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TESTING FOR DOWNWARD VEIN EXTENSIONS OF  
GOLD-SILVER MINERALIZATION IN THE WOLF  
CREEK-FAIRBANKS CREEK DIVIDE AREA,  
FAIRBANKS DISTRICT, ALASKA

by Robert S. Warfield

\* \* \* \* \* open-file report

UNITED STATES DEPARTMENT OF THE INTERIOR  
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by

Robert S. Warfield<sup>1</sup>

INTRODUCTION AND SUMMARY

During the summer field season of 1967, the Bureau of Mines core-drilled two holes on the Keystone properties near the Fairbanks Creek-Wolf Creek divide in the Pedro Dome-Cleary Summit area; this location is about 20 miles N. E. of Fairbanks, (figure 1). The purpose of the drilling was to test at depth the continuity of gold, silver, and base metal (mainly lead and antimony) mineralization that has recently been mined by opencut and relatively shallow underground methods. The two holes were drilled vertically to depths of 716.6 feet and 690 feet. Assays of samples from each hole established that gold, silver, and base metal mineralization is present at depth, although grade was fairly low.

GEOLOGY

The geology of the Fairbanks district is described in a number of publications, the most recent of which is an open-file report<sup>2/</sup> by the

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<sup>2/</sup> Forbes, R.B., H.D. Pilkington, and Daniel B. Hawkins, Gold Gradients and Anomalies in the Pedro Dome-Cleary Summit Area, Fairbanks District, Alaska. Geological Survey open-file report, August 30, 1968. 43 pp.

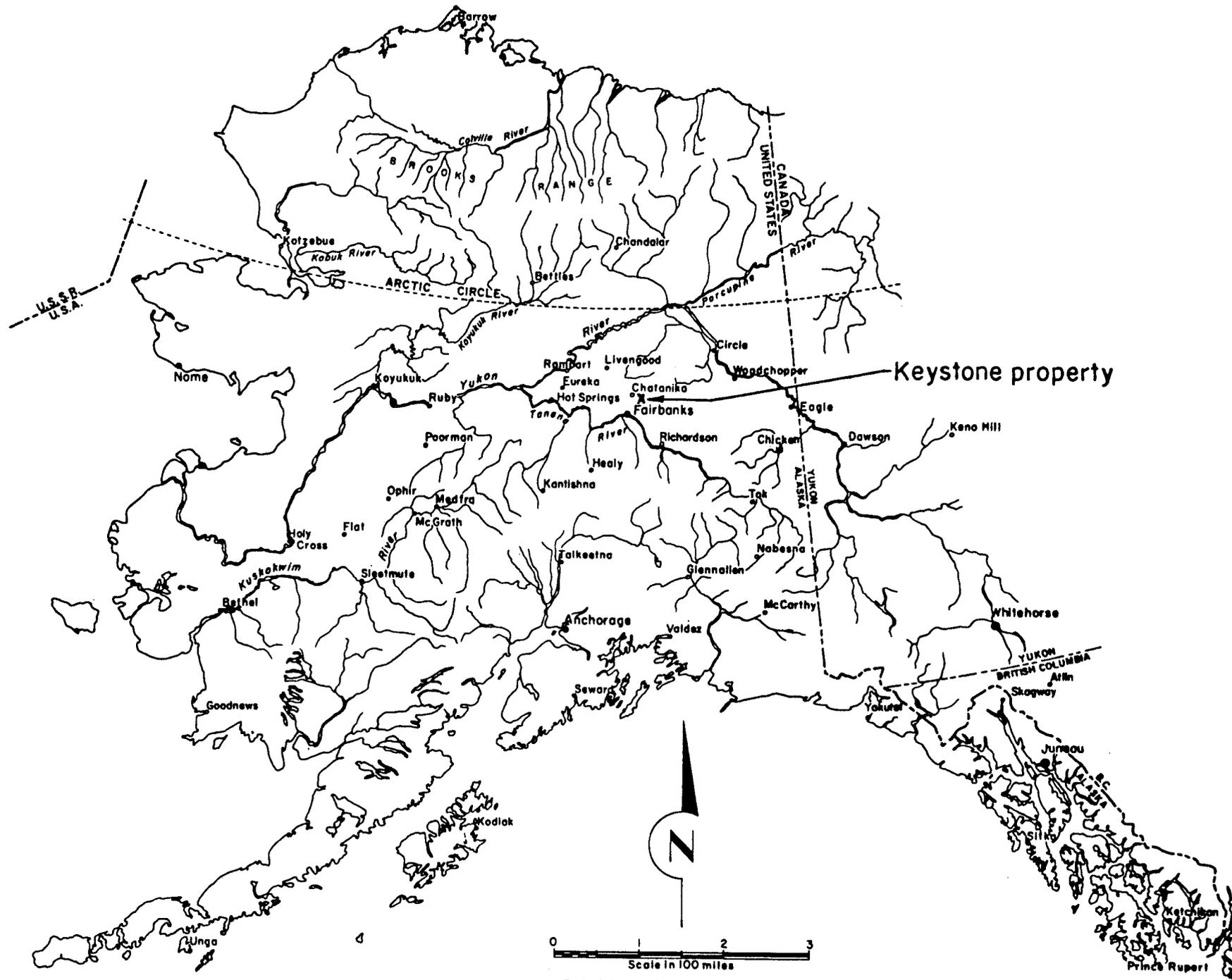


FIGURE I.- Index map of Alaska

U. S. Geological Survey that describes heavy metal (gold) investigations in the Pedro Dome-Cleary Summit area. Another comprehensive publication is, "Geological Survey Bulletin 849-B." <sup>3/</sup> The very brief geologic description presented herein is summarized mainly from these publications.

The Keystone properties, as is most of the Fairbanks district, are underlain by Precambrian metamorphic rocks that are known as the Birch Creek Schist. The schists have been intruded by small quartz diorite and quartz monzonite plutons in the Pedro Dome-Cleary Summit area. Metalliferous deposits occur in both the metamorphic and intrusive rocks, and four distinct phases of mineralization have been recognized. Phase 1 is characterized by barren quartz veins. Phase 2 consists of quartz arsenopyrite-pyrite gold veins which cut both the schists and altered quartz monzonite intrusives. Most of the high-grade lodes of the district are of the phase 3 type, and characteristically contain quartz-stibnite-gold + arsenopyrite and sulfosalts. The Kawalita and Jamesonite veins of the Keystone properties belong to the phase 3 type mineralization. The host rocks are typically quartz mica schist or micaceous quartzite. The phase 4 type of mineralization consists of quartz and stibnite, with little or no gold.

The Pedro Dome-Cleary Summit-Fairbanks Creek area, within which the Keystone properties lie, is coincident with an anticline. The recent work of Forbes, Pilkington, and Hawkins <sup>3/</sup> indicates that, "the anticlinal structure may be confined to rocks composing the upper plate of

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<sup>3/</sup> Hill, James M., "Lode Deposits of the Fairbanks District, Alaska." Geological Survey Bull 849-B, 1933, 163 pp.

<sup>4/</sup> Work Cited in Footnote 2.

a thrust which overrides an older basement complex of higher-grade and more complexly deformed rocks. Mineralization appears to be rare to absent in the rocks of the older complex." The anticlinal structure is intricately cut by a double series of closely spaced faults, some of which are of considerable magnitude. The main fractures trend easterly and the less conspicuous faults strike nearly north.

Measured angles of foliation in the drill holes, and on the surface in the near vicinity of the drill holes, range from horizontal to 60°; the more flat foliation is the most common. The Kawalita and Jamesonite veins strike about S 20° E, and dip 45° S with no apparent relationship to host rock foliation. These foliations, dip, and strike measurements are within a range common to this part of the district.

#### MINING HISTORY

A historical resume of mining and development is given for only that part of the Keystone properties adjacent to the core-drilled area. This includes mining of the Homestake, Kawalita, and Jamesonite veins. Other past lode mining on the Keystone properties and in the Fairbanks district has been well documented.<sup>5/</sup>

The principal development of the Homestake mine is a southward directed crosscut tunnel, about 800 feet in length and about 1500 feet of east and west drifts, turned on the Homestake vein about 350 feet from the crosscut portal. These workings, driven prior to 1931, reportedly pro-

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<sup>5/</sup> Work cited in footnote 3.

dured about \$60,000.00 of \$20.67 per fine oz of gold from development and stopes on the narrow vein. The vein is described as extremely rich in spots, but was never worked below tunnel level because of a heavy inflow of water. [U.S.G.S. Bull. 849-B, pp 101-102] The Homestake portal is now, 1969, caved and the workings inaccessible.

In 1963, following several years of surface work and minor underground work which produced some gold from the Kawalita vein, Keystone Mines Inc. applied for and received an OME (Office of Mineral Exploration) loan to further explore the prospect. Under the OME contract, an inclined shaft was extended from the previously driven 50-foot level to the 147-foot level. Water and heavy ground were encountered a short distance below the 50-foot level, which became increasingly troublesome as the work progressed. This condition caused some of the drift on the 147-foot level to be driven in the footwall with occasional probes to examine and sample the vein, and ultimately caused stoppage of the exploration in late 1965. The workings now, 1969, are flooded and inaccessible.

During the term of the OME contract, and on into 1966, productive mining was carried on from the surface by underhand stoping methods, and from the 50-foot level upward. A small amount of ore from the OME work also was milled.

In the late fall of 1966, surface exploration of the Jamesonite vein, to the east of the Kawalita workings, exposed lead-antimony-silver ore (principally jamesonite) in a vein ranging in width from 2 feet to 6 feet, and averaging about 4 feet. Approximately 400 feet of strike length was stripped and readied for open-cut mining, and some additional strike length

was indicated by surface evidence. Subsequently, some ore was open-cut mined, hand-sorted, and at least one shipment made to the Selby, California smelter. Still later flotation, grinding, and classification equipment were added to the old Cleary stamp mill, and at least one small shipment of concentrates was made. Only a very small amount of mining was done on the Jamesonite vein during 1968.

#### BUREAU OF MINES WORK

Core drilling on the Keystone properties consisted of two vertically drilled holes, the purpose of which was to test continuity to depth of the Jamesonite and Kawalita veins. Hopefully, proof of continuity would provide the necessary incentive for private enterprise to re-open and extend the Homestake crosscut to intersections with the Jamesonite and Kawalita veins. Thus, low-level drainage and a haulageway would be established.

Hole 1, drilled to a depth of 714 feet, was located about 350 feet south of the Jamesonite vein open-cut, and was designed to intersect the vein at about 420 feet of hole depth. Hole 2, located 420 feet south of the Kawalita shaft, was designed to intersect the Kawalita vein at about 520 feet; this hole had a total length of 690 feet. Figure 2 shows the locations of the drill holes, mine workings, and other surface features. Figures 3 and 4, sections through each drill hole, show some assays and adjacent mine workings.

Assays of samples from each hole established that gold, silver, and base metal mineralization are present at several intervals in each hole,

although grade was fairly low. The assay data from either hole does not clearly indicate intersections with the Jamesonite or Kawalita veins.

Several possible reasons for this follow:

1. Dip of the veins steepened to an angle where the holes were not deep enough to obtain an intersection.
2. Assay values decreased with depth.
3. Due to poor core and sludge recovery, the veins were not clearly recognizable, either from assay data or visual logging.
4. The drill holes may have intersected relatively barren zones of each vein. From previous mining experience, each vein is known to contain relatively barren zones.

Drill hole 1 intersected an apparently major fault at about 680 feet of hole depth. From 682 feet to 692 feet, no core was recovered and the material recovered on either side of this interval was a soft clayey gouge. Since this was the only intersection of the fault, no estimate of its attitude is possible.

All core was logged at the drilling site by Dr. H. Dean Pilkington, Associate Professor, Dept. of Geology, University of Alaska, who was working under a University contract from the U. S. Geological Survey on a heavy metals program which included detailed geologic mapping and sampling of parts of the Fairbanks lode gold belt. Upon completion of the drilling, all cores and sludges were shipped to the Bureau of Mines laboratory in Juneau, where the cores were re-logged and sampled. Only minor changes and additions were made to the original logs. The core

sampling method consisted of placing the entire core into a given sample, except a very small representative segment which was split; half of the split was placed in the sample, the other half retained in a skeleton core representation of the drill hole on file in the Bureau's Juneau core library. At the time of re-logging and sampling, all cores were black-lamped; no fluorescent minerals were detected, except occasional calcite and fluorescent grease used in the drilling process. Cores were also tested with a Geiger counter, but no radioactivity above background was detected. The samples were prepared for assay in a normal manner, except that two pulps were made for selected footages of each drill hole. The second pulp was prepared at the request of Dr. Pilkington and was returned to Fairbanks, where gold analysis of each sample was made by the atomic absorption method.

The Bureau of Mines laboratory in Juneau fire assayed for gold and silver core samples for all of hole 2, and a number of selected samples from hole 1. Some sludge samples were fire assayed for gold and silver, especially drill hole intervals where core recovery was poor. In addition, base metal assays by wet chemical methods were made on a number of selected samples. Selection of samples for base metal assay was based on the drill-hole logs and, in some instances, on a subjective spectroscopic estimate made by the Bureau's petrographer. A combined table of drill logs and assays (both fire and atomic absorption gold) is presented in the appendix.

Core recovery was poor and drilling conditions difficult throughout large intervals of hole 1. At least some of the poor core recovery, and

perhaps a large part, were attributable to mechanical problems with the wire-line drilling equipment used. Prior to drilling hole 2, certain additions were made to the wire-line equipment which solved most of the mechanical problems. This, coupled with somewhat better drilling conditions, led to relatively good core recovery throughout hole 2.

Sludges were collected for all hole footages from which there was a sludge return. Collection was in a sluicelike container, 12 feet long by 12 inches wide by 12 inches deep, set at a very flat grade to permit quiescent settlement of drill cuttings before overflow of the clarified water at the outlet end of the box. Upon completion of a drilling run, a system of gradual decantation of the sludge box was used until the thickened sludge sample was collected directly through the bottom of the box into a washtub. The washtub containing the sample was transferred to a large low-sided baking pan for air drying. Each sludge collection coincided with a core run, except occasionally, when very short core runs were made several sludges were combined.

In each hole, after only a few feet of drilling, circulation was either totally lost or markedly reduced. A number of systems were tried in attempts to regain circulation. These included circulation of a bentonite mud solution, batch additions of thick bentonite mud, additions of sawdust, additions of grain bran, and additions of detergent. But circulation apparently was never totally regained, and probably did not average more than 50 percent return. For this reason, and also because some classification and disproportionate loss of heavy materials undoubtedly

occured during ascent of the cuttings in the drill hole, sludge samples were not representative. Assays of sludge samples are considered no more than indicative, and no attempt was made to correlate sludge assays with core assays.

Drilling was accomplished under a contract which specified the use of wire-line drilling equipment. All drilling, with the exception of the lower 88 feet of hole 1, was BX (1 5/8" core): the lower 88 feet of hole was AX (1 1/8" core). Hole 1 was collared June 30, 1967 and completed August 12. Hole 2 was collared August 21 and completed September 5.

The drill used by the contractor was gasoline engine driven, skid mounted, and had a hydraulic swivel-head with 2-foot feed capacity. The spindle bore of the head was of sufficient diameter to pass BX wire-line drill rods, so that the inner tube of the wire-line core barrel could be inserted and retrieved directly through the head of the machine. A separate air-cooled, gasoline engine driven, wire-line hoist was used for retrieving the inner tube of the core barrel. A timber tripod, with clearance enough for pulling 20-foot lengths of drill rods, was erected over each hole. All drilling water was truck-hauled to the drill sites. The pump used for fluid circulation in the drill holes was of the Moyno type, and was air-cooled, gasoline engine driven.





Table 1. - Loss and assays, Diamond-drill hole 1. - Keystone property Mt.

| Description |       | Core  |       |               |         |                   |                |       |          |       |        |         | Sludge   |                 |       |                |                   |            |          |         |        |         |     |          |
|-------------|-------|---|-------|---------------|---------|-------------------|----------------|-------|----------|-------|--------|---------|----------|-----------------|-------|----------------|-------------------|------------|----------|---------|--------|---------|-----|----------|
| Depth, feet |       | Sample interval   |       | Core recovery |         | Atomic absorption | Fire assay     |       | Percent  |       |        |         | p. p. m. | Sample interval |       | Dry weight     | Atomic absorption | Fire assay |          | Percent |        |         |     | p. p. m. |
| From        | To    | From  | To    | Feet          | Percent | Ounces per ton    | Ounces per ton | Lead  | Antimony | Zinc  | Copper | Arsenic | From     | To              | grams | Ounces per ton | Ounces per ton    | Lead       | Antimony | Zinc    | Copper | Arsenic |     |          |
|             |       |   |       |               |         | Gold              | Gold           |       |          |       |        |         |          |                 |       | Gold           | Gold              |            |          |         |        |         |     |          |
| 324.5       | 330.1 | Same with foliation inclined about 10 degrees. Small vein filled with calcite and a gray sulfide at 328.0 feet.           | 324.5 | 330.1         | 5.5     | 98                |                | N11   | N11      |       |        |         |          |                 |       |                |                   |            |          |         |        |         |     |          |
| 330.1       | 337.0 | Silvery gray micaceous layers intercalated with quartzite.  | 330.1 | 337.0         | 3.1     | 45                |                |       |          |       |        |         |          |                 |       |                |                   |            |          |         |        |         |     |          |
| 337.0       | 339.4 | Gray quartz mica schist, minor pyrite and stibnite.   | 337.0 |               | 4.5     | 69                |                | N11   | N11      |       |        |         | 339.4    | 343.5           | 2,118 |                | N11               | N11        |          |         |        |         |     |          |
| 339.4       | 343.5 | Same, considerable vein quartz and pyrite.  |       | 343.5         |         |                   |                |       |          |       |        |         |          |                 |       |                |                   |            |          |         |        |         |     |          |
| 343.5       |       | Silicified quartz mica schist with disseminated sulfides in the upper 1.0 ft.   | 343.5 | 344.5         | 1.0     | 100               |                | 0.005 | N11      |       |        |         |          |                 |       |                |                   |            |          |         |        |         |     |          |
|             | 348.4 |   | 344.5 |               | 6.3     | 96                |                | 0.005 | N11      |       |        |         |          |                 |       |                |                   |            |          |         |        |         |     |          |
| 348.4       | 351.1 | Same with minor disseminated sulfides throughout.   |       | 351.1         |         |                   |                |       |          |       |        |         |          |                 |       |                |                   |            |          |         |        |         |     |          |
| 351.1       |       | Same  | 351.1 | 356.1         | 2.9     | 58                |                | .0023 | N11      | Trace |        |         |          |                 |       |                |                   |            |          |         |        |         |     |          |
|             | 361.1 |   | 356.1 |               | 2.9     | 58                |                | .0012 | N11      | N11   |        |         |          |                 |       |                |                   |            |          |         |        |         |     |          |
| 361.1       | 365.3 | Light gray quartz mica schist with no observed sulfides.  | 361.1 | 365.3         | 3.8     | 90                |                | .0012 | N11      | N11   |        |         |          |                 |       |                |                   |            |          |         |        |         |     |          |
| 365.3       | 369.5 | Schist with segregation masses of quartz with sulfides concentrated along the selvages, up to 1 percent.                  | 365.3 | 369.5         | 4.2     | 100               |                | .0023 | 0.002    | N11   | <0.01  | 0.02    | 0.10     |                 |       |                |                   |            |          |         |        |         |     |          |
| 369.5       | 375.1 | Same with minor quartz vein cutting the flat-lying foliation.   | 369.5 | 375.1         | 5.6     | 100               |                | .0012 | 0.008    | 0.02  |        |         |          |                 |       |                |                   |            |          |         |        |         |     |          |
| 375.1       | 377.4 | Schist with segregation masses of quartz  | 375.1 | 377.4         | 1.3     | 57                |                | -     | N11      | 0.13  |        |         |          |                 |       |                |                   |            |          |         |        |         |     |          |
| 377.4       | 381.5 | Silvery gray phyllitic schist, foliation inclined at 20 degrees.  | 377.4 |               | 4.3     | 74                |                |       | N11      | 0.06  |        |         | 377.4    |                 |       |                |                   |            |          |         |        |         |     |          |
| 381.5       | 383.2 | Black "graphitic" schist with disseminated sulfides.  |       | 383.2         |         |                   |                |       |          |       |        |         |          | 383.2           | 937   |                | 0.005             | Trace      |          |         |        |         |     |          |
| 383.2       | 388.1 | Gray-green micaceous quartzite with minor disseminated sulfides, longitudinal calcite stringer fluoresced red.            | 383.2 | 388.1         | 4.9     | 100               |                | -     | N11      | N11   |        |         | 383.2    |                 |       |                |                   |            |          |         |        |         |     |          |
| 388.1       | 390.5 | Same  | 388.1 | 390.5         | 0.4     | 17                |                | -     | N11      | N11   |        |         |          | 487             |       |                | N11               | 0.1        |          |         |        |         |     |          |
| 390.5       | 393.5 | Light gray quartz mica schist with one mass of segregation quartz and pyrite along its selvages.                          | 390.5 | 393.5         | 2.5     | 83                |                | -     | N11      | 0.10  |        |         |          | 390.5           |       |                |                   |            |          |         |        |         |     |          |
| 393.5       | 400.7 | Same  | 393.5 | 400.7         | 0.5     | 07                |                | -     | 0.008    | 0.04  |        |         | 393.5    | 400.7           | 4,481 |                | 0.01              | Trace      |          |         |        |         |     |          |
| 400.7       | 403.6 | Same with foliation inclined at 20 degrees and containing some disseminated pyrite.                                       | 400.7 |               |         |                   |                |       |          |       |        |         | 400.7    |                 |       |                |                   |            |          |         |        |         |     |          |
| 403.6       | 406.5 | Same, but no sulfides.  |       |               | 6.1     | 62                |                |       |          |       |        |         | 406.5    | 1,491           |       | 0.01           | Trace             |            |          |         |        |         |     |          |
| 406.5       | 410.6 | Gray silicified schist with 1-2 percent disseminated sulfides.  |       | 410.6         |         |                   |                |       |          |       |        |         |          |                 |       |                |                   |            |          |         |        |         |     |          |
| 410.6       | 413.3 | Sheared and altered schist with minor sulfides.   | 410.6 | 413.3         | 1.8     | 67                |                |       |          |       |        |         | 410.6    | 413.3           |       | 0.004          | 0.02              | 0.99       | 0.05     | 0.19    | 0.13   | N11     |     |          |
| 413.3       | 415.5 | Schist with 1.0 foot quartz vein, considerable disseminated sulfides--mostly pyrite.                                      | 413.3 | 415.5         | 1.3     | 59                |                | 0.01  | Trace    |       |        |         | 413.3    | 415.5           |       | 0.003          | 0.02              | 0.85       | 0.12     | 0.17    | 0.15   | N11     |     |          |
| 415.5       | 417.4 | Sheared and altered schist, but more silicified and about 3 percent sulfides only one nubbin core recovered--not sampled. | 415.5 | 417.4         | 0.2     | 11                |                |       |          |       |        |         | 415.5    | 417.4           |       | 0.003          | 0.015             | 0.75       | 0.05     | 0.15    | 0.11   | N11     |     |          |
| 417.4       | 420.0 | No core.  | 417.4 | 420.0         | 0.0     | 0.0               |                |       |          |       |        |         | 417.4    | 420.0           |       | 0.002          | 0.01              | 0.56       | 0.07     | 0.15    |        |         |     |          |
| 420.0       | 421.6 | Gray quartz mica schist with small vein of quartz pyrite.   | 420.0 |               | 3.2     | 56                |                | 0.01  | 0.42     | 0.14  | 0.12   |         | 420.0    | 421.6           |       | 0.003          | 0.01              | 0.58       | 0.07     | 0.17    |        |         |     |          |
| 421.6       | 425.7 | Gray quartz mica schist with considerable disseminated pyrite, minor lead antimony sulfides.                              |       | 425.7         |         |                   |                |       |          |       |        | 10,800  | 421.6    | 425.7           |       | 0.002          | 0.01              | 0.31       | 0.03     | 0.15    |        |         |     |          |
| 425.7       | 428.3 | Same  | 425.7 | 428.3         | 1.9     | 73                |                | 0.06  | 0.68     | 0.58  | 1.58   | 30,000  | 425.7    | 428.3           |       | 0.001          | 0.02              | 0.50       | 0.15     | 0.18    | 0.20   | N11     |     |          |
| 428.3       | 429.8 | Gray quartz mica schist with very minor sulfides, foliation nearly horizontal.  | 428.3 | 429.8         | 1.2     | 80                |                | 0.008 | 0.08     | <0.01 | 0.02   | 0.2     | N11      | 428.3           | 429.8 |                | 0.001             | 0.02       | 0.61     | 0.15    | 0.17   | 0.16    | N11 |          |
| 429.8       | 440.0 | Gray quartz mica schist with very minor sulfides.   | 429.8 | 444.0         | 7.7     | 54                |                |       |          |       |        |         | 429.8    | 433.0           | 5,686 |                | 0.005             | 0.28       | <0.01    | 0.09    | 0.12   | N11     |     |          |
| 444.0       | 451.4 | Gray quartz mica schist with no observable sulfides, 0.5 feet quartz vein at 445 feet--minor pyrite in quartz vein.       | 444.0 | 451.4         | 3.2     | 43                |                |       | N11      | 0.18  |        |         | 444.0    | 451.4           | 2,096 |                | 0.01              | 0.17       | <0.01    | 0.10    |        |         |     |          |
|             |       |   |       |               |         |                   |                |       |          |       |        |         | 440.7    | 444.0           | 2,902 |                | 0.01              | 0.13       | <0.01    | 0.06    |        |         |     |          |











