Preliminary Report on the Clancy Creek Area, Jefferson City Quadrangle, Jefferson County, Montana

By George E. Becraft

Trace Elements Investigations Report 257

UNITED STATES DEPARTMENT OF THE INTERIOR
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Geology - Mineralogy

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UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

PRELIMINARY REPORT ON THE CLANCY CREEK AREA JEFFERSON CITY QUADRANGLE, JEFFERSON COUNTY, MONTANA*

By

George E. Becraft

March 1953

Trace Elements Investigations Report 257

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*This report concerns work done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission

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PRELIMINARY REPORT ON THE CLANCY CREEK AREA, JEFFERSON CITY QUADRANGLE, JEFFERSON COUNTY, MONTANA

By George E. Becraft

ABSTRACT

Several radioactivity anomalies and secondary uranium minerals have been found in the Clancy Creek area near the northern margin of the Boulder batholith. These are principally associated with chalcedonic zones that consist of one or more discontinuous stringers and veins of cryptocrystalline silica and fine-grained quartz in silicified quartz monzonite and alaskite. Uranium ore has been produced at the W. Wilson mine from one of these vein zones, and exploration work is being done on another--the G. Washington-A. Lincoln. Some very fine-grained pyrite and minute quantities of other sulfides have been recognized in deposits of this type.

At the Lone Eagle mine, a small amount of uranium ore has been developed along a siliceous vein that contains sooty pitchblende (?) in small irregular fractures; significant amounts of galena and sphalerite are distributed sporadically along the vein.

In the Clancy Creek area, no anomalous radioactivity has been detected in the pre-batholithic volcanic rocks or in the post-batholithic dacite and andesite.

INTRODUCTION

The Clancy Creek area is a few miles west of Clancey and Jefferson City and about 10 miles south of Helena, Montana (fig. 1). U. S. Highway 91 between Butte and Helena and a branch of the Great Northern Railroad cross the southeastern corner of the area. Several graded county roads that, in general, follow the main valleys, cross the area. The drainage is northeastward through Clancy Creek, Lump Gulch, and other tributaries of Prickly Pear Creek. The maximum relief of the area is about 3,000 feet. Most of the hills are about 1,000 feet above the two main valleys.

The geology of about five square miles in the northeastern corner of the area was mapped in 1950 by Roberts and Gude. The remainder of the area was mapped between June and October in 1952 by Becraft, Samuel Rosenblum, and Robert F. Gosman; Payome Aranyakanon assisted during part of July and August. The mapping was under the supervision of M. R. Klepper and was carried out on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

With the exception of the detailed study in the vicinity of Clancey, previous geologic work in this area has been of a reconnaissance nature in connection with studies of the mineral deposits in and near the Boulder batholith. The most complete reports are by Knopf (1913), Billingsley (1915), Billingsley and Grimes (1918), and Pardee and Schrader (1933).

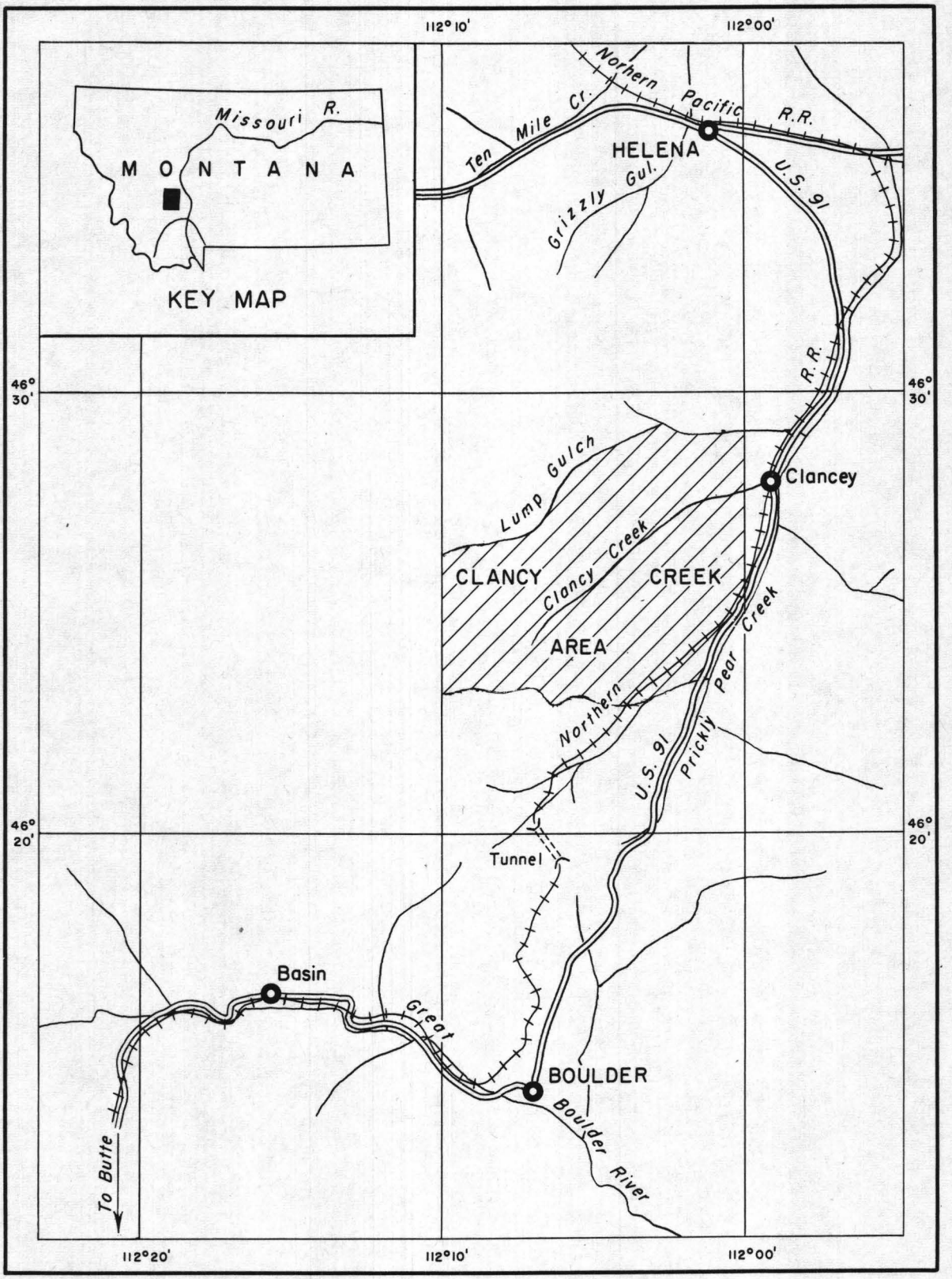

FIGURE 1 — INDEX MAP SHOWING LOCATION OF CLANCY CREEK AREA, JEFFERSON CITY QUADRANGLE, JEFFERSON COUNTY, MONTANA

0 5 10 Miles

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GEOLOGY

General features

The Clancy Creek area is near the northern margin of the Boulder batholith and is underlain principally by quartz monzonite. The rocks of the batholith were intruded into a series of volcanic rocks, of which small, isolated remnants are exposed in the southwestern corner of the area (fig. 2). Both the quartz monzonite and the volcanic rocks have been intruded by silicic rocks-including aplite, alaskite, alaskite-porphyry, granite, and pegmatite--that are designated as alaskite on figure 2. The youngest consolidated rocks in the are are dacites and andesites that occur as steeply-dipping dikes cutting the alaskitic and older rocks.

Throughout the area, but particularly in the eastern part, the rocks have been recurrently sheared, brecciated and silicified along predominantly northeasterly-trending, steeply-dipping faults. The resultant chalcedonic zones consist of one or more discontinuous stringers and veins of cryptocrystalline silica and fine-grained quartz in silicified quartz monzonite, alaskite, and rarely dacite or andesite. A few of the zones contain no distinct chalcedony stringers but consist only of silicified country rock. Unsilicified faults are common in the area, but because of poor exposures and the lack of distinctive rock units, only a few could be traced.

Pleistocene (?) and Recent alluvial and colluvial material are the only sediments in the area.

Igneous rocks

The pre-batholithic volcanic rocks, remnants of a large roof pendant that extends southward beyond the limits of the map, are fine-grained, light- to dark gray andesite with small phenocrysts of plagioclase and hornblende. Knopf (1913, p. 28) concluded that these rocks are of Late Cretaceous age.

The quartz monzonite has been divided by the writer into four mappable units according to textural and modal differences that are apparent in hand specimens. The most common unit is dominantly medium-grained, biotite quartz monzonite. From hand specimens the composition is estimated to be 30 to 40 percent plagioclase, 20 to 30 percent potash feldspar, 20 to 30 percent quartz, 2 to 7 percent biotite, and as much as a few percent hornblende.

A porphyritic quartz monzonite present in the western part of the mapped area, is distinguished in hand specimen by its distinctive porphyritic texture and a slight difference in composition. The phenocrysts are plagioclase, orthoclase, quartz, and biotite in approximately the same relative abundance as in the medium-grained quartz monzonite. The groundmass, however, differs considerably in composition, for it is estimated to contain 50 to 60 percent quartz, 20 to 25 percent orthoclase, and 15 to 20 percent plagioclase. In some places this rock type appears to be gradational into medium-grained quartz monzonite and may represent rock that has been impregnated by later more silicic solutions after partial or complete crystallization.

Near the center of the Clancy Creek area (fig. 2) a distinctive type of quartz monzonite contains many large phenocrysts of potash feldspar in a gray goundmass and is estimated to contain 50 percent quartz, 30 percent plagioclase, and 20 percent potash feldspar. A fine-grained variety of quartz monzonite was mapped in sec. 22, T. 8 N., R. 4 W.

The complex group of quartz-rich rocks--aplite, alaskite, alaskite-porphyry, granite, and pegmatite--occur as dikes, gently dipping sheets, and bodies of irregular shape as much as one square mile in extent. The aplite and pegmatite principally constitute small dikes in the larger irregular bodies, which consist essentially of alaskite, alaskite-porphyry, or granite, in the quartz monzonite. Alaskite and alaskite-porphyry also commonly occur in small dikes. The average modal composition of this group of rocks is estimated to be potash feldspar 40 to 60 percent, quartz 25 to 40 percent, plagioclase 5 to 25 percent and less than 2 percent biotite.

The youngest consolidated rocks--dacite and andesite--form steeply-dipping dikes. The texture of these rocks varies from glassy to fine-grained but completely crystalline, and the color ranges from light gray to dark green, dark gray, and black. In the crystalline rocks, phenocrysts of glassy euhedral plagioclase and biotite are common; euhedral quartz crystals are visible in some hand specimens and entirely lacking in others from the same outcrop.

MINERAL DEPOSITS

General statement

The Clancy Creek area contains a number of base- and precious-metal deposits that have been developed by a few mines and by numerous prospects. Gold, silver, lead, zinc, and copper have been produced from mines in this area.

A younger and distinctly different type of deposit in the chalcedonic veins locally contains rich bodies of silver and gold ore but only relatively small amounts of base metals.

The formation of the chalcedonic zones took place over a long period of time. The initial faulting and introduction of silica probably occurred soon after the intrusion of the alaskitic rocks; the final period of mineralization followed the intrusion of the dacite and andesite. Chalcedonic zones cut by dacite dikes are not uncommon but dacite dikes cut by silicified zones or veins are rare. Uranium mineralization appears to have taken place late in the period of silicification, but probably prior to the intrusion of dacite and andesite.

Most of the chalcedonic zones are nearly vertical and trend predominantly N. 60° E. The zones typically form the crests of ridges and commonly protrude at least a few inches above the surface; some form cliffs as much as 100 feet high. The zones are generally discontinuous and rarely are more than a mile in length and 20 feet in width.

Chalcedonic zones are abundant in a northeasterly trending belt about 3½ miles wide that extends through the eastern part of the mapped area; radioactivity anomalies, with few exceptions, are confined to an area of a few square miles in the northeastern part of this belt (fig. 3).

Uranium minerals and abnormally high radioactivity anomalies have been found principally in the chalcedonic vein zones that contain some very fine-grained pyrite, but only minute quantities of other sulfide minerals; however, in one mine significant amounts of lead and zinc and traces of copper are present.

Very little development work has been done on most of the uranium deposits, therefore, little is known of the form and structure of the deposits. In the W. Wilson mine, the two developed ore bodies are about 25 feet long and from about 1 foot to 5 feet thick; one shoot extends to a depth of about 12 feet and the other to a depth of about 60 feet, with a slight rake to the northeast.

Knopf (1913) and Pardee and Schrader (1933) have described the general features of the mineral deposits in this area and discussed a few of the principal ones in more detail. Accordingly only the deposits with abnormal radioactivity are described in this report.

Descriptions of radioactive deposits

W. Wilson mine

The only mine in the Clancy Creek area from which uranium ore was being produced in 1952 was the W. Wilson, in sec. 17, T. 8 N., R. 3 W., slightly outside the eastern margin of the mapped area (fig. 3). The first shipment of uranium ore was made late in 1951; two more shipments were made in 1952. The ore shipped ranged from about 0.3 percent to 1.1 percent U_3O_8. This mine is described by Roberts and Gude and by Meschter. In addition to the W. Wilson, Roberts and Gude describe eight other nearby localities, all along chalcedonic vein zones, that contain anomalous radioactivity. Two of these, the Forty-niner claim and the G. Washington-A. Lincoln claims, have since been explored by underground workings.

G. Washington-A. Lincoln claims

In 1952 an Atomic Energy Commission contract was awarded to the owners for exploration of a moderately radioactive chalcedonic vein zone exposed on the G. Washington and A. Lincoln claims. A crosscut adit, 212 feet long, and two drifts, 102 feet to the northeast and 109 feet to the southwest, have been completed. A raise is now being driven on a strongly radioactive zone within the vein zone.

Forty-niner claim

In September 1951, the Elkhorn Mining Company of Boulder, Montana, after obtaining a lease on the Forty-niner claim and operating under a Defense Minerals Exploration Administration contract, began a crosscut to intersect a moderately radioactive chalcedonic vein zone at a depth of about 220 feet beneath the outcrop. From the attitude of the vein zone at the surface, an intersection with the adit was anticipated at about 250 feet. The crosscut was driven 500 feet (fig. 4) and intersected only a few narrow chalcedonic stringers, none of which contained anomalous radioactivity. None of the stringers could be correlated with the vein zone exposed at the surface.

Lone Eagle mine

The Lone Eagle mine (fig. 3 and 5) on the South Fork of Quartz Creek in sec. 31, T. 8 N., R. 4 W., was originally opened prior to 1900, but there are no records of ore shipments made from the property. In 1948, Dave Nieminen, Morris Nelligan, and A. H. Eiselein of Boulder relocated the claim. Radioactivity was first detected in the mine in 1950, and in 1952 the owners were granted a Defense Minerals Exploration Administration contract to explore a moderately radioactive vein exposed in the old adit.

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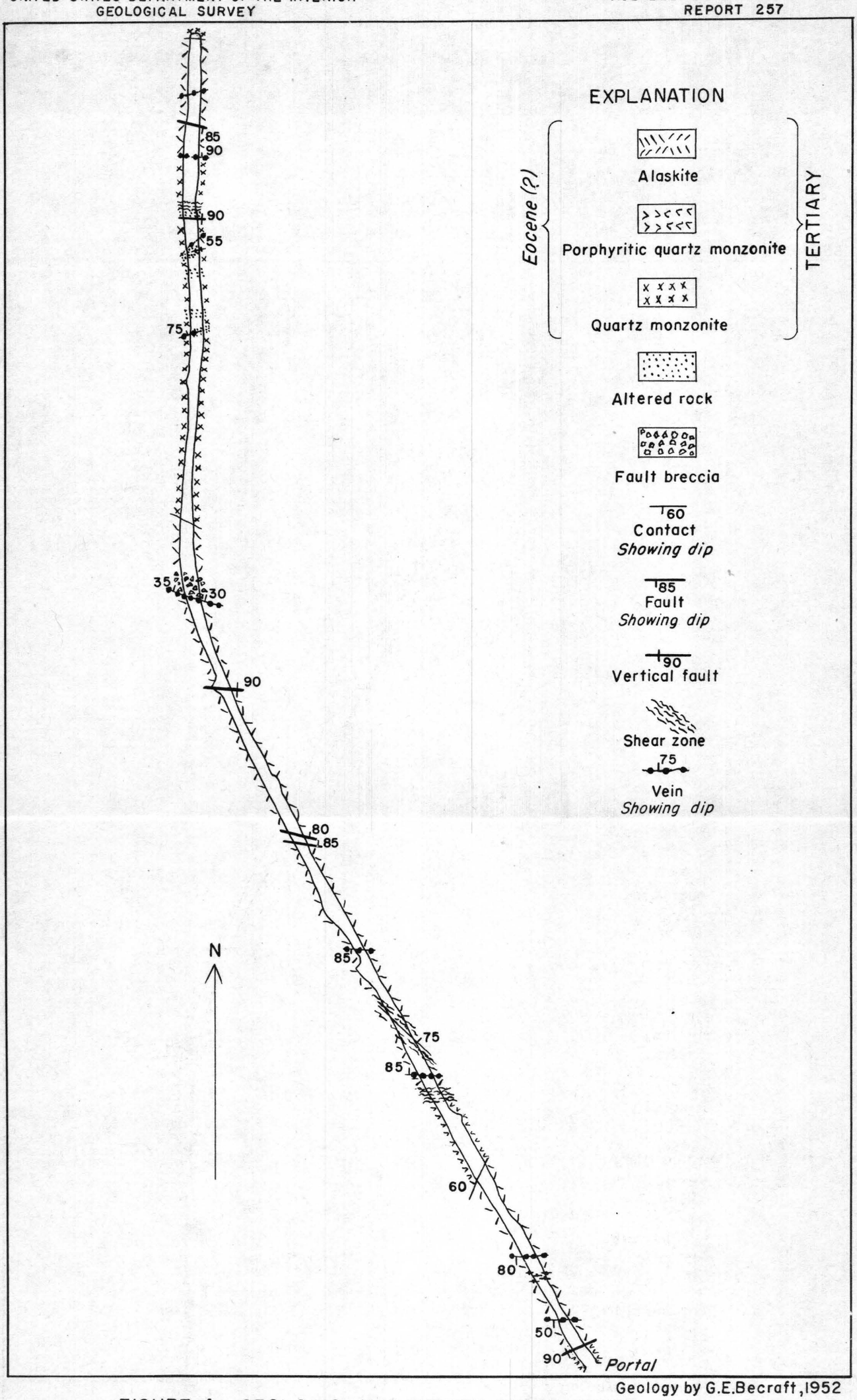

Geology by G.E.Becraft, 1952

FIGURE 4.—GEOLOGIC MAP OF THE FORTY-NINER ADIT, JEFFERSON COUNTY, MONTANA.

40 0 40 80 Feet

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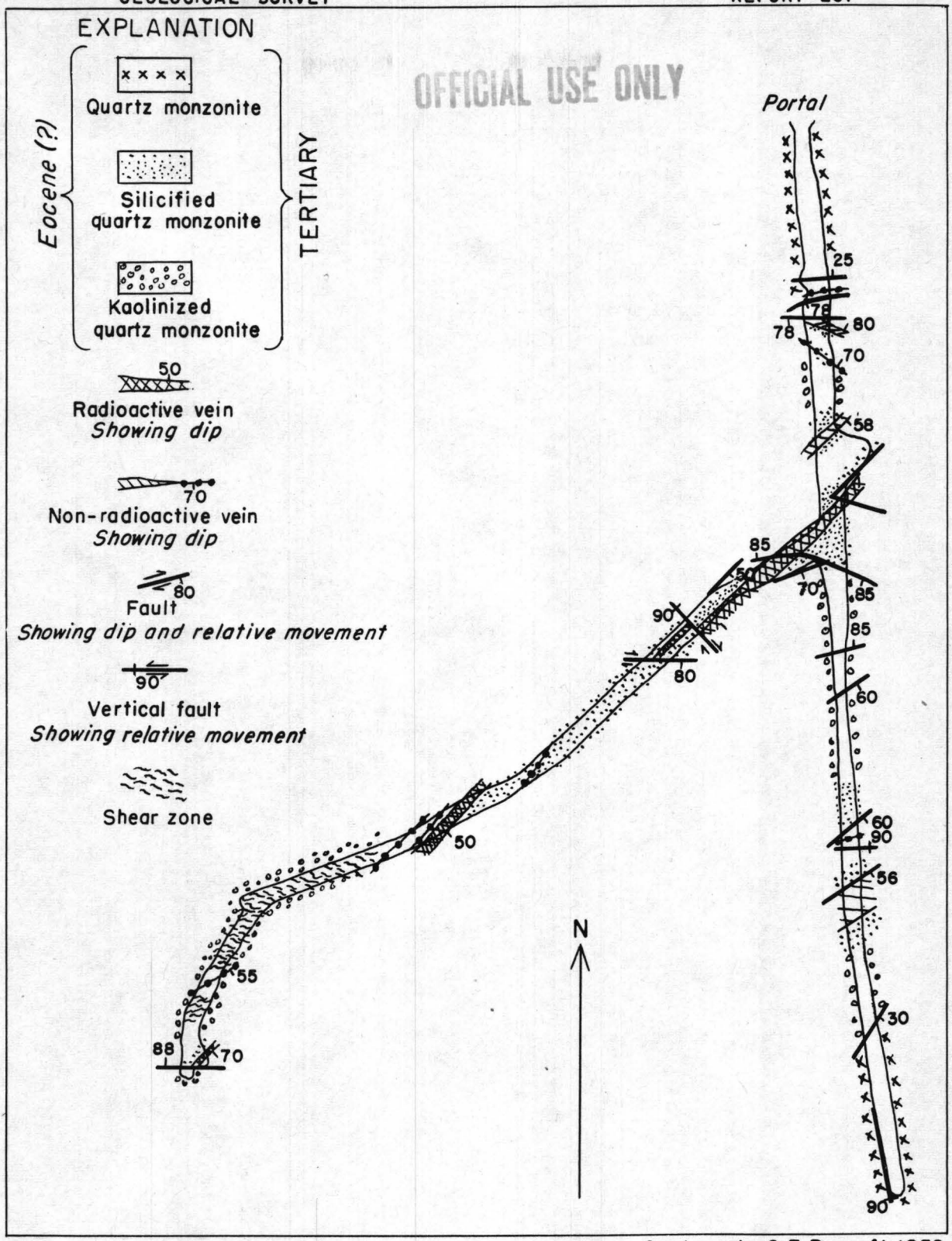

Geology by G.E. Becraft, 1952

FIGURE 5.—GEOLOGIC MAP OF THE LONE EAGLE MINE, JEFFERSON COUNTY, MONTANA.

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The mine is entirely within quartz monzonite. Typically the feldspars are altered to a light-gray to greenish clay and sericite. The quartz monzonite has been silicified adjacent to quartz veins and veinlets; the silicified zones range in width from less than an inch adjacent to the small quartz veinlets near the portal to as much as 25 feet adjacent to the radioactive vein about 110 feet from the portal. Intense faulting and shearing are common in the mine.

The radioactive vein strikes about N. 45° E., dips about 60° SE., and ranges from 1 to 5 feet thick. In the drift about 45 feet from the junction with the crosscut, the vein is faulted a short distance to the northwest by a vertical, northwest-trending fault. The vein is again faulted to the west by an east-west fault at about 55 feet from the crosscut. Southwest from this fault, the drift continues through silicified quartz monzonite and again intersects the vein at about 110 feet. At this point the vein is about three feet wide and strongly radioactive. A few feet beyond this vein, and essentially parallel to it, is a stringer of galena from 1 inch to 3 inches wide that has no anomalous radioactivity. The drift extends to 189 feet in kaolinized and intensely sheared medium-grained quartz monzonite. A crosscut was driven from the end of the drift, and it intersected the vein on the floor of the east wall at 48 feet, where the vein is about a foot wide and strongly radioactive. On the floor, it feathers out upward to several small stringers containing only slight radioactivity. It is again faulted, probably to the west, at 50 feet. This vein is exposed at only one point on the surface.

No uranium minerals were identified, but the radioactivity appears to be confined to a sooty black material, probably pitchblende, which occurs in and adjacent to small, irregular fractures less than 0.1 inch wide in the vein and in intensely altered wall rock adjacent to it. The grade of the ore appears to depend upon the spacing and abundance of these small fractures. The black sooty material locally has the appearance of being disseminated throughout the rock. The relationship of uranium mineralization to the base metal mineralization, which is sporadically distributed along the vein, is not yet known.

A 3-foot chip sample across the vein on the southeast wall of the drift at 130 feet and a one-foot chip sample across the vein at the end of the short crosscut were analyzed by the Trace Elements Section Denver Laboratory. The 3-foot sample contained 0.20 percent equivalent uranium and 0.22 percent uranium; the 1-foot sample 0.51 percent equivalent uranium and 0.66 percent uranium. Geiger counter surveys of the remainder of the vein indicate that the grade over a 2.5 foot width probably averages about 0.20 percent.

The vein is exposed for a total length of 95 feet (fig. 5) and averages about 2.5 feet thick. No information is available as to the downward or lateral extent of the vein beyond the present workings.

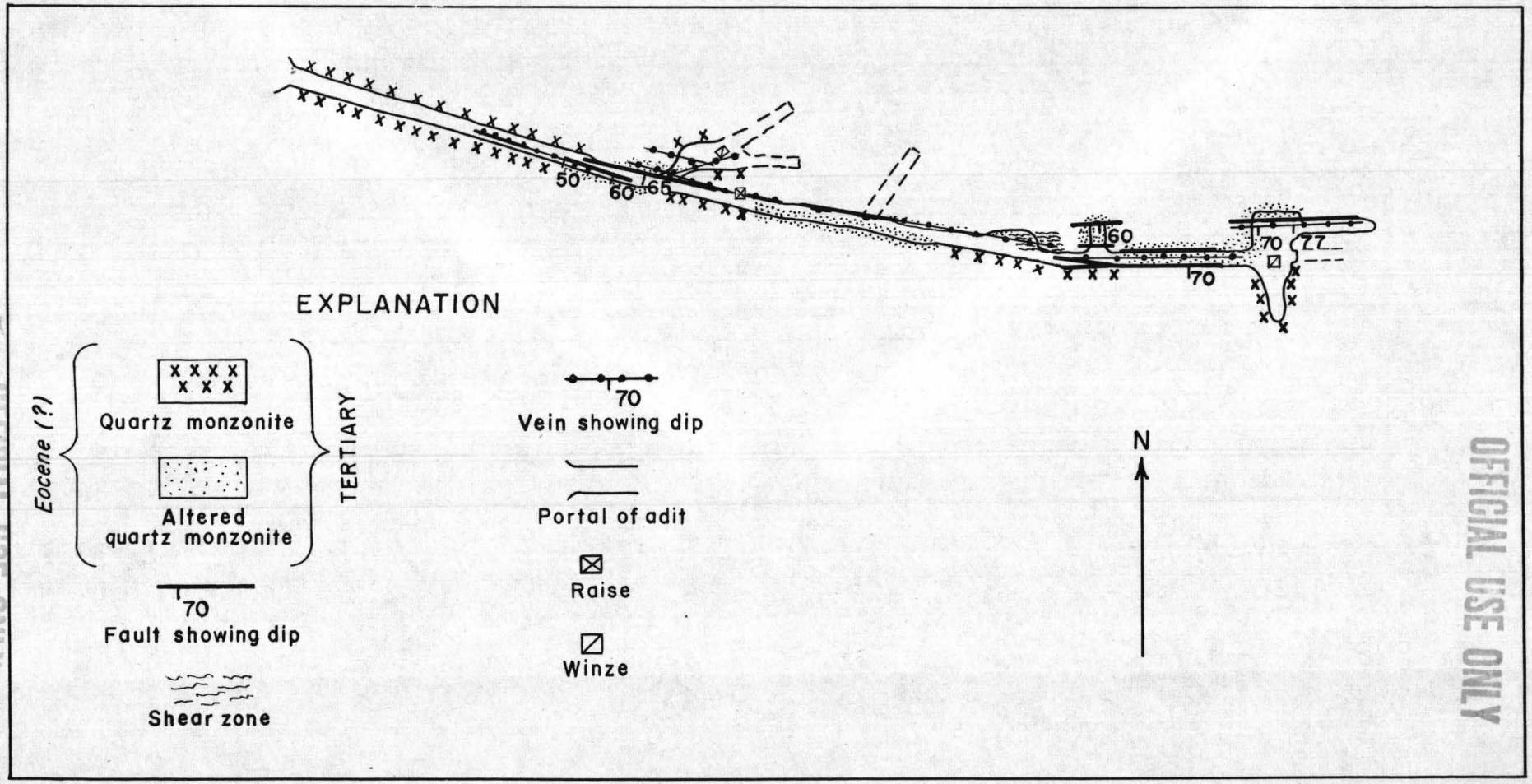
Mineral Hill mine

The Mineral Hill mine (fig. 3) in sec. 14, T. 8 N., R. 4 W. was originally opened about 1933. Reportedly a few tons of low-grade silver-gold ore was shipped. In 1952 anomalous radioactivity was detected on the dump by E. C. Miles of Helena, Montana. The mine was reopened by Miles to permit access to the mine for people seeking alleviation or cure of arthritis and related ailments. Several highly radioactive samples were found on the dump during the present survey, but these samples probably did not come from this mine.

The mine comprises a 280-foot adit, several short crosscuts, a 22-foot raise, and two flooded, shallow winzes (fig. 6). The adit follows a 2-to 6-inch chalcedonic quartz stringer in moderately altered quartz monzonite. The vein is localized along faults that in places have as much as three inches of gouge along them. The strongest radioactivity--0.21 mr/hr on a scintillation detector--was found in gouge and brecciated vein material in the large room near the winze. There are no indications that any commercial ore bodies will be found along this strucuture.

Sec. 1, T. 8 N., R. 4 W.

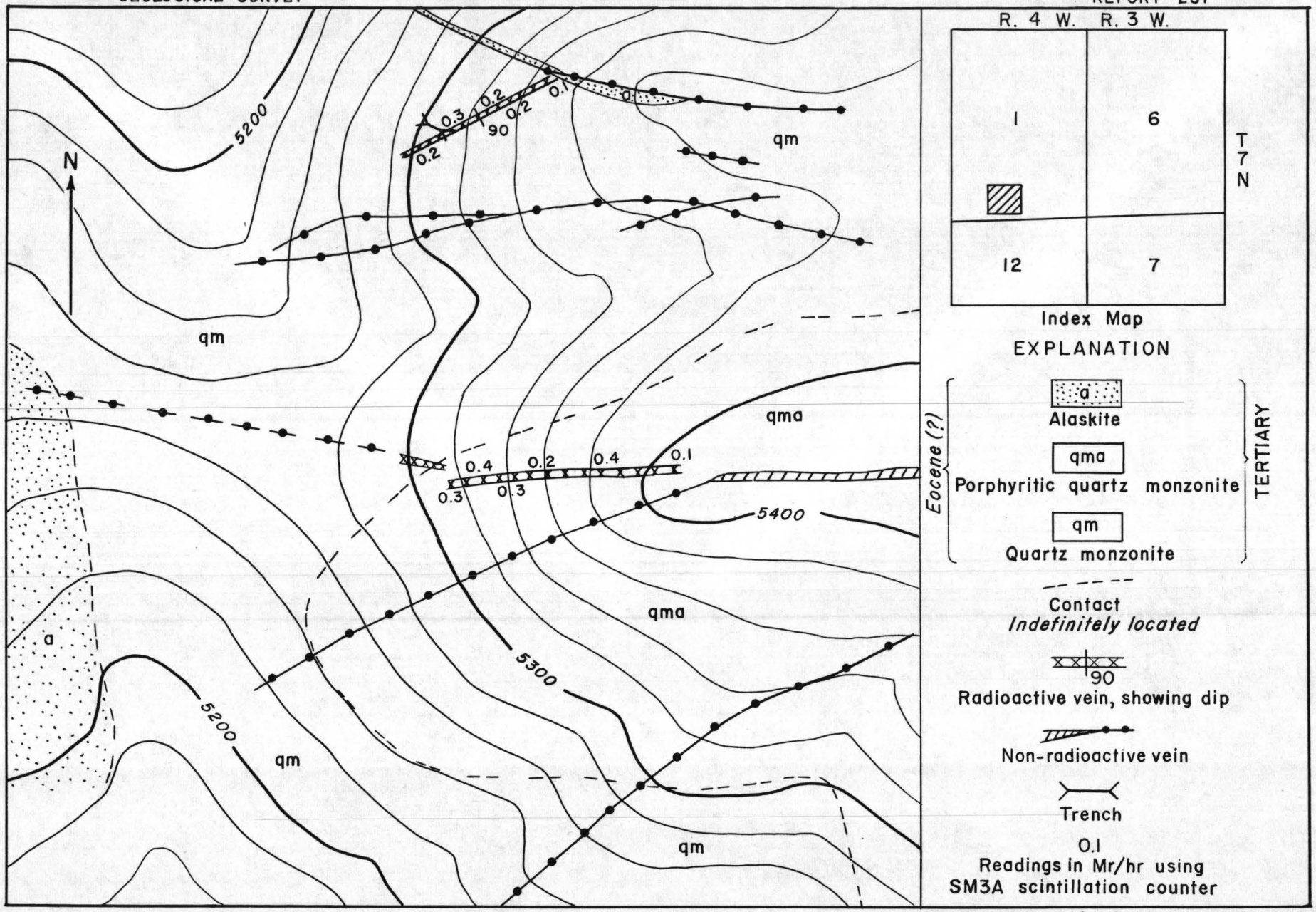
Anomalous radioactivity was detected along two chalcedonic vein zones at the top of the ridge near the southern margin of sec. 1, T. 8 N., R. 4 W. (fig. 3). Figure 7 is a large-scale map of the surface showing readings obtained on a scintillation detector.



Geology by G. E. Becraft and S. Rosenblum, 1952.

FIGURE 6.—GEOLOGIC MAP OF THE MINERAL HILL MINE, JEFFERSON COUNTY, MONTANA.

40 0 40 Feet



Geology and topography by G. E. Becraft, 1952.

FIGURE 7–GEOLOGIC MAP OF PART OF SEC. 1, T8N, R4W, JEFFERSON COUNTY, MONTANA.

200 0 200 Feet

Contour interval 20 feet
Datum is mean sea level

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The northern radioactive vein zone is 3 to 5 feet wide and comprises a few dark-gray chalcedonic stringers as much as 2 inches wide in intensely silicified quartz monzonite. The radioactivity is strongest in a small trench near the western end of the vein zone. No uranium minerals were recognized. Mr. Wayne Hinman, Clancey, Montana, has located a claim that includes this vein zone.

The southern radioactive vein zone, about 8 to 10 feet wide, comprises a few tan to dark-gray chalcedony veinlets in intensely silicified porphyritic quartz monzonite. Anomalous radioactivity was detected over a distance of 400 feet. Two secondary uranium minerals, tentatively identified as metatorbernite, $Cu(UO_2)_2(PO_4^+)_2 \cdot 8H_2O$ and uranophane, $Ca(UO_2)_2 Si_2O_7 \cdot 6H_2O$, were found in altered porphyritic quartz monzonite near the western end of the zone. Two samples analyzed by the Trace Elements Section Denver Laboratory contained 0.17 percent equivalent uranium, 0.14 percent uranium; and 0.15 percent equivalent uranium, and 0.12 percent uranium. The first sample was intensely altered porphyritic quartz monzonite with several small, dark-gray chalcedonic stringers.

The strength of the radioactivity and the results of the two analyses indicate that these chalcedonic zones might be considered for exploration.

Other localities

Several other small areas of weak anomalous radioactivity are indicated on figure 3. These anomalies are all associated with chalcedonic zones, and no uranium minerals were detected.

CONCLUSIONS

The areal mapping in the Clancy Creek area and in the Comet area near Boulder, Montana (Becraft, 1953) indicates that the chalcedonic zones have a predomianatly northeasterly trend and occur principally in broad bands which also have a northeasterly trend and appear to have a close spatial relationship with areas of abundant alaskite bodies. The anomalous radioactivity associated with these chalcedonic vein zones, with rare exceptions, occurs in regions of a few square miles extent in both the Comet and Clancy Creek areas; and accordingly these areas appear to be most favorable for prospecting for uranium.

LITERATURE CITED

Becraft, George E. 1953, Preliminary report on the Comet area, Jefferson County, Montana: U. S. Geol. Survey Circ. 277.

Billingsley, Paul, 1915, The Boulder batholith of Montana: Am. Inst. Min. Met. Eng. Trans., vol. 51.

Billingsley, Paul, and Grines, J. A., 1918, Ore deposits of the Boulder batholith of Montana: Am. Inst. Min. Met. Eng. Trans. vol. 58.

Knopf, Adolph, 1913, Ore deposits of the Helena mining region, Montana: U. S. Geol. Survey Bull. 527.

Pardee, J. T., and Schrader, F. C., 1933, Metalliferous deposits of the greater Helena mining region, Montana: U. S. Geol. Survey Bull. 842.

Roberts, W. A., and Gude, A. J., III, 1953, Uranium-bearing deposits west of Clancey, Jefferson County, Montana: U. S. Geol. Survey Bull. 988-F.

UNPUBLISHED REPORT

Meschter, D. Y., August 1953, The geology and mineralogy of the W. Wilson mine near Clancey, Jefferson County, Montana: U. S. Geol. Survey Trace Elements Inv. Rept. 256.

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RESERVES

In 1952 the W. Wilson mine was the only mine in the Clancy Creek area that was yielding uranium ore, and 125 tons ranging in grade from about 0.3 percent U_3O_8 to 1.1 percent U_3O_8 had been shipped by the end of the year. Exploration for uranium was carried out in 1952 at three other mines--the G. Washington-A. Lincoln, Forty-niner, and Lone Eagle, but no ore was shipped.

Because we do not yet know enough about the size, shape, and grade of known ore bodies, nor enough about the spatial occurrence of ore bodies along a radioactive vein, the economic potential and reserves for the Clancy area are not known.

Detailed studies of the mine workings in the W. Wilson mine and the Lone Eagle mine have provided enough data, however, to yield preliminary estimates of reserves of uranium.

In the Lone Eagle mine a radioactive vein, averaging about 2.5 feet thick, is exposed for a total length of 95 feet. Chemical and radiometric determinations of uranium indicate that the ore averages about 0.20 percent U. It is estimated that this deposit contains about 3,750 tons of indicated and inferred ore, or 7.5 tons of uranium. This calcuation assumes a block of indicated ore with a vertical extent equal to the exposed length; also a block of inferred ore, equal in size, is believed to exist. An additional 5,000 tons of ore (10 tons of uranium), or more, is thought to be geologically probable, for it is believed that the vein, at adit level, extends laterally beyond the present limits of the mine workings.

The reserves at the W. Wilson mine have been estimated by Meschter. He estimates that the east ore shoot in the mine is about 60 feet high and that it contains about 175 tons of 0.3 percent U_3O_8, or about 1,100 pounds of U_3O_8. Probably additional ore bodies, similar in grade, will be found.

PLANS

The geology of about 75 square miles adjacent to the Clancey area and near the Boulder-Comet area will be mapped during fiscal year 1954 as part of the uranium studies. This area is underlain almost entirely by rocks of the batholith and is known to contain several radioactive base and precious metal deposits (Josephine and Bullion; weak radioactivity at a few mines in Rimini district). Also it is anticipated that radioactive reefs of the Clancey type may be found in the northern part of the area. The remainder of the Jefferson City quadrangle (about 70 square miles) will be mapped during fiscal year 1954 without AEC funds. In addition, detailed petrologic studies will be continued. These will include studies of distribution of uranium in different types of intrusive rocks, of petrologic variations in the batholith and related igneous rocks, and of alteration associated with different types of mineral deposits.