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ERRO CORPORATION
AND SUBSIDIARIES | NEW YORK

INTERNAL MEMORANDUM

SHOW NAME, TITLE AND CORPORATION OF ADDRESSEE AND ADDRESSER

ELG

OTHER ADDRESSEES • FOR INFORMATION

Item 129

F. H. Spencer, Jr.
N. Y. Central File

JFW

TO: R. P. Koenig, President, Cerrocorp

August 14, 1961

DATE

FROM: S. B. Keith, Chief Geologist, Cerrocorp

Elko Co

SUBJECT: Spruce Mountain Prospect, Nevada

A Mr. Harold Ginsberg of Cornish Associates Ltd. brought in data on property of the Nevada Monarch Consolidated Mining Corporation in northeastern Nevada that they hold under a lease and option. The property consists of some 52 patented and 283 unpatented contiguous claims covering about 9 square miles and resulted from a merger of the holdings of four companies that had been mining lead-silver ore for many years.

The late Dr. R. Bruce Graham of Toronto made a detail study of the area in 1957 and 1958, including surface examination, geochemical testing, partial magnetometer survey and thirteen diamond drill holes. He concluded that further exploration work was warranted in view of the known but so far limited contact deposits of copper and favorable possibilities for a porphyry-type copper-molybdenum deposit in an altered and oxidized quartz-feldspar porphyry cutting through faulted and folded sediments.

The lease and option held by Cornish Associates expires in June 1962 and Ginsberg stated that they had spent approximately $180,000 in the four years past. He suggested that Cerro take over the option without any down payment but with an agreement to do sufficient exploration work to at least cover the cost of keeping the property in good standing (estimated at $33,000/yr.). If Cerro exercises the option, he mentioned a figure of $1.5 million to be paid to Cornish Associates but I believe this figure is not set and could be negotiated downward considerably.

Consolidated Coppermines was very interested in the property in 1958 and considered it a good bet. Combined Metals have holdings to the north and three claims within the area of the Cornish lease. Consolidated Coppermines considered churn drilling on a participating basis. W. M. Archibald, former chief of operations for Consolidated Mining and Smelting, was responsible for merging the properties together originally.

COPY

Date: August 14, 1961

Subject: Spruce Mountain Prospect, Nevada

The property looks interesting and the work so far neither proves nor disproves the possibilities of a large porphyry copper or contact copper deposit. The drawbacks are that less than a year remains in the lease and option to Cornish Associates and if anything was to be done, it would have to be pushed rapidly to a large extent this year; that further exploration would require considerable deep drilling, probably churn holes, costing between $40,000 - $60,000 and total exploration costs could easily approach $100,000 if anything encouraging was found.

Before proceeding further, I would like to know if a proposition of this kind should be of interest to Cerro at this time. If it is, I would have it examined in the field and attempt to negotiate a reasonable deal with Ginsberg, including a possible extension of the lease and option, minimum required expenditures to cover holding the property in good standing and a realistic option price.

Original signed by
S. B. Keith

S. B. Keith

SBK:as/Cerrocorp

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.RO CORPORATION
ND SUBSIDIARIES | NEW YORK

INTERNAL MEMORANDUM

SHOW NAME, TITLE AND CORPORATION OF ADDRESSEE AND ADDRESSOR

OTHER ADDRESSEES • FOR INFORMATION

F. N. Spencer, Jr.
N. Y. Central File

August 24, 1961
DATE

TO: Files

FROM: S. B. Keith

SUBJECT: Spruce Mountain, Nevada Monarch Consolidated Mines Corporation, Elko Co., Nevada

Mr. Harold Ginsberg of Cornish Associates Ltd., 200 E. 42nd Street, New York 17, N. Y. (Yukon 6-7665), submitted data on a 9 sq. mile area of mineralized land held under option until June 1962. The area is one well known in the past for small lead-silver ore bodies but present interest is in finding porphyry or contact metamorphic copper deposits. The geologic features are favorable but exploration work to date, consisting of mapping, geochemical and geophysical investigations and limited diamond drilling have not given any positive results. Further work would require extensive drilling over a large area and would call for heavy expenditures.

Although there are favorable geologic features and the possibilities of a porphyry deposit cannot be proven or disproven at present, the time limitation under the present option does not allow a sufficient period in which to adequately explore even the more favorable areas without substantial expenditures of funds. The latter cannot be justified at this time. Mr. Ginsberg is being informed that Cerro is not in a position to be interested at this time.

The property is located along the southern part of Spruce Mt., 45 miles south of Wells, Nevada, in Sections 13 thru 17, 20 thru 24, 26 thru 29 and 32 thru 33, T31N, R63E. The area is accessible from Wells by 39 miles south on Route 93 and east 7-1/2 miles on a gravel road. The Nevada Northern Railroad lies 14 miles away and the Western Pacific 16 miles.

Cornish Associates holds a lease and option on some 283 unpatented and 52 patented contiguous claims covering about 9 sq. miles. The original agreement for 3 years with a two year extension, calling for $100,000 per year expenditure and an end price of around $277,000 ends in June, 1962. Cornish Associates claim to have spent some $180,000 on the property. Ginsberg offered Cerro a sublease and option with no down payment but with a guarantee of doing enough work to hold the property and an end price of around $1,500,000.

Date: August 24, 1961

Subject: Spruce Mountain, Nevada Monarch Consolidated Mines Corporation, Elko Co., Nevada

The area is one well known for small, rich lead-silver veins. In 1929, Nevada Monarch Consolidated Mines initiated a series of mergers with Eastern Nevada Exploration Co., Missouri Monarch Mines Co., Spruce Monarch Lead and Silver Mining Co. and Spruce Monarch Consolidated Mining Co. under the leadership of W. M. Archibald, former Chief of Operations for Consolidated Mining and Smelting, who believed that a deep-seated sulfide ore body existed in the area. It is estimated that about $3 million had been produced in lead, silver, gold, copper and zinc in the district. Combined Metals holds some property in the district. E. H. Eakland, Jr., now with Scudder, Stevens & Clark in New York, examined the property for Anaconda in the 1940's and felt that it was a good long-shot prospect. Newmont is reported to have looked at it and drilled two holes in the early 1950's. At the time Consolidated Copper Mines ceased operations, they were favorably considering the property and had had correspondence with Ginsberg. The late Dr. R. Bruce Graham of Toronto made a detail examination of the property for Cornish Associates in 1957 and 1958 and planned the exploration.

The country is partly rugged and partly hilly with a moderate climate. Due to varying elevations, vegetation and water supply also varies within the property.

A sedimentary series of limestone, dolomite, quartzite, conglomerate and argillite, Ordovician to Mississippian in age, occur on the western flank of a large north trending anticline. This series is cut by an E-W elongated quartz-feldspar porphyry intrusive and strong E and NE striking faults. The faulting and drag folding complicate the structural picture. The porphyry exhibits silicification, kaolinization and sericitization and contact metamorphism along its contacts. The outcrop is oxidized, highly iron stained and leached. Pyritization is noted where cut in depth. The 14 drill holes showed persistent 0.02 - 0.05% Cu, 0.01-0.03 Mo and 0.3-0.4 oz. Ag in the porphyry. The contact metamorphic zones gave values slightly over 1% Cu but were relatively narrow.

Unfortunately, none of the geochemical, geophysical or drilling work gives clear indications of the loci of economic mineralization and no definite targets are known. The latest suggestion is that the best possibility for secondary enrichment lies at the western end of the property in conformity with the present drainage.

S. B. Keith

S. B. Keith

SBK:as/Cerrocorp

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FORM NO. 44 OTHER ADDRESSEES • FOR INFORMATION

CERRO CORPORATION
AND SUBSIDIARIES | NEW YORK

INTERNAL MEMORANDUM

SHOW NAME, TITLE AND CORPORATION OF ADDRESSEE AND ADDRESSOR

TO: H. R. Craig, Jr., Manager of Exploration
Cerromin NY

January 26, 1970
DATE

FROM: T. W. Mitcham, District Exploration Geologist
Cerromin SLC

SUBJECT: Spruce Mtn. District
Elko County, Nevada

Past production from this district was mainly limestone replacement Ag-Pb ore, from bodies controlled by faults. Copper mineralization, in narrow zones mainly in the walls of an elongated stock or dike complex, and partly in the igneous rocks, does not appear to be intense or widespread. Also, the remaining potential for Ag-Pb-Zn ores is low.

I am in agreement with the conclusions expressed by Justin Kreek, in his attached report (1-23-70), that the district potential for porphyry copper or other types of orebodies is low. This presumably checks conclusions reached by others, e. g., Newmont and Occidental, who have explored in the district in recent years.

The district is recommended as being of no further interest at the present time.

Thomas W. Mitcham
by LK

Thomas W. Mitcham

TWM/lk

Attach.

FORM NO. 44

OTHER ADDRESSEES • FOR INFORMATION

CERRO CORPORATION
AND SUBSIDIARIES | NEW YORK

INTERNAL MEMORANDUM

SHOW NAME, TITLE AND CORPORATION OF ADDRESSEE AND ADDRESSOR

TO: T. W. Mitcham, District Expl. Geologist
Cerromin SLC

January 23, 1970
DATE

FROM: Justin Kreek, Senior Geologist
Cerromin SLC

SUBJECT: Westland Minerals Submittal
Spruce Mountain District
Elko County, Nevada

Summary, conclusions, recommendations. -- The Spruce Mountain district is in T31N, R63 and 64E, MDM, Elko County, Nevada. It is about 45 miles south of Wells, Nevada, the nearest town. Westland Minerals Corporation has offered their holdings in the district, 47 patented and 384 unpatented mining claims. Published figures show a district total production of 105,000 tons of ore valued at $3 million for the period 1869-1952. The composite average grade was computed to be Au .01 oz., Ag 12 oz., Pb 11.5%, Zn 1.5%, Cu 0.4%. Principal values were in an oxidized lead-silver vein and bedded replacement ores.

The copper was produced from partially oxidized contact deposits in altered limestone adjacent to a small granite porphyry intrusive. Probably zinc deposits are nearly as extensive as the lead-silver deposits, but were not exploited due to the prohibitive distance to a zinc smelter and low metal prices.

Most of the ore deposits occur where favorable horizons of the Devonian Guilmette Formation are intersected by mineralized faults and fractures. The Guilmette is interpreted as being part of the lowest plate of a structural complex with imbricate thrust faults superposing unmineralized Mississippian and younger rocks in at least two thrust sheets over a normal sequence of lower Paleozoic rocks. The mineralization may be associated with a granite porphyry dike which is interpreted as cutting only the pre-Pennsylvanian rocks.

Previous modern exploration of the area has been undertaken by Newmont and Occidental, among others. Much of the area has been tested by geophysical and geochemical surveys and nearly twenty drill holes have been put down to test for a possible porphyry copper deposit within the dike.

Two drill holes, some 150 feet apart, intersected a silicified shear zone adjacent to the north wall of the granite porphyry dike which averaged 1% copper over widths of 20 to 40 feet. The porphyry is generally altered but contains only pyrite

except in shear zones, where low grade chalcopyrite mineralization has been found. All other holes were essentially barren.

Although the possibilities have not been exhausted, it seems extremely unlikely that a porphyry copper body of economic significance exists in the district. The potential for finding additional lead-silver and zinc vein and replacement deposits seems good, but their tonnage must be expected to be too small to be economic so far from a smelter.

No further work is recommended.

Justin Kreek

Justin Kreek

JK:lk

Additional pages plus Attachments A through J.

Scope. -- Most of August, 1969, was spent in field checking and mapping the Spruce Mountain district. Additional weeks have been spent assembling and assimilating information on the district. The structural complexity of the area has resulted in a confusing variety of interpretations regarding ore controls, correlation of host rocks, and the age and type of intrusions. The principal reason for examining the property was the marked similarity to the Ward Mountain district, near Ely, Nevada, structurally, lithologically, and mineralogically. Phillips has announced the discovery of six million tons of $30 ore indicated by drilling at Ward Mountain, and exploration drilling continues.

Location and accessibility. -- The Spruce Mountain district is 45 miles south of Wells in T31N, R63 and 64E, MDM, Elko County, Nevada. The abandoned town of Sprucemont is seven miles from paved U. S. Highway 93.

Many miles of mine and drill roads give access to most of the surface areas of interest. The recent construction of a road serving a microwave and TV relay station on the north peak of Spruce Mountain exposed stratigraphic and structural features which are of considerable help in interpreting the geology of the district.

Ownership. -- Westland Minerals controls four groups of claims in the Spruce Mountain district, a total of 47 patented and 384 unpatented mining claims.

Jack Boundy Group 39 patented, 12 unpatented
Westland purchased 100% interest.
Index-Daly Group 8 patented, 72 unpatented
Leased from Index-Daly Mines Co.
c/o Charles S. Woodward, Jr.
19 West South Temple, SLC, Utah
West Spruce Group 297 unpatented
Option from West Spruce Mines Co.
c/o Charles S. Woodward, Jr.
19 West South Temple, SLC, Utah
Reginald Lee Group (Ada H.) 3 unpatented
Lease or option from Marybell M., Gary M., Nancy F., and John D. Lee, Pioche, Nevada

Westland Minerals has offered an option on these claims until November 1, 1970, for $50,000 and a guaranteed minimum expenditure of $100,000 on the property. If we exercise our option, they would retain a 40% working interest subject our recovery of 115% of previous costs from 90% of the gross.

The property has been extensively developed by shafts, adits, and tunnels. Most of the shafts have caved, but many of the adits are still accessible, though in need of repair. Surface installations have generally been abandoned for twenty to thirty years and are only shells, with the exception of two large antique compressors remaining at the Black Forest mine.

The workings of the Black Forest and Monarch mines, on opposite sides of Spruce Mountain, were connected at the 8,400 foot elevation with the Bronco tunnel to facilitate ore haulage and access during the winter months. This 7,000 foot tunnel has probably caved, but air still circulates through it.

The Monarch has been kept in fair condition, with track and air lines still in place in the main haulage way. Some rehabilitation of timber sets in the Monarch has been done within the last 10 years, whether as assessment work or as part of a proposed mining operation is unknown.

The Westland controlled properties include all but two of the known producing properties in the district. The major property outstanding is a group of about 47 claims held by Combined Metals, a company recently purchased by International Smelting and Refining Co. (Anaconda). This group includes the Killie mine, the first discovered and the last operating mine in the district. These claims form the north boundary of the Jack Boundy group.

The other property with a history of production not controlled by Westland is the Parker or Humbug mine. These claims cover vein lead-silver deposits about a mile northeast of the main district. Current ownership is unknown.

Production and development. -- First discoveries were made at the Killie mine in 1869. Other early lead-silver discoveries were the Juniper, Fourth of July, and Black Forest mines. By 1872-73 a smelter to treat lead carbonate ores was handling 35 tons of ore per day at Sprucemont. This effort failed, but a 50-ton furnace was built about 1906 in the valley northeast of Spruce Mountain. Much of the ore handled at this smelter came from the Black Forest mine until low metal prices forced suspension of operations in 1910.

Production from the district resumed with the recovery of the market and continued through 1952. Major periods of production were restricted to the periods of higher metal prices, the middle 1920's and the middle and late 1940's.

Production for the period 1869-1952, according to Granger (1952), was 105,000 tons valued at $3 million.

Modern exploration efforts have been made by several companies. Cornish Associates reportedly spent nearly $200,000 in drilling and geophysical evaluation in 1957 through 1959. The core from 14 drill holes is stored at Sprucemont, but has been badly jumbled by the collapse of the storage racks. The only copper values of economic interest were intersected in two adjacent holes, shown in cross-section (Attachment F).

The Killie mine was reopened and an attempt made to mine near surface low-grade deposits by open pit methods but the attempt was unsuccessful. Attachment I is a sketch map of the Killie pit. A grab sample from the dump north of the pit assayed 0.26% Copper, 1.8% lead, 5.0% zinc, and 4 ppm molybdenum. The dump is estimated to contain 3,000 tons.

Earlier evaluations were made by Anaconda and Newmont. Core from two holes drilled by Newmont was stored in a cabin near the porphyry adit, but has been destroyed by vandals. The only available record of the holes is a cross-section indicating they penetrated the intrusive at similar elevations, below a thrust plate, suggesting the sill hypothesis. The Black Forest ore horizon should be present below the sill, but its depth is conjectural.

Westland Minerals acquired the property as part of its assets during organization of the company and did a detailed geophysical and geochemical study of the general area from the Killie mine to the copper adit.

Occidental Petroleum took an option on the property in 1969 but turned it back after evaluating the data and running a few IP lines. The Occidental data corroborates the Westland data, but the anomalies have apparently already been tested by drilling or underground workings. Attachment E is a map of the Black Forest mine workings made by Wilson in 1937. His cross-sections are Attachment D.

Physical features. -- Spruce Mountain, elevation 10,262 feet above sea level, and Spruce Ridge, maximum elevation about 8,900, form an arc or spur to the west from the main Pequop Range. The protected slopes are thickly forested with juniper and pine, and the exposed areas are generally grassy slopes.

Sufficient water to supply a two-rig drilling program is available at a spring developed for a stock tank. Westland has filed for the water rights on the spring, reportedly without opposition. The Black Forest and Monarch mine adits make only a few gallons per minute in the fall, probably enough for underground drilling, but insufficient for surface drilling. Water flow during spring runoff is probably much greater.

Geology. -- Sedimentary Rocks. The sedimentary rocks of the Spruce Mountain area range in age from Cambrian (?) to Recent. With the exception of the relatively non-resistant shales, siltstones, and Tertiary sediments, good exposures were found. Structural complexity adds severe handicaps to unravelling the stratigraphic sequence. Three mutually exclusive sequences of pre-Tertiary rocks were found in the area. The two higher sequences are interpreted as superposed by thrusting along shaly, clastic strata.

Cambrian (?) and Ordovician rocks are exposed in the area between Sprucemont and the Monarch mine. These are mapped as Є (?) -O and consist of cherty limestones, shale, and dolomites older than the overlying Eureka quartzite.

The highly metamorphosed rocks cropping out between Sprucemont and the Spruce Standard mine were mapped as "skarn" and may be part of this sequence affected by alteration adjacent to a granite porphry dike. The Ely Formation, as exposed a few hundred feet north of the Standard mine, is relatively unaltered, and a thrust is hypothecated superposing the Ely over the skarn.

A few hundred feet north of the Ada H mine a shale-quartzite sequence assigned to the Mississippian Diamond Peak Formation is in low angle fault contact with cherty limestone resembling Cambrian rocks. This may be an exposure of the theoretical thrust.

The Ordovician Eureka quartzite is represented by a light gray to white, compact, vitreous quartzite about 25 feet in thickness which is exposed continuously along the west flank of Spruce Mountain from a small canyon just south of the Monarch mine main adit.

Overlying the Eureka quartzite is a light to dark gray dolomite sequence, mapped as the Du unit. These rocks range from upper Ordovician to lower Devonian in age and probably could be divided into the Laketown, Sevy, and Simonson units with adequate field work. The lighter dolomites are locally marbleized near the thrusts and the intrusive.

The Devonian Guilmette Formation is recognized as the principal ore horizon in the major mines of the district. It consists of basal dolomites grading upward into limestones. Bedding-plane-shearing is common in the mines and the crushed or brecciated "favorable bed" near the base of the unit mapped as Guilmette may actually be a thrust zone, or at least a major bedding-plane-shear zone.

The Mississippian Diamond Peak Formation overlies the Guilmette, but with a fault contact everywhere the interval is exposed. This is interpreted as a thrust contact because of the deformation of the Diamond Peak near this contact and a rubble zone possibly associated with a low angle fault between the Mississippian and Devonian rocks in the Killie Pass area.

The Diamond Peak is an extremely distinctive formation composed of interbedded shales, quartzites, chert pebble conglomerates, and relatively thin massive limestone beds with abundant horn corals. The lower third of the formation contains brown to black, brown-weathering shales reminiscent of the Pilot shale interbedded with brown quartzites. The central third of the formation is predominately brown quartzite with shale interbeds giving way to chert pebble conglomerates upward. The upper third contains the limestones interbedded with quartzite conglomerate. The best exposed section is on the west flank of Spruce ridge about three miles north of Sprucemont.

On the road leading to the microwave and TV relay station on the north peak of Spruce Mountain, a black shale with Mississippian fossils is exposed near the 10,000 foot level. This shale is apparently interbedded with the same horn-coral bearing limestone noted at other outcrops, and resembles the Chainman shale in the Ely area.

Above the Diamond Peak Formation is a thick sequence of light to dark gray limestone beds with abundant chert. This formation is the Ely limestone. The basal contact of the Ely is gradational with the Diamond Peak in some areas and a fault contact in others.

Overlying the Ely, in thrust contact, is the Arcturus Group, a sequence of silty limestones and thin calcareous shales. No mineralization is known in the area in sediments younger than the Ely.

Just south and east of the mapped area, the Kaibab, Phosphoria, and Dinwoody Formations successively overlie the Arcturus Group in apparent normal stratigraphic sequence.

Coarse conglomerates grading outward into sandy tuffs from the base of the mountain are correlated with the Tertiary Humboldt Formation.

Remnants of a welded lithic tuff, presumed to be Tertiary, overlies all but the recent alluvium and fanglomerates on the east side of the range.

Intrusive Rocks. Three types of intrusive rocks occur in the area, granite porphyry, quartz monzonite porphyry, and a darker finer-grained intrusive mapped as diorite.

The porphyry rocks are interpreted as a complex dike and sill intrusion of pre-Arcturus sediments. Exposures are poor, as the intrusives are among the rocks most susceptible to weathering in the district, but from the limited exposures and from cross-sections of old drill holes it appears that the porphyries are in fault contact with the younger Paleozoic sediments. The dikes intruded the pre-Arcturus sediments and sills developed at shaly, clastic horizons. Later thrusting developed movement along the same shale horizons. A rubble zone within Diamond Peak Formation rocks on the north face of the North Peak contains large blocks of altered quartz monzonite porphyry mixed with limestones and shales.

The main dike can be traced about two miles along strike, from the Banner Hill fault on the east to the Bronco fault on the west. Exposures are too poor to determine a true width, but it seems to average about 500 feet. Schrader (1931) described this dike as extending to the Spruce Standard mine area at Sprucemont, with an average width of 500 feet, but no surface exposures of porphyry could be found along this line and it is believed that he projected underground intersections with porphyry in the lower plate to the surface. A trend of silicification of upper plate rocks does approximate Schrader's outline of intrusive outcrop.

Harlow (1956) describes the granite porphyry as "... light gray and medium-grained with phenocrysts of quartz and orthoclase up to 3 mm in diameter in a fine-grained groundmass. It is compact and breaks into blocky angular fragments. Under the microscope the groundmass contains a minor amount of plagioclase and traces of biotite and hornblende. Most of the feldspar has been altered to sericite and clay minerals, and the biotite to chlorite and iron oxides ... ... The main ore deposition appears to be associated with this dike in the Killie Pass area."

Isolated small outcrops of porphyry occur north of the road through Killie Pass and in saddles along the crest of Spruce Mountain.

The diorite is generally present as small, widely scattered dikes which have been found cutting both lower and upper plate rocks. Harlow describes the diorite as "... generally rather strongly weathered and disintegrated. In hand specimen this rock is greenish-brown to greenish-gray, medium-grained, and composed of well-crystallized hornblende and plagioclase. Under the microscope the hornblende is euhedral, greenish-brown in color, and in some thin sections is altered in part to chlorite and epidote. A very minor amount of augite is present ... ... The plagioclase is largely altered to sericite and clay minerals."

The longest exposed diorite outcrop in the area occurs along the west flank of Spruce Ridge about two miles north of Sprucemont. The outcrop width is less than forty feet and occurs within the limestone sequence mapped as Ely. The contacts are covered, but pieces of float were found which displayed the contact. There is no visible alteration of the limestone or chill-border of the intrusive. The attitude of the diorite could not be determined. There is no evidence of mineralization related to the diorite.

Mineralization. -- The ore deposits appear to be restricted to zones related to the granitic intrusive. Most of the copper mineralization borders the intrusive, generally within thirty feet of the contact. Only a few exposures indicate more extensive alteration of the wall rock, and these are mineralized but are far below ore grade. The copper ores mined contained malachite, chrysocolla, chalcopyrite, chalcocite, and minor bornite and covellite.

The zinc deposits occur as veins and bedded replacements at favorable horizons generally farther from the intrusive than the copper. These deposits have generally not been exploited because of economic factors. There is only minor overlap of the zinc and lead-silver zones. Not enough is known of the geology of the mines to determine whether the zinc to lead zoning is vertical or horizontal. The zinc deposits may be stratigraphically lower than the lead-silver deposits, or perhaps are in portions of the same favorable horizon which was farther below the surface at the time of mineralization. The zinc ore contains residual sphalerite, smithsonite, and hemimorphite. There is no gold or silver associated with the zinc minerals.

The lead-silver deposits are generally farther from the intrusive than the zinc deposits and occur as veins and replacement of a favorable horizon at fault and fracture intersections. Clark Wilson described these deposits in 1938 while mining was still in progress:

> "The ore deposits are replacements in dolomite, closely associated with fractures, faults ... The replacement deposits are of two types, bed replacement and fissure. The fissure deposits are the most numerous, but most of the production from the Black Forest mine and from the district has been from bed deposits.
>
> "A ten-foot dolomite bed that is brittle and shatters when faulted has been especially favorable to replacement. The bed ore occurs as pipes at the intersection of N40°W and N50°W fissures with this bed; the pipes follow the intersection as much as several hundred feet. The Dutch fissure, which has produced considerable ore, is an example of this type of deposit. This fissure has been followed for 1,000 feet on the dip of the beds.
>
> "Most of the fissure deposits have replaced the dolomite for a foot or two from the fissure walls. The ore has formed in the favorable ore horizon.
>
> "The Black Forest ore is an oxidized lead-silver ore containing on the average twenty percent lead, twenty ounces of silver per ton, twenty to forty percent iron, and a small percentage of lime and 'insoluble', but no appreciable gold, copper or zinc. Some of the ore contains small amounts of arsenic.
>
> "The principal ore minerals are cerussite and plumbojarosite, cerussite being the more abundant. ... minor minerals include anglesite, galena, sphalerite, pyrrhotite, chalcopyrite, pyrite, and arsenopyrite."

The Black Forest and adjacent mines followed the favorable bed down dip over 2,000 feet horizontally over a vertical range of 400 feet.

The Monarch mine deposits were fissure veins with wall rocks of undifferentiated Devonian and Ordovician dolomites. The deposits took the form of oreshoots which reportedly bottomed out above the 600 level, the lowest level developed. The oreshoots were stoped over a vertical range of 500 feet, at several locations along a 1,200 foot segment of the N20E to N20W trending fractures.

The Spruce Standard, Paramount, and Ada H mines, among others on the west flank of the range, were developed on oreshoots formed at fracture intersections. All three seem to have been stopped at about 150 feet below the surface, the approximate depth of oxidation in the western part of the district.

Maps INT-69-99 through INT-69-108 show the results of IP, resistivity, and geochemical surveys. The geochemical surveys indicate highs over the mined areas, but this may reflect the surface enrichment by dump material as much as true anomalies.

The IP surveys show anomalies over the Black Forest mine workings and smaller anomalies along the north edge of the claims, north of the dike. The Newmont drill holes appear to have been drilled to test one of these anomalies.

Small anomalies in the vicinity of the Standard and Ada H. mines on the west were tested by Cornish Associates with negative results.

Attachment J is a composite rock sample map and mineralization map of the area. In general the molybdenum content is universally low, and strong copper values are limited to mined out areas. The oxidized copper minerals are generally in calcareous rocks prohibiting an acid leach operation.

Possible exploration targets. -- The most obvious anomalies shown by the geophysical surveys (Attachment G) have been tested, at least with shallow drilling. Additional geophysical surveys of the area along the west flank would be helpful in evaluating the mineral potential of the only untested mineralized area of the claims.

An aeromagnetic survey would be another low cost aid in the evaluation. A second area of interest is north of the dike and possibly beneath the sill between the Killie mine and the copper adit, but much of this area is off the claims.

The most desirable target, a large porphyry copper deposit, seems most unlikely to occur in the district. It is probable that new deposits of lead-silver and zinc, similar in size to those mined out, could be found by an intensive drilling program, though most are probably at depths exceeding 1,500 feet. The probable aggregate tonnage is too small to justify the large exploration effort required with the potential overproduction of lead and zinc in other districts. The tenor of the undiscovered orebodies is probably on the order of one-third that of the exploited ores, which were enriched by oxidation.

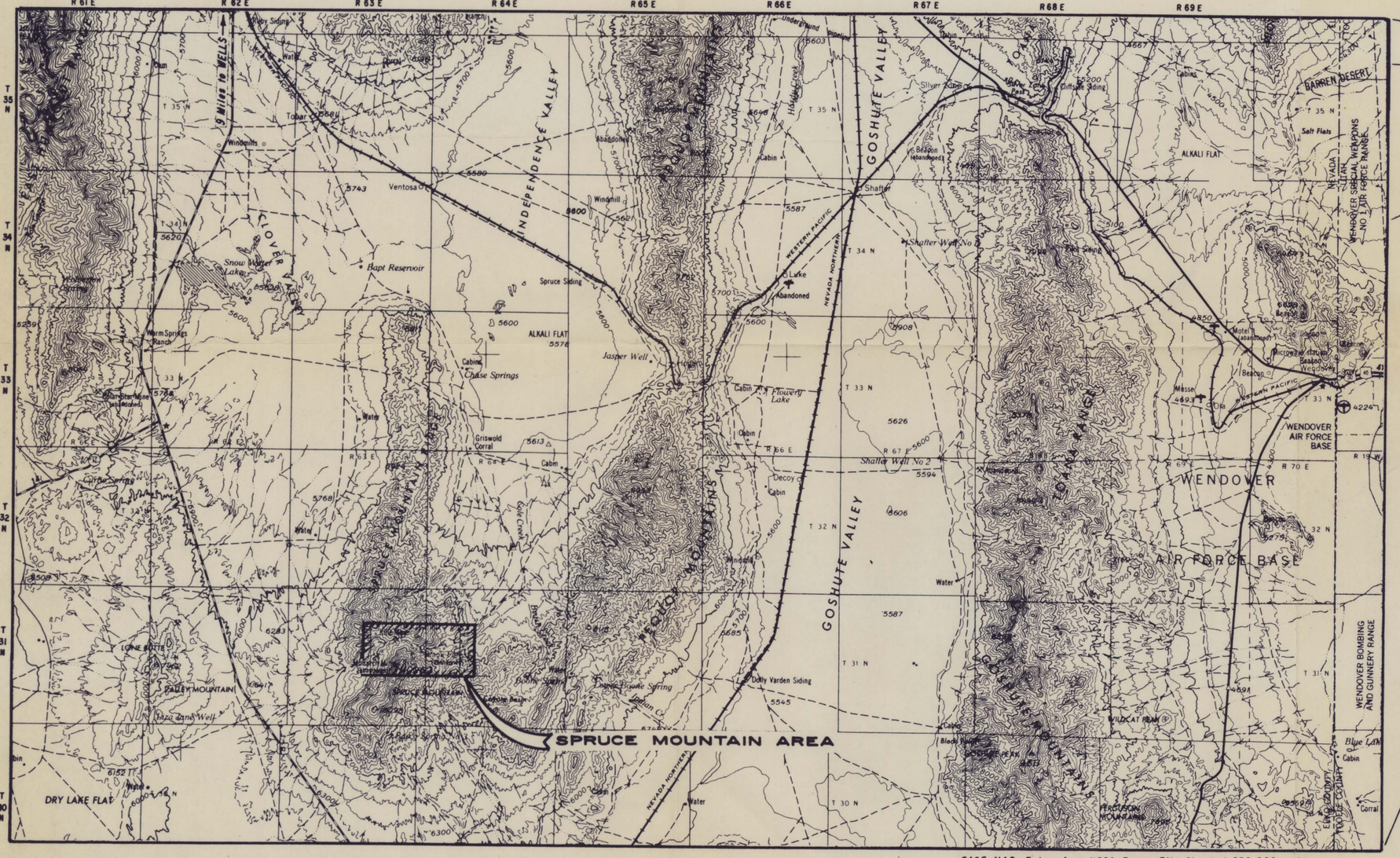
To summarize, the possible undiscovered orebodies should be of the same three types known to exist in the district. The copper deposits are only of economic grade in the contact metamorphic zone of the intrusive, a limited tonnage in this district. The lead-silver deposits can be expected to be found as narrow vein deposits of limited tonnage and bedded replacement deposits at favorable horizons.

The Guilmette Formation contains the only known favorable horizon for this type in the district, and stoping heighths rarely exceeded 15 feet. Considerable strike length can be expected for this type, however. The known zinc deposits are principally in veins, although this may be the result of development work, guided by the much higher grade cut-off for zinc ore, the bedded deposits being avoided as uneconomic.

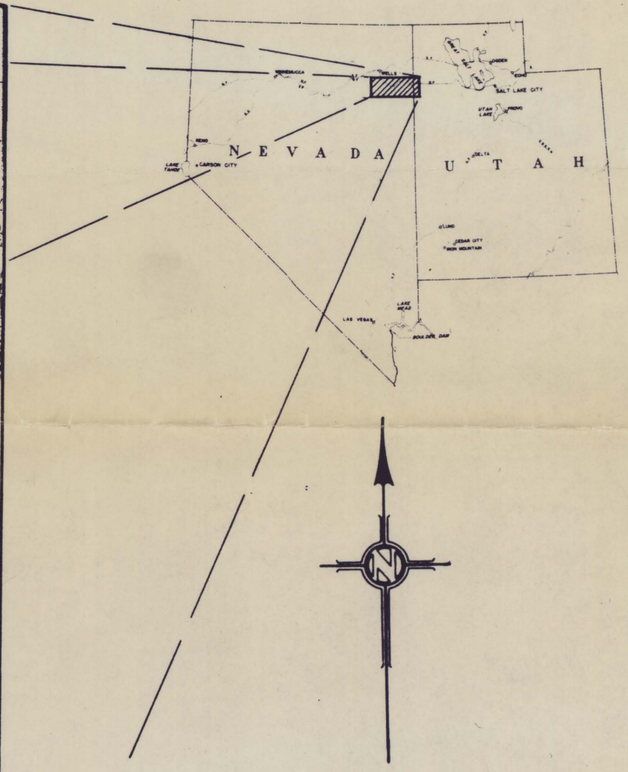
Quantitatively the undiscovered tonnage at reasonable depth cannot be expected to exceed the past production, and should have about one-third the metal content, a potential of 100,000 tons of $20 ore at current prices.

Justin Kreek

Justin Kreek



BASE MAP: Taken from USGS Topog. Elko Sheet 1:250,000 series



LOCATION MAP

SPRUCE MOUNTAIN AREA

ELKO COUNTY – NEVADA

SCALE IN MILES

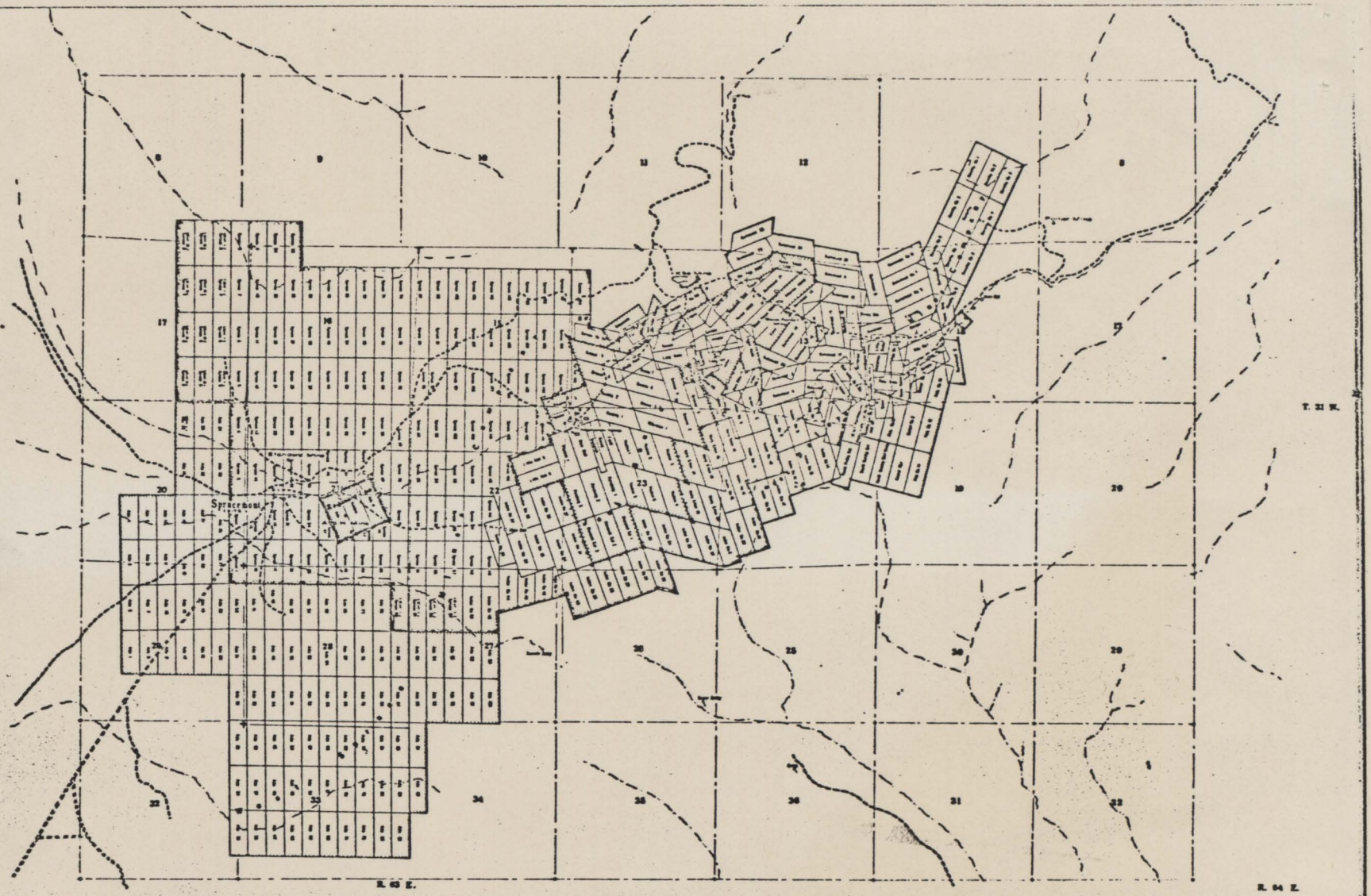
5 0 5 10 15

ATTACHMENT A

SP 1

4590 C035

INT-69-97

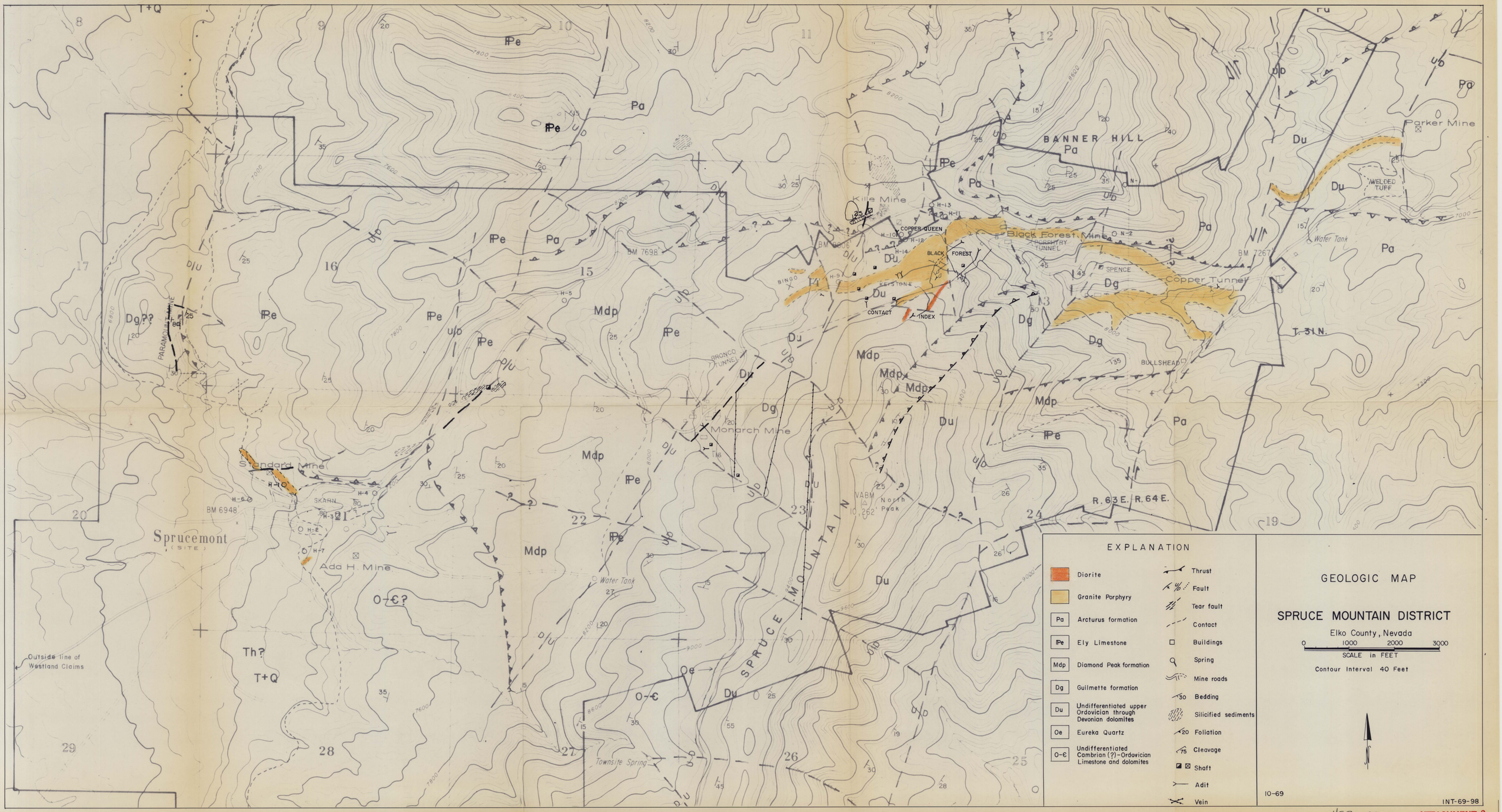


PROPERTY MAP
WESTLAND MINERALS CORPORATION
SPRUCE MOUNTAIN MINING DISTRICT
Elko County, Nevada

4590 0035

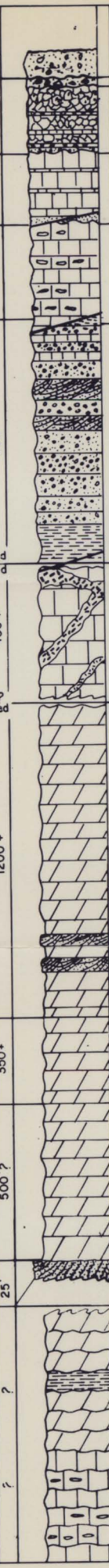
ATTACHMENT B
INT-69-111

ATTACHMENT B



4590 0035 ATTACHMENT C

SEDIMENTARY ROCKS



QUATERNARY	Q	ALLUVIUM	?	Alluvium. Poorly consolidated material derived from the surrounding hills.
				Welded-tuffs.
	unconformity			
TERTIARY	T	TERTIARY SED.	?	Breccias. Breccias and thin bedded conglomerates derived from Paleozoic and metamorphosed Paleozoic? rocks. Local thin bedded fresh water limestone
	unconformity			
PERMIAN	Pa	ARCTURUS FOR.	?	Limestone. Brown to tan weathering silty to sandy limestone, base is marked by abundant fusulinids.
				Sandstone. Porous, reddish weathering calcareous sandstone.
	Thrust			
PENNSYLVANIAN	IPe	ELY LIMESTONE	1400'+	Limestone. Massive, tan to light grey limestone beds six to ten feet thick; black to tan chert lenses are common throughout.
	Thrust			
	Mdp	DIAMOND PEAK FORMATION	900'+	Chert pebble conglomerate. Chert-pebble beds up to six to eight feet thick with quartzite matrix, interbedded with cross-bedded, fine to coarse grained, light brown to white quartzite Beds commonly iron-stained. Conglomerate interbedded with two or more Joanna-type limestone beds in upper third. Black shale unit near top(?) of formation on North Peak resembles Chainman or Manning Canyon, may be omitted by thrusting elsewhere.
MISSISSIPPIAN				Shale. Brown weathering shale, resembles
	base not exposed			Probable thrust contact
	top not preserved			
DEVONIAN	Dg	GUILMETTE FORMATION	450'+	Limestone. Fine to medium grained, dark grey to black limestone which weathers medium grey; beds are one to two feet thick in the lower portion and six to ten feet in the upper portion Principal ore horizon. Granite porphyry intrusive(Tertiary?) Diorite dikes(Tertiary?).
	thrust contact? top not preserved			
	Du	SIMONSON DOLOMITE	1200'+	Dolomite. Strongly laminated, fine-to medium grained, grey to charcoal grey dolomite; the overall color range is darker than the lower member; mottling is common
				Dolomite. Alternating beds of laminated, medium-grained, brownish weathering dark dolomite and dense, faintly laminated, light grey dolomite; the amount of light grey dolomite decreases upward in the section. Two beds of sandy dolomite are present in the lower portion of this member; they are cross-bedded and weather reddish-brown.
		SEVY DOLOMITE	350'+	
ISILURIAN		UNDIFFERENTIATED UPPER ORDOVICIAN-SILURIAN DOLOMITES	500'?	
ORDOVICIAN	Oe	EUREKA QTZITE.	25'	Quartzite, Tight grey to white, compact to vitreous.
				METAMORPHIC ROCKS
	O-Є	CAMBRIAN(?) UNDIFFERENTIATED CAMBRIAN CARBONATES	?	Dolomite. Black or light to dark grey, massive bedded dolomite, fine-grained, locally calcareous, weathers light to dark grey to a tan.
CAMBRIAN			?	Limestone, massive, medium to dark grey, weathers dark grey. Black chert lenses.

4590 0035

ATTACHMENT C

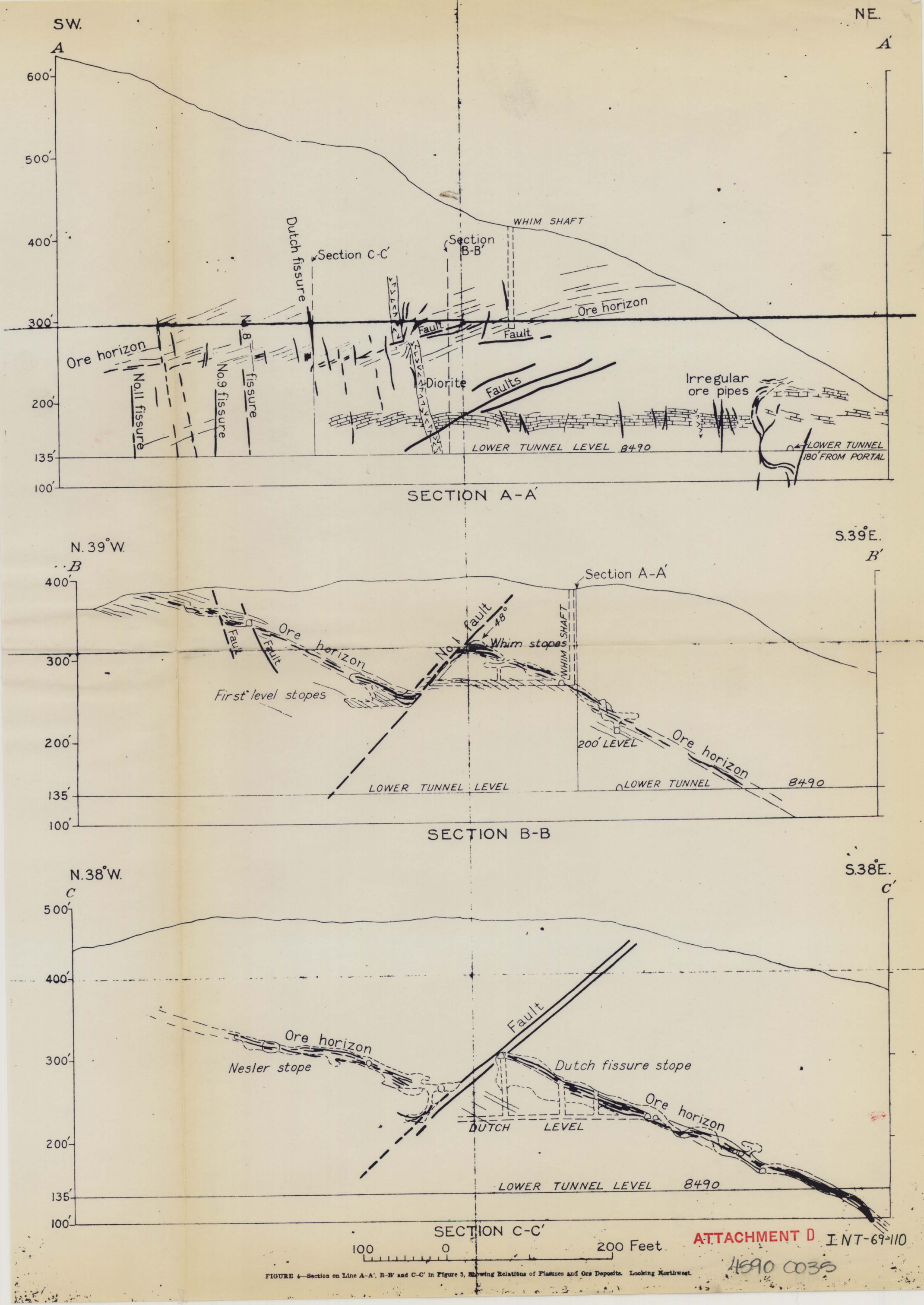
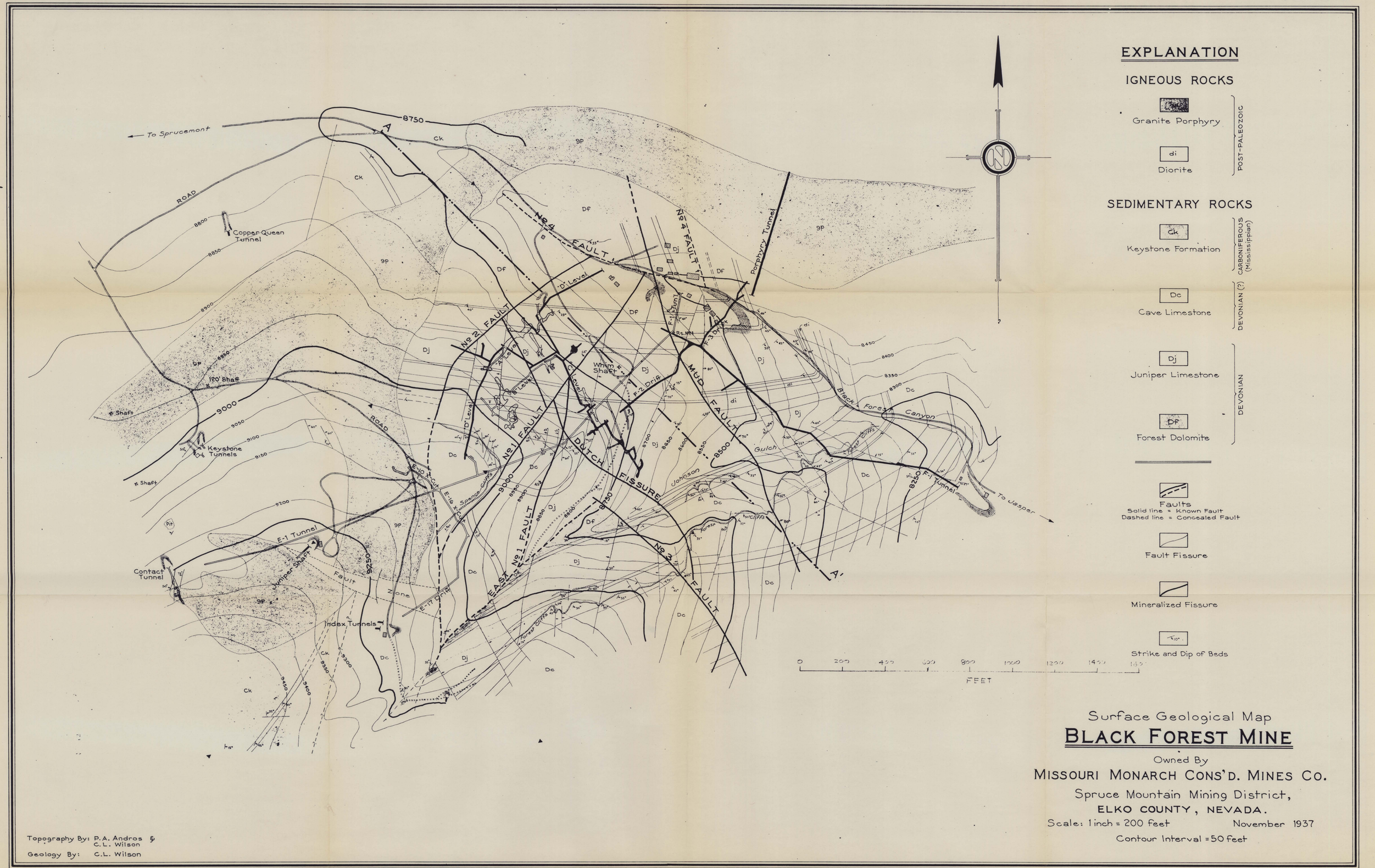


FIGURE 4—Section on Line A–A', B–B' and C–C' in Figure 3, Showing Relations of Fissures and Ore Deposits. Looking Northwest.



Surface Geological Map

BLACK FOREST MINE

Owned By

MISSOURI MONARCH CONS'D. MINES CO.

Spruce Mountain Mining District,

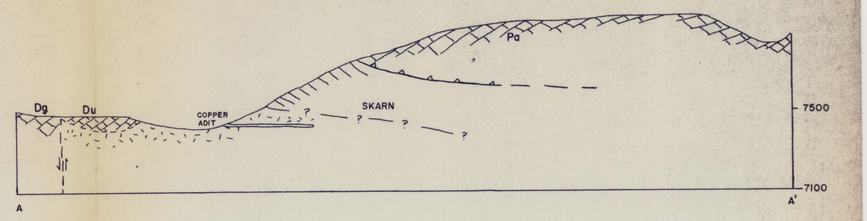
ELKO COUNTY, NEVADA.

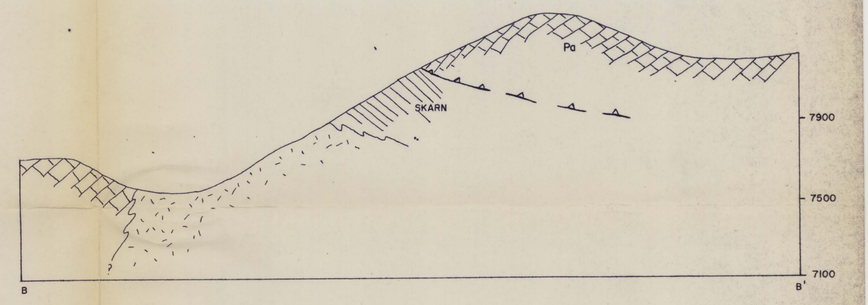
Scale: 1 inch = 200 feet November 1937

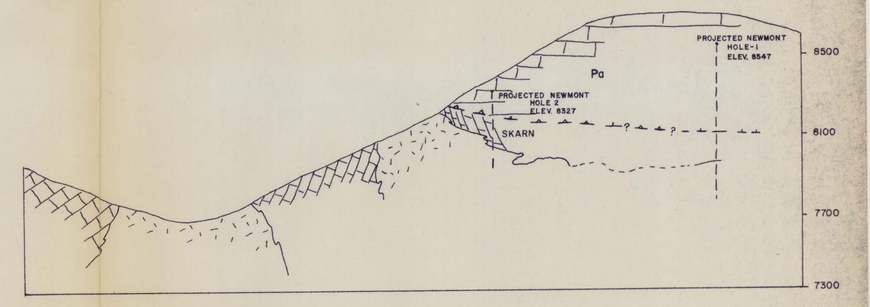
Contour Interval = 50 feet

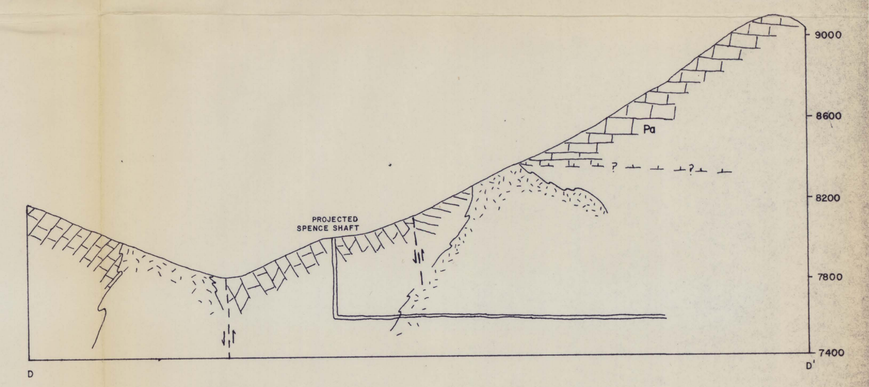
Topography By: P.A. Andros & C.L. Wilson

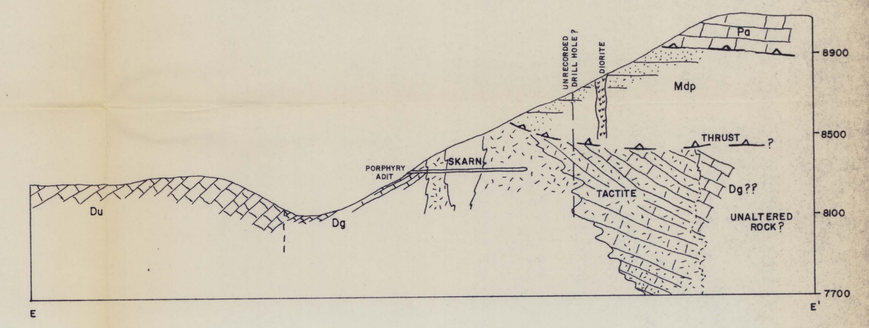
Geology By: C.L. Wilson

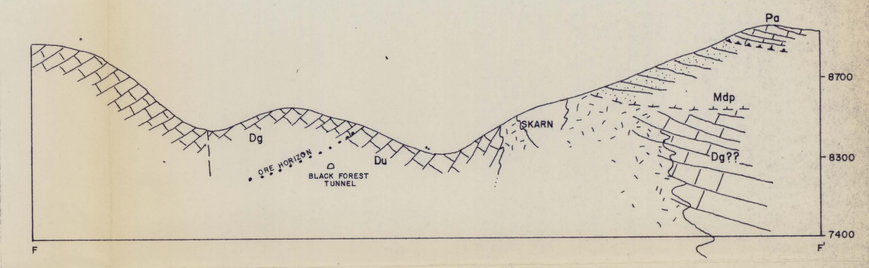


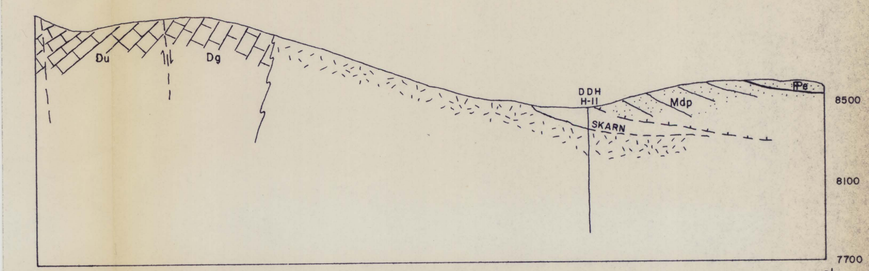












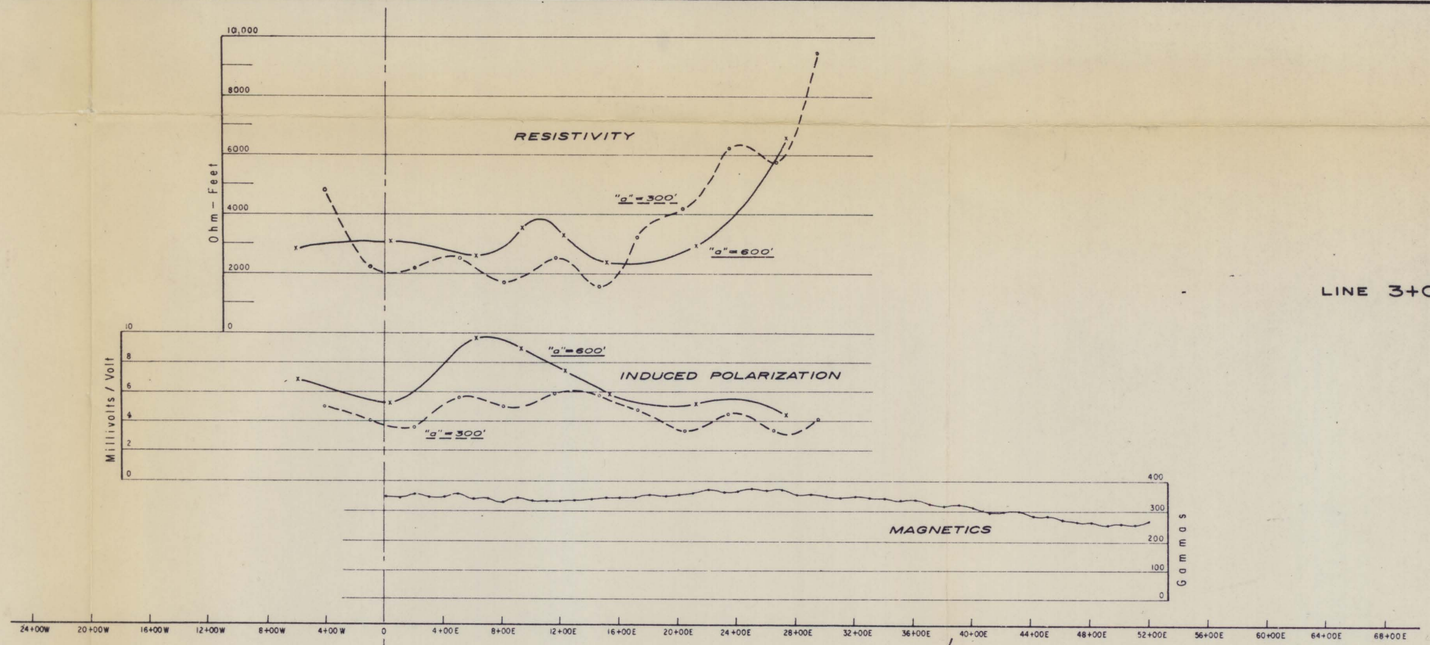
SPRUCE MOUNTAIN DISTRICT

CROSS SECTIONS AT 1000 Ft. INTERVALS THRU.
BLACK FOREST - SPENCE SHAFT - COPPER ADIT
(Looking west)

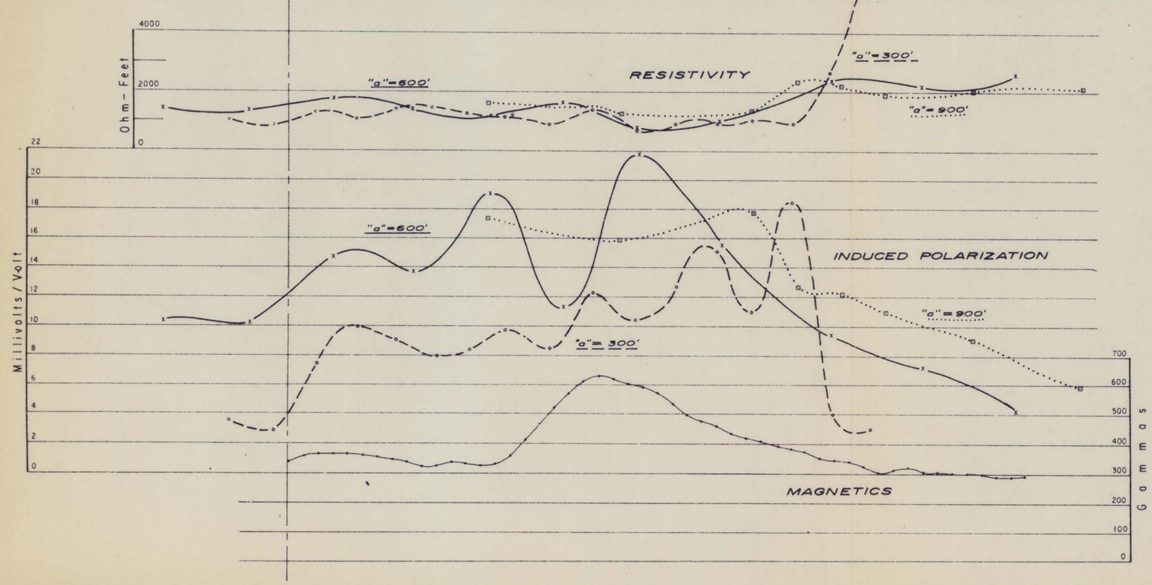
SCALE 1" = 400'

ATTACHMENT F

4590 0035 INT-69-112



LINE 3+00S



LINE 9+00S

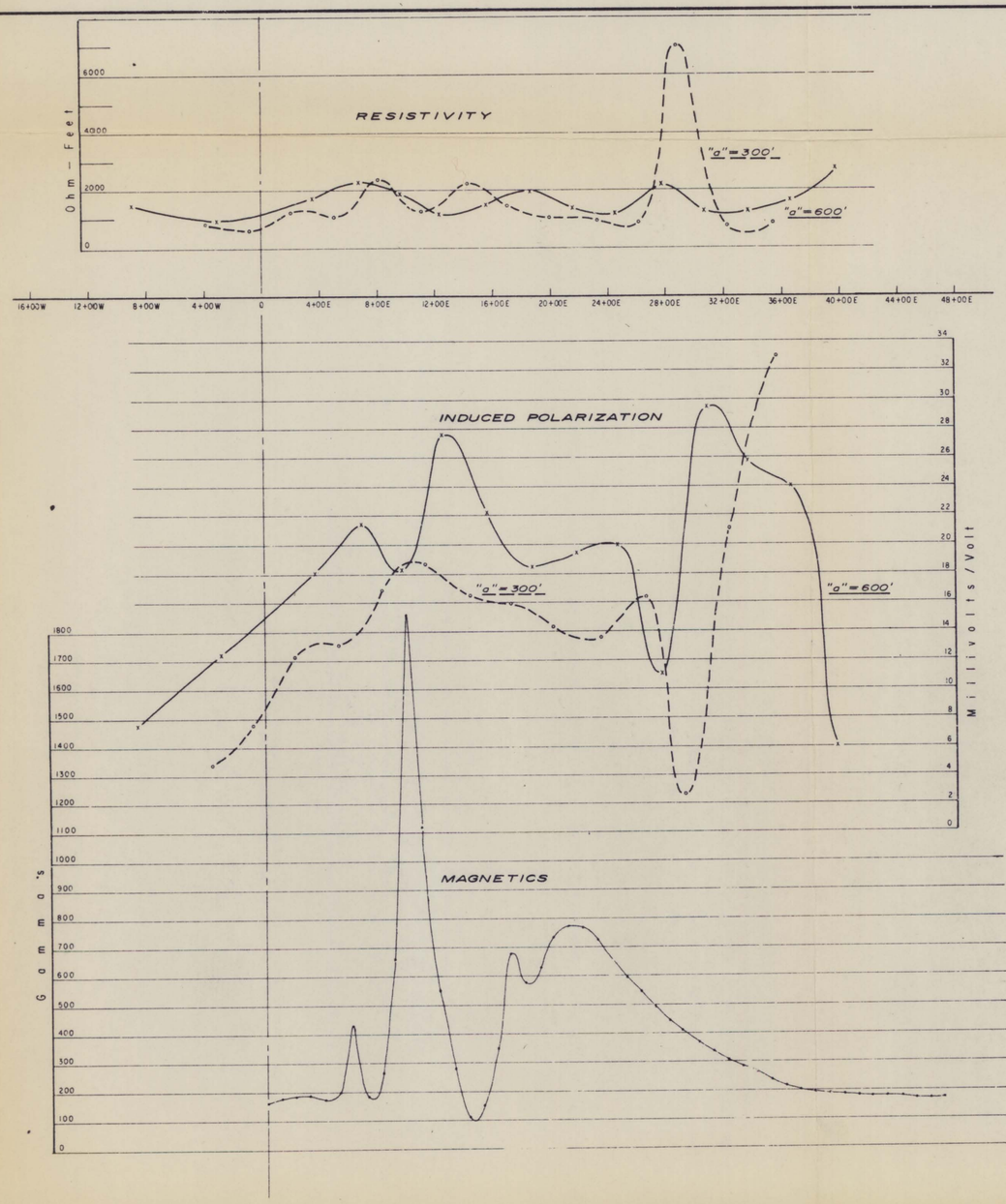
GEOPHYSICAL PROFILES

SPRUCE MOUNTAIN DISTRICT

ELKO COUNTY - NEVADA

FIELD WORK by:
J. Powers
T. Posey
S. Evans
July-Aug 1967
SP 13

ATTACHMENT G-1 INT-69-115



LINE 12+00S

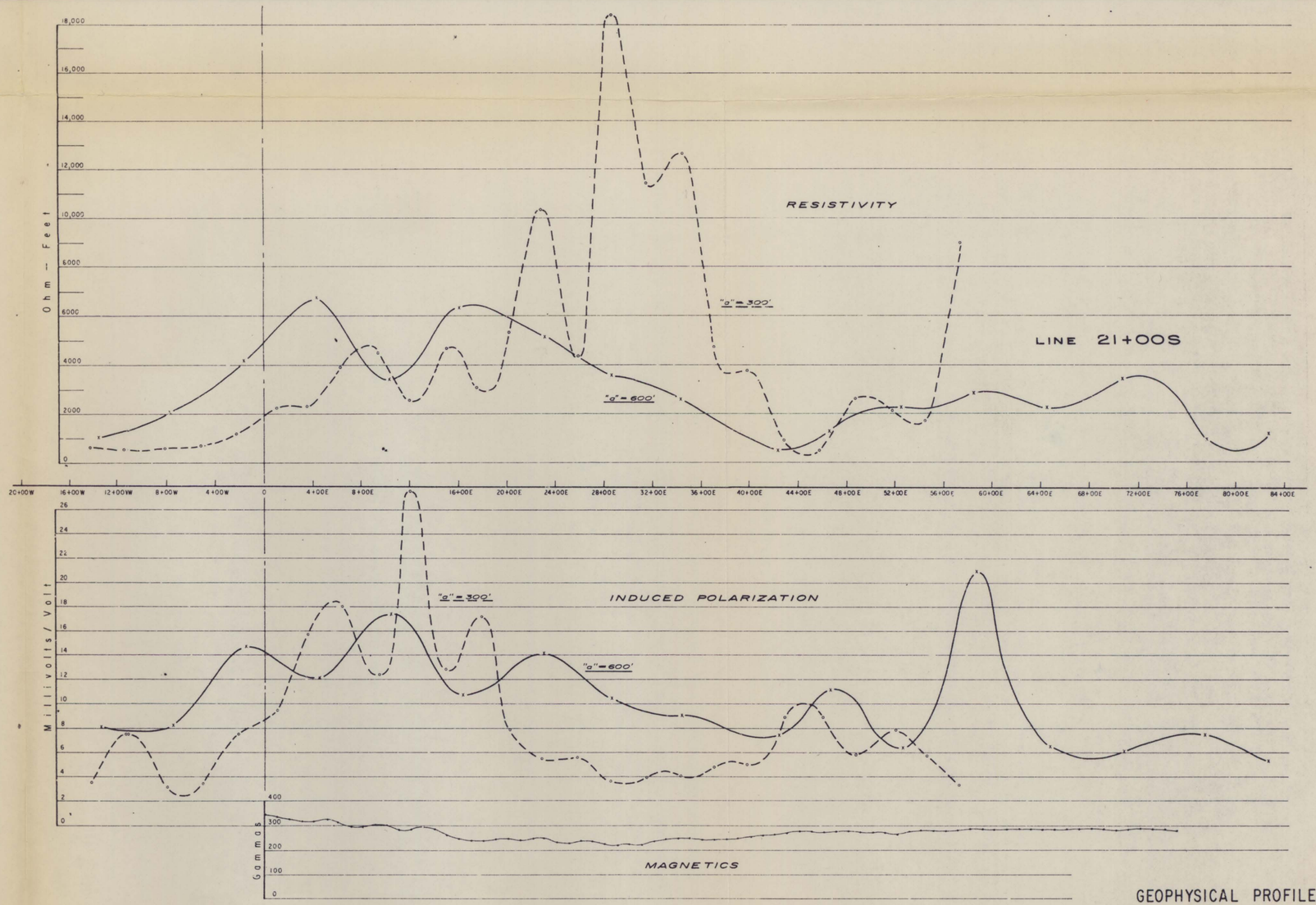
GEOPHYSICAL PROFILES

SPRUCE MOUNTAIN DISTRICT

ELKO COUNTY - NEVADA

FIELD WORK by:
J. Powers
T. Posey
S. Evans
July-Aug. 1967
SP-14

4590 0035 ATTACHMENT G - 2 INT-69-116



GEOPHYSICAL PROFILES

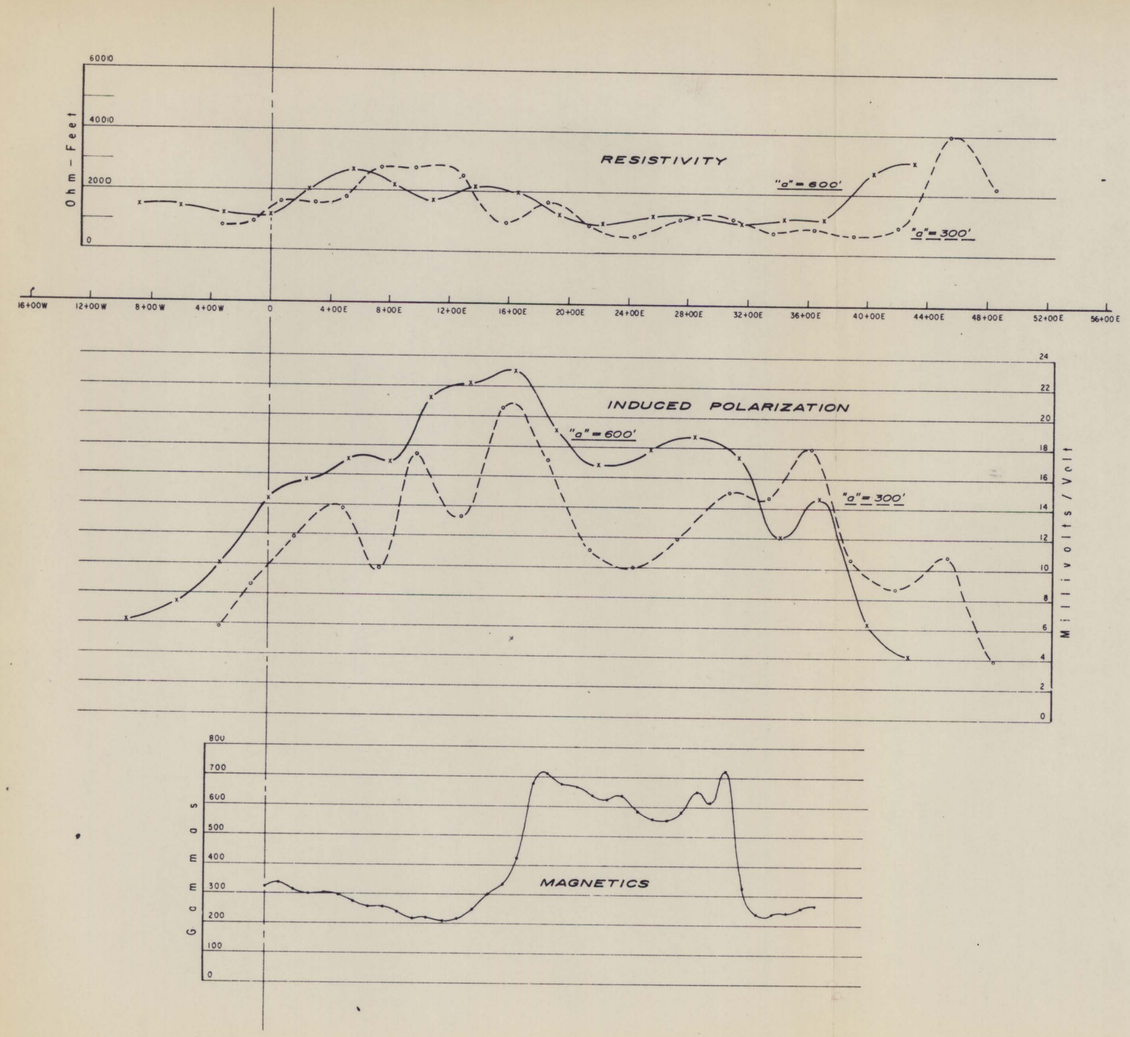
SPRUCE MOUNTAIN DISTRICT

ELKO COUNTY - NEVADA

FIELD WORK by:
J. Powers
T. Posey
S. Evans
July-Aug. 1967
SP16

INT-69-117

4590 0035 ATTACHMENT G-3



LINE 15+00S

GEOPHYSICAL PROFILES

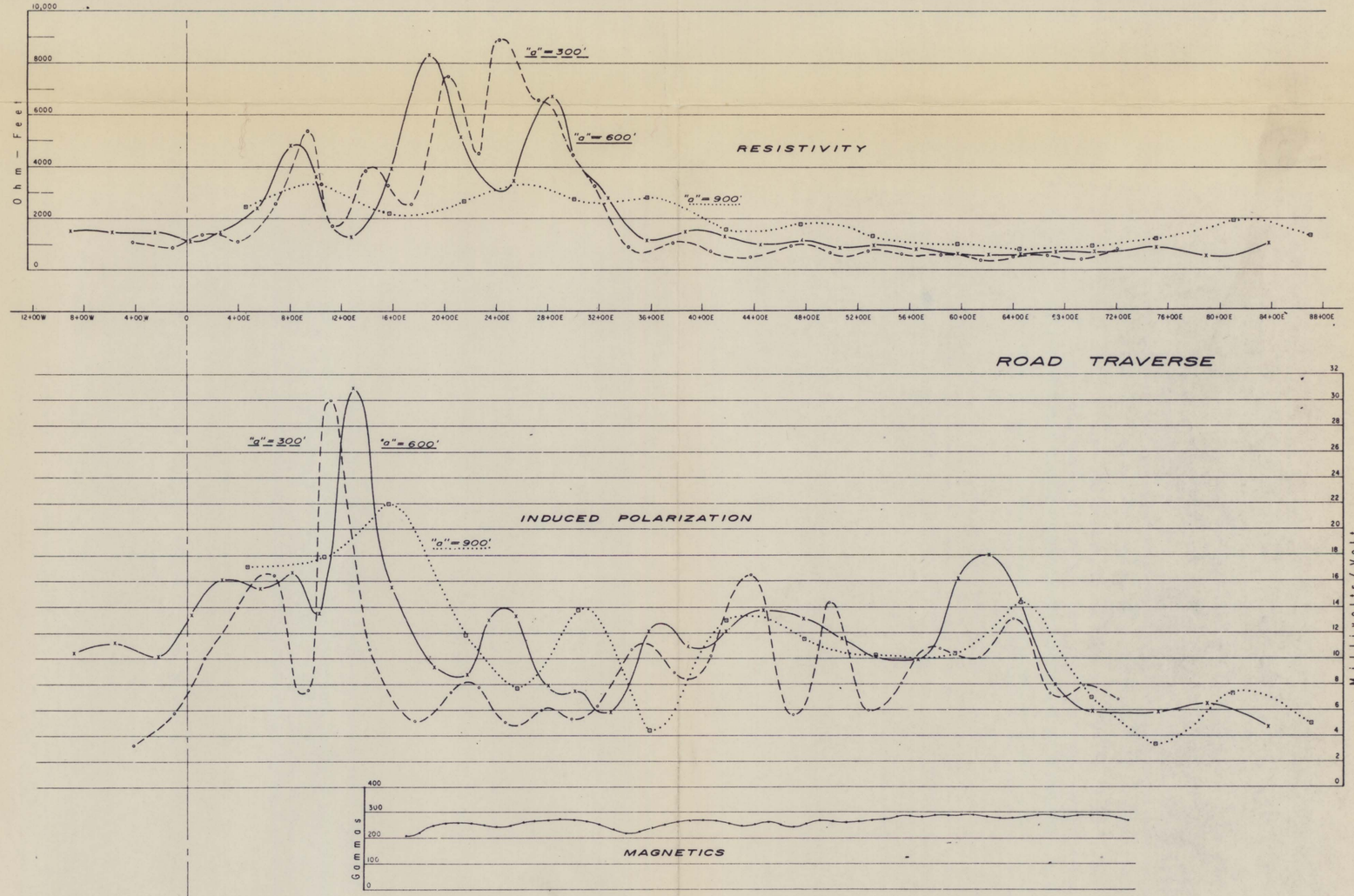
SPRUCE MOUNTAIN DISTRICT

ELKO COUNTY - NEVADA

FIELD WORK by:
J. Powers
T. Posey
S. Evans
July-Aug. 1967

INT-69-118 SP-15

ATTACHMENT G-4



GEOPHYSICAL PROFILES

SPRUCE MOUNTAIN DISTRICT

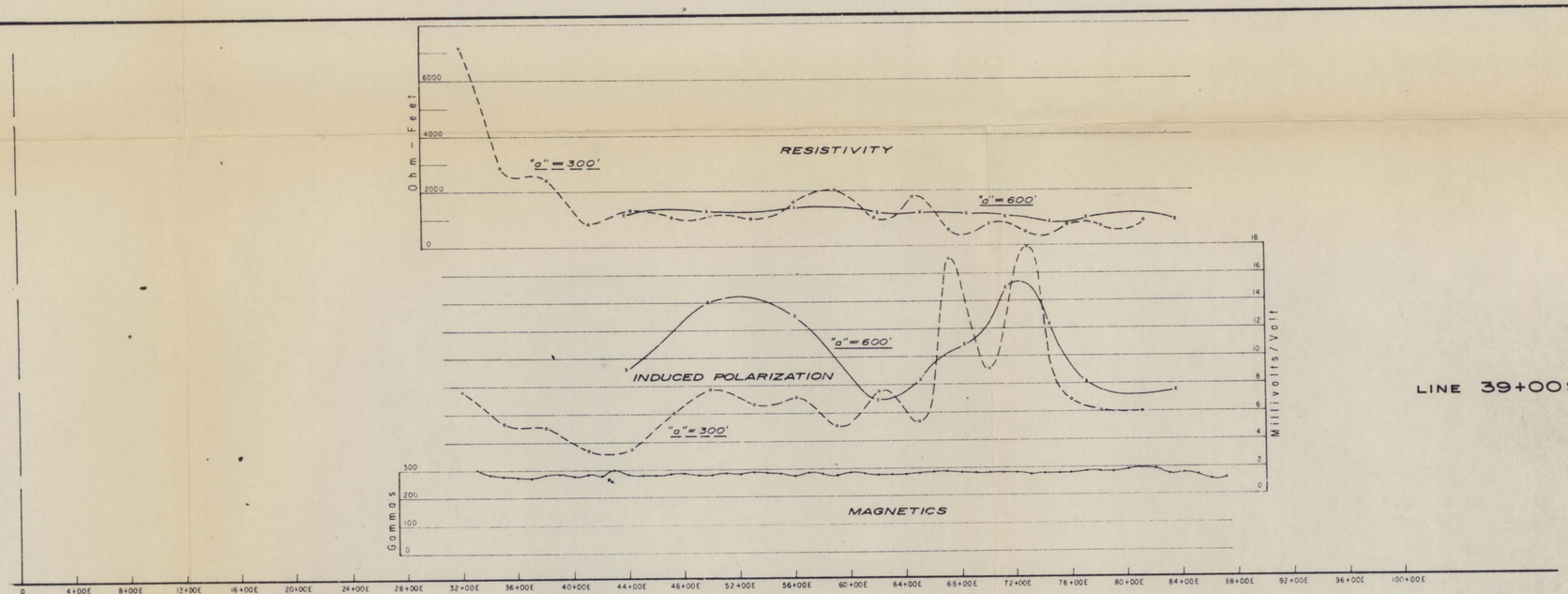
ELKO COUNTY - NEVADA

FIELD WORK by:
J. Powers
T. Posey
S. Evans
July-Aug. 1967
SP-17

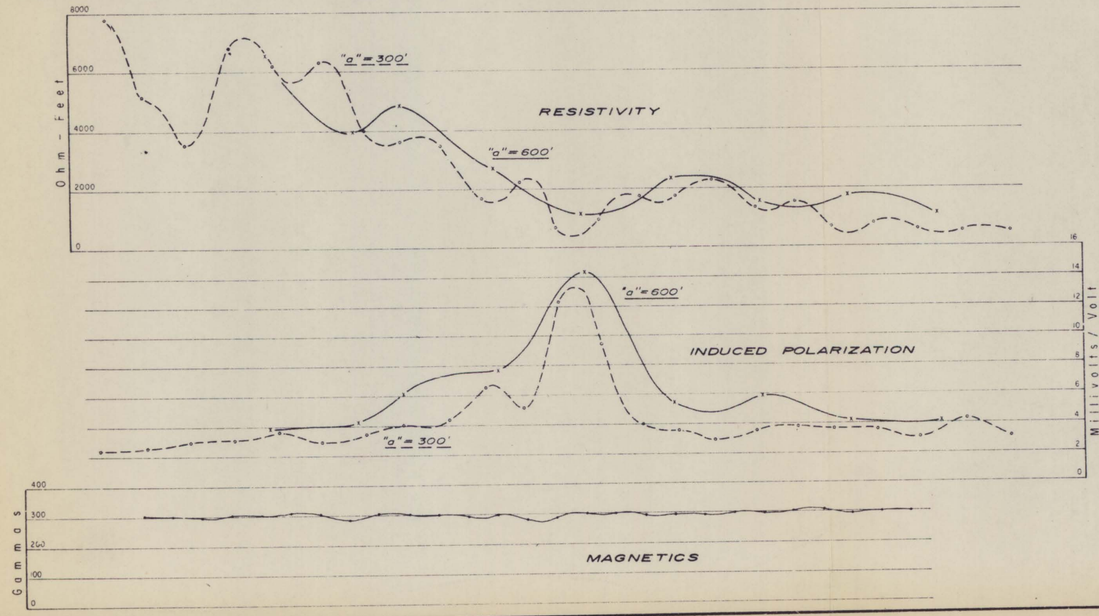
INT-69-119

4590 0035

ATTACHMENT G-5



LINE 39+00S



LINE 45+00S

GEOPHYSICAL PROFILES

SPRUCE MOUNTAIN DISTRICT

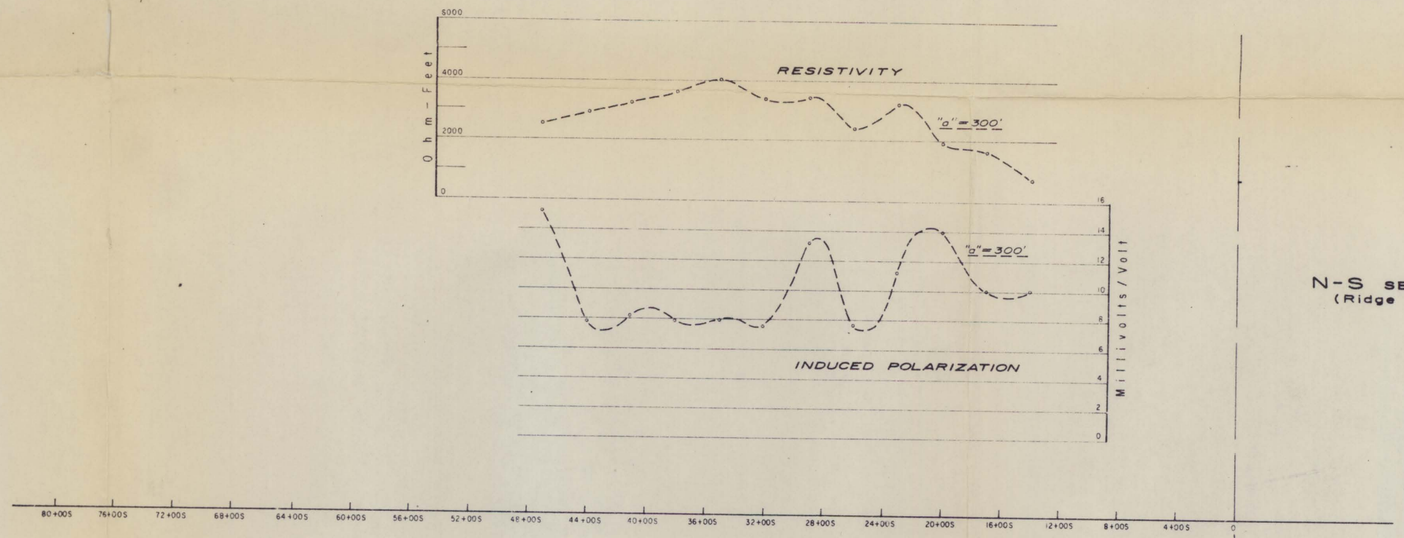
ELKO COUNTY - NEVADA

FIELD WORK by:
J. Powers
T. Pooley
S. Evans
July-Aug. 1967

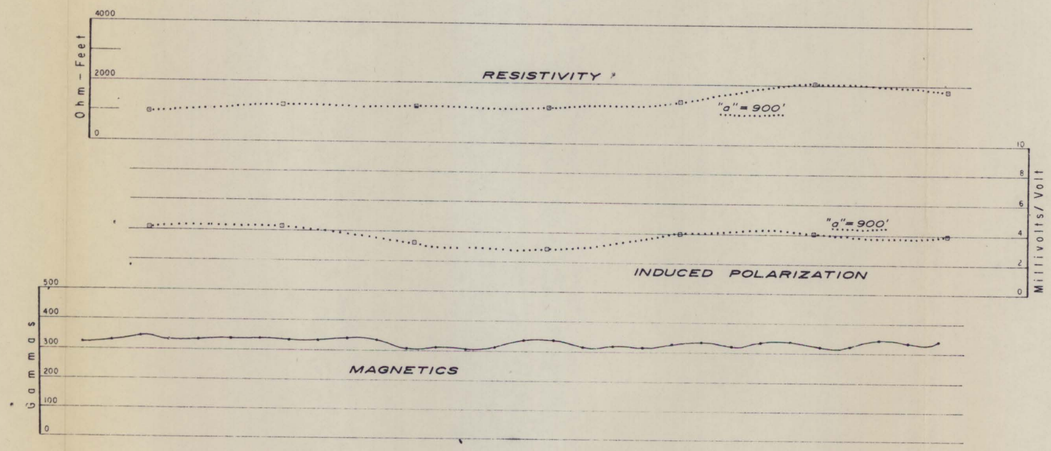
INT-69-120

SP-18

4590.0035 ATTACHMENT G-6



N-S SECTION LINE
(Ridge Traverse)



LINE 93+00 E
(Road Traverse)

GEOPHYSICAL PROFILES

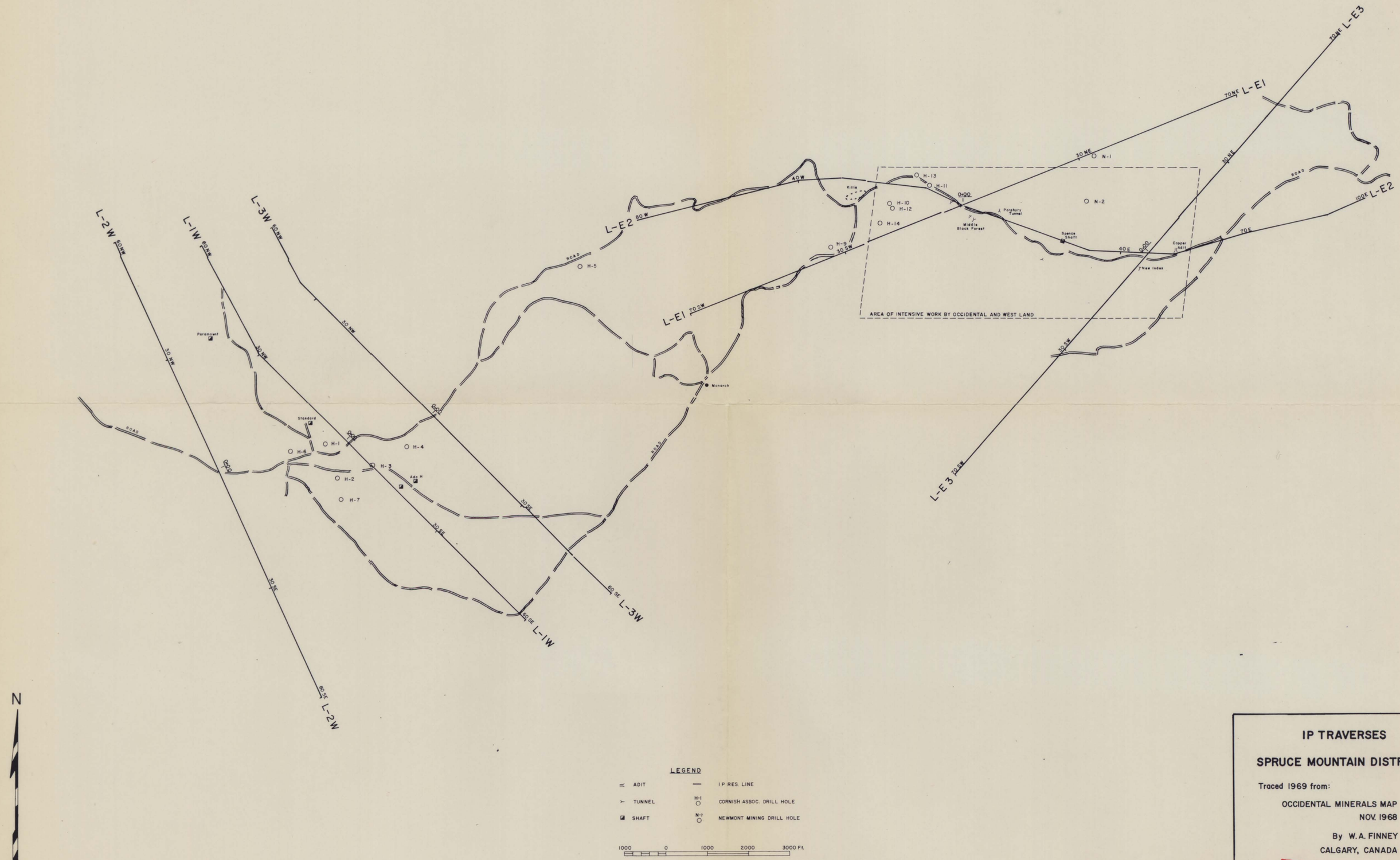
SPRUCE MOUNTAIN DISTRICT

ELKO COUNTY - NEVADA

FIELD WORK by:
J. Powers
T. Posey
S. Evans
July-Aug. 1967
SP-19

INT-69-121

ATTACHMENT G-7



IP TRAVERSES

SPRUCE MOUNTAIN DISTRICT

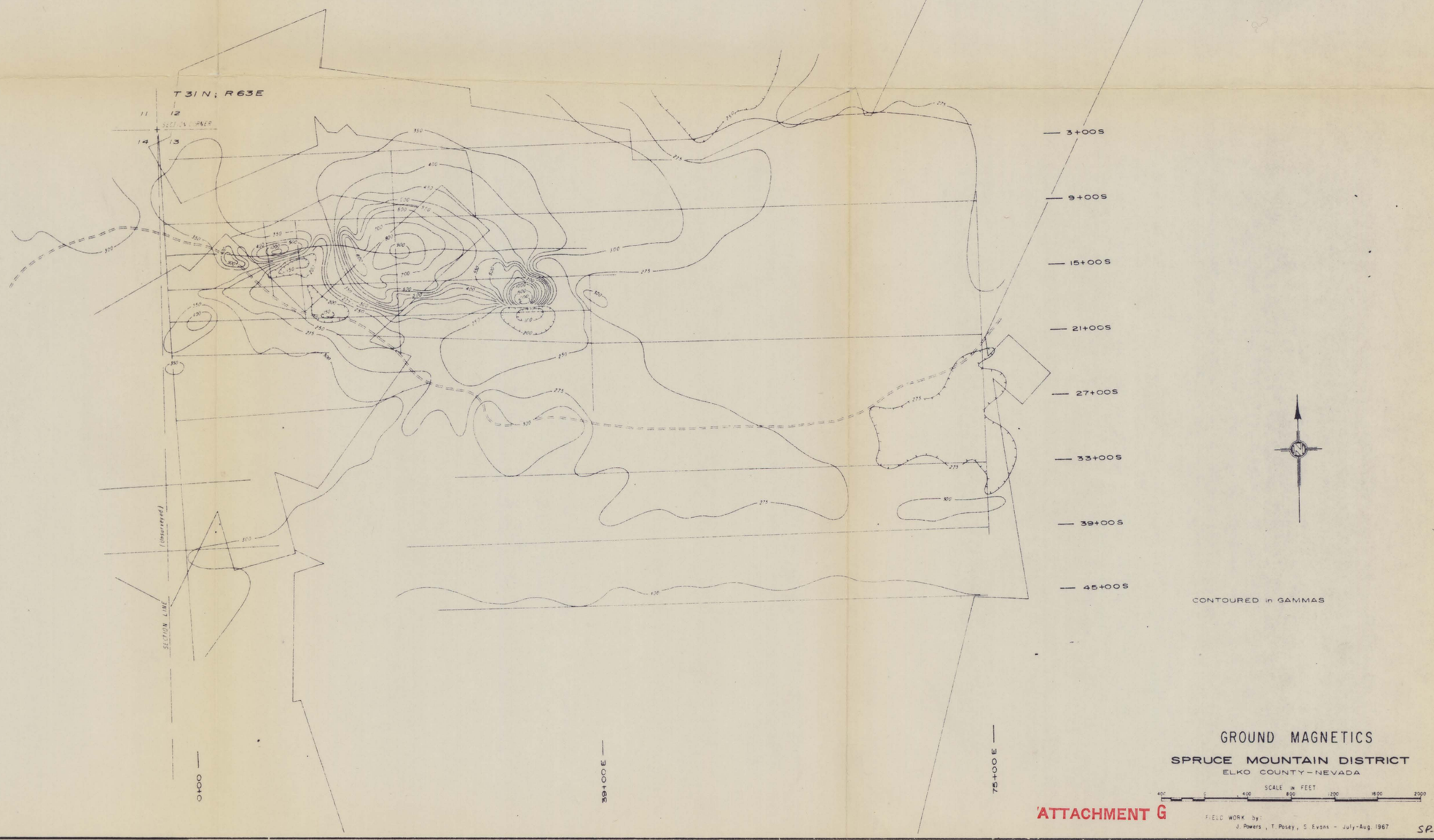
Traced 1969 from:

OCCIDENTAL MINERALS MAP
NOV. 1968

By W. A. FINNEY
CALGARY, CANADA

ATTACHMENT G

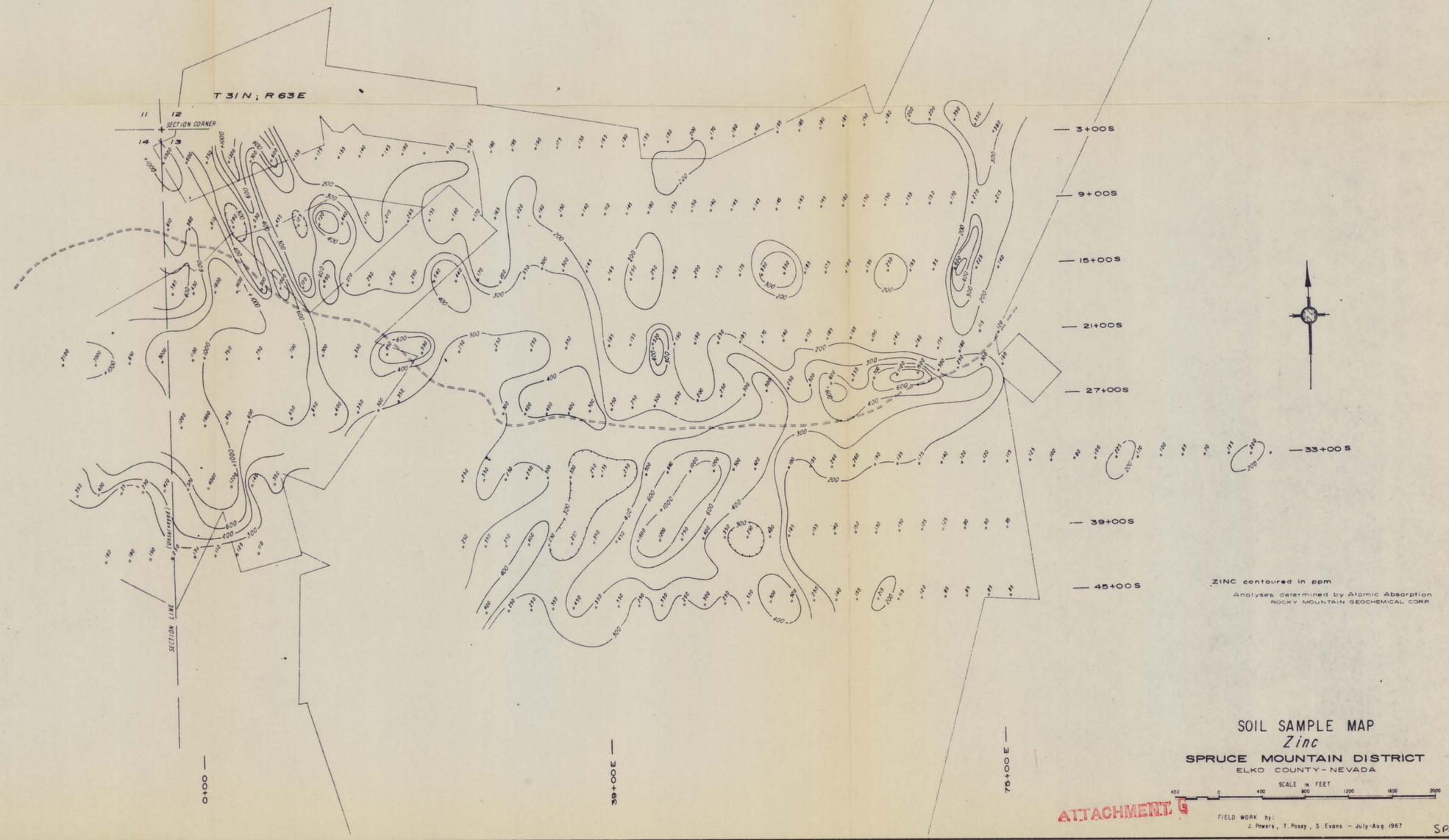
4690 0038 INT-69-99



ATTACHMENT G

4590 0035

INT-69-100



ZINC contoured in ppm

Analyses determined by Atomic Absorption
ROCKY MOUNTAIN GEOCHEMICAL CORP.

SOIL SAMPLE MAP
Zinc
SPRUCE MOUNTAIN DISTRICT
ELKO COUNTY - NEVADA

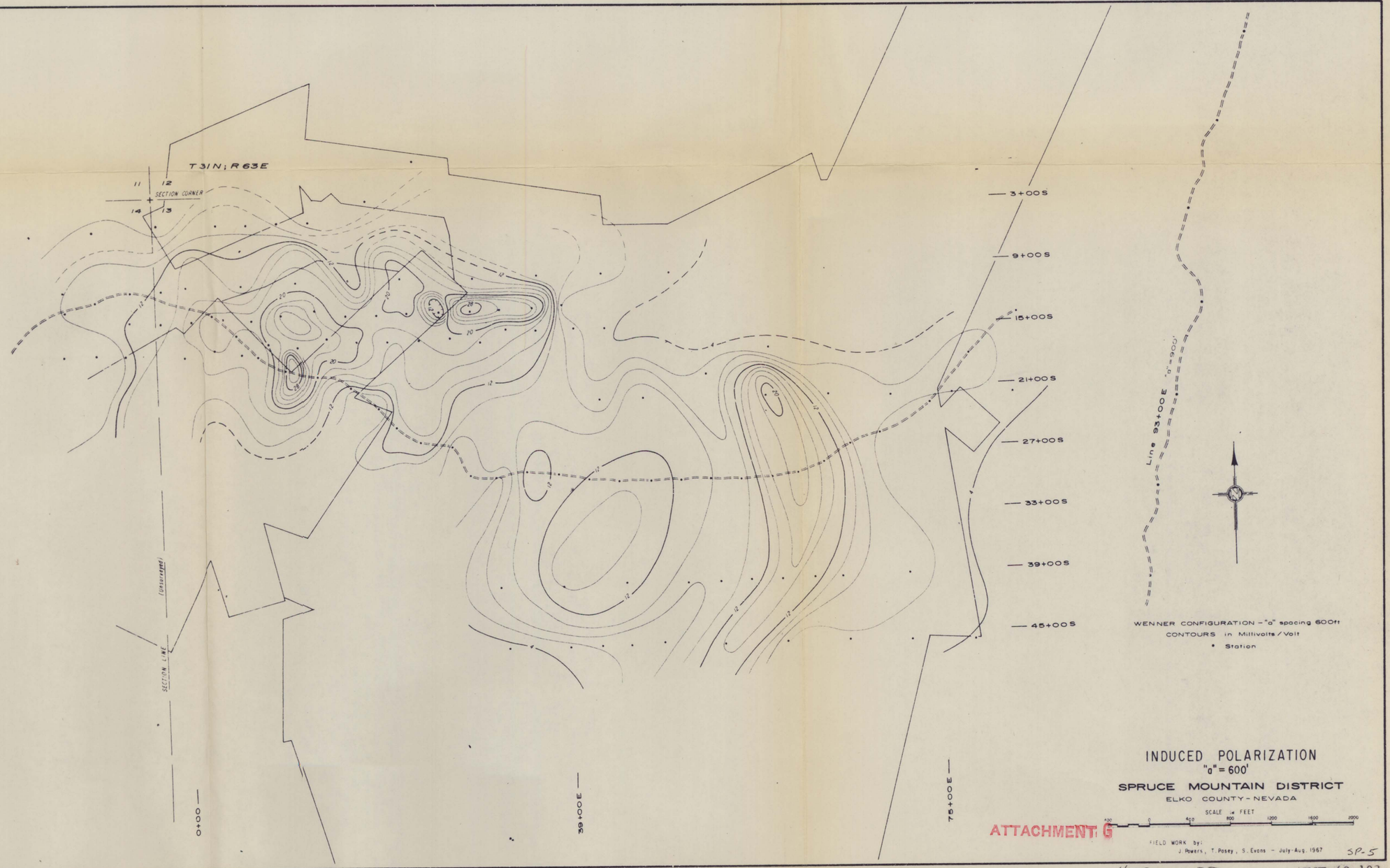
SCALE IN FEET
400 0 400 800 1200 1600 2000

FIELD WORK by:
J. Powers, T. Posey, S. Evans - July-Aug. 1967

ATTACHMENT G

SP-9

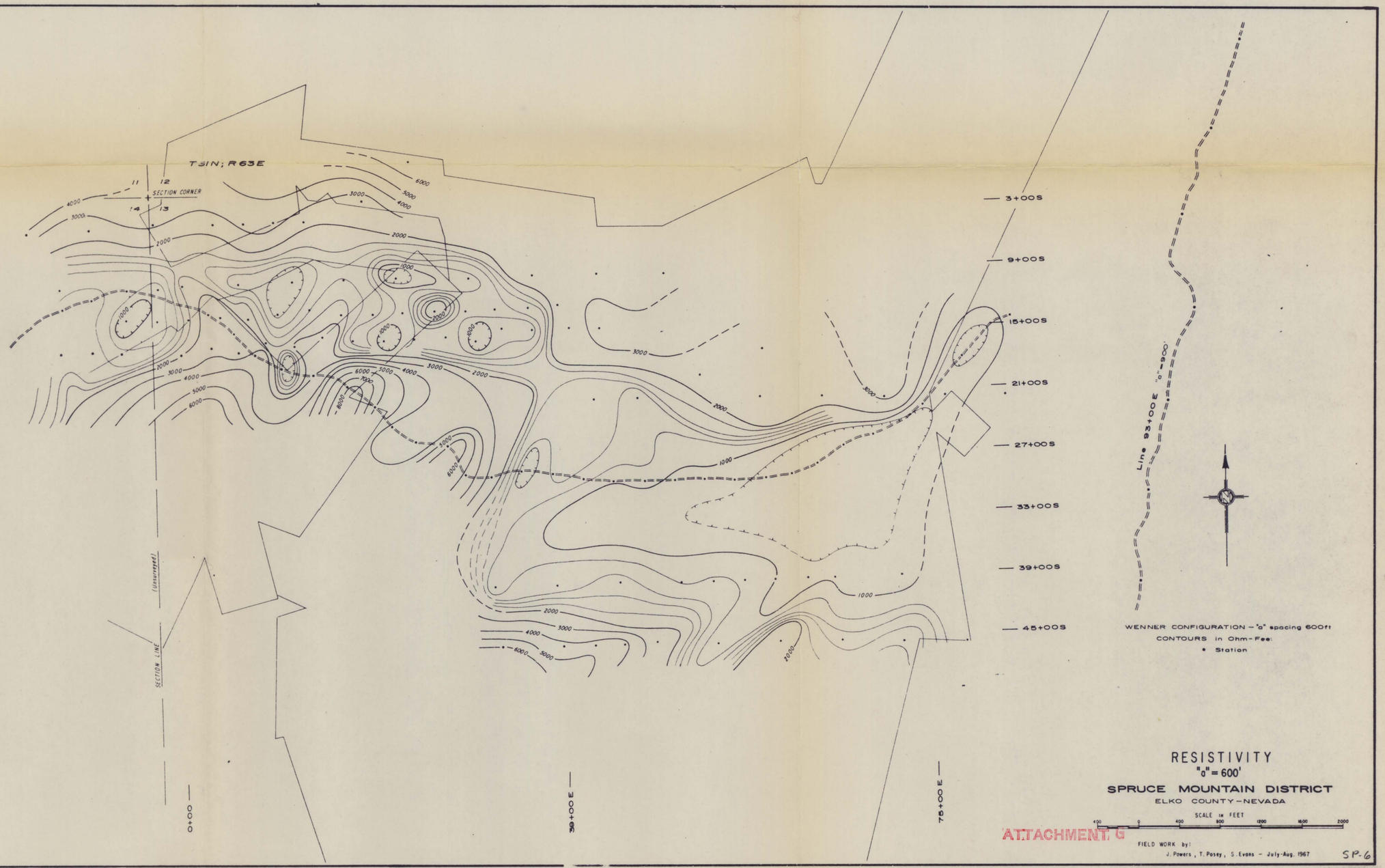
INT-69-108



ATTACHMENT G

4590 0035

INT-69-102



ATTACHMENT G

4590 0035

INT-69-103

WENNER CONFIGURATION – "a" spacing 300ft
CONTOURS in Millivolts/Volt
• Station

INDUCED POLARIZATION
"a" = 300'
SPRUCE MOUNTAIN DISTRICT
ELKO COUNTY – NEVADA

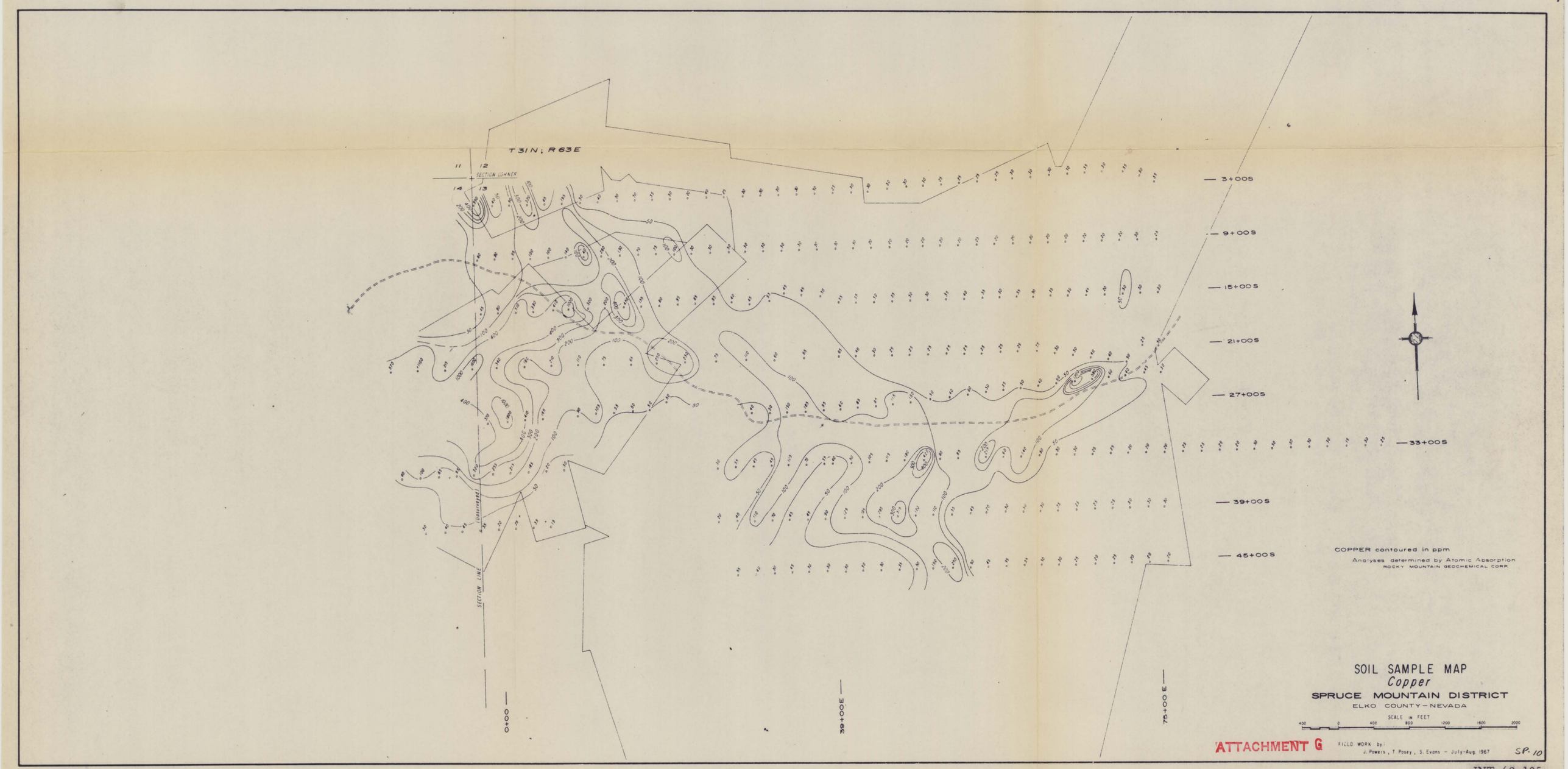
SCALE IN FEET
400 0 400 800 1200 1600 2000

FIELD WORK by:
J. Powers, T. Posey, S. Evans – July-Aug 1967

SP-7

ATTACHMENT G

INT-69-101

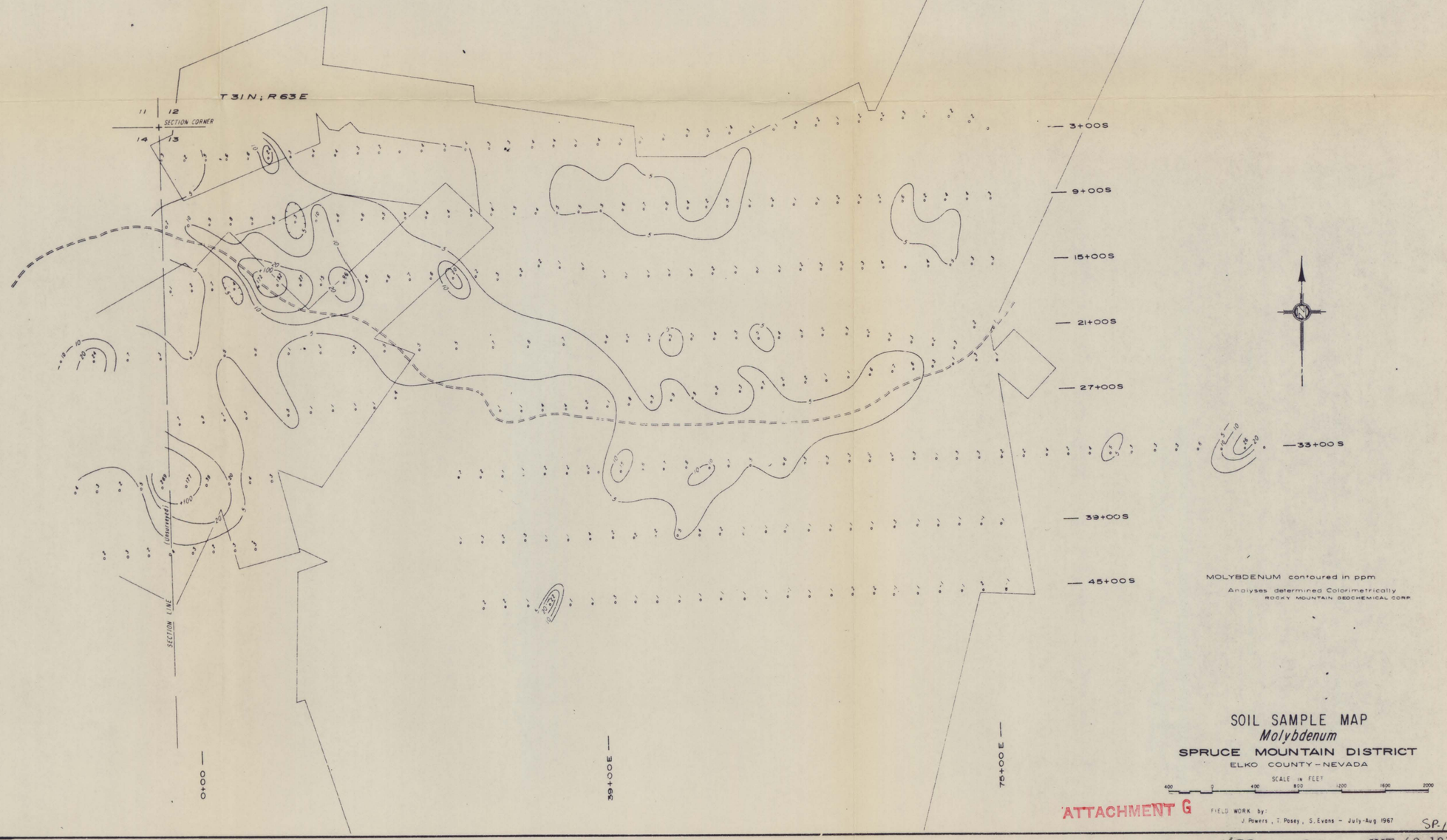

T31N; R63E
11
12
14
13
SECTION CORNER
SECTION LINE
(UNSURVEYED)
3+00S
9+00S
15+00S
21+00S
27+00S
33+00S
39+00S
45+00S
0+00
39+00E
75+00E
COPPER contoured in ppm
Analyses determined by Atomic Absorption
ROCKY MOUNTAIN GEOCHEMICAL CORP.
SOIL SAMPLE MAP
Copper
SPRUCE MOUNTAIN DISTRICT
ELKO COUNTY-NEVADA
SCALE IN FEET
400 0 400 800 1200 1600 2000
ATTACHMENT G
FIELD WORK by:
J. Powers, T. Posey, S. Evans - July-Aug. 1967
SP. 10

INT-69-105

ATTACHMENT G

4590 0035

INT-69-104

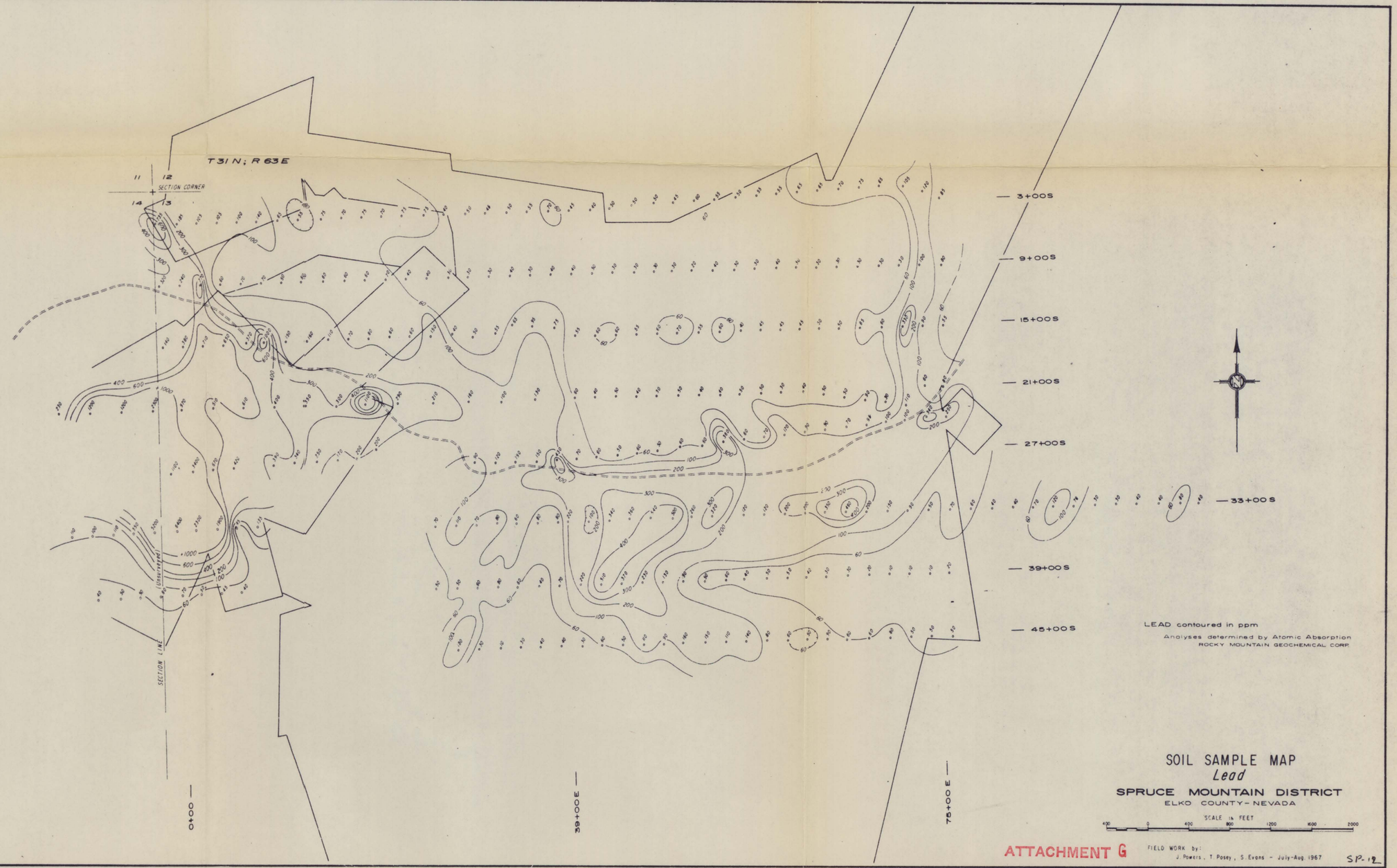


ATTACHMENT G

SP.11

4590 C035

INT-69-107



SOIL SAMPLE MAP
Lead
SPRUCE MOUNTAIN DISTRICT
ELKO COUNTY - NEVADA

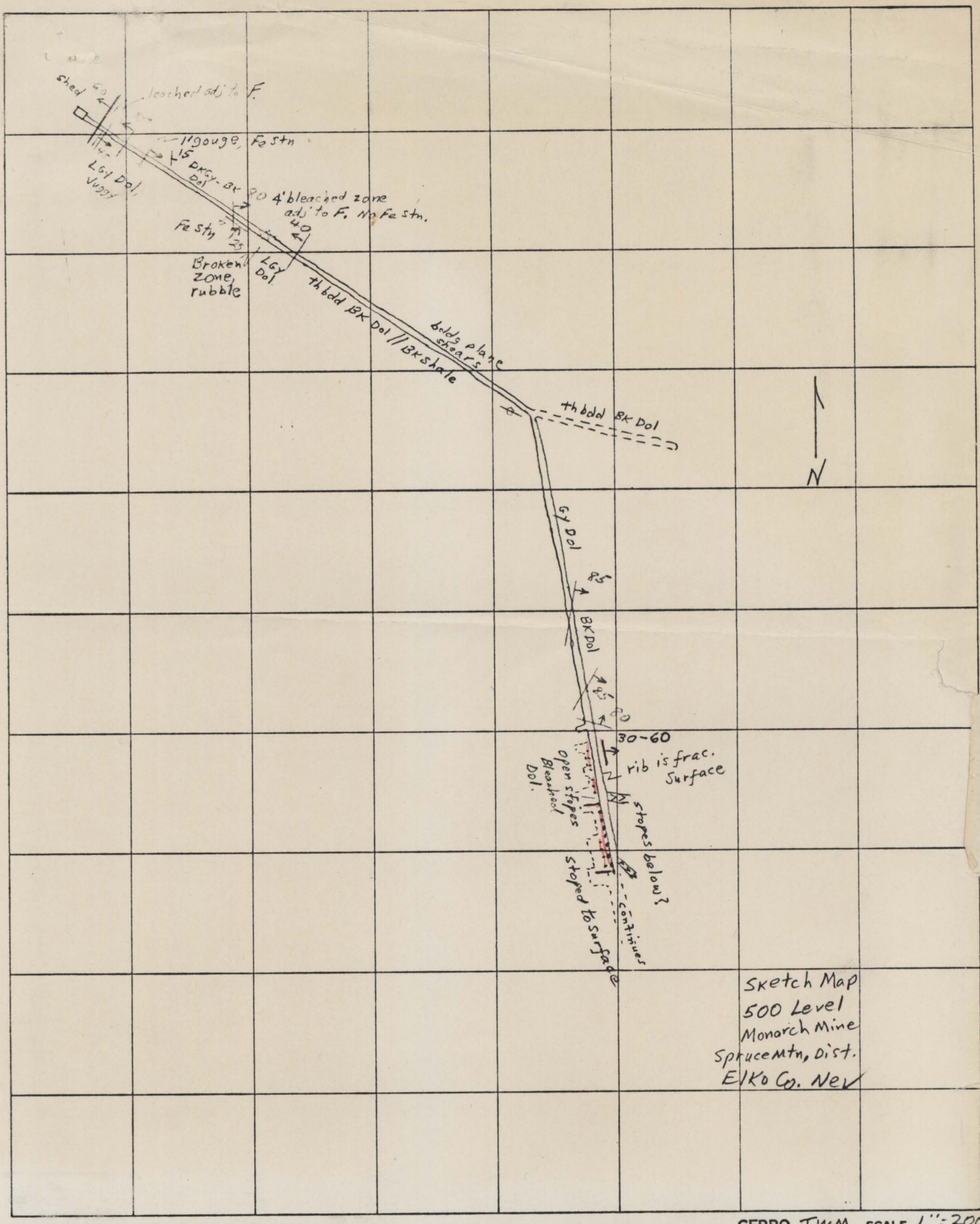
FIELD WORK by:
J. Powers, T. Posey, S. Evans - July-Aug. 1967

SP-12

ATTACHMENT G

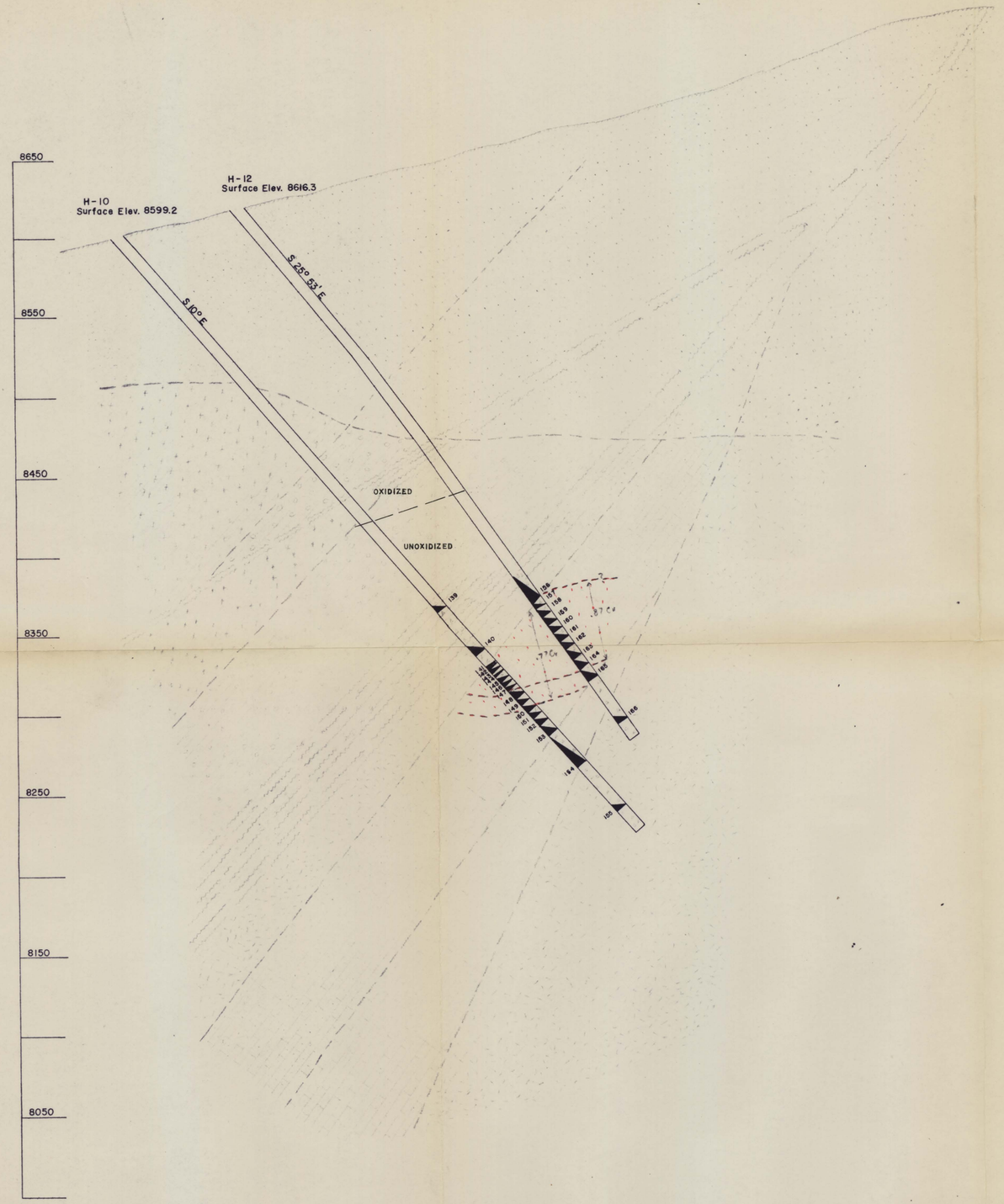
4590 0035

INT-69-106



CERRO TWM SCALE 1" = 200'
GEOLOGY JaK DATE 10-69
FORM-19-A-NY No. INT 69-172

45900035 ATTACHMENT I



SAMPLE RECORD HOLE NO-10

NO.	FROM	TO	Au-Oz	Ag-Oz	Cu %	Pb %	Zn %	Mo %	LOST CORE
139	308.0	314.5		NIL			0.1		3.0
140	342.0	351.0			0.03			0.124	5.0
141	358.5	361.0	TR.	NIL	0.66				
142	361.0	363.0	TR.	0.4	1.37				
143	363.0	366.0	0.005	0.3	1.63				
144	366.0	369.0	TR.	NIL	0.53				
145	369.0	374.0	TR.	0.1	0.63				
146	374.0	377.0	TR.	NIL	1.04				
147	377.0	381.0	0.005	0.1	0.92				
148	381.0	388.0	TR.	0.3	0.409	NIL	0.2		
149	388.0	393.0	TR.	0.1	0.277				1.0
150	393.0	399.0	TR.	0.2	0.415	NIL	0.5		
151	399.0	404.2	TR.	0.1	0.113				
152	404.2	409.8	TR.	NIL	0.333				0.8
153	408.8	418.0	TR.	0.1	0.296				3.2
154	418.0	445.0	TR.	NIL	0.056	NIL	NIL		21.0
155	477.0	482.0	TR.	NIL	0.031			0.035	

SAMPLE RECORD HOLE NO-12

NO.	FROM	TO	Au-Oz	Ag-Oz	Cu %	Ni %	Zn %	Mo %	LOST CORE
156	293.5	314.5	TR.		0.170			0.035	14.0
157	314.5	318.3	0.005	0.3	1.63				
158	318.5	325.0	TR.	NIL	1.02	NIL			
159	325.0	331.0	TR.	0.1	0.969				
160	331.0	336.0	TR.	0.3	0.841				
161	336.0	343.0	TR.	0.1	0.943				
162	343.0	349.5	TR.	0.4	0.943				
163	349.5	358.0	TR.	0.2	0.663				
164	358.0	365.0	TR.	0.3	0.642				
165	365.0	375.0	TR.	0.1	0.453				
166	402.0	407.0	TR.	0.2	0.031			0.031	

LEGEND

- Drift
- Quartzite
- Limestone
- Quartz, Feldspar, Porphyry
- Shale
- Copper Zone in Shale
- Breccia
- Fault
- Dip of Bedding to Core Axis
- Assay

DRILL HOLES NO-10-12

SPRUCE MOUNTAIN DISTRICT

SCALE 1" = 50'

TRACED FROM CORNISH ASSOCIATES
1958

ATTACHMENT H,

INT-69-113

4590 0035

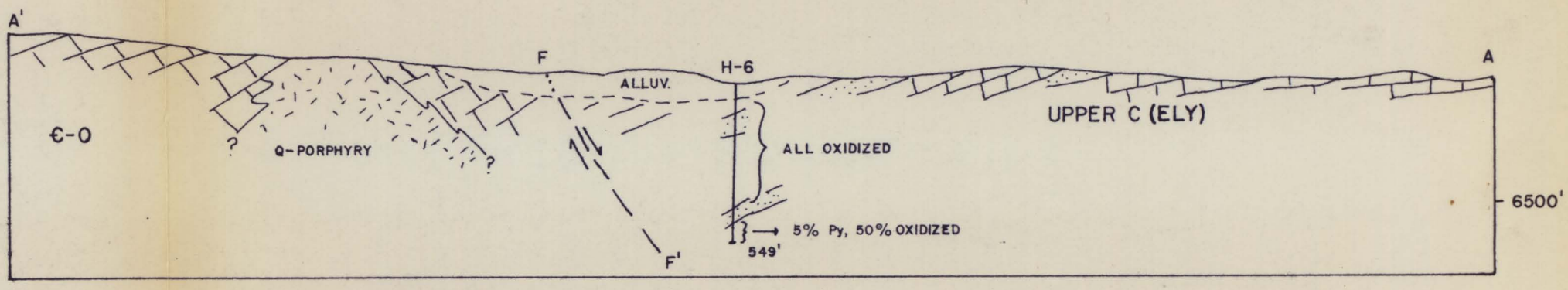
ATTACHMENT H

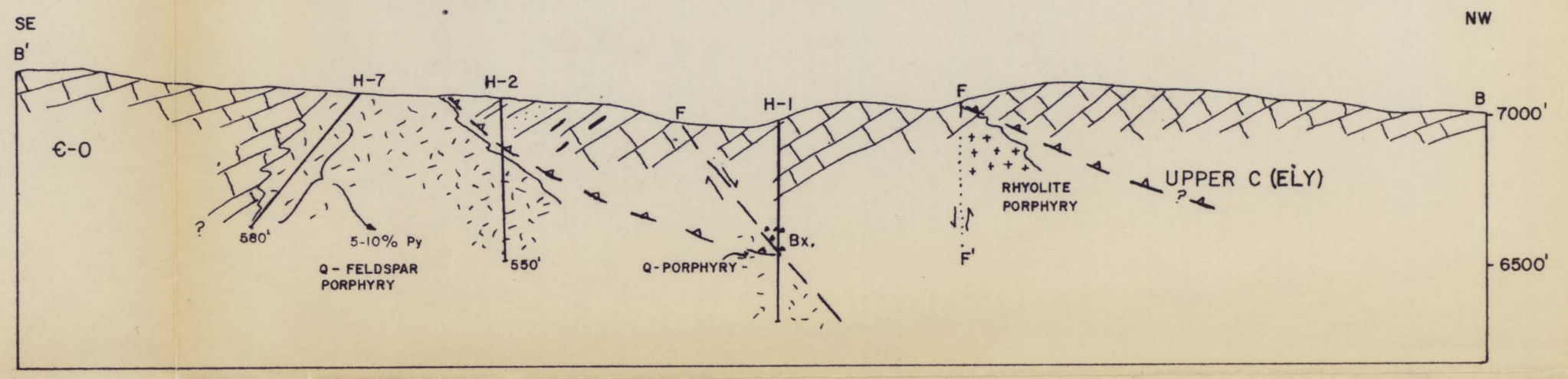
SPRUCE MOUNTAIN DISTRICT

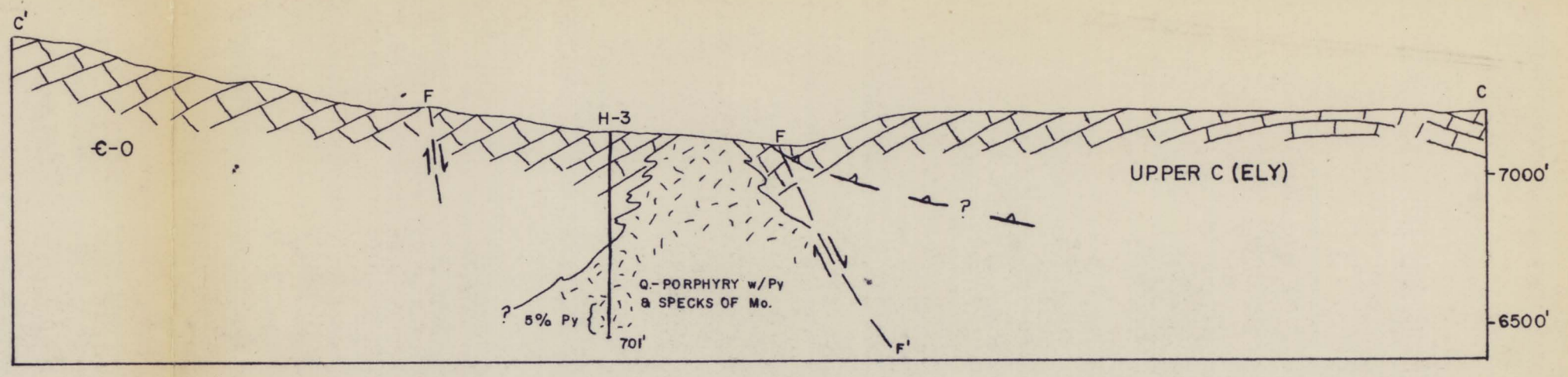
N17S CROSS-SECTION THRU. HOLES H-6; H-1; H-3; H-4 AT STANDARD AND ADA H. MINES (Looking west)

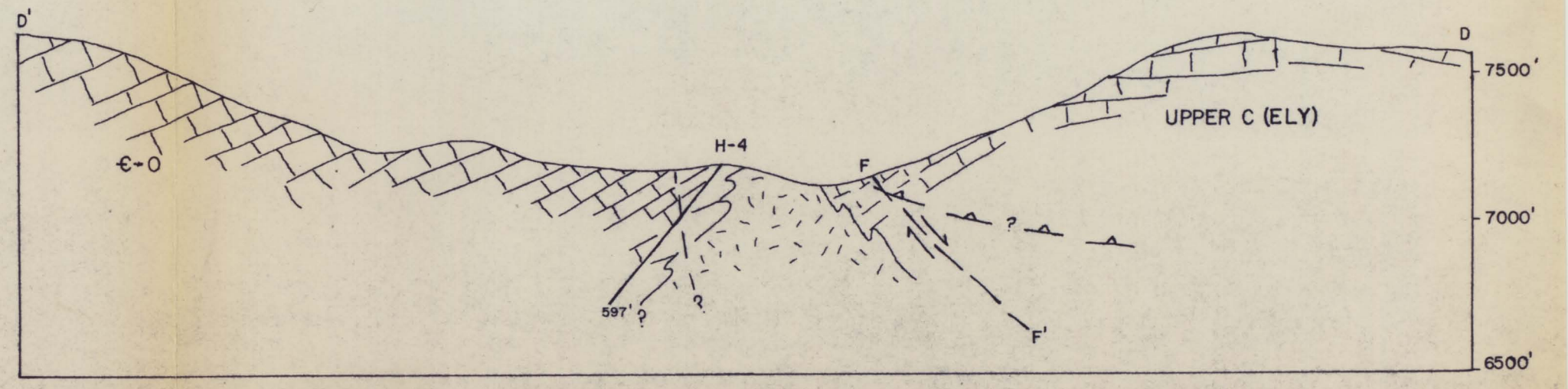
SCALE 1" = 500'

ADAPTED FROM WORK BY OCCIDENTAL 1969



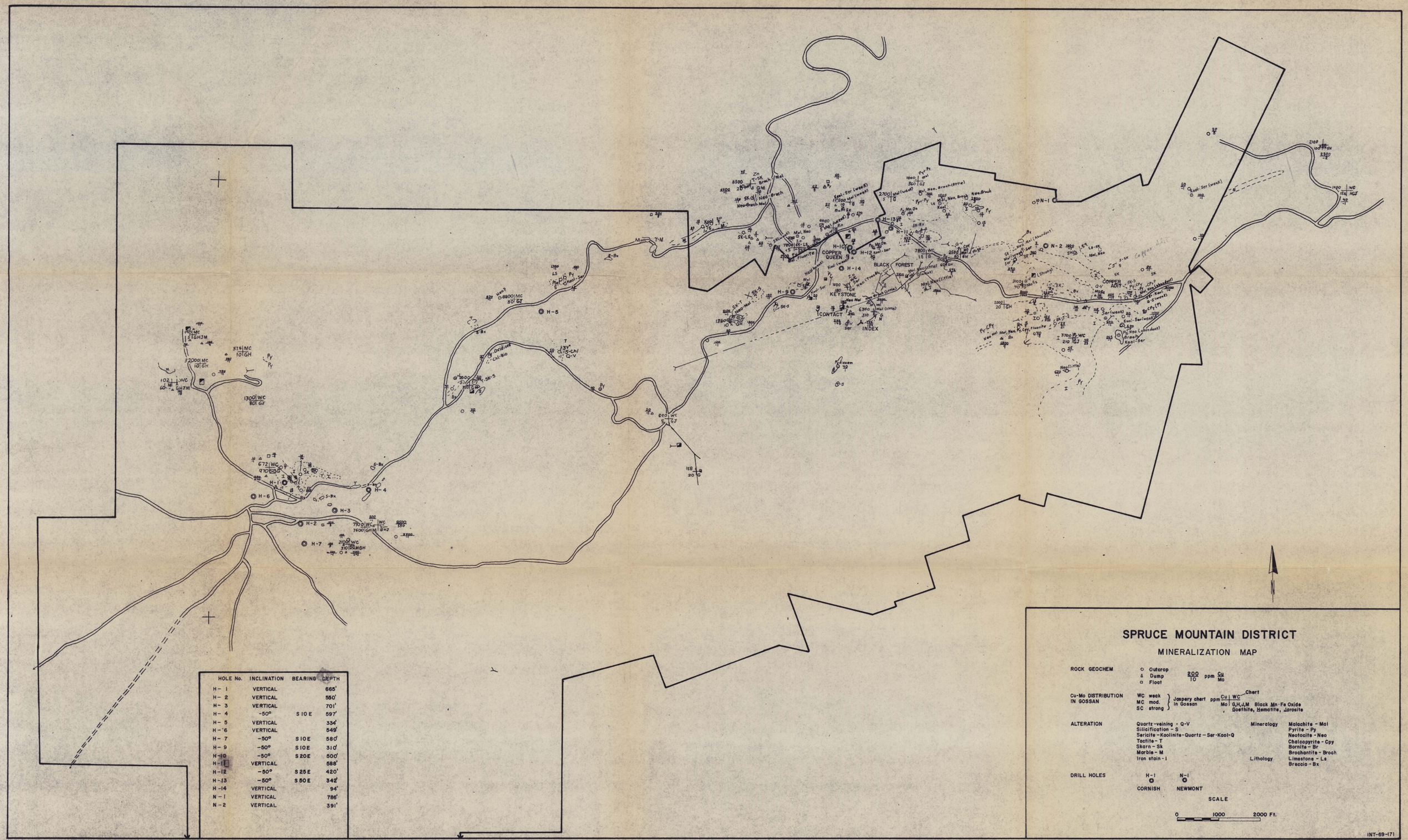






ATTACHMENT H2

4590 0035 INT-69-114



HOLE No.	INCLINATION	BEARING	DEPTH
H- 1	VERTICAL		665'
H- 2	VERTICAL		550'
H- 3	VERTICAL		701'
H- 4	-50°	S 10 E	597'
H- 5	VERTICAL		334'
H- 6	VERTICAL		549'
H- 7	-50°	S 10 E	580'
H- 9	-50°	S 10 E	310'
H-10	-50°	S 20 E	500'
H-11	VERTICAL		588'
H-12	-50°	S 25 E	420'
H-13	-50°	S 50 E	342'
H-14	VERTICAL		94'
N- 1	VERTICAL		786'
N- 2	VERTICAL		391'

ATTACHMENT 1