 160 | .1 | |
| 20 | M1W-9N | M 43725 | 47 | - 75 | - 5 | 6 | 20 | -.1 | .004 |
| 22 | M1E-9N | M 43713 | 6 | - 50 | 3 | 7 | - 3 | -.1 | |
| 27 | AT-8M | M 43718 | -20 | I.S. | -15 | 9 | -15 | .2 | .009 |
| 28 | AT-7M | M 43717 | - 1 | - 30 | - 2 | 12 | - 2 | -.1 | .005 |
| 29 | AT-6M | M 43690 | - 6 | -150 | -10 | 12 | -10 | 0.1 | .02 |
| 30 | AT6-M2 | M 43710 | 114 | - 30 | 16 | - 1 | 12 | .2 | |
| 31 | 2W-8N | M 43699 | 7 | - 30 | - 2 | 4 | - 2 | -.1 | |
| 34 | M1E-8N | M 43712 | 42 | -150 | -10 | 16 | 50 | .1 | |
| 44 | S5W-6N | M 43715 | 12 | - 30 | 14 | 5 | - 2 | -.1 | .003 |
| 48 | S5W-5N | S 43739 | 3 | - 30 | - 3 | 1 | - 3 | -.1 | .003 |
| 49 | S4W-5N | S 43738 | 11 | - 30 | - 2 | 2 | - 2 | -.1 | .003 |
| 55 | M1E-5N | M 43723 | 441 | -150 | -10 | 23 | 70 | -.1 | .01 |
| 59 | AT4-M | M 43701 | 13 | - 50 | 7 | - 1 | 20 | .2 | |
| 60 | AT5-M | M 43709 | 15 | -150 | -10 | 25 | 40 | .1 | |
| 61 | AT2-M | M 43707 | 12 | - 37 | 7 | - 1 | 5 | -.1 | |
| 65 | AT-1M | M 43697 | 19 | - 50 | - 3 | 11 | 15 | .2 | |
| 66 | AT-3M | M 43698 | -20 | I.S. | -15 | 15 | 25 | 1.45 | |
| 67 | S5W-4N | M 43706 | 93 | -150 | -10 | 323 | 40 | .3 | |
| 72 | S5W-3N | S 43737 | 2 | - 30 | - 3 | 2 | - 3 | -.1 | .007 |
| 77 | M1E-3N | M 43691 | 110 | - 30 | 12 | 4 | 4 | -.1 | .001 |
| 81 | AT-9M | M 43719 | 3 | - 30 | 18 | 4 | 10 | -.1 | .004 |
| 82 | AT-10M | M 43720 | -20 | I.S. | -15 | 6 | 35 | .2 | .009 |
| 84 | S5W-2N | S 43736 | 5 | | 2 | 16 | - 2 | -.1 | .003 |
| 107 | S200E-50S | M 43705 | 22 | - 30 | - 2 | 2 | - 2 | -.1 | |
| 127 | MOE-800S | M 43722 | 12 | - 30 | 20 | 6 | - 2 | -.1 | .006 |
| 132 | M-1 | M 43701 | 35 | -150 | -10 | 25 | 50 | .1 | |
| 133 | MOE-10S | M 43714 | 12 | - 75 | 15 | 80 | 25 | .2 | |
| 134 | M1E-10S | M 43724 | 238 | - 75 | 5 | 12 | 30 | -.1 | .004 |
| 136 | M-2 | M 43726 | 39 | - 75 | -15 | 9 | 45 | .2 | .02 |
| 138 | MOE-11S | M 43721 | -20 | I.S. | -20 | 16 | -20 | .3 | .01 |
| 139 | M1E-11S | M 43700 | -20 | I.S. | -15 | 19 | 45 | .4 | |
| 140 | M-3 | M 43702 | 1 | - 30 | 10 | 5 | 6 | -.1 | |
| 141 | M-4 | M 43696 | - 6 | -150 | -10 | 4 | 20 | .4 | |
| | M-7 | M 43703 | - 3 | - 75 | - 5 | 7 | 05 | -.1 | |
| | M-6 | M 43704 | 8 | - 30 | 34 | 1 | 14 | .1 | |
| | M-5 | M 43711 | 1 | - 30 | - 2 | - 1 | 2 | .2 | |

M = Mulch S = Soil

Table 11

Stream Sediment Analyses

| Map No. | Field No. | Analytical Code No. | U ppm | V ppm | Mo ppm | As ppm | Cu ppm | Mn % | Zn % |
|---|---|---|---|---|---|---|---|---|---|
| 1 | RAC-10 | | | | | | | | |
| | 0W-900N | 43733 | 7 | -30 | -2 | 2 | -2 | -.1 | .003 |
| 2 | RAC-11 | | | | | | | | |
| | 300E-500N | 43734 | 8 | -30 | -2 | 2 | -2 | .1 | .001 |
| 3 | RAC-12 | | | | | | | | |
| | 650E-450N | 43735 | 33 | -30 | -2 | 2 | -2 | -.1 | .003 |
| 4 | C-1 | 43727 | 554 | -30 | -2 | 5 | -2 | -.1 | .002 |
| 5 | C-2 | 43728 | 315 | -30 | -2 | 3 | -2 | -.1 | .003 |
| 6 | C-3 | 43729 | 253 | -30 | -2 | 2 | -2 | -.1 | .002 |
| 7 | C-4 | 43730 | 291 | -30 | -2 | 3 | -2 | .1 | .004 |
| 8 | C-5 | 43731 | 198 | -30 | -2 | 4 | -2 | -.1 | .003 |
| 9 | C-6 | 43732 | 77 | 100 | -2 | 6 | 4 | -.1 | .005 |

Table 12

Semi-Quantitative Spectrographic Analyses of Six Geobotanical Samples

| Map No. | 98 | 118 | 97 | 91 | 83 | 4 |
|---|---|---|---|---|---|---|
| Type of Sample: | Lodgepole Pine | Lodgepole Pine | Lodgepole Pine | Western Cedar | Spruce | Stream Sediment |
| Lab. No. | 43341 | 43382 | 43428 | 43458 | 43543 | 43727 |
| The following are reported as oxides of the elements indicated. | | | | | | |
| Element: | % | % | % | % | % | % |
| Si | 6. | 4. | 5. | 3. | 8. | N.D. |
| Ca | 12. | 12. | 12. | 40. | 15. | 0.25 |
| Mg | 8. | 15. | 6. | 5. | 20. | .35 |
| K | 18. | 30. | 15. | 15. | 18. | 5. |
| Na | 3.5 | 3. | 3.5 | .6 | 3.5 | 6. |
| Al | 2.5 | 2. | 2.5 | .4 | 2.5 | 18. |
| P | 3.5 | 4. | 5. | 3. | 6. | -- |
| Fe | 1. | .8 | 1.2 | .5 | 2. | 7. |
| Mn | 1.2 | 2. | 1. | .08 | 4. | .3 |
| B | .2 | .3 | .25 | .3 | 1. | -- |
| Pb | .03 | .02 | .04 | .015 | .06 | .02 |
| Ga | .001 | -- | .001 | -- | .001 | .01 |
| Mo | -- | -.002 | -- | -- | -- | -- |
| Cu | .02 | .015 | .02 | .003 | .02 | .001 |
| Yb | .002 | -.001 | .002 | -.001 | .001 | .004 |
| Zn | .35 | .15 | .4 | -- | .1 | -- |
| Ti | .025 | .03 | .03 | .03 | .06 | .3 |
| Ag | .0005 | .001 | -.0005 | -- | -- | -- |
| Zr | .025 | .004 | .04 | .05 | .02 | .2 |
| Ni | .003 | .004 | .003 | .001 | .005 | .001 |
| Sr | .04 | .03 | .02 | .05 | .05 | .01 |
| Cr | .0005 | .0007 | -.0005 | -.0005 | .0008 | .0005 |
| V | .002 | .002 | -.001 | -- | .002 | -- |
| Y | .02 | .015 | .01 | .003 | .03 | .06 |
| Ba | .01 | .01 | .01 | .03 | .01 | .015 |

Balance in first five samples: Not found. N.D: Si + nondetectables: Balance in #43727.

| Uranium in ppm by Fluorimetric method: | 1020 | 573 | 2396 | 155 | 208 | 554 |
|---|---|---|---|---|---|---|

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