(3290) 6000 0114

FILE:	
CIRCULATE:	
RETURN TO:	
GD-CP	GLD
GRD ✓	R&D

POST MORTEM
BLACK WASSUK (12040140)
MINERAL COUNTY, NEVADA

PHASE I: September, 1966: The pyritic stockwork north of volcanic capped and talus sloped Black Mountain was found in reconnaissance. It was remembered that a similar stockwork was mapped at the south end of the mountain during the Northern Lights Examination. Surface copper shows are primarily on a NE structure at the Black Mountain copper mine, where pre-WWI an oxidized chalcocite blanket had some production. The total setting was recognized as a possible halo to a chalcocite target under Black Mountain.

Decision: Because of exploration activity in the adjoining parts of the Walker River Indian Reservation and the exciting target concept, it was recommended and approved that ND stake and perfect a claim block to control the target area.

Comments: The ruggedness of the terrain and the oncoming winter weather played a role in the decision to stake, which appears justified. Probably the perfection of the claims should have been deferred until more data were collected on the target.

PHASE II: October, 1966: Samples of the stockwork showed the copper content to be very low, while sulfides outcropped in many places. Further study of the talus slopes indicated two small patches of rhyolitic volcanics between the 500' thick andesite flow cap of Black Mountain and the erosion surface of pre-mineral bedrock (see map 1966 Annual Report).

Decision: No change of Phase I.

Comments: The first indication of another volcanic unit was considered of local importance, or possibly reflecting another NNW fault with down drop on the west side. The talus near the Black Mountain copper mine covers an average of 400 vertical feet between the andesite base and pre-mineral outcrops. The choice of tracing the older volcanic unit below the talus at the north slope by dozer work was discarded. Even if these older volcanics were the full 400 ft. thick, the target was considered worth drilling. The weather urgency of getting a road up to the Black Mountain plateau for claim perfection prevailed.

PHASE III: Nov. - Dec., 1966: Access road from south completed. Five shallow holes drilled, deepest one stuck at 515' in a rhyolitic volcanic(?). Claims perfected. Expensive water haul and rough access were critical factors in decision to continue drilling as early as possible in the spring of 1967, using the playa lakes on Black Mountain as water supply.

Comments: We were lucky with weather. No problems encountered.

PHASE IV: May - Oct., 1967: Drilling program.

Three holes reached 1370-1730' of depth, and each intersected over 1000' of pre-andesite volcanics. This came as a complete surprise, as we anticipated bedrock at no deeper than 1000 ft.

Drilling problems were numerous, in part caused by rough conditions, in part by working at capacity limits of equipment. Contractor's performance, cost and time-wise, was mediocre.

Comments: BCMC supervisory organization was good. Little geologists' time was wasted. Core haulage and contractor contacts were handled okay by a field assistant. The critical holes BW-4 and BW-5 were lost but I see nothing ND could have done to prevent this.

PHASE V: October, 1967 - Present

a. Evaluation of drill data, indicative of rapidly westward thickening pre-andesite volcanics led to a very detailed outcrop search on the north and northeast flanks of Black Mountain. Overlying pre-mineral rocks with a subhorizontal, depositional contact is a dense, gray, rhyolitic lava. About 200' above this contact are porous, rhyolitic ashflows and tuffs, similar to rocks encountered by our 1967 drill holes.

b. Trenching above the Black Mountain copper mine workings, to uncover capping, revealed extensive rhyolitic ashflow outcrops below the talus. The contact between mineralized rock and the older volcanics west of the mine must be a steep west-dipping trench, which appears to have cut below the level of the blanket in the workings.

The capping exposed is indicative of enrichment and fair copper values only immediately above the vein zone and offshoot structures. Capping away from the vein is over pyritic mineralization with an average of 45 ppm Cu.

Conclusion: No support was developed of a once existing blanket. The level at which such blanket is expected appears partly eroded away. Any part preserved would be at least at 2000' below present surface of Black Mountain.

Decision: Let claims expire.

Comments: Decision okay. As we learn more on volcanic stratigraphy near Yerington, we may reconsider trying to define blocks of shallow bedrock in and west of the area, which has only weakly substantiated deep possibilities for either enriched or primary copper ore left.

In hindsight, it appears that the crucial data we obtained too late in the program were by trenching, primarily to uncover capping as near as possible to the target, and secondly to map distribution and contacts of rhyolitic volcanics under talus cover. I doubt that this data would have discouraged us from drilling altogether, but probably we would have anticipated thicker cover and planned only one

deep hole (at BW-5 site). Our current knowledge about several barren, pyritic stockworks in the Wassuk Range would also have cautioned against a major drilling program.

Land: No specific land problems were encountered.

T. A. Netelbeek

TAN/kp

May 21, 1969

cc: H. L. Bauer, Jr. (2)
R. C. Holmer (2)
P. M. Wright (1)

(3290) 6000 0114

BEAR CREEK MINING COMPANY

NEVADA DISTRICT

FINAL REPORT
BLACK WASSUK EXAMINATION (12010140)

MINERAL COUNTY, NEVADA

By
James W. Allan
May, 1969

Bear Creek Mining Company
Nevada District

3075 MILL STREET
RENO, NEVADA 89502

TELEPHONE: 702-329-0683

May 21, 1969

Mr. H. L. Bauer, Jr., President
Bear Creek Mining Company
1826 Kennecott Building
10 East South Temple
Salt Lake City, Utah 84111

Re: Black Wassuk Examination
Final Report by J. W. Allan

Dear Herm:

Jim's detailed description of our 1966-1967 Black Wassuk Examination is enclosed. Trenching in the fall of 1968 developed enough unfavorable data that ND decided to drop its 1969 budget request for one deep drill hole.

I agree with Jim that chances for an extensive preserved chalcocite blanket below a probably 2000'+ thickness of cover are minimal. It appears indicated that pre-cover structural events caused erosion of major parts of such a hypothetical blanket. The possibility for a primary target below thick cover is nearly as speculative, since no zoning of alteration types or of Cu-Mo in rock was established. The best explanation for the exposed mineralization is that it is one of the numerous pyritic stockworks of the Wassuk Range, with limited associated base metal values.

Unless we learn that current exploration by competitors on lands adjoining our claim group to the West has produced unexpected favorable results, ND plans to allow its claims at Black Wassuk to expire on September 1, 1969.

Yours sincerely,

TAN

T. A. Netelbeek

TAN/kp

Encl.

cc: R. C. Holmer w/2 encls.
A. Weiss w/1 encl.

TABLE OF CONTENTS

TABLE OF CONTENTS - continued

LIST OF ILLUSTRATIONS

FINAL REPORT
BLACK WASSUK EXAMINATION (12010140)
MINERAL COUNTY, NEVADA

INTRODUCTION

History

The northeastern portion of the Black Wassuk prospect area was examined and briefly described by D. W. Maltzahn of BCMC in December 1957. Further reconnaissance in the area was recommended.

In mid-1966, reconnaissance examination of aeromagnetic anomalies east of Yerington resulted in the discovery of the pyritic stockwork at Black Wassuk overlapped by post-mineral volcanic rocks to the south. The prospect area was located in Bear Creek's name and in late 1966 a drilling program was initiated. Drilling was resumed in 1967 and following evaluation of the results some dozer trenching and sampling was done at the north end of the prospect area in late 1968 terminating physical exploratory work at Black Wassuk.

Among the earliest references to the Black Wassuk mineralization are USGS publications by Ransome (6) in 1909 and Hill (2) in 1915. At the time of Ransome's visit, the mine was known as the Beach and the lower adit was just being driven. When examined by Hill the Beach copper mine was being operated by the Yerington Mountain Copper Company.

Location

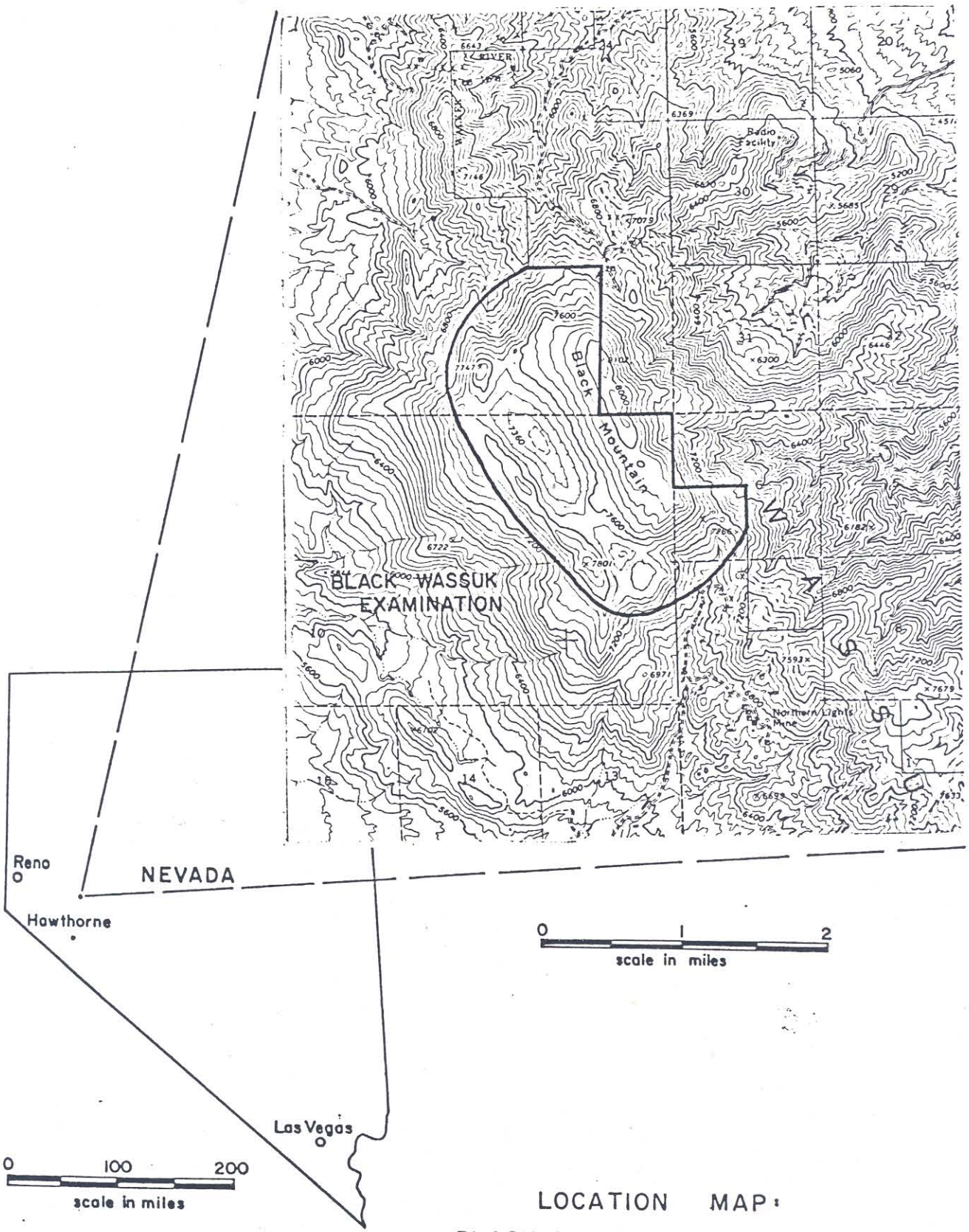
The Black Wassuk prospect covers about three square miles in extreme northwestern Mineral County, Nevada about 15 miles east of Yerington (Fig. 1). The prospect area is included in Sections 35 and 36; T 13 N, R 27 E and Sections 1 and 2; T 12 N, R 27 E.

The volcanic rock-covered area of interest caps and laps over Black Mountain, an 8,100-foot high promontory at the north end of the Wassuk Range. Topography ranges from moderate to rugged.

During most of the year the prospect is easily accessible from Schurz or Yerington. The north end of the prospect area is most easily reached from Schurz, the northwest corner from Highway 95A between Schurz and Yerington, and the south end from either Hawthorne or Yerington via the Reese River Canyon road.

Previous Exploration Ideas

Records from the USBLM and numerous old, well marked and surveyed claim posts indicate the volcanic covered area was of interest at about the time of World War I. The idea then probably was to cover the southwestern extension of the Black Mountain (Yerington Mountain) copper vein, a modest producer of oxidized and enriched copper ores



LOCATION MAP:
BLACK WASSUK EXAMINATION

FIGURE 1

just prior to and during World War I. Since that time, other than a little sporadic, seemingly ill-directed underground exploratory work, nothing appears to have been done at Black Wassuk.

SUMMARY OF RESULTS

Bear Creek Plans for Exploration

Strong pyritic stockwork mineralization exposed for more than one mile along an overlap of post-mineral rocks and similar mineralization exposed about two miles away at the other edge of the post-mineral cover was considered as possibly fringe mineralization to a covered porphyry copper deposit. Physiographic considerations and the occurrence of supergene sulfide enrichment at the Black Mountain copper mine enhanced the possibility that the deposit could be of the enriched or blanket type buried beneath not more than 600 or 700 feet of post-mineral volcanic rocks.

Summary of Work Done and Results

During the last half of 1966, the prospect area was mapped on a reconnaissance scale, the area of interest was located in Bear Creek's name, an access road was constructed up to the crest of Black Mountain, and a limited drill program of five relatively shallow holes was completed as location work.

In 1967 drilling was resumed and four of the five location holes were deepened to depths ranging from 383 feet or 1,732 feet. None of the holes penetrated through the post-mineral volcanic formations. The unsuspected presence of more than 1,000 feet of volcanic gravels, sands, and clays, and older welded ash flows and lavas beneath the 500 to 600-foot thick andesite cap or Black Mountain was the only positive information learned from the drilling.

Because of commitments elsewhere in west-central Nevada, further work on the prospect was deferred until late 1968. Dozer trenching to improve bedrock exposures and a limited amount of geochemical sampling was done in the vicinity of the Black Mountain copper mine. Interpretation of the results of this work were unfavorable and tipped the balance toward abandonment of the examination at the end of 1968.

Current Interest in the Area

During the past several months, the area immediately northwest, west, and southwest of Black Mountain has been the scene of intensive prospecting by several major companies, including U.S. Smelting and Quintana. The progress of their work will be watched closely and if results appear to warrant it, the performance of some sort of assessment work to hold the 100-odd BCMC claims on Black Mountain should be considered.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Evaluation of drill results and more recently trenching and mapping at the prospect's northern end have diminished hope for finding a covered, enriched porphyry copper at Black Wassuk. The steep walled, volcanic filled valley indicated immediately southwest of the Black Mountain copper mine area probably would cut out a large portion of any projected chalcocite zone.

The possibility for a deep hypogene deposit similar to the deeper mineralization at Yerington remains but is remote. Strong tilting of the pre-older volcanic surface and/or normal faulting has dropped the target zone to unpredictable depths making it a low ranking, long shot at best.

Current competitor interest in the areas immediately west and northwest of Black Mountain gives cause for thought in deciding whether or not to hold the perfected BCMC claims at Black Wassuk.

Recommendation

The Black Wassuk prospect as such should be considered of no present interest. Current competitor exploration activities in the area should be followed carefully and results of work done learned if at all possible. At some time just prior to September 1st, when assessment work must be underway, the decision on whether to hold the BCMC claims on Black Mountain should be reconsidered.

OLDER DEVELOPMENT AND PROPERTY

Older Development

Significant older workings at Black Wassuk include the Black Mountain copper mine and the Northern Lights copper mine, respectively at the northern and southern ends of the prospect area. Neither has extensive underground workings and none of these reach any significant distance laterally beneath the post-mineral cap.

There is no known drilling previous to that by BCMC at Black Mountain. One hole had been drilled south of the Northern Lights mine by BCMC on an IP anomaly several years ago.

Property

The western boundary of the Walker River Indian Reservation crosses the northeastern corner of the prospect area; however, chances that the Reservation ground could overlie any ore have been considered remote from the start. An inquiry concerning a possible lease arrangement for dump and/or backslope ground was directed toward the Reservation authorities; no steps were taken past a brief consideration

of their reply mainly because at the time of prospect's chances were becoming dimmer as drill results were gained.

Other than a few claims of doubtful validity at the Black Mountain mine which straddle the Reservation boundary, virtually the entire area of interest was open to location. This was located in BCMC's name and required 75 claims, 60 of which were perfected and 15 of which were held by relocation but have now been allowed to expire (Fig. 2). Assessment work on the 60 perfected claims is due September 1, 1969.

GEOLOGY

Summary

At Black Wassuk, a large Nevadan(?) granodiorite stock and related porphyries intrude steeply tilted and faulted Permian to Triassic metavolcanic rocks and limestones. Overlying and obscuring these older rocks to a large extent is a thick complex of middle and late Tertiary volcanic rocks.

A large stockwork sulfide deposit occurs in the metavolcanic rocks and in the adjacent intrusives. Post-mineral volcanic rocks lap over much of the stockwork and it is this covered portion of the mineralization which constitutes the Black Wassuk prospect.

Regional Setting

The Black Wassuk prospect is situated in what might be termed the transition zone between the Sierra Nevada province on the west and the Basin-Range province on the east. The Walker Lane, more a topographic/physiographic line of discontinuity than a well defined structural feature trends northwest, presumably just a few miles east of Black Wassuk.

The prospect is near the crest of the northern Wassuk Range, a typical fault black range which trends about north-south. As is the case in the Sierra Nevada, the range's eastern scarp is much higher and more abrupt than the western indicating vertical displacement there several times that on the west. This faulting and tilting is late Tertiary-Quaternary in age and probably exerted little or no influence on the emplacement of the Nevadan(?) intrusives and mineralization. However, it probably had a profound influence of the history of erosion, oxidation, and enrichment which will be described later under "Oxidation and Supergene Enrichment."

Two west-northwest, premineral fracture zones pass through and near the Black Wassuk prospect (Fig. 3). The better substantiated one on the south is the Reese River Canyon zone and the other, at present less well defined, northern zone can be referred to as the Black Mountain zone. Projected westward the Black Mountain zone passes through the Copper Ridge-Blue Jay mines area and McLeod Hill north of the town of Yerington. Structures of these trends

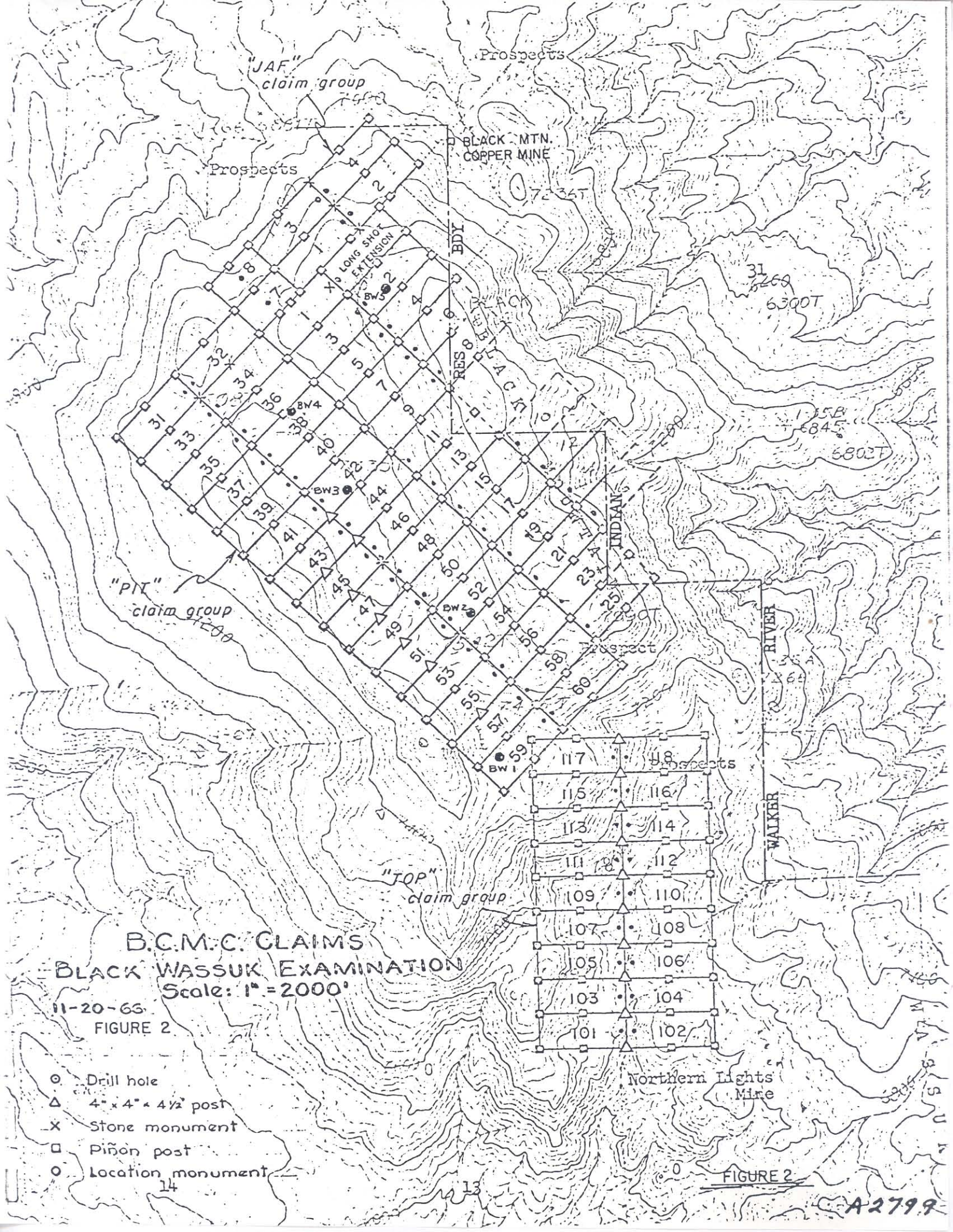
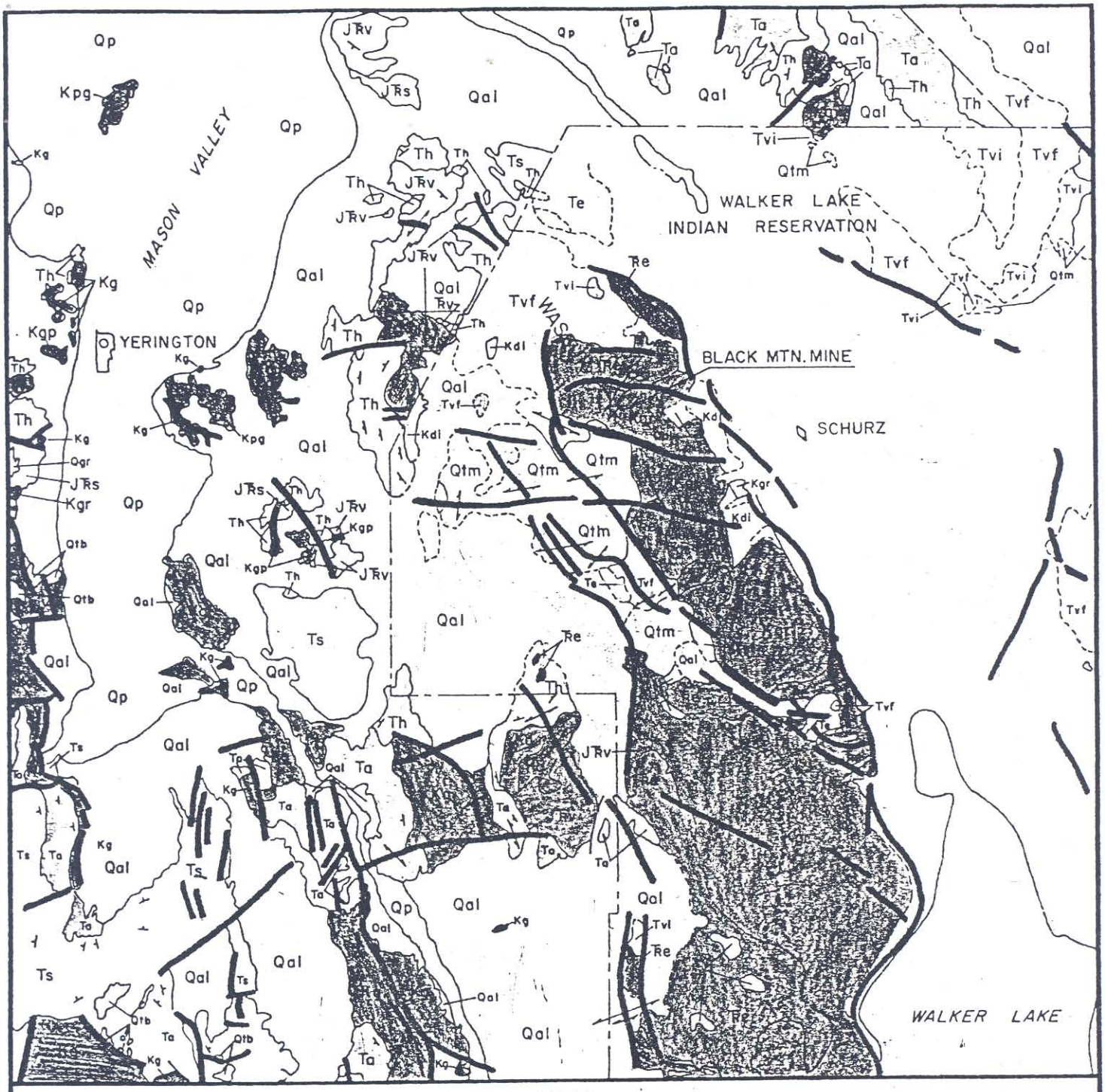


FIGURE 2

A2798



EXPLANATION

Qal Qp	Alluvium	Kpg	Granite porphyry	JTrs	Metasedimentary rocks
Qtb Qtm	Andesite & basalt	Kg Kgr	Porphyritic Qtz. monzonite	JTrv	Metavolcanic rocks
Ta Ts Tvi Tvf	Volcanic rocks	Kgp	Granitic rocks		Fault, probably pre-mineral in origin
Th Te	Rhyolitic lava & tuff	Kdi	Diorite		Fault, post-mineral

AREA: BLACK WASSUK EXAMINATION		BEAR CREEK MINING COMPANY - NEVADA DISTRICT		
TITLE: AREAL GEOLOGY	DATA BY: J.W. Allan	STATE: Nevada	MAP NO.: 12040140	
4 Mi 0 4 8 Mi	DRAFTSMAN: RER DATE: 5-21-69	COUNTY: Mineral	B3989	
	REVISIONS	TOWNSHIP, RANGE: T.12N., R.27-28E.	Fig.3	

elsewhere in western Nevada show a definite control for intrusion and sulfide mineralization and the Yerinton orebody itself appears to be localized on the Reese River Canyon zone.

Rocks

Permian Excelsior Formation

The oldest rocks exposed in the prospect area are metamorphosed tuffs and intermediate lavas of the Permian Excelsior formation. Where unaffected by the mineralization processes related to the Black Wassuk sulfide stockwork, the Excelsior rocks are dominantly a thick series of massive, dark, very hard and dense greenstones. Only rarely can bedding be clearly distinguished.

These rocks are typical of the Gold Range formation as it occurs throughout western Nevada. The Gold Range formation as proposed by R. L. Nielsen was once considered the lower part of the Excelsior formation whose upper part consists mainly of massive bedded chert and dense siliceous tuffs.

Within the Excelsior (Gold Range) formation are quartz porphyry lavas and suspected intrusives of approximate quartz diorite composition. Where hydrothermally altered within the stockwork, these rocks are extremely difficult or impossible to distinguish from the later intrusive porphyries which might be genetically related to the mineralization.

The metavolcanic rocks are widespread in the prospect area and constitute the bulk of premineral exposures. These rocks are by far the most abundant within the exposed sulfide stockwork.

Triassic Luning formation

Unconformably overlying the Excelsior-Gold Range formation are limestones and siltstones of the Triassic Luning formation. These rocks were seen exposed only at the extreme southern end of the prospect area near the Northern Lights mine and do not occur within the exposed portions of the sulfide stockwork.

Nevadan(?) granodiorite

A large, irregular stock of medium to coarse grained, holocrystalline granodiorite intrudes the older metamorphic-sedimentary rocks. Granodiorites of this type, of which there are several very large stocks further south in the Wassuk Range, in extreme western Nevada have been considered to be offshoots from and probably connected at depth with the Sierra Nevada batholith 50 miles to the west.

The granodiorite is extensively exposed along the eastern and southern flanks of Black Mountain. This rock comprises only a small portion of the exposed sulfide stockwork.

Nevadan(?) porphyries

Generally small, irregular porphyry intrusives, probably within the granite-quartz monzonite composition range, intrude the Excelsior, Gold Range and Luning formations and though none were seen cutting the granodiorite, similar porphyries do intrude the granodiorite elsewhere in the region.

The porphyries are most extensively exposed in the extreme northwest part of the sulfide stockwork. Several intervals of strongly altered "quartz porphyry" exposed in the undergroundworkings of the Black Mountain copper mine may represent these later porphyries.

Middle to late Tertiary volcanic rocks

Tertiary volcanic rocks can be divided into two distinct groups; the older is a thick series of welded ash flows, agglomerates, sands, and clays, correlative in part with the Miocene Esmeralda formation and the younger is a thick, hornblende andesite flow underlain by a thin oxidized conglomerate (Fig. 4).

The older volcanic rocks are extensively exposed west of the western range-front fault where they are tilted almost vertically and may be overturned in places. These rocks are exposed in generally small, scattered outcrops around the northern and northeastern flanks of Black Mountain and appear to be lying at much flatter altitudes than those to the west. Drill results show these older volcanic rocks to be thick and extensive beneath the later andesite flow.

The total thickness of the older volcanic sequence in the prospect area is not known; however, it probably exceeds 2,000 ft. as a maximum. The lowermost of the older volcanic rocks, whose contact with the underlying granodiorite is well exposed on Black Mountain's eastern slope is a dense, gray lava or intensely indurated, welded ash flow unlike any of the rocks cut by our drill holes (Knopf's quartz latite in Fig. 4?). About 200 ft. vertically above the contact, tuffs and relatively porous welded ash flows, very similar to those cut deep in our drill holes, overlie the dense gray lava.

The younger hornblende andesite flow was shown by the drilling to be about 500 ft. thick and tilted 15 or 20 degrees to the west. It is underlain by up to 50 ft. of oxidized andesite agglomerate.

Alluvium and talus

Most of the critical areas of interest on the northern and eastern slopes of Black Mountain are masked by thick talus accumulations and large rock slides from the andesite cap. The thick series of clays and sands cut by the drilling under the andesite are only slightly indurated and are nowhere exposed on Black Mountain.

Clay beds in two unusual playa lakes perched high on Black Mountain were augered to a depth of 24 ft. to check on a possible source for drill water. The clays are damp but far too impermeable to hold any significant ground water.

Structure

Introduction

Stockwork fracturing at Black Wassuk is fairly typical "porphyry copper" structural preparation. It is best developed, as exposed, in the Excelsior metavolcanic rocks and is almost certainly of

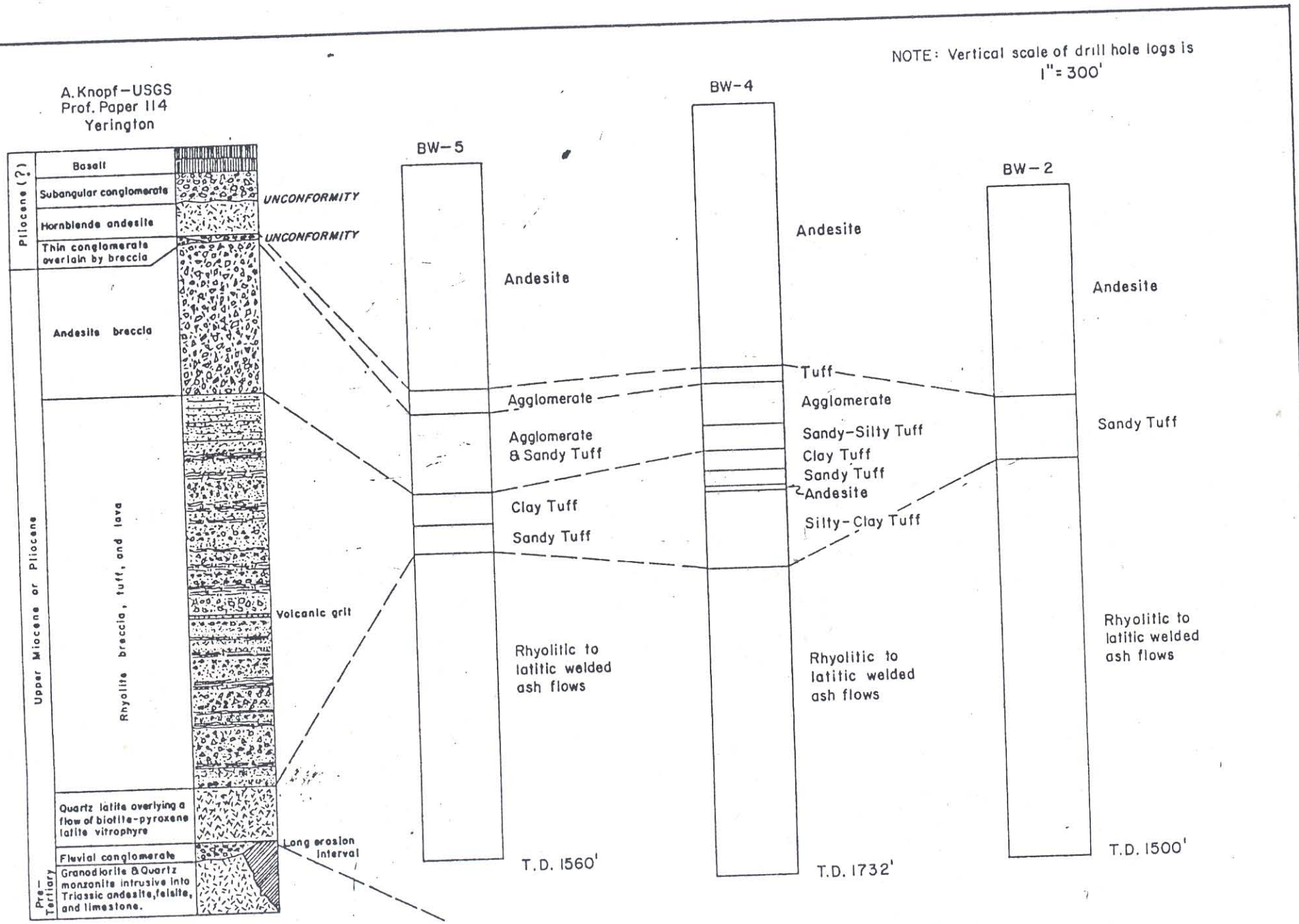


Figure 4. Generalized graphic logs of Black Wassuk drill holes compared with tertiary volcanic section at Yerington.

tectonic origin although no regional or large scale structures have yet been clearly linked with it.

Post-mineral structure is of unusual concern at Black Wassuk. Tertiary and Recent physiographic history and present geometry of the post-mineral volcanic formations enter importantly into the prospects evaluation.

Pre-mineral structure

Other than the stockwork itself, the only known, significant mineralized structure at Black Wassuk is the Black Mountain copper "vein" (Pl. 1). The vein occupies a near vertical, sheeted fault zone up to 30 ft. in width striking approximately N 50 E. Rather than a singular, persistent, and well-defined structure, the mineralization seemingly occupies several different fractures in the zone. Walls of the zone are very strongly fractured and more strongly altered and mineralized than the bulk of the exposed stockwork in general.

A peculiarity of the stockwork worthy of mention is the common abrupt termination of strong fracturing and mineralization of the Excelsior rocks at Excelsior-granodiorite contacts suggesting that the strong fracturing in the Excelsior is pre-granodiorite in age. Contacts showing this relation are exposed immediately east of and about 4,000 ft. NNW of the Black Mountain copper mine.

Post-mineral structure

The pre-volcanic surface cut in the mineralized rocks was apparently of considerable relief as indicated by the wide range of thicknesses of certain sedimentary units within the older volcanic sequence (Pl. 2). Bedding in the clays and fine sands indicates these rocks have been tilted as much as 40 degrees (probably to the west) since their deposition by normal movement on the eastern range-front fault. Several west trending faults exposed on the eastern flank of Black Mountain have downfaulted blocks of the older volcanic rocks into the mineralized rocks prior to the deposition of the younger andesite flow capping the Range.

The lack of surface exposures of the thick (1,055 ft.) series of conglomerates, sands, and clays cut beneath the andesite cap by drill hole BW-4 may be in part a result of erosion beveling caused by the above mentioned pre-andesite faulting and tilting. The vertical distance between the highest pre-mineral outcrop and the bottom of the andesite flow of approximately 400 ft. provides less than half the heighth needed for the section cut in BW-4.

The andesite cap itself is tilted 15 to 20 degrees to the west indicating the tilting continued after its deposition. Surface features along the eastern front-fault of the Wassuk Range clearly show Recent movement. The andesite cap is cut and displaced vertically by north-northwest trending faults along the western slope of the Range (Pl. 1). The unusual playa lakes on Black Mountain

are a result of this faulting. Bedding in the clay deposits in these lakes appears absolutely horizontal.

Mineralization

Stockwork

Sulfides in the stockwork occur as narrow, impersistent veinlets along fractures and as disseminated grains in the rock in about equal proportions. Overall total sulfide content at Black Wassuk probably ranges between two and six volume percent in the more strongly mineralized zones.

Pyrite and scarce chalcopyrite are the only sulfides noted in the stockwork. Quartz is widespread and abundant, occuring mainly in narrow veinlets with the sulfides. Irregular, impersistent lenses and pods of coarse calcite cutting strongly altered metavolcanics are exposed in the workings of the Black Mountain copper mine.

The actual size of the Black Wassuk stockwork was not clearly or reliably determined. If the exposed stockwork at the north end of Black Mountain extends southward beneath the volcanic rocks and connects with the Northern Lights stockwork, the whole will cover a wedge shaped area about one mile across its base and three miles long.

Distribution of copper-molybdenum values in the exposed stockwork shows no definite patterns of concentration or directions of increasing grade (Pl. 1 Overlay). About 30 samples taken at widely scattered sites show the capping to contain from 5 to 130 ppm copper and from 2 to 15 ppm molybdenum.

Black Mountain Copper vein zone

Vein minerals in the Black Mountain Copper vein are dominant quartz and pyrite with lesser amounts of calcite, chalcopyrite, and supergene chalcocite. Quartz-sulfide mineralization for a few tens of feet into the strongly fractured walls of the vein zone is stronger than that in the stockwork in general, probably ranging up to 10 and 12 volume percent total sulfides. Chalcopyrite is scarce in the walls and occurs in significant amounts only in the central, strong veins of the zone.

Hydrothermal Alteration

The following observations are based on megascopic and hand lens examination in the field and on petrographic analysis of four specimens by R. L. Nielsen of KES-GRD. No attempt was made to map or otherwise determine alteration patterns other than trying to note any increase in alteration intensity in the direction of post-mineral cover.

Quartz-sericite alteration within areas of strong sulfide mineralization is intense and pervasive. Occasionally sericite gives way to fairly coarse grained muscovite. This type alteration is fairly

clearly related to the sulfide mineralization as it definitely is not characteristic of the Excelsior-Gold Range rocks in general. The type is well exposed in the lower adit of the Black Mountain copper mine.

More widespread but less certainly a direct result of sulfide mineralization is pervasive silicification of the Excelsior-Gold Range rocks within the stockwork. Usually the rock appears to have been almost completely replaced by dense, fine grained quartz. Where granodiorite is the host for mineralization of this intensity, alteration consists essentially of strong chloritization of ferromagnesian minerals and moderate to strong argillation of feldspars.

It was not definitely determined whether or not the intensity of alteration within the stockwork increased in the direction of post-mineral cover. In the largest, exposed area of stockwork mineralization, any patterns or trends present were complicated by the alteration effects related to the Black Mountain copper vein.

Oxidation and Supergene Enrichment

Oxidation and leaching

In the exposed stockwork below the general datum of lower Black Mountain copper mine workings, oxidation is very shallow to almost non-existent; fresh hypogene sulfides can be found in almost every outcrop. In the upper mine workings and in outcrops above, near the pre-older volcanic surface, oxidation is essentially complete and moderate to strong leaching probably reaches depths of from 70 to 100 ft. below the pre-older volcanic surface.

Enrichment

Partially oxidized, enriched ores were mined in the lower and middle workings of the Black Mountain copper mine; high-grade oxide copper ores (malachite, azurite, cuprite) very probably derived from supergene chalcocite, were mined in the older, upper workings. In the middle adit, a careful search will reveal remnant grains of chalcocite in the old stopes. Ransome (6) and Hill (2) both noted the enriched character of the ores being mined at the times of their visits.

Capping

In what little capping is developed in the relatively unoxidized outcrops at the lower altitudes, the limonites are dominantly jarositic, particularly along fracture planes. Some of the disseminated grains yield casts of darker limonite which may contain some goethite/hematite.

The chances for even a first cycle of enrichment at depth in this area appear to be nil. Nor is there any reason to expect improvement of hypogene grades with depth.

The capping immediately below the pre-older volcanic surface appears slightly more favorable but is limited to a zone extending a few tens of feet on either side of the Black Mountain copper vein. The limonites here also are dominantly jarositic with occasional hematite veinlets and oxide copper veinlets.

Indications are that a thin, relatively high grade enriched chalcocite zone formed beneath the pre-older volcanic surface prior to the eruption of the volcanic rocks. The geometry of the old surface and the mine workings suggest the enriched blanket was probably only a few tens of feet thick and of very low grade laterally away from the Black Mountain copper vein zone.

Physiographic history

Following the exposure by erosion of the hypogene sulfide stockwork in the early to middle Tertiary, the physiographic history of the mineralization can be recounted in five probable steps (Fig. 5):

1. Formation of a relatively thin, generally low grade chalcocite blanket of few, possibly just one, enrichment cycles in relation to the pre-Miocene surface.

2. Eruption of the middle Tertiary volcanics and deposition of the Miocene Esmeralda volcanic sediments on a surface of moderate to severe relief.

3. Faulting along the eastern and western (Wassuk) range-front faults with a westward tilting of the fault block some 15 or 20 degrees followed by erosion and possible beveling of the volcanic sequence.

4. Eruption of the hornblende andesite on a surface of essentially unknown character.

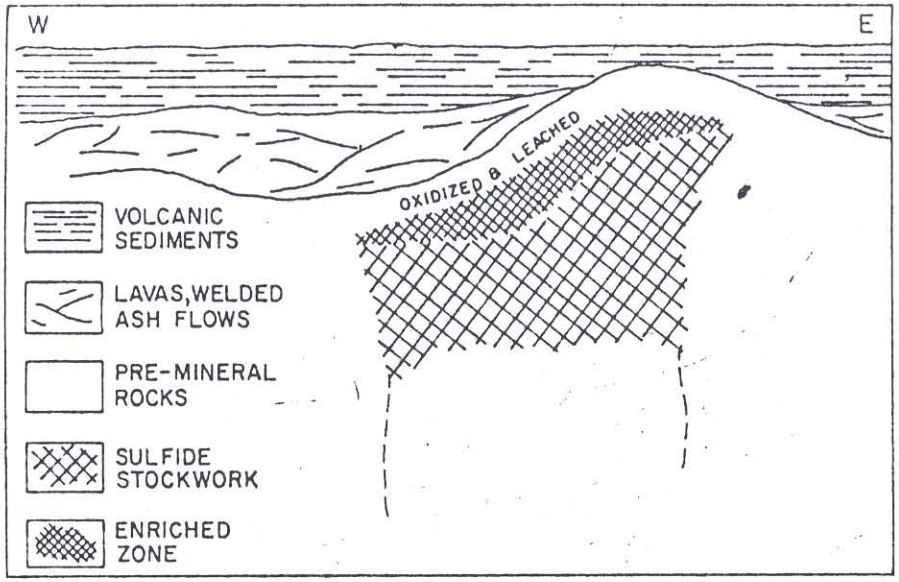
5. Recurrent movement on the range-front faults and further tilting of 10 to 15 degrees westward. Rapid erosion and dissection of the chalcocite blanket and exposure of hypogene sulfides in areas of deeper erosion.

METHODS AND RESULTS OF EXPLORATION

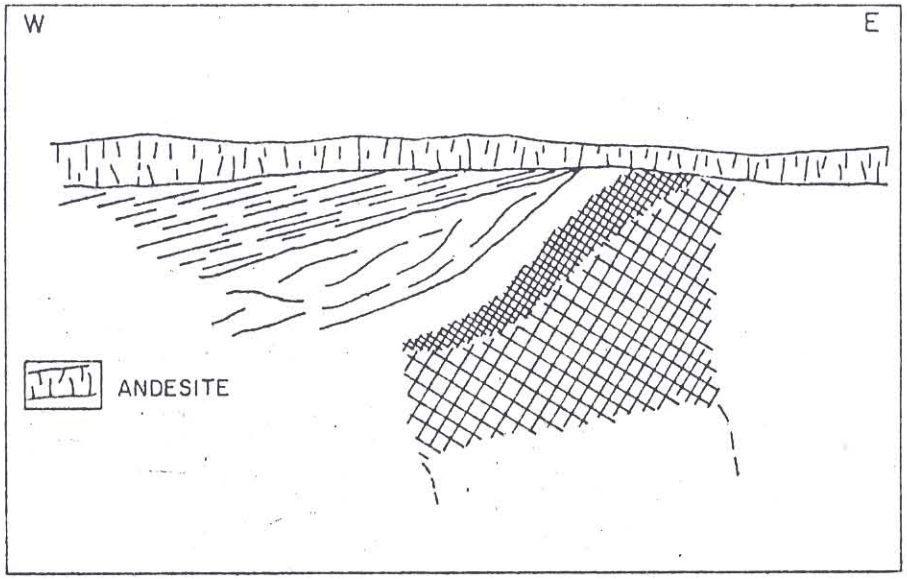
Geologic Mapping

Preliminary mapping

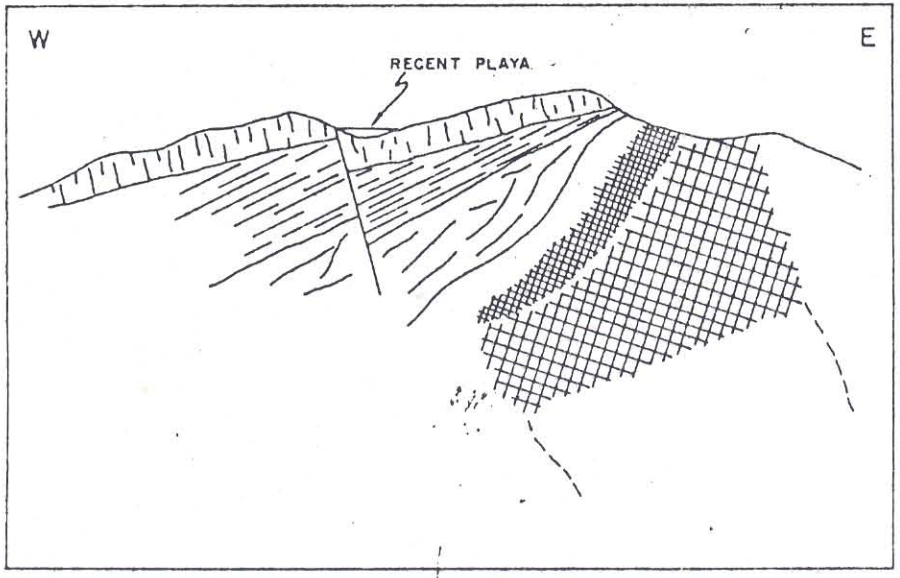
An area of approximately 10 square miles centered around Black Mountain was mapped on a reconnaissance scale during the early



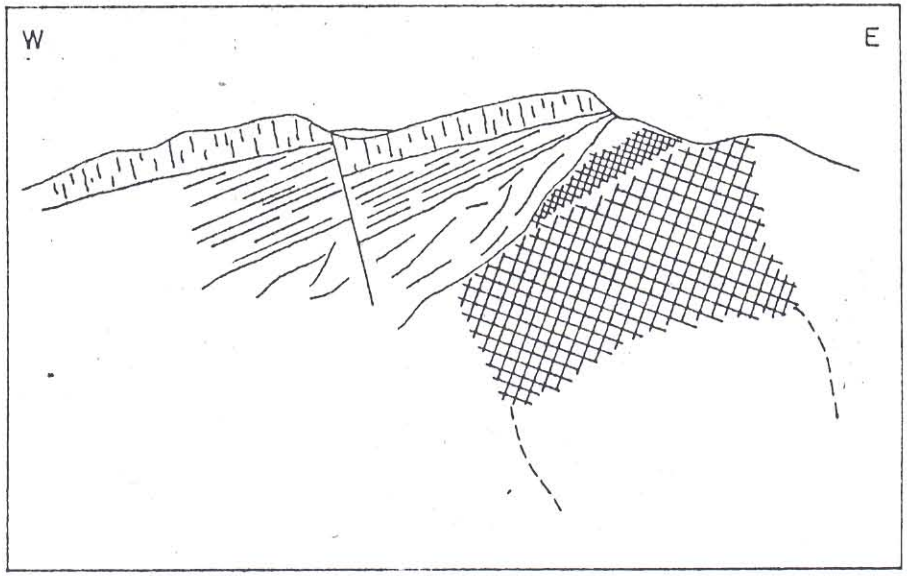
1. Desposition of Miocene (?) volcanic rocks on rugged surface of exposed sulfide stockwork.



2. Westward tilting by block faulting, more erosion with some beveling of the older volcanic rocks; deposition of andesite.



3A. Further westward tilting and rapid erosion. Possible present situation.



3B. Probable present situation if pre-older volcanic erosion outstripped oxidation and leaching just prior to Stage I above.

Figure 5. Graphic Presentation of Possible Post-Mineral Geologic History at Black Wassuk

stages of the Examination. The geologic picture of the prospect derived from this mapping proved to be generally reliable; however, results of drilling and dozer trenching later caused some revision. An excellent 1 : 24,000 scale topgraphic map was available as a base.

Most of the structures mapped were originally recognized on air photos and many were later verified on the ground. Probably the greatest shortcomings of the early mapping were not suspecting the great thickness of Esmeralda volcanic sediments lying between the older and younger volcanic rocks and the mistaken impression that the older volcanic rocks directly overlying the pre-mineral rocks were patchy and limited in thickness.

Dozer Trenching

Several dozer cuts and trenches were cut in slope wash and talus in an attempt to map and sample bedrock in the poorly exposed slopes above the Black Mountain copper mine (Fig. 6). Bedrock exposed in several cuts was examined and sampled (see Geochemical Sampling). Geologic information gained from the dozer work resulted in a revision of ideas regarding the pre-mineral rock-older volcanic rock contact in the vicinity of the mine.

Revision of mapping

Areas of the prospect were re-examined after drilling revealed unexpected thicknesses of post-mineral rocks under the andesite cap and after dozer trenching yielded a few mild surprises at the northern end of the prospect. Results of this re-mapping, if done before drilling, might have made us a little more apprehensive regarding the extent of the older volcanic rocks under Black Mountain; however, it very probably would not have affected the decision to drill.

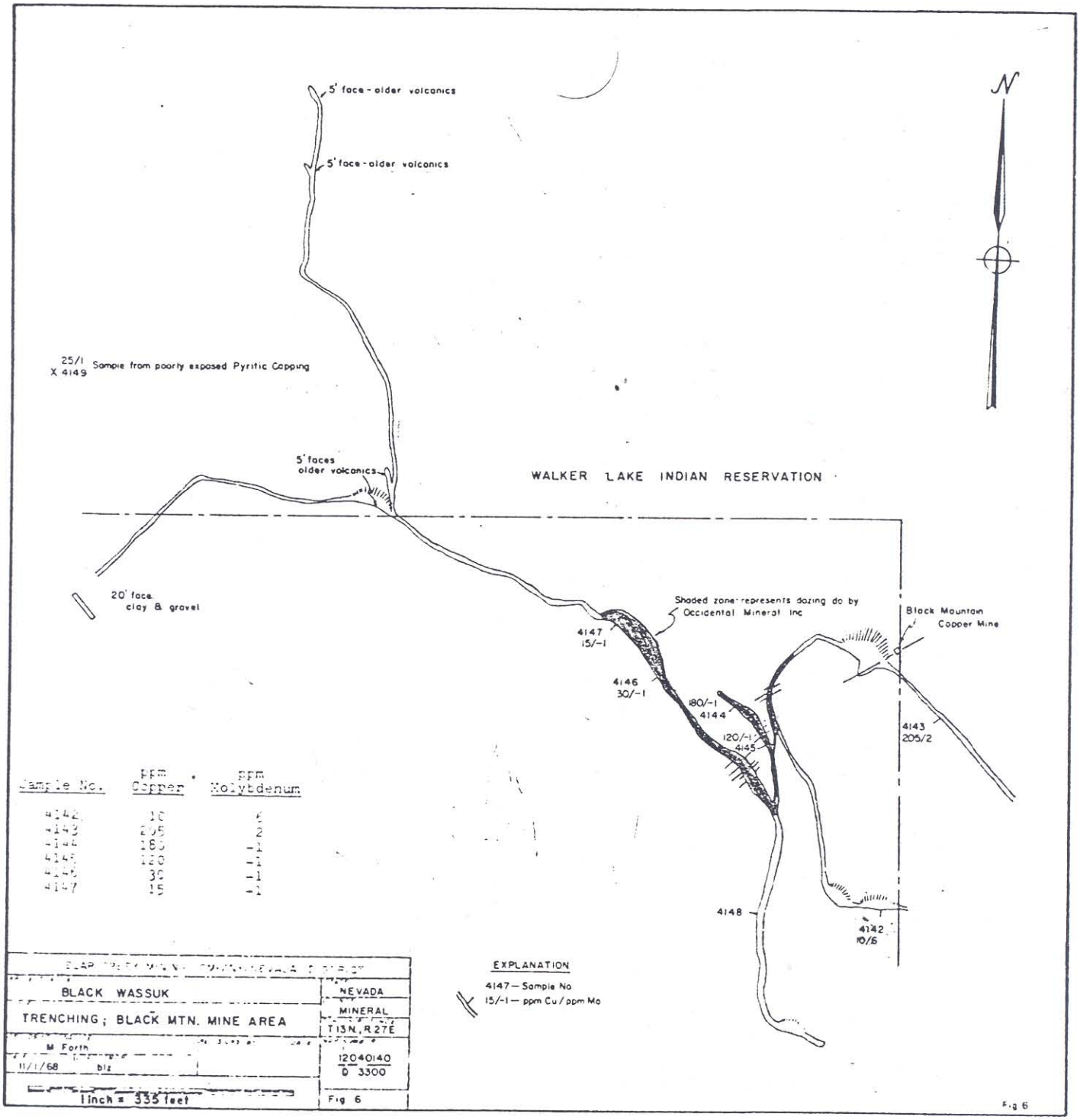
Underground mapping

Accessible workings of the Black Mountain copper mine were examined and sampled; however, preparation of a detailed underground geologic map did not seem justified. Probably the most significant results were verification of the occurrence of chalcocite in the mine and learning of the very low copper-molybdenum tenor of the unoxidized pyritic stockwork.

Geochemical Sampling

Surface rock chip samples

During the preliminary mapping twenty-three (23) out crop samples were taken from widely scattered sites in the northern capping area (Pl. 1 Overlay). Most were strongly oxidized capping but several contained partially oxidized pyrite. Copper values ranged from 5 to 130 ppm but averaged only 27 ppm and molybdenum values ranged from 1 to 15 ppm and averaged 5 ppm.



Sample No.	ppm Copper	ppm Molybdenum
4142	10	6
4143	205	2
4144	180	-1
4145	120	-1
4146	30	-1
4147	15	-1

EXPLANATION

4147 — Sample No.
15/-1 — ppm Cu / ppm Mo

BLACK WASSUK

NEVADA

TRENCHING; BLACK MTN. MINE AREA

MINERAL

T13N, R27E

M Forth

11/1/68 biz

1204140
D 3300

1 inch = 335 feet

Fig 6

Fig 6

No pattern of copper or molybdenum concentration was detected nor were any directions of increasing grade determined. The highest copper value was from the vicinity of the Black Mountain copper mine.

Late in the Examination eight (8) samples were taken from dozer cuts and a nearby out crop (Fig. 6). Three samples taken in the vicinity of the Black Mountain copper vein zone contain 120, 180, and 205 ppm Cu and respectively -1, -1, and 2 ppm Mo. Five samples taken farther from the vein zone and in the direction of hoped for improvement in Cu - Mo grades range from 10 to 145 ppm Cu and average 45 ppm Cu. Molybdenum values range from -1 to 6 ppm and average -3 ppm.

The southern capping area near the Northern Lights Mine is practically identical with that in the Black Mountain copper mine area. Nineteen rock chip samples, taken during the Northern Lights Examination, contain from 4 to 402 ppm Cu and average 65 ppm Cu; molybdenum values range from 2 to 18 ppm Mo and average 6 ppm Mo.

Underground samples

Three samples taken from unoxidized pyritic mineralization in the lower adit of the Black Mountain copper mine contain 310, 10, and 20 ppm Cu and respectively 1, 16, and 14 ppm Mo.

Drill Samples

Seventy-six feet of oxidized agglomerate with a few altered porphyry fragments cut by drill hole BW-5 immediately beneath the hornblende andesite was analyzed for copper and molybdenum. Six samples between 500 ft. and 576 ft. ranged from 20 ppm to 35 ppm Cu and averaged 29 ppm. Cu. Molybdenum content ranged from -1 ppm to 3 ppm Mo and averaged 1 ppm Mo.

Drilling

Access roads and drill sites

Six drill sites and approximately 5½ miles of access road were completed in 1966 at a cost of $5748. The ruggedness of the approaches to Black Mountain and the "malpais" surface on top were the main reasons for the unusually high road cost. When drilling was resumed in 1967 the access road was improved at a cost of $952 to accomodate larger drill rigs.

Contracts

The initial drilling contract was let to Boyles Brothers Drilling Company in October, 1966. Terms of the contract for this "claim location" drilling are summarized as follows:
Mobilization and demobilization $150

Rates:

Drilling with tri-cone bits. $25/hour plus cost of bits, drill mud, and additives.

Drilling with down hole hammer. $27.50/hour plus cost of bits.

Coring with rotary drill. $25/hour plus cost of bits, drill mud, and additives.

For the later, deeper drilling a contract was let to Boyles Brothers Drilling Company in May, 1967. Terms of the contract are summarized as follows:

Rotary Drilling

Mobilization and demobilization	$300.00
Rate	
Overburden (rotary/hammer to 1,000 ft.)	$4.15/ft.
Reaming	3.00/ft.

Core Drilling

Mobilization and demobilization	$600.00

Rates:

Depth	NX & NXWL	BX & BXWL
0 - 500	$ 8.40	$ 7.90
500 - 1,000	9.25	8.75
1,000 - 1,500	10.25	9.75
1,500 - 1,750	11.25	10.75
1,750 - 2,000	12.25	11.75

Setting up over rotary holes, casing, and pulling casing. $15/hour.

Cost of drilling

For the initial "claim location" drilling, a total of 1,140 ft. in five holes were drilled at a cost of $10,004.10, not including sampling, resulting in a cost per foot of $8.80. A breakdown of major drilling expenditures is as follows:

Mobilization & demobilization	$ 150.00
Rig time 282 hr. @ $25/hour	7,050.00
Bits, ⅝ 1/8", 16 new @ $65, 10 re-tip @ $37.50	
3 re-tip @ $32.50	1,512.50
Fishing-removing stuck rods - BW-5,	
77 hours @ $12.50	962.00

For the later, deeper drilling a total of 2,467 ft. of rotary/hammer and 2,483 ft. of core drilling was done at a cost of $53,846.74, not including sampling, resulting in a cost per foot of $10.88.

A breakdown of major drilling expenditures is as follows:

Mobilization & demobilization	$ 900.00
Rotary/hammer-direct footage charge	7,569.60
Core - direct footage charge	30,375.25
Water Haul	3,131.61
Dozer assistance	501.00
Misc. (incl. additives, moving rigs, reaming, casing, etc.)	11,369.28

Results of drilling

Five drill holes were drilled at Black Wassuk. All were located at sites considered to adequately test pre-mineral bedrock beneath the volcanic rocks and during 1966, each was drilled "a thousand dollars" deep to serve as location work for ten contiguous claims. Drilling was resumed in 1967 and completed in October of that year. Four of the five "location" drill holes were deepened; none penetrated through the post-mineral cover. Results are tabulated below.

Hole No. 1	1966	1967	Remarks
BW-1	0 - 235	235 - 383	All holes bottomed in post-mineral volcanic rocks.
2	0 - 130	130 - 1500	
3	0 - 130	----	
4	0 - 130	130 - 1732	
5	0 - 515	515 - 1560	

At the outset the post-mineral, volcanic cover at Black Wassuk was estimated to be about 600 feet thick. Based on reconnaissance mapping around the flanks of Black Mountain, it was predicted that this cover would consist of 500 to 600 feet of hornblende andesite flows underlain by mineralized bedrock and probably in several areas by remnant patches of older, post-mineral acidic volcanic rocks.

Summarized drill logs are included in the appendix; detailed logs are filed at the Nevada District Office in Reno. Significant results of the holes are briefly discussed below.

Drill hole BW-1: Bottomed in hornblende andesite at 383 feet.
Drill hole BW-2: From collar to 470 feet cut hornblende andesite; 470 feet to 615 feet cut 145 feet of weakly indurated sand and clay; from 615 feet to bottom at 1,500 feet cut 885 feet of acid to intermediate welded ash flows. Bedding in clay and fragment elongation in the ash flows ranged from 60 to 80 degrees angle with core's axis.
Drill hole BW-3: Bottomed in hornblende andesite at 130 feet.
Drill hole BW-4: From collar to 587 feet cut hornblende andesite; from 587 feet to 1,642 feet cut 1,055 feet of weakly indurated agglomerate, sand, and clay; from 1,642 feet to bottom at 1,732 cut 90 feet of dacite(?) welded ash flow. Bedding-core axis angles range between 65 and 90 degrees.

Drill hole BW-5: From collar to 499 feet cut hornblende andesite; from 499 feet to 866 feet cut 367 feet of weakly indurated agglomerate, and clay; from 866 feet to bottom at 1,560 feet cut 694 feet of acidic to intermediate welded ash flows. First hole at this site was lost at the base of the hornblende andesite in extremely loose and porous agglomerate.

Work by KES-GRD

Reddish, oxidized "mud" clinging to the bit from the last drilling run in BW-5 during the initial drilling was examined by John Wilson (7). John reasoned the strongly anomalous zinc, copper, and lead values in the material were unnatural contaminants, a fact later proven when BW-5 was deepened.

Specimens of unoxidized mineralization from the Black Mountain copper mine were examined in thin section and through X-ray diffraction techniques by R. L. Nielsen (5). This work confirmed field observations regarding certain rock and hydrothermal alteration types.

REFERENCES

1949 Ferguson, H. G. & Muller, S. W., Structural Geology of Hawthorne and Tonopah Quadrangles, Nevada, USGS Prof. Paper 216.

1915 Hill, J. M., Some Mining Districts in Northeastern California and Northwestern Nevada. USGS Bulletin 594.

1918 Knopf, A., Geology and Ore Deposits of the Yerington District, Nevada, USGS Prof. Paper 114.

1957 Maltzahn, D. W., BCMC Memorandum - Black Mountain Copper Prospect, Mineral County, Nevada.

1968 Nielsen, R. L., KES - GRD Mineralogical and Petrographic Service Report.

1909 Ransome, F. L. in Contributions to Economic Geology, 1908, Part 1., USGS Bulletin 308.

1967 Wilson, John C., KES - GRD Mineralogical and Petrographic Service Report.

APPENDIX

SUMMARIZED DRILL LOGS

BW-1 Rotary tricone: 0'-383'

Depth	Description
0'-266'	Blue-gray hornblende andesite. At 266 air circulation was lost and only a handful of cuttings was recovered. These consist of a fine-grained metavolcanic with abundant pyrite.
266'-383'	Blue-gray hornblende andesite.

BW-2 Rotary tricone & hammer: 0'-833'
NXWL core 833'-1500'

Depth	Description
0'-470'	Andesite, blue gray.
470'-615'	Tuff, sandy. Light gray.
615'-833'	Quartz latite, brownish red & orange from flooded "limonite."
833'-1169'	Quartz latite, brownish red and orange from flooded "limonite."
1169'-1500'	Quartz latite, light purple.

End of hole.

BW-3 Rotary tricone: 0'-130'

Depth	Description
0'-130'	Blue-gray hornblende andesite.

SUMMARIZED DRILL LOGS

BW-4

Rotary tricone & hammer: 0'-558'
NXWL core 558'-725'
NX wire line 725'-1073'

Rotary-tricone rock bit: 1073'-1732'

Intermittent cored intervals: 1082'-1087', 1119'-1124', 1642'-1647'

Depth	Description
0'-165'	Andesite, blue-gray.
165'-587'	Andesite, blue-gray.
587'-589'	Agglomerate, maroon red.
589'-725'	Tuff, sandy, dark-gray.
725'-796'	Tuff, light brown or gray, locally silty or sandy, loosely consolidated.
796'-855'	Tuff, light brown or gray grading into tuffaceous sandstone, loosely consolidated.
855'-865'	Andesite, purplish gray.
865'-883'	Tuff, sandy, bedding 70° from core axis.
883'-997'	Volcanic mudstone, gray, occasional sandy layers, laminations 75° from core axis.
997'-1038.8'	Volcanic siltstone, laminations 77° from core axis, occasional pumice fragments.
1038.8'-1073'	Volcanic sandstone, dark gray to black, fine to very fine-grained, poorly consolidated.
1073'-1082'	No recovery.
1082'-1087'	Sand. Gray to light gray. Fine grained, very poorly consolidated. Bedding at approximately 75° to core axis.
1087'-1119'	No recovery.
1119'-1124'	Sandstone. Light gray, tuffaceous, occasional biotite flakes, moderately indurated.
1124'-1328'	No recovery.
1328'-1642'	Sand ? Tuffaceous, grading downward in to lighter gray, more indurated material. Cutting recovery about 60%.
1642'-1647'	(Core) Tuff. Light gray, agglomeritic. Well indurated, possibly weakly welded.
1647'-1732'	Tuff, as above. Cutting recovery about 60%. Drill rods & bit stuck and hole lost at 1732'.

END OF HOLE.

SUMMARIZED DRILL LOGS

BW-5 Rotary tricone: 0'-515'; NX: 392'-694'; BX: 694'-1246.5'; AX Standard: 1246.5'-1560'

Depth	Description
0'-399'	Andesite, blue gray.
399'-499'	Andesite, blue gray to purple gray.
499'-543'	Agglomerate, purple to maroon. Abundant light colored porphyry(?) fragments.
543'-727'	Tuffaceous sand, reddish brown.
727'-866'	Tuffaceous clay, light gray to white.
866'-1035'	Acidic welded tuff(?), light purple.
1035'-1281'	Acidic welded tuff(?), light purple.
1281'-1560'	Acidic welded tuff(?), light purple. Drill rods and bit stuck and hole lost at 1560'.