Circular 67

GEOLOGY AND GEOCHEMICAL SURVEY OF A MOLYBDENUM DEPOSIT NEAR NOGAL PEAK, LINCOLN COUNTY, NEW MEXICO

by ***GEORGE B. GRISWOLD***
and ***FAZLOLLAH MISSAGHI***

STATE BUREAU OF MINES AND MINERAL RESOURCES
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Introduction

The presence of molybdenite in a Tertiary granitic stock on the east slope of Nogal Peak has been known for many years, but little geological information pertaining to the deposit has been available. The area possesses certain favorable features; hence, it was decided that the New Mexico Bureau of Mines and Mineral Resources should conduct a preliminary survey of the area to compile fundamental information concerning the geologic setting in which the deposit is located, perform a geochemical soil and rock survey with the aim of delineating the deposit and possibly indicating other nearby but concealed deposits, thoroughly sample the known molybdenite-bearing outcrops to ascertain their tenor, and do selected stream water sampling which, if successful, would indicate the existence of other deposits lying within the upper drainage of Bonito and Nogal creeks. It was hoped that such a reconnaissance survey would provide enough information to encourage others to examine the area.

METHOD OF INVESTIGATION

Field work for this project was done during the summer of 1963. The geologic mapping and rock sampling was done by Griswold, and the soil sampling program was done by Missaghi. All geologic mapping and locating of geochemical samples were done on aerial photographs obtained from the U. S. Forest Service. No controlled photo mosaic is available for the area studied; therefore, both the geologic and geochemical survey base maps are only approximate.

PREVIOUS WORK

The extreme northern part of the mapped area lies within the Carrizozo 15-minute quadrangle. This has been mapped by Robert Weber of the Bureau staff. His report has not been published but adds greatly to knowledge of the regional geology in the area studied. The molybdenum deposit was briefly studied in 1957 by Griswold (1959). Several private, but very brief, reports also have been written on the area.

ACKNOWLEDGMENTS

The writers were given full co-operation by the owners of mining claims. Special thanks are extended to Ralph Forsythe and Leonard Sharpe in this regard. Percy Sheppard and Charles Chisholm of the East Utah Mining Company and Robert Wyant of the Grand Deposits Mining Company greatly aided mapping of the southern part of the area by reviewing the geologic map.

The Rocky Mountain Geochemical Laboratories, Prescott, Arizona, did the bulk of the geochemical sample analyses. Some samples were analyzed in the Bureau's laboratory by Dominador C. Uy and George R. Felt under the supervision of Dexter Reynolds. David L. Haupt worked as a field assistant during June 1963. Thomas I. Poe, III, examined and identified the rock thin-sections. Max E. Willard reviewed the manuscript; Robert H. Weber, Frederick J. Kuellmer, and Frank E. Kottlowski assisted in reviewing much of the data presented; and Robert Price and Ray Molina drafted the illustrations. Editorial work was done by Miss. Teri Ray, and Mrs. Lois Devlin typed the manuscript. All are of the Bureau staff.

GEOGRAPHY

The area studied lies in south-central Lincoln County, New Mexico (fig. 1; after Dane and Bachman, 1957) and is contained within the northern part of the Sierra Blanca, a north-trending range lying on the eastern edge of the Tularosa Basin. Carrizozo is the nearest substantial community, being some ten air-line miles northwest of the area.

The region is mountainous and is in part covered with fine stands of pine and fir. Elevations range from 7800 feet at Nogal Creek to 10, 000 feet on Nogal Peak which is right at the timberline for this latitude. Most of the area lying within the Nogal Creek drainage is covered with a scrubby oak growth in contrast to the coniferous growth in the Bonito Creek drainage. The climate is typical of mountainous areas of the southwest, having mild summers and cold, but not severe, winters. Rainfall is estimated at 20 to 25 inches a year in contrast to less than half this amount in the Tularosa Basin immediately to the east.

HISTORY OF MINING

The area investigated is within the western part of the Nogal mining district, as defined by Griswold (p. 41). Mining in this district dates as far back as the 1860's when gold was mined in Dry Gulch a few miles west of the village of Nogal. Numerous lead-zinc-copper-silver veins along Bonito Creek were prospected, and a few mined on a small scale, prior to 1900. The most substantial mining effort in the immediate vicinity of Nogal Peak, however, was at the Parsons gold mine, discovered by R. C. Parsons in 1884, at the head of Tanbark Canyon. An estimated 75, 000 tons of low-grade gold ore were taken from this deposit from the time of discovery until 1918.

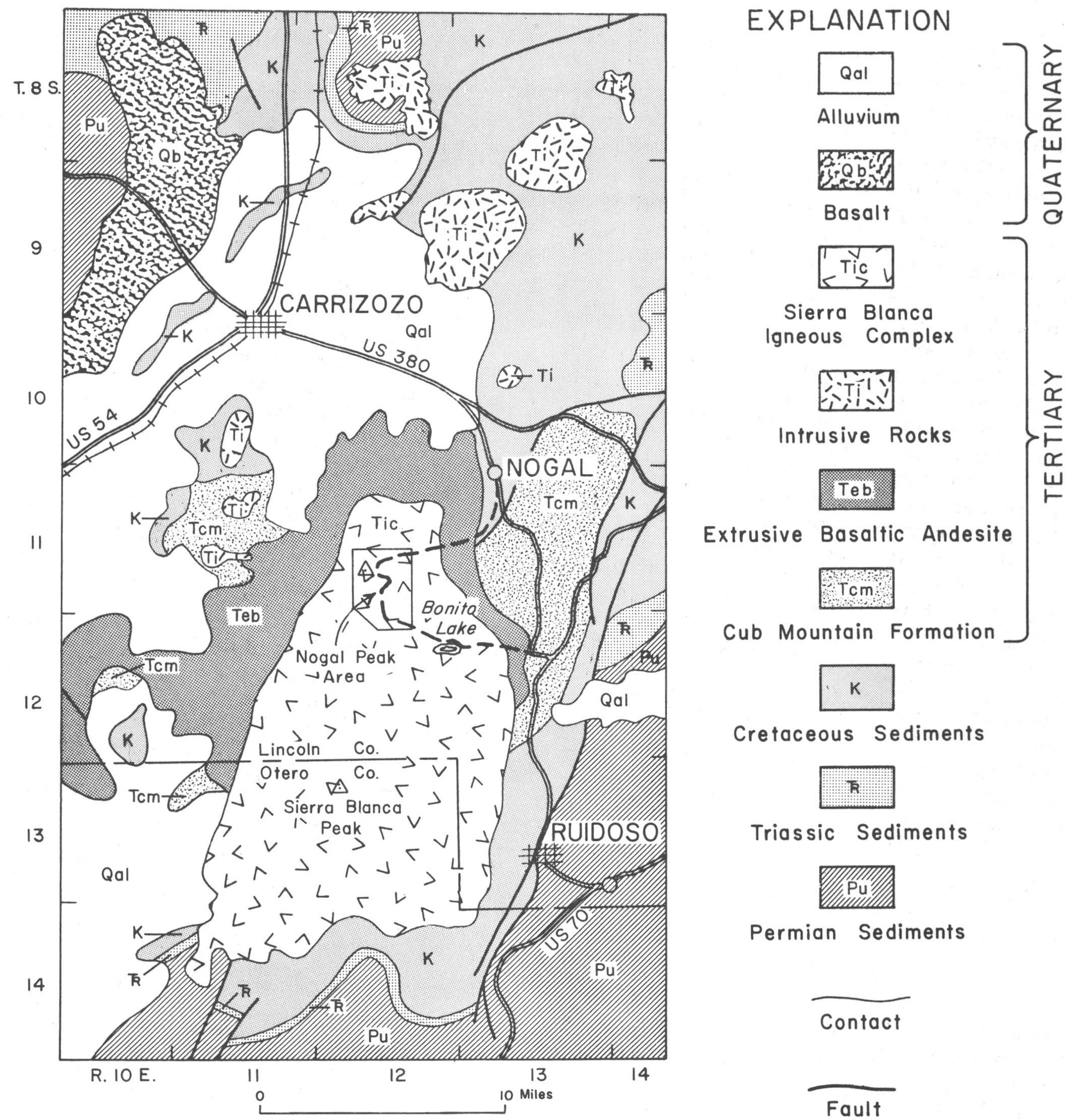


FIGURE 1 GENERALIZED GEOLOGIC MAP OF THE SIERRA BLANCA AND VICINITY

During the course of the early prospecting of the area, attention was drawn to the abundant iron staining on the ridge north of and above the Parsons mine. This area was staked, by M. D. Gaylord in 1894 as the Rialto Group (Gaylord, 1901). Soon afterward, two short adits were driven from the north side of the ridge to prospect below the iron-stained outcrop in the hopes of discovering sulfide gold-silver ore. The lower adit, now known as the Fulmer adit (or tunnel), encountered sulfide mineralization (molybdenite, pyrite, and chalcopyrite) but the gold and silver content was discouragingly low. Inasmuch as the molybdenum was not considered to be economically important, driving of the adit was stopped.

Exploration of the Rialto Group ceased until 1957 when the Climax Molybdenum Company (now American Metals Climax, Inc.) obtained an option on the property. The deposit at that time was owned by a group of seven persons; namely, Leonard Sharpe, Ralph Forsythe, Marlow Sharpe, Ernest Key, Clint Rice, Gordon Sipple, and Winton Friend. Climax completed 2319 feet of diamond drilling on the property during 1957. The results were discouraging, and the company dropped its option. With the exception of the present study, little other than annual assessment work has been done.

Almost concurrent with the starting of field work for this report, interest was renewed in the lead-zinc-copper-silver veins in Tanbark Canyon and along Bonito Creek immediately south of the Rialto molybdenum deposit. As of this writing, three closely associated companies--East Utah Mining Company, Grand Deposits Mining Company, and New Park Mining Company--are actively exploring for silver in the area. Most of the activity is centered on the Crow vein in lower Tanbark Canyon where Ira Young uncovered a promising silver ore shoot in 1962. Another recent development in the area has been the announcement that Bear Creek Mining Company has staked several hundred mining claims on the northern slopes of Sierra Blanca Peak, some two to four miles south of Bonito Creek. The company will explore for molybdenum. Both of these exploration activities are in the initial stages and little information has been reported.

REGIONAL GEOLOGIC SETTING

The rocks exposed in south-central Lincoln County range in age from Permian to Quaternary (fig. 1). Not exposed, but expected to lie between the Permian sediments and the Precambrian basement in the extreme western part of the area, are approximately 2000 feet of Pennsylvanian limestones. Such rocks are not believed to be present under the actual area studied. A summary of the Permian to Cretaceous stratigraphy of Lincoln County has been given by Griswold (1959).

Tertiary rocks form the bulk of the outcrops in the area. The Cub Mountain Formation, composed of approximately 2000 feet of early Tertiary conglomerates, sandstone, shale, and clays, is the basal unit of the Tertiary. Overlying this formation are up to 4000 feet of basaltic andesite flows, breccias, and agglomerates which form the bulk of the Sierra Blanca. Numerous stocks and dikes of subsilicic crystalline rocks have invaded the sediments and the basaltic andesite. Several of the isolated stocks in the northeastern part are shown in Figure 1; however, the intrusions into the basaltic andesite are so complicated in the central part of the Sierra Blanca that they have been called simply an igneous complex. The complex probably includes also some of the old igneous centers from which the basaltic andesite pile was emitted. The age of the intrusive crystalline rocks is not accurately known, other than being postbasaltic andesite. Latitic flows are known overlying the basaltic andesite sequence in the extreme northern part of the Sierra Blanca. The latite is believed to have accumulated after emplacement of the stock, but the evidence is not conclusive.

The main geologic structure in central Lincoln County is the basin underlying the Sierra Blanca. This structure trends north-northeast, is 40 miles long, and 20 miles wide. The most significant fault trend in the area is also north-no rthea st.

Geology of the Nogal Peak Area

Plate 1 is a geologic map of the Nogal Peak area. The area lies within what has been previously mapped as Tertiary igneous .complex. Lack of good exposures, due to thick soil and colluvium, made it desirable to divide the Tertiary rocks into four broad groups for the purpose of mapping: (1) basaltic andesite, (2) altered basaltic andesite, (3) syenodiorite stocks, and (4) igneous complex.

TERTIARY ROCKS

Basaltic Andesite

The basaltic andesite is typical of the region, being perhaps 3000 feet thick in this particular area. The formation is well exposed on Nogal Peak where it contains dark grayish purple breccias, agglomerates, and flows. Some of the individual units are as much as 100 feet thick. Flow structure indicates that the sequence is essentially flat under Nogal Peak itself, with a slight eastward dip farther east. As the map shows, individual outcrops have dips which depart radically from this general attitude. On the steep slopes of Nogal Peak, where exposures are good, it would be feasible to break the sequence into as many as ten distinct units. However, such a division was not justified because the units are all so lithologically similar that they could not be positively identified in the remaining part of the area. Because of this lack of suitable horizon markers, little is known of the structure of the Nogal Peak area.

Altered Basaltic Andesite

The basaltic andesite has undergone considerable hydrothermal alteration along its contact with the syenodiorite stocks. This alteration is believed to have, been nearly concurrent with the emplacement of the stocks and is not directly related to the later hydrothermal alteration which accompanied the deposition of molybdenite.

The basaltic andesite is mainly altered to an argillaceous material, and considerable pyrite has been added. Commonly, the rock is changed in color from typical grayish purple to a yellowish brown. The mafic minerals were most susceptible to alteration, and in the porphyritic flows, it is quite usual to find the feldspar phenocrysts relatively unaltered compared to the hornblende, biotite, and other dark minerals. The formation of pyrite is common both as disseminated grains and as "paint" along fractures. It is probable that the formation of the pyrite represents a simple combining of introduced sulfur and iron liberated by the destruction of the mafic minerals.

Syenodiorite

Three separate stocks are exposed in the mapped area. For the purpose of identification, the three stocks have been named as follows: Rialto, the northernmost stock lying immediately south of Nogal Creek; Tanbark, an elongate mass lying astraddle of Tanbark Canyon; and Bonito Lake, only the westernmost tip of this large stock appearing in the southeast corner of the mapped area. The composition of the three stocks is so similar that they probably were derived from a common source at depth.

Typically, the syenodiorite is a gray to brownish gray equigranular medium- to coarse-grained rock. Normally, there is a good balance between the alkali and plagioclase feldspars. The rock contains little quartz, and the use of the term syenodiorite is justified. The most common dark minerals are biotite and hornblende; magnetite is abundant in some areas; and chlorite, apatite, and epidote occur sparingly.

The Bonito Lake stock is by far the largest of the three. Although only a small portion of the mass extends into the mapped area, its total outcrop farther east covers at least 16 square miles. As would be expected in such a large body, the compositional range is greater than in the Rialto or Tanbark stocks. Whereas the only significant compositional variation in the latter is the amounts of modal quartz, the Bonito Lake stock ranges from diorite to syenite.

The outcrop of the Rialto stock is roughly circular and covers about one square mile. Known molybdenite mineralization in the vicinity of Nogal Peak is confined to this stock; therefore, its outcrop area was more carefully studied than other areas. It is the only one of the three stocks which exhibits significant hydrothermal alteration over large areas. The Tanbark stock covers an outcrop area slightly larger than one square mile. The stock is identical to the Rialto, but known hydrothermal alteration is absent except There it is adjacent to the lead-zinc-copper-silver veins.

Igneous Complex

The rocks exposed south of the Bonito Lake and Tanbark stocks are badly altered, and outcrops are limited. The bulk of the area is basaltic andesite ranging from altered to fresh. Numerous irregular outcrops of syenodiorite are present. Post-syenodiorite dikes ranging from latite t9 dacite in composition are present. An east-striking andesite porphyry dike of unknown age follows the course of the Renowned—Crow—Martha Washington vein system. In certain areas, the fresh basaltic andesite is very massive and porphyritic, pointing to the possibility that intrusive equivalents of that normally extrusive sequence exist. Very careful study would be required here to unravel the profusion of rock types. Until such detailed work is done, the area is best defined as an igneous complex.

QUATERNARY ALLUVIUM

Essentially all the alluvial deposits in the Nogal Peak area are of Recent age. There is no evidence of older terrace deposits along Nogal or Bonito creeks. The alluvium in the principal drainages consists of thin floodplain deposits of silt, sand, and coarser material ranging from gravel to large boulders. The active stream channels truncate these plains.

The steeper slopes are covered with talus, colluvium, and shallow soils. Landslide material is present on some of the steeper slopes, particularly on the west side of Nogal Peak. Thin soil and colluvium deposits effectively mask bedrock in much of the area but rarely exceed five feet in thickness. Typical soil profiles are simple, consisting of fine soil at the surface changing to a rock and soil mixture about one foot above actual bedrock. In the more forested areas, considerable partly decomposed organic material overlies the soil.

STRUCTURE

As stated previously, the basaltic andesite sequence is fairly flat-lying in the vicinity of Nogal Peak and tends to dip gently to the east in the eastern part of the area. Reliable mapping horizons were not recognized in the basaltic andesite, and hence, many geologic structures may not have been mapped. This may also be true for the syenodiorite stocks. Many diverse attitudes within the basaltic andesite sequence suggest the existence of considerable postbasaltic andesite folding or faulting (pl. 1). Only one fault was mapped (pl. 1); it strikes north-northwest and forms the eastern margin of Tanbark stock and the western margin of the Bonito Lake stock. The trace of this fault is clearly shown on the aerial photos. In the field, it is marked by the cleaved contact between the Tanbark stock and the basaltic andesite. Its displacement is not known. The lead-zinc-copper-silver veins usually strike east-west and are probably controlled by previously existing faults.

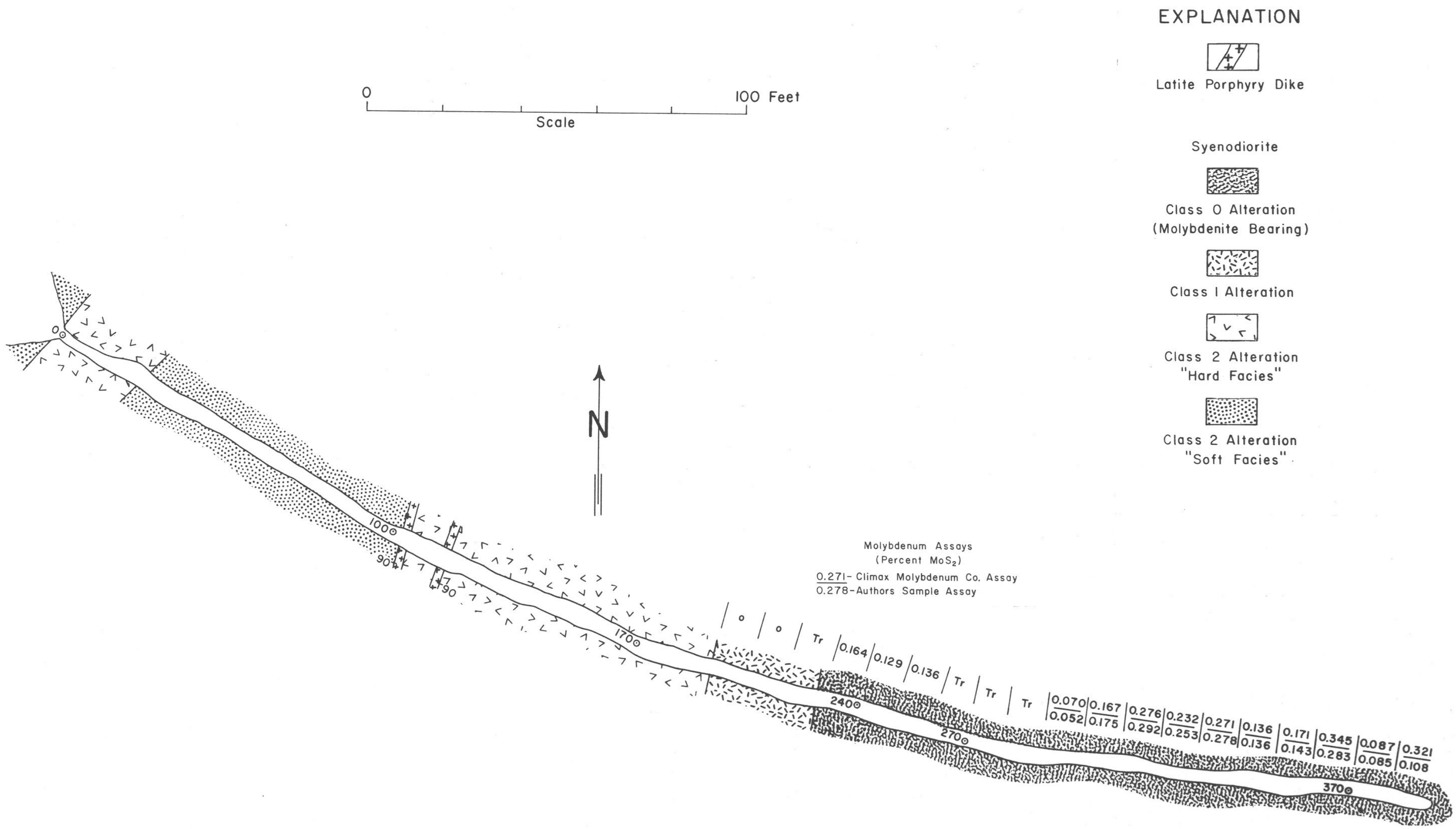


FIGURE 3 GEOLOGIC PLAN OF THE FULMER ADIT

Molybdenite and Associated Hydrothermal Alteration in the Rialto Stock

Molybdenite can be readily identified on the surface in only two places: in a shallow prospect shaft in the tongue of the Rialto stock which extends north across Nogal Creek into the NW1/4 sec. 26, and in a shallow cut near the common corner of secs. 26, 27, 34, and 36, T. 9 S., R. 11 E. The most significant molybdenite occurrence known is exposed in the end of the Fulmer adit. The surface directly above the adit is thoroughly oxidized, and abundant limonite containing traces of molybdenum is the only clue to the existence of molybdenite at depth. Molybdenite can be identified in minute quantities in many of the dumps of prospect pits in the area, but these three are the only places in which the amount present approaches ore grade.

Geochemical analyses of rock samples taken from the altered zones tended to verify a close relationship between the pervasive alteration and the deposition of molybdenite. Hence, mapping of hydrothermal alteration gives considerable insight into the possible areal extent of molybdenite in the Rialto stock.

HYDROTHERMAL ALTERATION

Alteration in the Rialto stock ranges from mild to intense; accordingly, five classes of alteration were defined to assist the geologic mapping:

<u>Class 3--mild.</u> In this class, the syenodiorite exhibits little, if any, effect of hydrothermal alteration. The principal rock minerals are easily identified in the field. Only 20 per cent of the outcrop of the Rialto stock exhibits such mild alteration (pl. 1).

<u>Class 2--argillic alteration.</u> The bulk of Rialto stock exhibits some degree of argillic alteration. The feldspar grains in the rock have lost their original luster because of partial conversion into clay minerals. The dark minerals like biotite and hornblende are generally destroyed. Evidence of pyritization (limonite stains and fracture fillings on outcrops) is found in some areas.

<u>Class 1--sericitization, silicification, and pyritization</u>. About 15 per cent of the exposures of the Rialto stock have been highly altered hydrothermally. Most of the original rock texture was destroyed during the formation of quartz, sericite, and clay. Pyrite, or its oxidization products, is common as veinlets and disseminations. The alteration associated with the molybdenite-bearing portion of the Fulmer adit is of this type.

<u>Class 0--molybdenite-bearing.</u> A distinct class was defined for those areas containing visible amounts of molybdenite. Except for the presence of molybdenite, the alteration in this class is of the intense Class 1 type. The

EXPLANATION

QUATERNARY

Qal

Alluvium

Stream channel sediments of sand, silt, and gravel.

TERTIARY

Tb

Breccia Pipe

Breccia of highly altered syenodiorite and basaltic andesite.

B

Breccia

Breccia of small fragments of syenodiorite exposed above the Fulmer Adit.

Syenodiorite

Brownish-gray equigranular syenodiorite Includes some diorite in the southeastern part of the mapped area.

Alteration Types

Tsd_o – *Known molybdenite-bearing zones.*

Tsd_s – *Highly silicified and sericitized zones.*

Tsd_1 – *Highly altered syenodiorite. Silicification, sericitization, kaolinization, and pyritization have destroyed most of the original rock texture.*

Tsd_2 – *Slightly altered syenodiorite. Argillic alteration has partly destroyed some of the original rock texture. Sericitization and silicification are weak.*

Tsd_3 – *Unaltered syenodiorite.*

Ta Taa

Basaltic Andesite

Ta – *Dark gray to grayish purple basaltic andesite flows, breccias, and agglomerates. May include some intrusive sills of the same composition.*

Taa – *Bleached and, in places, pyritized equivalent of* Ta.

Contact

Approximately located

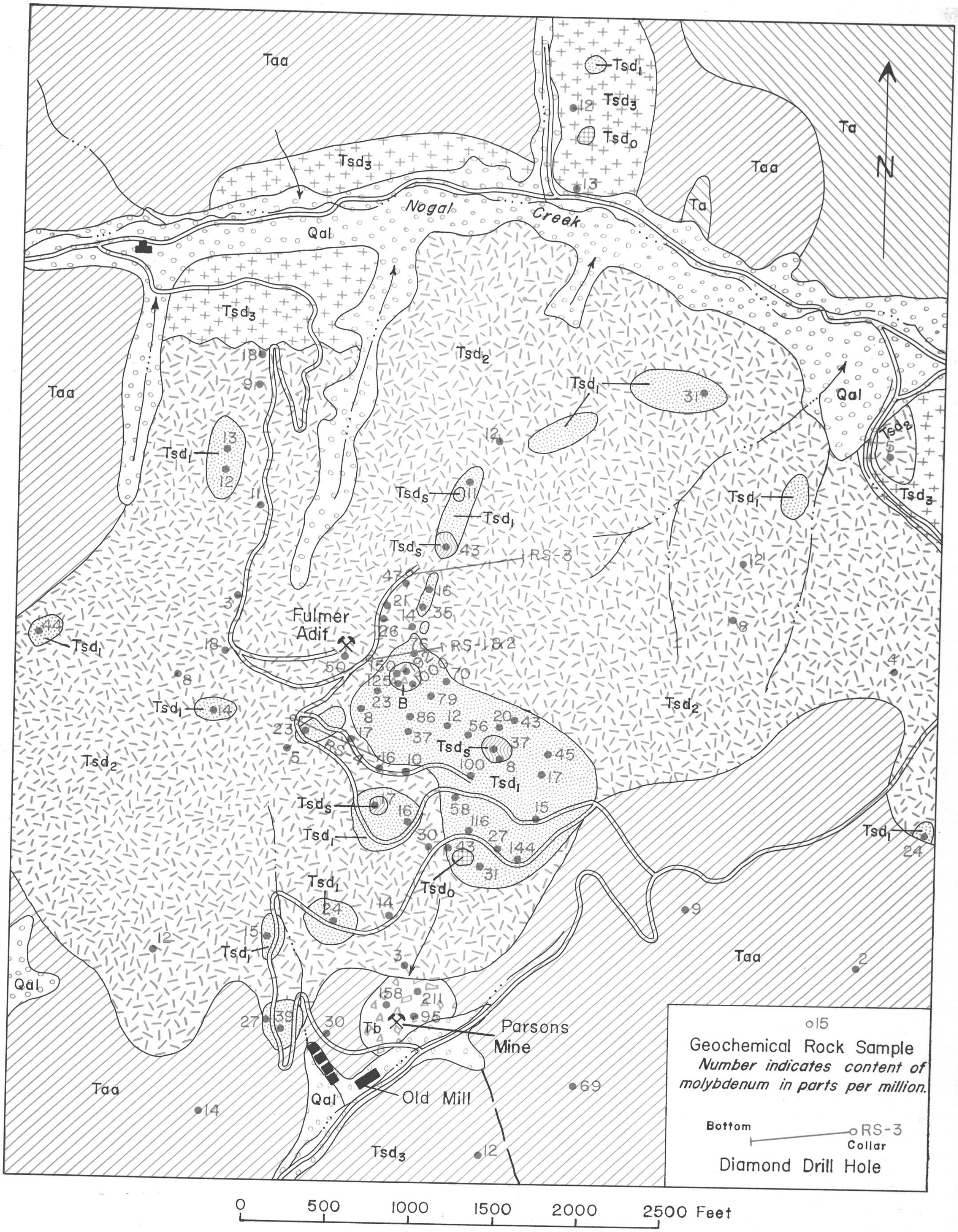
Fault

Approximately located

Mine or prospect

Road

FIGURE 2 GEOLOGY AND GEOCHEMICAL



ROCK SAMPLING OF THE RIALTO STOCK

molybdenite-bearing areas, however, are always more intensely silicified than those in most of the Class 1 zones.

Class S--siliceous sericite. Three prominent but small outcrops of this alteration class are known in the Rialto stock. The rock is fine-grained sericite and quartz; no remnant rock texture is visible. The largest and best exposed of the three outcrops is on the ridge crest about 1000 feet southwest of the Fulmer adit portal. There, the siliceous sericite mass is about 150 feet in diameter and appears to have sharp vertical boundaries against the surrounding Class 1 altered syenodiorite. The relief of the weathered surface of the outcrop suggests a highly altered breccia; however, close examination of the rock does not reveal outlines of individual fragments. The origin of the Class S zones is in doubt. They could be highly altered breccia pipes, xenoliths of basaltic andesite trapped in the syenodiorite, or highly fractured zones which acted as conduits for hydrothermal fluids. Normally, the outcrops have only a small amount of iron staining, and the content of trace molybdenum is not exceptionally high.

Significance of Hydrothermal Alteration

Figure 2 shows the results of the trace molybdenum analyses of rock samples in relation to hydrothermal alteration. There is definite agreement between the two surveys. The average of 35 samples of Class 1 altered rock is 50 ppm (parts per million) molybdenum in contrast to an average of 11 ppm for 19 samples in Class 2 areas and 7 ppm for 14 samples in Class 3 zones.

The mapping of alteration within the Rialto stock had to be limited to areas of good bedrock exposure, namely, the ridge crests and roadcuts. There is a possibility that Class 1 alteration extends over a greater area than that mapped. It would certainly be interesting to examine bedrock under the short gully extending northward from the Fulmer adit to Nogal Creek and in the small basin to the east.

THE FULMER ADIT AREA

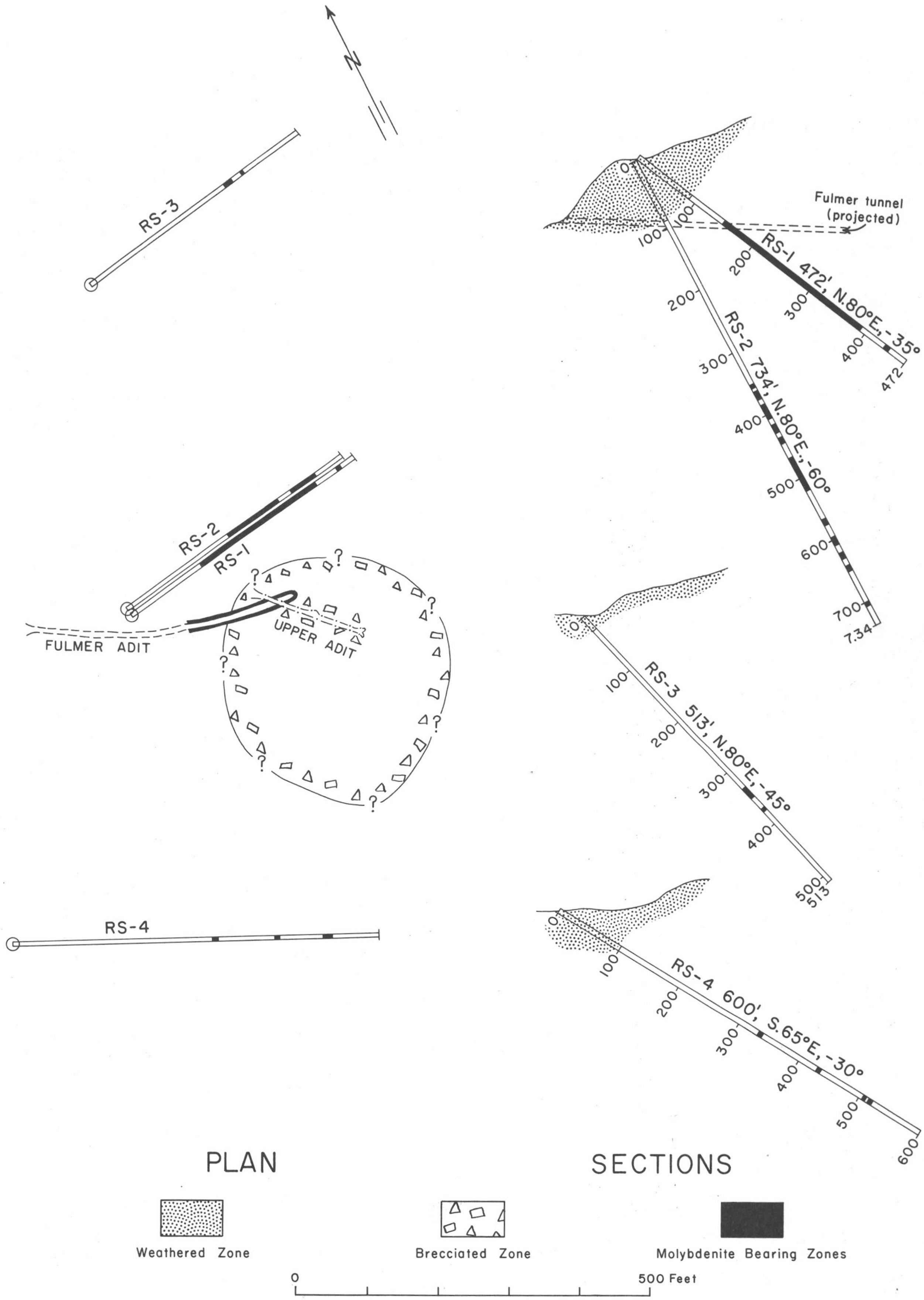
The Fulmer adit is 392 feet in length and was driven in a slightly southof-east direction (fig. 3). The adit starts in Class 2 type of alteration which changes to Class 1 about 200 feet inside the portal. Significant molybdenite mineralization (Class 0 alteration) starts at 230 feet and continues to the face. Figure 3 lists the results of both Griswold's and the Climax Molybdenum Company personnel's sampling of the molybdenite-bearing zone. Fairly close agreement was obtained, except for the last interval at the face. The grade of molybdenite in the adit from the face to a point 102 feet back averaged 0.207 per cent molybdenite and 0.181 per cent molybdenite for Griswold's and Climax's sampling, respectively.

The molybdenite-bearing zone is in highly fractured syenodiorite. Silicification, sericitization, kaolinization, and pyritization are intense. The extent of the molybdenite-bearing zone is not known because the face of the adit is still well mineralized. North-trending veinlets of pyrite and quartz cut the

ASSAY DATA OF CORES

Interval from	Interval to	Length (feet)	Assay (%MoS_2)	Core recovery (percent)
		RS-1		
155	165	10	0.026	65
165	175	10	0.066	10
175	185	10	0.043	40
185	195	10	0.021	65
195	205	10	0.068	65
205	215	10	0.002	40
215	225	10	0.023	35
225	235	10	0.222	10
235	243	8	0.036	36
243	253	10	0.005	70
253	263	10	0.152	90
263	273	10	0.012	50
273	284	11	0.002	60
284	295	11	0.005	75
295	305	10	0.026	75
305	315	10	0.084	20
315	325	10	0.092	30
325	335	10	0.028	30
335	345	10	0.003	45
345	355	10	0.008	80
355	365	10	0.009	20
365	375	10	0.043	70
375	385	10	0.005	40
385	391	10	0.003	16
434	435	1	0.049	30
435	441	6	0.024	91
		RS-2		
355	358	3	0.010	50
364	373	9	0.005	69
373	376	3	0.005	55
386.6	397	10.4	0.002	50
397	407	10	0.003	35
419	428	9	0.003	78
437	444	7	0.008	70
444	455	11	0.015	64
470	479	9	0.020	45
479	488	9	0.005	75
488	497	9	0.003	65
497	506	9	0.007	38
506	515	9	0.005	45
515	521	6	0.013	46
568	573	5	0.024	75
573	577	4	0.037	64
597	607	10	0.016	58
624	630	6	0.028	76
641	647	6	0.075	79
699	703	4	0.011	54
		RS-3		
334	341	7	0.006	92
341	351	10	0.049	100
375	378	3	0.024	89
		RS-4		
333.5	337	3.5	0.072	100
430	431.5	1.5	0.016	100
514	521	7	0.003	100
506	511	5	0.004	100

FIGURE 4 LOCATION AND ASSAY RESULTS OF CLIMAX



MOLYBDENUM COMPANY DIAMOMD DRILL HOLES

molybdenite-bearing zone, indicating considerable pyritization after the deposition of molybdenite. Polished sections of the ore revealed that premolybdenite pyrite is also present. The molybdenite commonly occurs as individual grains ranging from mere specks to plates measuring one centimeter across. Some molybdenite also occurs as small grains in quartz filling open fractures. Chalcopyrite is present sparingly in some parts of the molybdenite-bearing zone.

Two north-trending latite porphyry dikes which cut the syenodiorite are exposed in the Fulmer adit. These dikes are probably preore. The exposures within the adit reveal two distinct types of syenodiorite which may represent separate facies of the Rialto stock. Two exposures, one just outside the portal and the other from 20 to 105 feet inside the portal, are highly weathered, soft, and mica-rich. The remaining exposures are much less weathered syenodiorite. Between the two types are steep knife-edge contacts at the portal and 20 feet inside. The contact at 105 feet is less pronounced. Under the microscope, the two rock types appear to be compositionally the same except for strong clay development in the "soft" type. The cuts along the road leading up from Nogal Creek to the Fulmer adit also suggest two facies, but in general the contacts are not so sharp as in the Fulmer adit. Detailed examination of these exposures leads Griswold to believe that the "soft" type is derived from the weathering of coarse-grained biotite-rich syenodiorite, while the "hard" type is derived from medium-grained syenodiorite.

The surface above the Fulmer adit is void of outcrops except near the vertical projection of the end of the tunnel. A second adit, locally known as the Upper adit and 160 feet above the Fulmer, was driven in a S. 45° E. direction for 150 feet. This adit cut highly fractured and in part brecciated Class 1 altered syenodiorite. The rock contains abundant limonite; sulfides are absent.

On the surface immediately over and extending southwest of the Upper adit portal is a limonite-rich breccia. The breccia is exposed in only two parallel bulldozer cuts, and the true area and shape of the breccia mass are not known. The area probably does not exceed one acre. The breccia is composed of fragments of syenodiorite that are commonly tabular and seldom have a maximum dimension exceeding six inches. The matrix between the fragments contains much limonite, suggesting an originally high sulfide mineral content. The highest trace-molybdenum assays were from this breccia zone; they ranged from 100 to more than 1000 parts per million. Samples from the Upper adit, which cuts under the northwest edge of the outcrop, contained 100 to 200 parts per million molybddnum.

Climax Molybdenum Diamond Drill Holes

The collar locations and horizontal projections of the four diamond drill holes made by the Climax Molybdenum Company in 1957 are shown in Figures 2 and 4. The holes were entirely in syenodiorite. Holes RS-1 and RS-2 were in the same vertical plane. The percentages of molybdenum shown are from core analyses. The molybdenum mineralization as revealed by the core analyses is spotty and far below ore grade. The holes are not located in the most favorable zones of alteration, nor do they cut under the limonite-rich breccia outcrop south of the Upper adit.

PARSONS BRECCIA PIPE

The old Parsons mine is a glory hole excavation that has exposed an intensely brecciated zone in sharp contact with the southern end of the Rialto stock. The breccia is well exposed within the small glory hole pit, but a thick soil mantle surrounding the mine prevents delineation of the breccia boundaries. The contact between the breccia and the Rialto stock is exposed by a short adit on the north end of the glory hole. Here the contact is sharp, nearly vertical, and trends east. This contact is suggestive of a breccia pipe.

The breccia contains fragments ranging up to several feet in diameter. Strong argillic alteration has destroyed the rock texture of the fragments; hence, positive identification of rock types in the breccia is impossible. The breccia fragments are tentatively identified as basaltic andesite and syenodiorite. The syenodiorite adjacent to the breccia is only slightly altered, principally by pyritization. A narrow postbreccia, but prealteration, dike is visible on the north face of the glory hole.

Old, but probably reliable, reports indicate that the gold content is low, averaging less than 0.1 ounce a ton. The breccia is assumed to contain a considerable amount of sulfide mineralization at depth because. of abundant limonite filling between breccia fragments at the surface. A shallow shaft (now caved) on the south side of the glory hole is reported to be 70 feet deep with pyrite and minor amounts of molybdenite present in the bottom. Three churn drill holes were sunk within the breccia, but detailed records for these holes are not available. Three rock samples taken from the glory hole contained 95, 158, and 211 parts per million molybdenum.

Geochemical Sampling Program

ANALYTICAL METHODS

All the soil samples and some of the rock samples were analyzed by the Rocky Mountain Geochemical Laboratories using a perchloric acid digestion method. The Bureau tested most of the rock samples using the techniques shown in Figure 5.

ROCK SAMPLING

A total of 110 rock samples from outcrops was taken during the course of the field investigation. Assay results from 75 of these samples are posted in Figure 2. The remaining samples were taken in the outlying areas for the purpose of more accurately establishing background values. Assay results by rock type for all the samples taken are as follows:

Rock type	Number of samples	Molybdenum (ppm) Average	Highest	Lowest
Class S altered syenodiorite	4	26	43	8
Class 1 altered syenodiorite	35	50	192	8
Class 2 altered syenodiorite	19	11	26	3
Class 3 altered syenodiorite	14	7	13	3
Basaltic andesite	4	16	22	9
Altered basaltic andesite	13	9	17	1
Parsons breccia pipe	3	155	211	95
Samples excluded from averages	18			

Eighteen samples were excluded from averages because of wide variance from the statistical averages. One sample of Class 1 altered syenodiorite from the brecciated zone above the Fulmer adit was excluded because it contained more than 1000 parts per million molybdenum. Three samples of Class 2 altered syenodiorite were excluded because of their high molybdenum content and proximity to the large Class 1 alteration zone; these samples contained 30, 47, and 50 parts per million molybdenum. Twelve Class 2 to Class 1 samples taken in the barren portion of the Fulmer adit were also excluded. Lastly, two samples of altered basaltic andesite were excluded because they contained 30 and 69 parts per million molybdenum. Only four samples of unaltered basaltic andesite were analyzed; the abnormally high average molybdenum content probably does. not represent a true average.

Samples consisted of about five pounds of random chips from outcrops at each location.

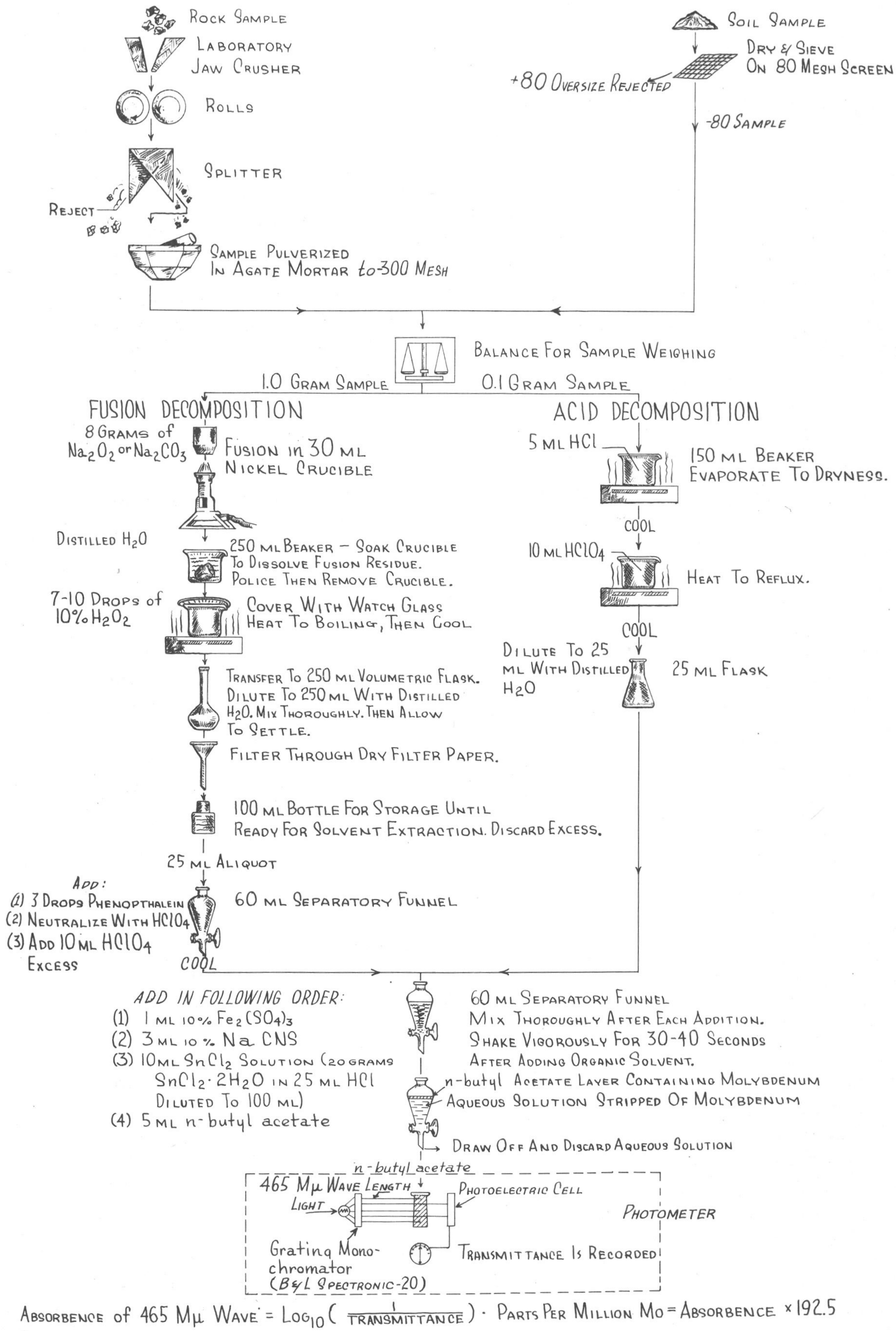


FIGURE 5 GEOCHEMICAL SAMPLE ANALYSIS DIAGRAM

SOIL SAMPLING

The results of 194 soil samples taken within the mapped area are shown on Plate 2 (overlay to pl. 1). Samples ranged from less than 1 to 100 parts per million molybdenum. The frequency distribution is shown in Figure 6. The soil samples are not so definitive as the rock samples, no doubt because of the transportation and admixing of soils derived from various source areas. The samples nevertheless do indicate an abnormally high molybdenum content in and around the Rialto stock; the normal soils (remote from molybdenum deposits) contain only a few parts per million molybdenum. The background content of the soils away from the Rialto stock appears to be very low--about 3 parts per million molybdenum.

Sampling was limited to the principal drainage network. Samples consisting of about five pounds of soil were collected at each location from shallow pits in the "A" soil horizon. Samples were taken in the floodplains of the valleys and in the bottoms of gullys; they are not true stream sediment samples. Samples were screened to minus 80 mesh before analyses.

STREAM WATER SAMPLING

Stream water sampling stations were located at eleven points along the Bonito and Nogal creeks drainages (fig. 7). Samples were taken twice, April 29 and June 5, 1963. The results obtained are given below:

	Sample points										
Date	A	B	C	D	E	F	G	H	I	J	K
	(Molybdenum content in parts per billion)										
April 29	5	16	11	11	16	4	nil	6	8	6	—
June 5	1	4	3	6	dry	9	4	dry	5	8	5

These results are not conclusive and, in one respect, are quite confusing. Sample points A and B were located in Nogal Creek above and below the molybdenite-bearing Rialto stock. The sample results for April 29 were encouraging in that the water contained only 5 parts per billion above the stock and jumped to 16 parts per billion below the stock. The sample results for June 5 show a similar jump in molybdenum content of the water between the same two points, but the absolute content dropped radically for both samples.

Water samples from point G, situated in Tanbark Creek just below the Parsons mine, gave very surprising results. This stream drains an area known to contain molybdenite, but the water contained essentially no molybdenum on April 29 and just 4 parts per million on June 5. The writers have no satisfactory explanation for these results.

The average metal content for all samples taken on June 5 is lower than those taken on April 29. This may be due to change in stream conditions between the two dates. The April 29 sampling was done near the end of the spring runoff, whereas the June 5 samples represent much lower stream

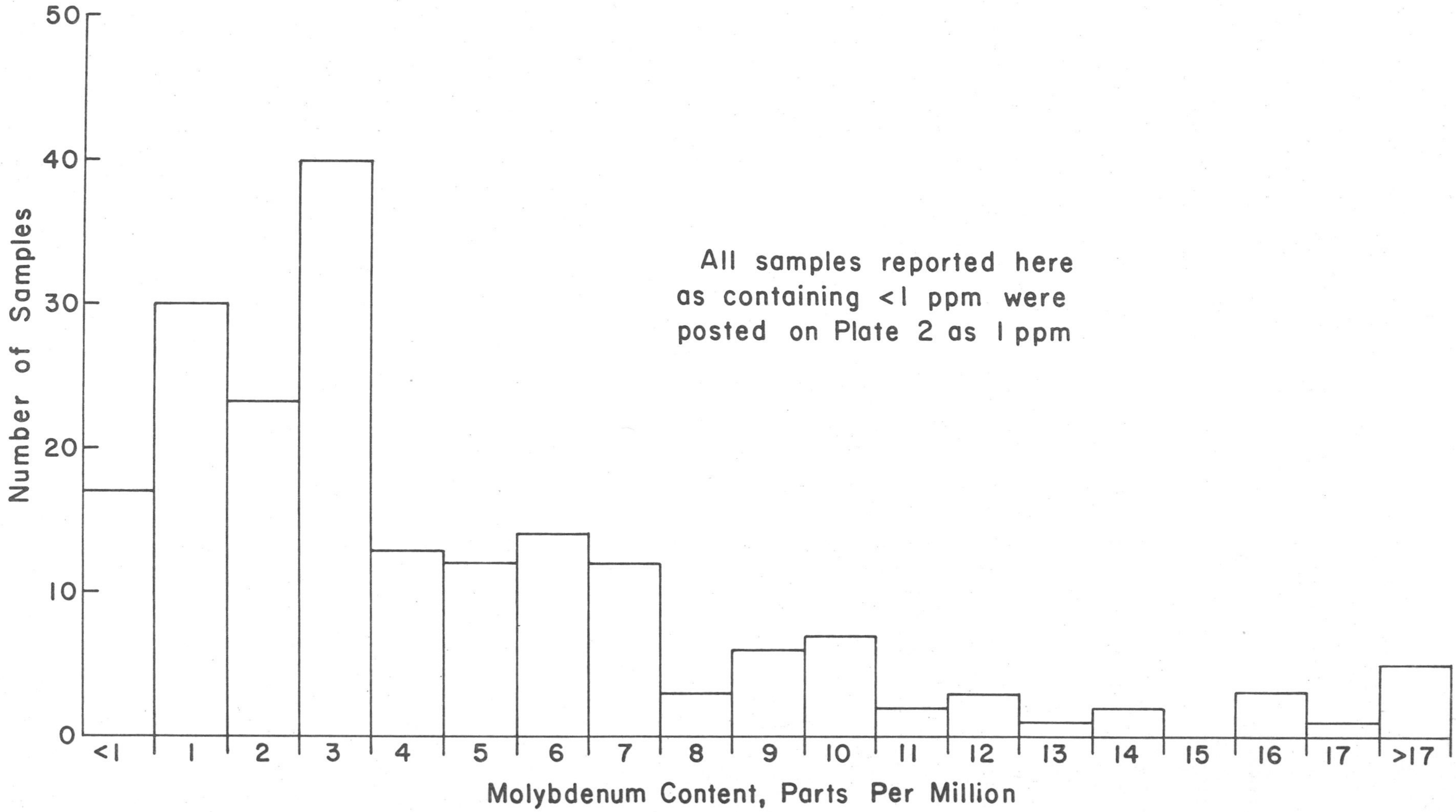


FIGURE 6 FREQUENCY DISTRIBUTION OF SAMPLE ANALYSIS

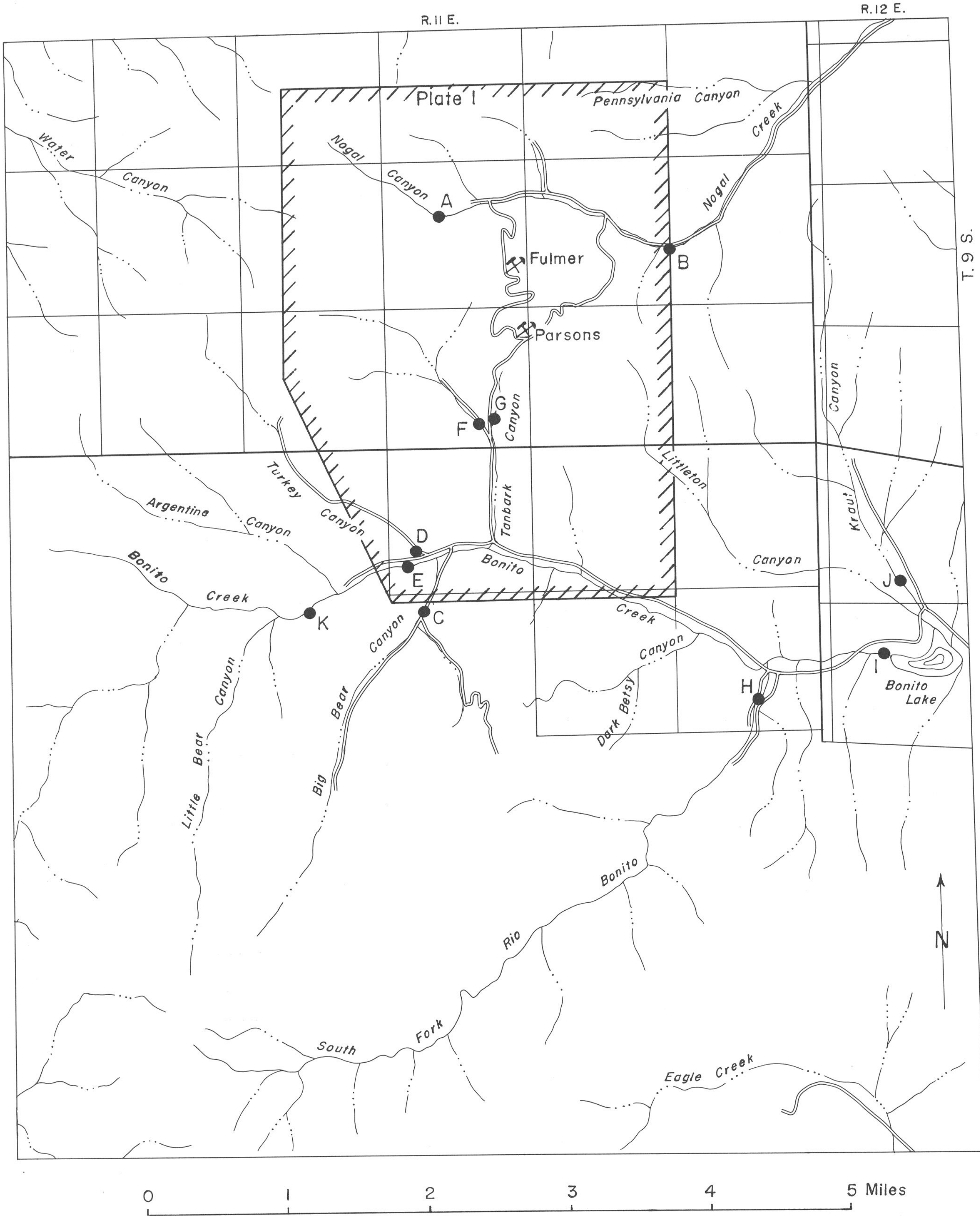


FIGURE 7 STREAM WATER SAMPLE ANALYSIS

discharge rates after the snow had melted. Considerably more stream water sampling, particularly in respect to various conditions of runoff, is necessary before reliable conclusions could be drawn as to the existence of other molybdenum deposits lying in the Nogal and Bonito creeks drainages.

Conclusions

Both the tenor and tonnage of the known molybdenum-bearing zones in the Nogal Peak area are far below that required to be economic under present or foreseeable market conditions. Material averaging 0.20 per cent molybdenite, about the grade of the mineralized portion of the Fulmer adit, has a molybdenum metal content of 2.4 pounds a ton. The 1963 market value of this ore, using a molybdenite concentrate price of $1.40 a pound of molybdenum contained, is $3.60 a ton. Such ore would demand very low mining and concentrating costs to be profitable. These low costs could be obtained only by a large-capacity mining and concentrating plant.

The large alteration areas within the Rialto stock have not been fully explored. The Fulmer adit penetrated only a short distance under the largest of the Class 1 alteration zones, the one covering the ridge crest above the adit. The vertical projection of the breccia zone containing molybdenum-rich limonite appears to have been missed or only partly penetrated by the Fulmer adit. A relatively small amount of crosscutting to the south from the end of the adit would explore under the breccia outcrop. Drilling probably would be the most economic method of exploring the Class 1 alteration zones. The Parsons breccia pipe is also worthy of consideration in future exploration because of its high trace-molybdenum content, and because its breccia structure appears to have been conducive to the deposition of sulfides.

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