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June 10, 1977

Mr. Jack E. Holloway, General Manager
Mines Development Corporation
2722 Kline Circle
Las Vegas, Nevada 89121

Dear Mr. Holloway:

Mr. O'Malley has referred your letter and report to me for Essex response to your inviting us to joint venture or lease your rare earth deposits located in San Bernardino County, California.

Essex currently has little interest in rare earth deposits such as your report describes. Our primary interest in exploration is copper. We do appreciate your thinking of us and sending the report. I wish to complement you and Dames and Moore on a very excellent and professional report. We don't often receive one quite so well done.

Per your request, I am returning your report herewith enclosed. Please give Dick Brittain my regards if you should be in contact with him in the near future.

Very truly yours,

E. Grover Heinrichs
Exploration Manager

EGH:aaw
enc.

MINES DEVELOPMENT CORPORATION

2722 KLINE CIRCLE
LAS VEGAS, NEVADA 89121

Telephone: (702) 457-7673

May 16, 1977

George Heinrichs
Tucson

Mr. Paul W. O'Malley, President
Essex International, Inc.
1601 Wall Street
Fort Wayne, Indiana 46804

Dear Sir:

A copy of a geology report on our rare earth deposit as prepared by Dames & Moore is attached for your review and consideration.

I am sending you this report for the purpose of inviting your company to consider entering into one of the following arrangements with us:

1) A joint venture to engage in an exploration program such as recommended by Dames & Moore.

2) A direct lease of the property with an over-riding royalty provision when the property is placed into operation.

If you would please have your geologists contact me, I will gladly arrange to show them the property on an mutually agreeable date.

If your company has no interest in this kind of property, kindly return the attached report to me.

Thank you for your consideration.

Sincerely yours,

Jack E. Holloway

Jack E. Holloway
General Manager

JEH:ms

Attahcment

RECONNAISSANCE GEOLOGIC EVALUATION OF CLAIMS PILOT PEAK AREA, EASTERN OLD WOMAN MOUNTAINS SAN BERNARDINO COUNTY, CALIFORNIA

FOR MINES DEVELOPMENT CORPORATION

09936-002-10

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April 29, 1977

Mine Development Corporation
2722 Kline Circle
Las Vegas, Nevada 89121

Attention: Mr. Jack E. Holloway
General Manager

Gentlemen:

RE: Reconnaissance Geologic Evaluation of Claims
Pilot Peak Area, Eastern Old Woman Mountains
San Bernardino County, California

We submit herewith fifty copies of the referenced report. It has been a pleasure to work with you on this most interesting and unique project. If you have any questions regarding this report or any further exploration activities, please do not hesitate to call.

Very truly yours,

DAMES & MOORE

Richard L. Brittain

Richard L. Brittain
Partner

Roland C. McEldowney

Roland C. McEldowney
Senior Geologist

RLB/RCM/dls

TABLE OF CONTENTS

List of Tables, Plates, and Figures

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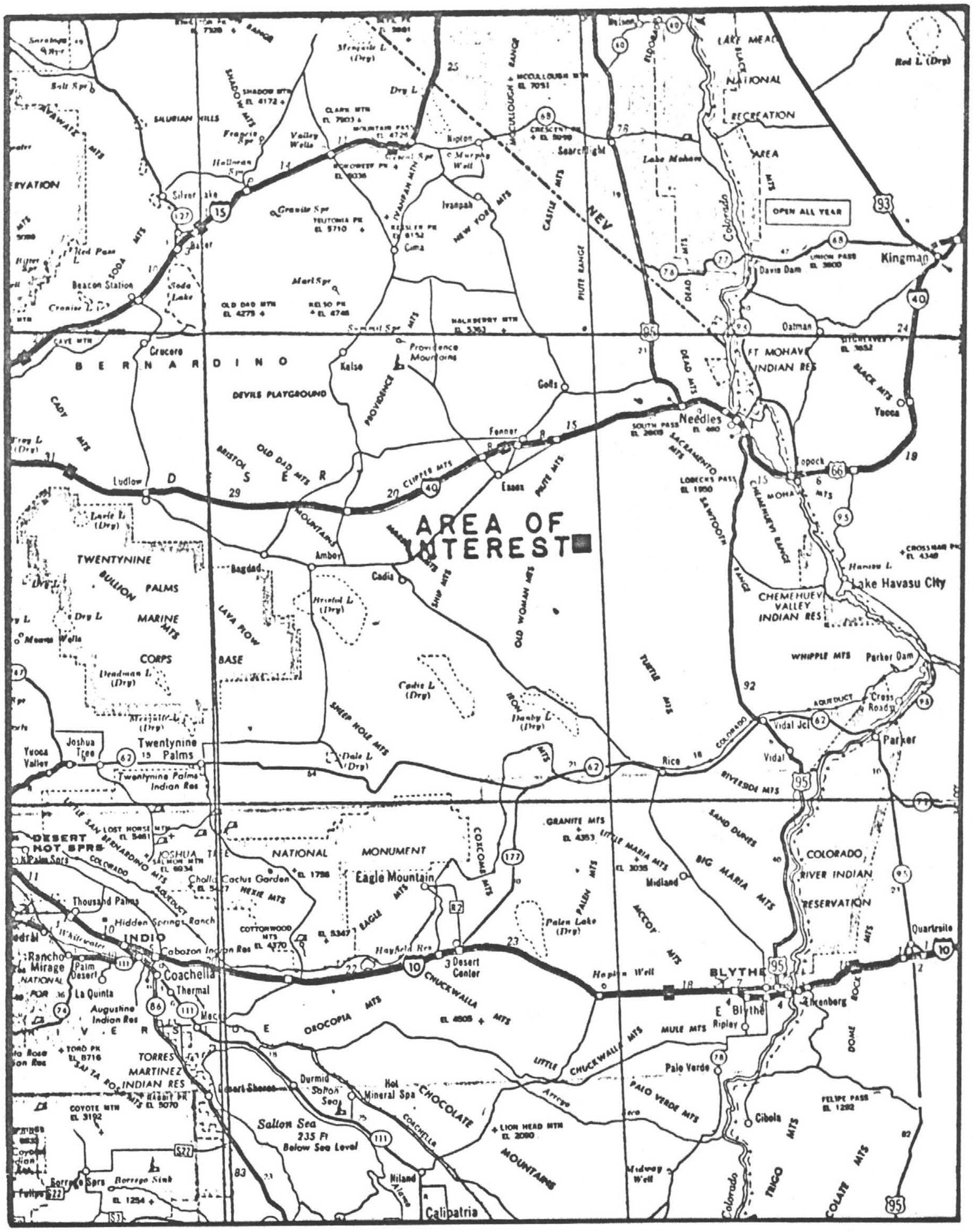
* Located in map pocket

RECONNAISSANCE GEOLOGIC EVALUATION OF CLAIMS
PILOT PEAK AREA
EASTERN OLD WOMAN MOUNTAINS
SAN BERNARDINO COUNTY, CALIFORNIA
FOR
MINES DEVELOPMENT CORPORATION

INTRODUCTION

GENERAL

This report contains the results of our reconnaissance geologic evaluation of the Star and Marie groups of claims, located south of Pilot Peak on the eastern flank of the Old Woman Mountains, San Bernardino County, California (Figure 1). Following submission of our "Final Report, Mineral Exploration Program Using Computer Processing of Multi-spectral Satellite Data," dated November 4, 1976, Mines Development Corporation (MDC) authorized a reconnaissance geologic evaluation of the area, outlined in our proposal dated February 14, 1977.



0 5 10 20 30 MILES

AREA LOCATION MAP

REFERENCE: CALIFORNIA SOUTHERN SECTION,
RAND MCNALLY & CO. 1975

DAMES & MOORE

FIGURE 1

PURPOSE AND SCOPE

MDC is engaged in exploration for rare earth deposits in the Old Woman Mountain area. The purpose of this investigation is to provide MDC with a reconnaissance geologic map of approximately 6 square miles of land, which may aid in identifying target areas for detailed geophysical, geochemical, and geological studies; and to understand the geology of radioactive rocks in a smaller area of interest.

The geologic studies described in this report were both regional and site-related, and consisted of the following three tasks:

1) Air photo geology of approximately 6 square miles at a scale of 1" = 400';

2) Reconnaissance geologic mapping at a scale of 1" = 400' of approximately 6 square miles; and

3) Detailed geologic mapping of approximately 250,000 square feet at a scale of 1" = 50'.

Air photo geology was done on color photos using stereo pairs along three north-south flight lines. The photographs were supplied by MDC. A base map, Plate 1, was prepared by correlating distances between all of the major (stream channels, roads) geographical features shown on the air photos using the radial-line method.

Geologic mapping was accomplished along east-west reconnaissance traverses, with some mapping done along strike in areas of carbonatite veining and complicated structure. Geology between traverse lines was extrapolated using the aerial photographs; hence, the reconnaissance nature of the map (Plate 1). Samples of major rock types were collected for petrographic description.

Detailed geologic mapping in the Marie claim group was done by pace and Brunton compass. Samples of each of the rock units in this area were collected for petrographic description. Thin sections of the rocks were prepared by the geology laboratory at the Colorado School of Mines. The petrography was performed by a Colorado School of Mines PhD candidate familiar with alkalic igneous and metamorphic rock mineralogies.

Limited geochemical sampling was undertaken by MDC. Ground magnetic and gravity surveying was completed on a portion of the property by Heinrich's Geoexploration Company and MDC. A brief correlation of these activities with the geology of the area is presented.

CONCLUSIONS AND RECOMMENDATIONS

Based on reconnaissance and detailed geologic mapping, petrographic studies, limited geochemical sampling, and detailed ground magnetometer and gravity surveys on a portion of the property, we conclude the following:

1) Syenite/carbonatite intrusive masses, dikes, and sills have been emplaced along a north-northwest-trending zone which extends beneath an alluvial-covered area to the north;

2) Rare-earth-bearing allanite gneisses are located along northwest-trending fault zones which display associated carbonatite veins, lamprophyre dikes, and biotite augen gneiss;

3) Geophysical studies indicate that major rock types and fault zones can be extended into the alluvium using ground magnetometer traverses;

4) Large alluvial-covered areas between the syenite/carbonatite complex and the allanite gneiss zones offer excellent exploration potential for additional rare earth deposits, especially at fault intersections.

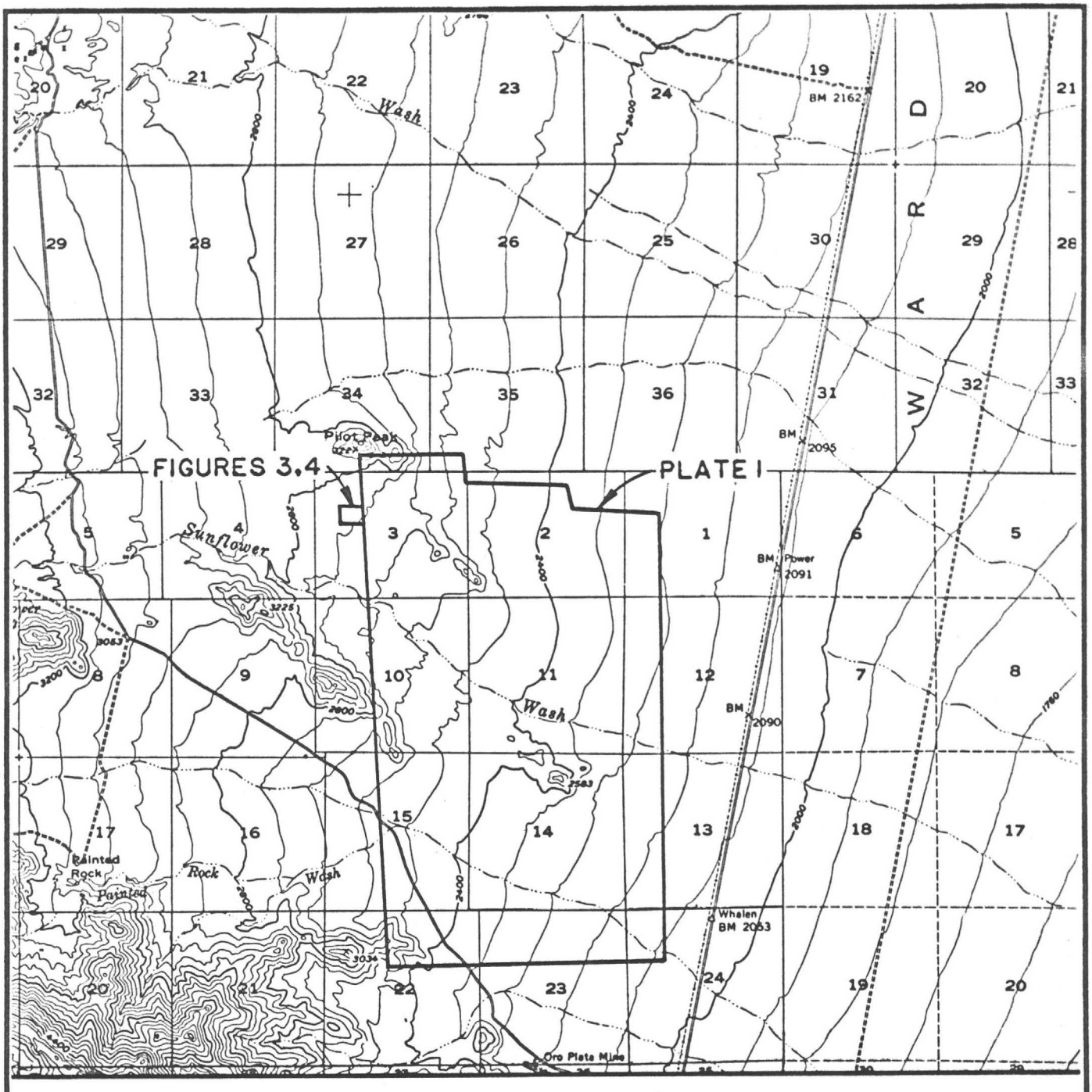
We recommend that MDC continue exploration of the rare earth deposits discovered to date by core drilling. Additionally, we recommend extending exploration activities into the alluvium to trace the syenite/carbonatite zone to the northwest, and the allanite gneiss zone to the southeast.

GEOLOGY

LOCATION AND GENERAL GEOLOGIC SETTING

The study area is located on the eastern flank of the Old Woman Mountains in Township 5N, Range 18E, Sections 1, 2, 3, 10, 11, 12, 13, 14, 15, 22, 23, and 24, approximately 16 miles southeast of Essex, California. The area shown in Figure 2 is covered generally with a thin alluvial fan, with bedrock cropping out in the higher elevations. The alluvial surface trends up from a low of approximately 2,100 feet above MSL in the southeastern portion of the area, to a high of approximately 2,800 feet in the northwestern portion. The highest elevations on the property, approximately 2,900 feet, are located on the slopes of Pilot Peak at the northwestern edge of the study area.

The Old Woman Mountains consist of a group of north-trending ridges and peaks, underlain primarily by Precambrian schists, gneisses, and igneous rocks. In the north-central portion of the range, immediately west of the area of investigation, Mesozoic granitic rocks (granite, adamellite, granodiorite, tonalite, and diorite) have intruded the Precambrian sequence. Numerous gold, silver, copper, and tungsten mines occur along this intrusive contact.



SITE LOCATION MAP

REFERENCE: ESSEX, CALIF. 15' QUAD

DAMES & MOORE

FIGURE 2

The Precambrian rocks are cut by NNW to NW-trending faults in the Old Woman Mountains and on strike to the southeast, across the valley in the Turtle Mountains (Geologic Map of California, 1963).

Rare earth deposits are presently being mined in the Mountain Pass district of San Bernardino County (Olson, et al, 1954), approximately 75 airline miles NNW of the site. The rare-earth-bearing carbonate rocks of Mountain Pass bear strong relationships to those discovered here; they are spatially and genetically related to potash-rich igneous rocks of probable Precambrian age which intrude a metamorphic complex.

Other rare-earth-bearing mineral occurrences have been reported in San Bernardino County. Dibblee (1967) reported brannerite and monazite in the Old Woman Springs quadrangle. Hewett, et al, reported euxenite and betafite in pegmatites (1953), uranothorite near Forest Home (1957a), and brannerite (1957b). Volborth reported allanite in pegmatites in the New York Mountains (1962).

SITE GEOLOGY AND MINERALIZATION

The Star claim group includes most of the rock outcrops in the central portion of the area shown in Plate 1. This area includes the most extensive outcrops of carbonatite and associated intrusive rocks in the area studied. Reconnaissance mapping was begun here. Detailed geologic mapping was accomplished in the Marie claim group (Figure 2), as the rare-earth content in this area is of more interest at the present time. Limited geophysical and geochemical studies of both areas have been completed by MDC, portions of which are included with this report.

Star Claim Group

Rock Types. The area shown on Plate 1 consists generally of a broad alluvial plain interrupted by hills which are cored by intrusives and surrounded by metamorphic rocks. Possibly the oldest rock types shown on Plate 1 are the plagioclase, chlorite gneiss and the quartz, k-feldspar gneiss. These are presumed to be Precambrian in age.

The plagioclase/chlorite/k-feldspar quartz gneiss (Appendix A, sample 11) crops out west and north of the syenite/carbonatite area in the southwestern quarter of Section

11. It is a distinct pink and green rock which reacts to cold dilute hydrochloric acid. Generally, it is found in a highly weathered, soft condition; and occurs in topographic lows between hard, resistant ribs of aplite and tonalite dikes. It may continue south of the east-north-east-trending fault at its southern end; however, no outcrops were found during reconnaissance mapping. The unit extends north of the wash, beneath older alluvium. It is believed to be metamorphosed to the upper green schist or lower amphibolite facies.

The quartz, k-feldspar, plagioclase, biotite gneiss is the most widespread unit in the area. Its composition varies in general from quartz-rich to biotite-rich, as the unit includes minor unmapped, interlayered migmatites and other mafic zones, and quartz diorite intrusives. Aplitic to pegmatitic dikes and sills are common as resistant ribs. The unit apparently originated, in part, as a quartz-rich, igneous intrusive and has since been metamorphosed, faulted, and intruded. Its relation to the unit mapped as quartz biotite gneiss to schist is generally unclear; portions of the unit appear to be younger than the quartz biotite gneiss, and are interlayered with it. This is considered the most complicated unit mapped, and only detailed geologic mapping, beyond the scope of this study, will reveal the true age relationships.

In the northwestern quadrant of the map, this gneiss exhibits a light tan coloration along fault zones. This appears to be a propylitic grade of alteration associated with an increase in iron minerals (pyrite, magnetite ?) near the faults. Several of the fault zones include radioactive allanite (?) rich gneisses (samples 7, 9, and 11, Appendix A), lamprophyres, and carbonatite veins. These rocks are commonly strongly magnetic along the faults, and are indicated as "R" on Plate 1.

The quartz biotite gneiss to schist unit is located primarily in the west-central portion of Plate 1, and occurs in scattered outcrops on the flanks of the hills in the area. It is generally an interlayered quartz-biotite, k-feldspar, and biotite-quartz, k-feldspar gneiss. The unit, as a whole, contains more mafic minerals than the preceding one, and is mappable in this respect.

Lamprophyre and amphibolite dikes (Appendix A, samples 1 and 2), and biotite augen gneiss units (Appendix A, sample 8) occur along the western edge of the large mass of quartz biotite gneiss in Section 10. Lamprophyre sills and dikes occur within the gneiss in Section 10 and crop out at various additional points on Plate 1, usually associated with carbonatite veinlets and alkalic intrusive rocks along fault zones. The close spatial association of lamprophyre, amphibolite,

biotite augen gneiss, and carbonate-rich rocks suggests a genetic relationship.

The main mass of alkali-lime syenite and included carbonatite veins and dikes occurs in the central portion of the area mapped. Outcrops and float indicate a general oval or ring shape. This may be misleading due to the lack of good outcrops in the area. Two steeply-dipping, north-northwest-trending zones of syenite/carbonatite (carbonatite intersected in Drill Hole 3 at 17 feet) have been documented by drilling in the area. These zones persist laterally some distance to the southeast. The zones appear to converge at the northern end of the outcrop next to the wash. Amphibolite and lamprophyre dikes appear closely associated along some portions of the unit. A latite dike was intersected in Drill Hole 2 at 82 feet, at the base of the syenite/carbonatite complex; and scrutiny of the up-dip surface area revealed a weathered outcrop of the material.

The syenite/carbonatite complex is interpreted to be an intrusive body which was emplaced along faults and fractures parallel to the rock layering. Along faults which lie at right angles to the layering, the intrusive either widens and converges, pinches out, or is offset.

Biotite quartz diorite (tonalite) has intruded the aforementioned Precambrian rocks, and forms the central or core zones of the hills in the area mapped. This material generally lacks foliation, except near the edges of the intrusive and along fault zones. It ranges in composition due to admixing of the Precambrian metamorphics. Mafic xenoliths are common. The tonalite is believed to be associated with the period of intrusive activity which invaded this area during Cretaceous time.

Young alluvium is differentiated from older alluvium on Plate 1 in order to identify drainage patterns. Young alluvium consists of gravel and sand presently in dry stream channels. Older alluvium is generally the unconsolidated to partly-consolidated gravel, sand, silt, and clay deposits which lie above the present channel deposits. This includes a semi-consolidated, alluvial fan material which overlies the quartz, k-feldspar gneiss along the western edge of Plate 1 in Section 10.

Structure. Folds and fold systems in the Precambrian rocks are complex and not well understood. An example of this is provided by outcrops of the quartz biotite gneiss to schist. This unit exhibits an overturned isoclinal,

NNW-striking fold system in several areas (Plate 1). This system is believed to be refolded along a NNE axis in the west-central portion of Section 10. This is interpreted as an anticlinal structure on Plate 1, but can also be interpreted as a synclinal structure or tilting along a major fault zone.

Faults mapped on Plate 1 exhibit generally NNW and ENE trends in tonalites, and NS to NNE and WNW trends in quartz biotite gneiss to schist. Faults mapped in the region (Geologic Map of California, 1963) strike NW to NNW in Precambrian rocks.

Lateral offsets include the following general observations:

1) Right lateral offsets along EW and WNW-trending faults;

2) Left lateral offsets along ENE-trending faults; and

3) Lateral or vertical (?) offsets along NS-trending faults.

Due to the complex faulting history in the area, no stress interpretations have been drawn from this data. Suffice it to say that lateral offsets have been noted in the area and can be expected along fault zones.

Alluvial-covered areas (topographic lows) trend generally NW to NNW parallel to the trend of the topographic highs. These areas may be underlain by large fault zones, especially in the alluvial-covered area north of the syenite/carbonatite mass.

Mineralization. Rare-earth oxides (ReOx) have been noted at several localities on the property. X-ray fluorescence of Union Carbide Corporation samples (number 919, 920, 923, and 925) taken on the Star claim group indicates a consistent 0.2 to 0.5 percent ReOx content. However, no rare earth or barium minerals were detected in thin section examination or heavy liquid separations of the same samples.

Radioactive allanite-bearing gneisses, located along fault zones in the northwestern corner of the area mapped, contain appreciable amounts of rare-earth oxides. Table 1 shows three selected analyses of geochemical samples obtained from rocks in the area shown on Plate 1, samples JH-2-2, JH-1-9, and JH-1-10.

Sample JH-2-2 was collected from an outcrop of allanite gneiss which appears closely associated with a biotite augen

TABLE 1

SELECTED SPECTROGRAPHIC ANALYSES*

RARE EARTH OXIDES

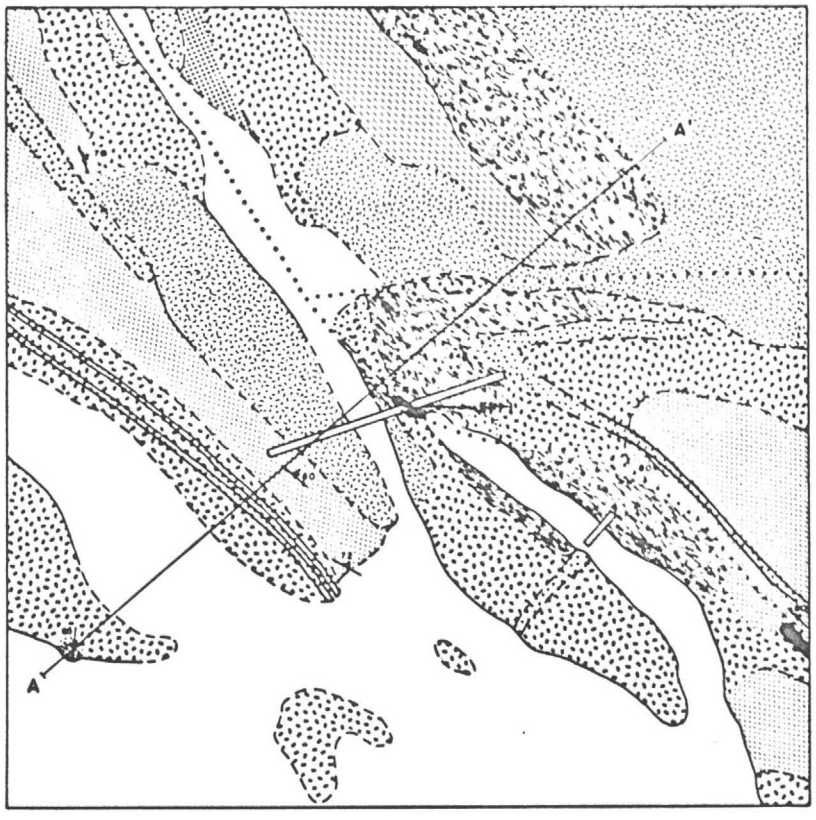
ANALYSES IN PARTS PER MILLION**

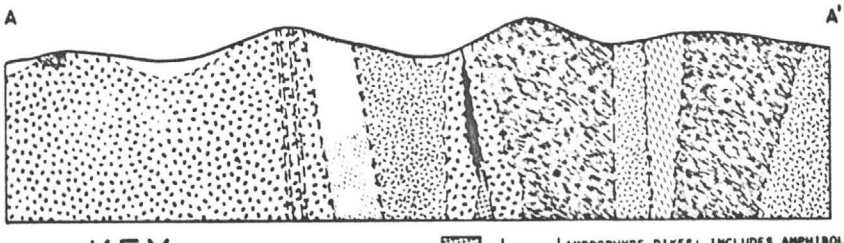
Element	Sample JH-1-1	JH-2-2	JH-1-9	JH-1-10
Lanthanum	9,400	2,500	1,700	610
Cerium	18,000	5,900	4,500	1,500
Praseodymium	370	---	---	---
Neodymium	1,900	740	370	100
Yttrium	560	490	170	64
Total Percent Rare Earth Oxides	3.6	1.1	0.8	0.25

* Analytical reports included in Appendix B

** Sample locations shown on Figure 3 and Plate 1)

GEOLOGIC MAP AND CROSS SECTION OF THE MARIE CLAIM AREA, OLD WOMAN MOUNTAINS, SAN BERNARDINO COUNTY, CALIFORNIA





KEY

	Qal	Young alluvium, mainly gravel and sand in present stream channels.
	Ka	Aplitic to pegmatitic dikes.
	Kd	Alkalic quartz diorite.
	Kt	Biotite, quartz diorite (tonalite).
	Kld	Altered, lime-rich diorite; includes minor carbonatite veinlets.
JH-1-1		Geochemical sample number, showing sample location
	L	Lamprophyre dikes; includes amphibolites and pyroxenites.
	PEm	Quartz, plagioclase, hornblende, allanite, biotite gneiss; coarse-grained, radioactive.
	PEa	Plagioclase, quartz, biotite, augen gneiss to schist.
	PEfg	Quartz, K-feldspar, plagioclase, biotite gneiss; fine-grained.
	PEcg	Quartz, K-feldspar, plagioclase gneiss; coarse-grained.
		Contact; dashed where approximate, dotted where covered.
48		Fault, located approximately; dotted where covered; arrow indicates direction and plunge of slickensides.
87		Strike and dip of foliation.
		Shallow trench.
A—A'		Line of cross section; cross section shows no vertical exaggeration.

0 50 100
FEET

N

DAMES & MOORE

FIGURE 3

gneiss. The outcrop (a hill 200 feet long by 50 feet wide) displays average scintillometer readings which are four times background readings. Thorium content in sample JH-2-2 is 160 parts per million.

Samples JH-1-9 and JH-1-10 were collected from an east-west-trending trench excavated into an alluvial-covered arroyo immediately east of an allanite gneiss outcrop. Both samples were radioactive; with JH-1-9 an allanite gneiss located on the west end of the trench, and JH-1-10 an altered alaskite to aplite (?) located at the bottom of the center of the trench.

Marie Claim Group

Rock Types. The Marie claim group (Figures 2 and 3) includes rock types which are similar to those shown on Plate 1 and described in the previous section of this report.

Biotite quartz diorite (tonalite), aplitic to pegmatitic dikes, and alkalic quartz diorite (Appendix A, samples 4 and 14) have intruded a Precambrian gneissic terrain composed of coarse-grained quartz, k-feldspar, plagioclase gneiss (Appendix A, sample 11); fine-grained quartz, k-feldspar, plagioclase, biotite gneiss (samples 3 and 13); plagioclase, quartz, biotite, augen gneiss (sample 8); and

a lamprophyre dike (samples 1 and 2). Associated with the lamprophyre dike along a NW-trending fault zone which intersects Figure 3 are coarse-grained quartz plagioclase, hornblende, allanite, biotite gneisses (sample 7); and altered, lime-rich diorites, including minor carbonatite veinlets (sample 12).

Structure. Foliation generally dips to the west in the eastern portion of the study area and to the east in the western portion of the area. This is apparently due to rotation along the NW-trending fault zone, although it may define a major fold axis centered along the fault.

Folding or faulting of the augen gneiss prior to intrusion of the tonalite is quite apparent just north of the long trench. If the offset is fault-related, the movement sense is right-lateral along an EW-trending fault.

Mineralization. Scintilometer readings of 0.15 milliroentgens per hour (mr/h) or ten times background are associated with the allanite-bearing gneiss. Anomalously high rare-earth oxides have been found in samples of the rock taken from the large trench (Figure 3).

Sample JH-1-1 (Table 1) shows the highest total percent of rare-earth oxides found to date on the property. This rock resembles the allanite gneiss found in the hill (JH-2-2) to the southeast and in the trench (JH-1-9) to the east.

Mineralization at JH-1-1 is exposed in a 2 to 3-foot-wide zone along the northwest-trending fault, and appears to be widening at dpeth. Argillic alteration is evident in the country rock for distances up to 20 feet from the fault zone.

Petrographic analysis of the mineralized rock (Appendix A, sample 7) indicates that allanite comprises approximately 10 percent of the rock by volume. Rare-earth-bearing allanites have been reported in the Boulder Creek batholith, Colorado (Hickling, et al, 1970). Total rare-earth oxides of eight allanite samples analyzed range from 17.5 to 21.3 percent by weight. This is consistent with total rare earths for worldwide allanites, as shown by Hasegawa (1960). Allanites typically contain radioactive constituents (Deer, Howie, and Zussman; 1966), which range from 0.35 to 2.23 weight percent ThO_2, and from 30 to 650 ppm uranium. Thus, without further laboratory testing, we believe the rare earths and radioactivity in the samples are closely associated with the allanite.

GEOPHYSICS

Heinrich's Geoexploration Company has completed ground magnetic and gravity studies on a portion of the Star claim group. MDC carried out ground magnetic studies on that portion of the Marie claim group mapped in detail by Dames & Moore. This section of the report provides a brief correlation of the geophysical studies performed by these groups with the geology presented herein.

STAR CLAIM GROUP

Both the ground magnetic map and the gravity map of the Star claim group indicate the north-northwest-trending fault zone which lies along the western edge of Sections 11 and 14. This fault separates a magnetically-quiet terrain on the east (tonalite and carbonatite/syenite intrusives into granite gneiss) from a magnetically-busy terrain on the west (schists, gneisses, amphibolite, and lamprophyre intrusives).

East-northeast-trending faults terminate magnetic and gravity highs and lows in the area mapped. Areas of carbonatite/syenite correlate well with magnetic lows and either gravity lows or broad, flat, gravity gradients.

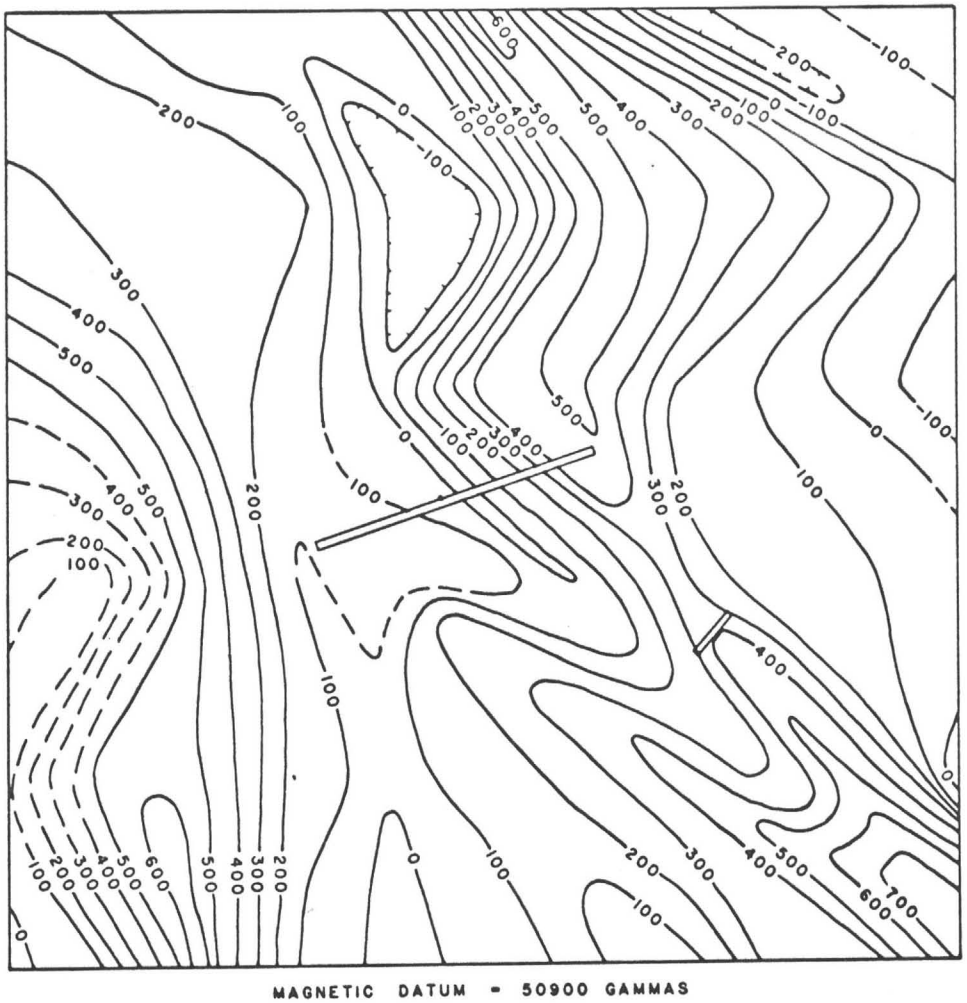
MARIE CLAIM GROUP

Figure 4 shows a ground magnetometer map of the same area as Figure 3.

Magnetic lows over the map area are consistently associated with the large intrusive bodies of alkalic quartz diorite and biotite, quartz diorite (tonalite). In general, magnetic highs occur over metamorphic rocks. The 500 gamma contour in the northeastern quarter of the map defines the approximate center of the augen gneiss body, and is clearly offset along the proposed east-west-trending fault. The rapid drop in magnetic intensity to the west of this contour is indicative of the contact between the metamorphic and intrusive bodies. Allanite present in the center of the map occurs along the fault which truncates the augen gneiss and brings it into contact with the intrusive diorites. Both allanite bodies mapped occur along fault zones which have brought metamorphic and igneous rocks in contact. In addition, the allanite bodies occur along 0 gamma contours which lie at the edges of abrupt magnetic highs.

The large high in the southwestern corner of Figure 4 probably indicates the presence of a sizeable metamorphic body below the alluvium, possibly augen gneiss.

MAGNETIC CONTOUR MAP OF THE MARIE CLAIM AREA
OLD WOMAN MOUNTAINS
SAN BERNARDINO COUNTY, CALIFORNIA



MAGNETIC DATUM = 50900 GAMMAS

0 50 100 150
FEET

N

SHALLOW TRENCH

NOTE: THIS MAP COVERS THE SAME AREA AS FIGURE 3.

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FIGURE 4

SUMMARY OF GEOPHYSICAL INVESTIGATIONS

The strong correlation between ground magnetic anomalies and rock types in both the Star and Marie claim groups indicates that this type of exploration can be an effective means of mapping in the alluvial-covered areas. Target areas exist at the intersection of the north-northwest carbonatite trend and a possible northwest-trending fault zone in the alluvial-covered area of the northwest quadrant of Section 11.

* * *

The following are attached and complete this report.

References Cited

Plate 1, Reconnaissance Geologic Map of A Portion of The Old Woman Mountains, San Bernardino County, California (located in map pocket)

Appendix A, Petrographic Descriptions

Appendix B, Geochemical Analyses

Respectfully submitted,

DAMES & MOORE

Richard L. Brittain sss

Richard L. Brittain
Partner

Roland C. McEldowney sss

Roland C. McEldowney
Senior Geologist

RLB/RCM/dls

REFERENCES CITED

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APPENDICES

APPENDIX A

PETROGRAPHIC DESCRIPTIONS

Classification based upon scheme presented in Williams, Turner and Gilbert- Petrography Text.

#1

Hand Specimen Description: greenish-black and white medium grained rock composed predominantly of hornblende and plagioclase, slightly foliated, no gneissic texture.

Mineralogy
(~50%) Hornblende-biaxial (-), 2V~50-60°, pleochroic from neutral to dk. blue green to dk. brown green, max. bire.≈.027, generally anhedral to subhedral grains ≤ 1 mm., grain clusters up to 4 mm. altering to biotite in places, some simple twins.
(~39%) Plagioclase-biaxial (-), 2V~85-90°, generally anhedral grains <.5 mm., albite and carlsbad twinning, commonly altering to sericite along clevages and twin planes.
(~5%) Chlorite-biaxial (-), 2V~5°, pleochroic from neutral to blue green to grass green, anomolous blue to lavander interference tints, in patches <1 mm., alteration of hornblende, Pennine.
(~3%) Biotite-biaxial (-), 2V~10°, pleochroic from lt. brown to dk. brown to green-brown, high bire, commonly rimming hlb. and along fractures.
(~2%) Epidote-biaxial (-), 2V~80°, pleochroic from neutral to lt. green, high relief, max. bire.~.035, grains 1 mm., commonly assoc. with chlorite.
(~1%) Opaque-hematite and magnetite, commonly assoc. with hlb. anhedral grains < .5 mm.

Textures: holocrystalline, generally xenomorphic granular texture, slight foliation due to allignment of micas, opaques and some hlb. Anhedral epidote grains commonly surrounded by chlorite and together with magnetite and biotite are probably alterations of hlb.

Origin: metamorphosed basic or magnesian igneous rock to the lower amphibolite facies.

Rock Name: hornblende-plagioclase-chlorite-biotite-epidote amphibolite

#2

Hand Specimen Description: dk. green, very coarse grained rock composed predominantly of hornblende- crystals up to 1 cm., slight effervesence indicates minor calcite.

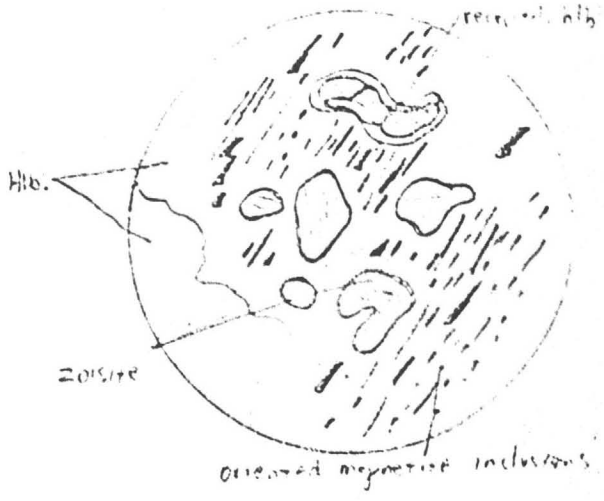
Mineralogy
(~80%) Hornblende-biaxial (-), 2V~80°, pleochroic from neutral to lt. yellow green to lt. brown green, large anhedral poikilitic grains up to 1 cm., max. bire.~.022, some simple twins.
(~10%) Ferrian-Zoisite-biaxial (+), 2V~55-60°, high relief, colorless, max. bire.~.03, as inclusions in hlb. and commonly assoc with calcite, grain patches up to 1 mm.
(~5%) Calcite-uniaxial (-), high relief, v. high bire., as grains (<.5 mm.) and grain clusters included in hlb. anhedral grains.
(~3%) Opaque-anhedral hematite and more abundant magnetite, as grains <.5 mm. and grain clusters up to 1 mm. and commonly as oriented inclusions in hlb.
(~1%) Biotite-biaxial (-), 2V~5°, pleochr from neutral to brn green to green, birds eye extinct., high bire.
(<1%) Chlorite-pleochr. neutral to lt. grn to blue green, anomolous blue to lavander interf. tints- Pennine.
(<1%) Zircon-very minor few grains of zircon and/or sphene.

Textures: holocrystalline, v. coarse grained poikilitic crystals of anhedral hornblende, with abundant inclusions. Hlb. exhibits mottled appearence due to recrystallized pods of hlb. and inclusions. Some grains contain abundant oriented minute magnetite inclusions-oriented parallel to clevages. Commonly pods of recrystallized hlb. and zoisite-calcite

inclusions in amphibole are surrounded by halos of depleted magnetite inclusions.

Origin: basic igneous (dike?) rock.

Rock Name: hornblende-zoisite-feldspar-free lamprophyre.



#3

Hand Specimen Description: lt. pink porphyritic rock with euhedral magnetite phenocrysts (up to .5 cm.) in a matrix of pinkish k-spar, plagioclase and quartz with foliated stringers of biotite and muscovite, development of gneissic texture.

Mineralogy
(~35%) Quartz-anhedral grains < .75 mm. exhibiting undulating extinction.
(~25%) Anorthoclase(?)-biaxial (-), 2V~25-30°, low bire., anhedral grains < 1 mm. sometimes with perthitic texture.
(~20%) Plagioclase-biaxial (-), 2V~70-80°, albite twinning, altering to sericite. Approx. An_{23} - andesine.
(~15%) Biotite-biaxial (-), 2V~5°, pleochroic from lt. brown to dk. reddish brown, high bire., grains up to 1 mm. long.
(~5%) Opaque-magnetite, subhedral to euhedral grains up to .5 cm. and as smaller anhedral grains in matrix.
(~1%) Apatite-uniaxial (-), high relief, v. low bire., commonly as subhedral inclusions in biotite and magnetite.
(<1%) Muscovite-v. minor, colorless, high bire., commonly assoc. with biotite - along margins of magnetite.
(<1%) Zircon-high relief, v. high bire., small anhedral grains .5 mm. commonly assoc. with magnetite. Probably some sphene also.

Textures: holocrystalline, generally xenomorphic granular matrix, porphyritic with large phenocrysts of magnetite. Foliation developed by parallel allignment of biotite grains. Minor symplectic intergrowths between k-spar and plagioclase, some perthitic textures.

Origin: metamorphosed quartzo-feldspathic igneous rock to the lower amphibolite facies.

Rock Name: quartz-kspar-plagioclase-biotite gneiss.

#4

Hand Specimen Description: black and white coarse grained equigranular rock composed predominantly of plagioclase and biotite, no preferred orientations. Slight effervesence indicates minor calcite. Weathered surface appears orangeish.

Mineralogy
(~58%) Plagioclase-biaxial (-), 2V~80°, albite and pericline twinning, commonly zoned, generally subhedral grains up to .5 cm.

(~20%) Biotite-biaxial (-), 2V~5°, pleochroic from lt. brown to green brown to dk. brown, grains up to 2 mm.
(~10%) Quartz-anhedral, interstitial grains exhibiting undulating extinct.
(~5%) Anorthoclase-biaxial (-), 2V~30-40°, low bire., generally anhedral grains up to 1.5 mm.
(~3%) Sphene-biaxial (+), 2V~40°, high relief, v. high bire., occurs as euhedral rhombic grains most commonly as inclusions in biotite. Probably some zircon.
(~2%) Opaque-anhedral magnetite, grains < .5mm., commonly associated with biotite.
(~1%) Chlorite-pleochroic from neutral to grass green, anomolous blue to lavander interf. tints., altering from biotite.
(~1%) Apatite-uniaxial (-), low bire., subhedral to euhedral (hexagonal) grains .5 mm. commonly associated with biotite.

Textures: holocrystalline, subhypidiomorphic granular texture, no preferred orientations. Minor symplectic intergrowths and perthitic texture in kspar. Biotite altering to chlorite and sphene.

Origin: quartzo-feldspathic igneous rock.

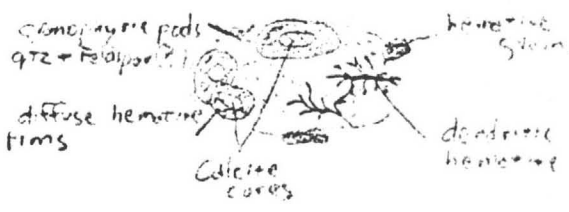
Rock Name: biotite-quartz diorite (tonalite).

#5

Hand Specimen Description: pinkish-orange, coarse grained rock composed predominantly of k-spar, effervesence indicates presence of calcite, lt. tanish weathering rind is porous and highly effervesent.

Mineralogy
(~50%) Anorthoclase-biaxial (-), 2V~35°, colorless, low relief, low bire., generally anhedral grains up to .5 cm.
(~20%) Plagioclase-biaxial (-), 2V~80°, generally anhedral to subhedral grains up to .5 cm. exhibiting albite twinning, highly altered.
(~10%) Quartz-recrystallized to v. fine grained granophyric pods, intergrown with feldspar (?), in places appear lt. brown stained and are associated with reddish diffuse growths (hematite or Fe staining) and calcite.
(~10%) Calcite-uniaxial (-), high relief, v. high bire, commonly as interconected network in anorthoclase grains and as pods with abundant hematite inclusions and rims.
(~7%) Opaque-hematite, generally anhedral grains < .5 mm. and as dendritic growths in and diffuse rims around granophyric pods.
(~2%) Leucoxene-opaque (white under reflected light) pseudomorphic aftter sphene.
(~1%) Muscovite-colorless, high bire., associated with altering plag.

Textures: holocrystalline, generally xenomorphic granular texture, no preferred orientations. Rock is highly altered, plag. going to sericite, qtz. is recrystallized and abundant hematite staning.



Origin: highly altered alkali-lime rich igneous rock.

Rock Name: alkali-lime syenite

#6

Hand Specimen Description: black and white coarse grained rock composed predominantly of plagioclase, qtz., and biotite. No preferred orientations.

Mineralogy
(~60%) Plagioclase-biaxial (-), 2V~70°, generally anhedral to subhedral grains up to 3.5 mm., albite twinning, some zoning, approx. An_{38} andesine.
(~15%) Quartz-generally anhedral interstitial grains up to 4mm. commonly fractured, exhibiting undulating extinction.
(~12%) Biotite-biaxial (-), 2V~5°, pleochroic from lt. brown to reddish brown to v. dk. brown, grains up to 1.5 mm.
(~8%) Anorthoclase-biaxial (-), 2V~45-55°, generally anhedral grains <2 mm., commonly zoned.
(~2%) Sphene-biaxial (+), 2V~40°, high relief, v. high bire., euhedral rhombs < .5 mm. commonly as inclusions in and associated with biotite.
(~1%) Allanite-biaxial (-), 2V~60-70°, high relief, pleochroic from lt. green brown to dk. reddish brown, simple twins, max. bire.~.027, generally anhedral to subhedral prismatic grains < .75 mm. associated with biotite.
(~1%) Opaque-magnetite, generally anhedral grains < .5 mm. commonly associated with biotite and sphene.
(~1%) Apatite-uniaxial (-), high relief, v. low bire., subhedral to euhedral grains (hexagonal), <.5 mm., commonly as inclusions in biotite.

Textures: holocrystalline, generally xenomorphic granular texture, no preferred orientations, minor symplectic textures and perthitic texture in anorthoclase.

Origin: quartzo-feldspathic igneous rock.

Rock Name: biotite-quartz diorite (tonalite).

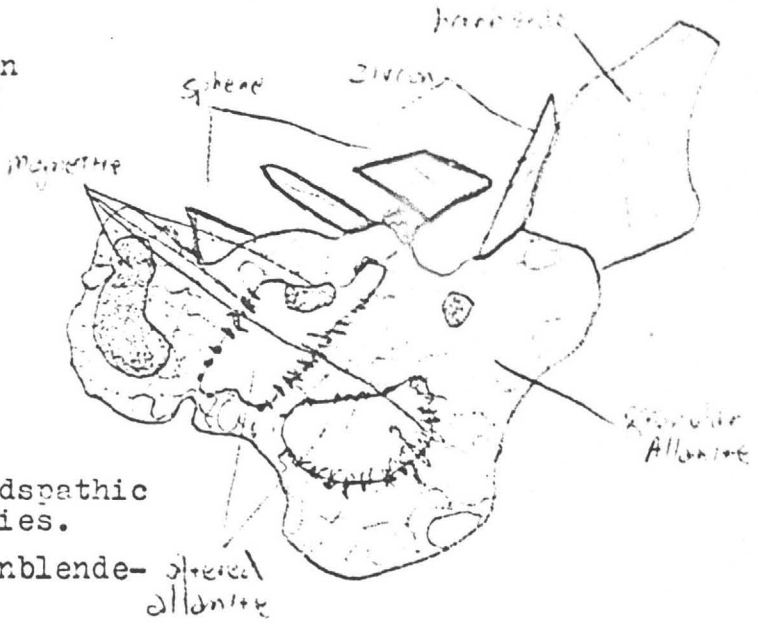
#7

Hand Specimen Description: pinkish, gray and black coarse grained rock composed predominantly of qtz., kspar, plagioclase and hornblende, foliated and developed gneissic texture.

Mineralogy
(~40%) Quartz-anhedral grains up to 3.5 mm. commonly exhibiting undulating extinction.
(~15%) Plagioclase-generally anhedral to subhedral grains up to 2 mm. albite twinning, highly altered to sericite.
(~10%) Hornblende-biaxial (-), 2V~30-40°, pleochroic from yellow to olive green to blue green, generally subhedral grains up to 1 mm. low bire.
(~10%) Allanite-biaxial (-), 2V~40-45°, pleochroic from neutral to green brown to dk. brown, parallel extinct., occurs as prisms <.5 mm. and as patches up to 1.5 mm. with a central core of dk. brown altered allanite hematite and leucoxene and surrounded by less altered allanite and sphene.
(~9%) Anorthoclase-biaxial (-), 2V~40°, low relief, low bire., generally anhedral grains <2 mm., perthitic texture and some symplectic intergrowths.
(~7%) Biotite-biaxial (-), 2V~5°, pleochroic from neutral to golden to dk. brown, poikilitic grains up to 1.5 mm.
(~5%) Opaque-hematite and magnetite, generally anhedral grains <.5mm., magnetite more abundant than hematite, conc in gneissic bands.
(~2%) Zircon-uniaxial (+), high relief, v. high bire., small subhedral to euhedral prisms .5mm., assoc. with hematite and magnetite.
(~1%) Sphene-biaxial (+), 2V~40°, high relief, v. high bire., small euhedral rhombs, assoc with zircon and mafics.
(~1%) Apatite-uniaxial (-), high relief, low bire., commonly as subhedral

to euhedral (hexagonal) inclusions in hlb. and biotite. grains .5 mm.

Textures: holocrystalline rock with foliation due to allignment of hlb., biotite, allanite, zircon and sphene. Differential conc. of minerals perpendicular to foliation due to development of gneissic texture. Matrix is composed of a generally xenomorphic coarse grained mosaic of qtz., plag., and kspar. Patches of allanite typically have darker altered cores and contain inclusions of magnetite surrounded by lighter nonaltered granular allanite.



Origin: metamorphosed quartzo-feldspathic rock to the lower amphibolite facies.

Rock Name: quartz-plagioclase-hornblende-allanite-biotite gneiss.

#8

Hand Specimen Description: black and white coarse grained rock composed predominantly of qtz., plagioclase, hornblende and biotite, strong foliation of mafics and developed augen gneissic texture.

Mineralogy
(~43%) Plagioclase-biaxial (-), 2V~85°, albite and pericline twinning, generally subhedral grains up to 3 mm.
(~20%) Quartz-anhedral interstitial grains up to 2 mm. commonly exhibiting undulating extinction, minor recrystallized mosaic pods.
(~10%) Biotite-biaxial (-), 2V~5°, pleochroic from neutral to reddish brown to dk. brown. grains up to 1 mm.
(~10%) Anorthoclase-biaxial (-), 2V~40°, some polysynthetic twinning generally anhedral grains.
(~3%) Sphene-biaxial (+), 2V~40°, high relief, v. high bire., anhedral to subhedral grains, some showing anomolous blue to yellow interference tints, assoc with zircon, opagues and mafics.
(~7%) Hornblende-biaxial (-), 2V~35°, pleochroic from lt. green to olive green to blue green, anhedral grains up to 1 mm.
(~2%) Opaque-hematite and mostly magnetite, generally anhedral grains up to .5 mm. assoc with mafic gneissic bands.
(~2%) Zircon-uniaxial (+), high relief, v. high bire., generally anhedral grains up to .5mm.
(~2%) Apatite-uniaxial (-), high relief, low bire., commonly anhedral rounded grains up to .5 mm. assoc with biotite and hlb.
(<1%) Chlorite(pennine)-pleochroic from lt. green to grass green, anomolous blue to lavander interf. tints, minor and assoc. with epidote.
(<1%) Epidote-few small prismatic grains, high relief, moderate bire., assoc. with sericite in fractures in altering plag. and with chlorite, slight greenish pleochroism.

Textures: holocrystalline, coarse grained rock exhibiting foliation due to allignment of biotite and hornblende. Development of gneissic banding resulting in differential mineral concentrations.

Origin: metamorphosed quartzo-feldspathic igneous rock to the lower amphibolite facies.
Rock Name: plagioclase-quartz-kspar-biotite-hornblende augen gneiss.

#9

Hand Specimen Description: pinkish white and gray coarse grained rock composed predominantly of quartz and kspar, minor mafics are foliated and concentrated into gneissic bands.

Mineralogy
(~50%) Quartz-generally anhedral grains up to 5 mm. and as mosaic recrystallized patches up to 1 cm. commonly exhibit undulating extinct.
(~30%) Anorthoclase-biaxial (-), 2V~30-40°, anhedral grains up to 3 mm. common perthitic texture some symplectic intergrowths.
(~10%) Plagioclase-biaxial (-), 2V~80°, generally anhedral grains altering to sericite and allanite(?), albite twinning.
(~2%) Allanite-biaxial (-), 2V~50-60°, pleochroic from neutral to lt. green to brown, simple twins, generally anhedral grains up to 1 mm. max. bire.~.026, larger grains have altered centers with inclusions of hematite and magnetite.
(~2%) Opaque-hematite and magnetite, generally anhedral grains <.5 mm., commonly intergrown with sphene and zircon and commonly rimmed by them.
(~2%) Hornblende-biaxial (-), 2V~40°, pleochroic from lt. brown to olive green to blue green, low bire., anhedral grains <1 mm.
(~1%) Zircon-uniaxial (+), high relief, v. high bire., generally anhedral grains <.5 mm.
(~1%) Sphene-biaxial (+), 2V~40°, high relief, v. high bire., anomolous blue to yellow interf. tints, generally anhedral grains <.5 mm. assoc. with zircon, hlb., allanite and opaques.
(~1%) Biotite-biaxial (-), 2V~5°, pleochroic from neutral to lt. brown to dk. brown, minor and assoc. with opaques.
(<1%) Epidote-minor small grains <.5 mm., high relief, max. bire.~.034, pleochroic from colorless to lt. green.

Textures: holocrystalline coarse grained rock, with incipient development of gneissic banding, slight foliation developed by allignment of mafic mineral bands and of recrystallized qtz. pods. Minor symplectic textures also perthitic anorthoclase.

Origin: metamorphosed quartzo-feldspathic rock to the lower amphibolite facies.

Rock Name: quartz-kspar-plagioclase-hornblende-allanite gneiss.

#10

Hand Specimen Description: white, orange, gray and black coarse grained rock composed predominantly of plagioclase, quartz and k-spar, slight gneissic texture.

Mineralogy
(~65%) Plagioclase-biaxial (-), 2V~80°, generally anhedral grains up to 5 mm., highly altered, albite twinning.
(~15%) Chlorite-biaxial (-), 2V~5°, pleochroic from neutral to deep aqua-green, anomolous blue to lavander interf. tints, contains inclusions of apatite and epidote, occurs as patches up to 3mm. interstitial and replacing plag.
(~8%) Anorthoclase-biaxial (-), 2V~40°, anhedral interstitial grains commonly poikilitically enclosing plagioclase grains, optically continuous growths up to 1 cm.
(~7%) Quartz-anhedral interstitial grains up to 2 mm. usually in pods exhibiting undulating extinction.
(~1%) Muscovite-minor in veins, colorless, high bire., assoc. with chlorite.

(~1%) Opaque-magnetite and minor hematite, anhedral fractured grains of magnetite sometimes with hematite rims, grains up to .75 mm.
(~1%) Epidote-biaxial (-), 2V~70°, slight yellow-green pleochroism, high relief, max. bire.~.036, generally anhedral grains up to 2 mm. assoc. with chlorite.
(~1%) Sphene-rhombs up to 1 mm. being extensively replaced by leucoxene, pseudomorphically.
(<1%) Apatite-uniaxial (-), low bire., moderate relief, generally anhedral to subhedral grains < .5 mm. assoc. with magnetite.

Textures: holocrystalline generally xenomorphic granular coarse grained rock, fairly extensively altered, mafics (hlb. and biotite?) replaced by chlorite and epidote; sphene replaced by leucoxene and plagioclase going to sericite and muscovite in small fractures.

Origin: metamorphosed quartzo-feldspathic igneous rock to the upper greenschist facies (?).

Rock Name: plagioclase-chlorite-kspar quartz gneiss.

#11

Hand Specimen Description: white to grayish-pink coarse grained rock composed predominantly of qtz. and kspar, macroscopic mineralogical banding due to developed gneissic texture.

Mineralogy
(~50%) Quartz-uniaxial (+), anhedral interstitial grains , some larger grains up to .7 cm. poikilitically enclose feldspars, commonly exhibit undulating extinction.
(~35%) Anorthoclase-biaxial (-), 2V~20-30°, generally anhedral grains up to 2 mm., some evidence of faint polysynthetic grid-iron twinning.
(~10%) Plagioclase-biaxial (-), 2V~85°, albite twinning, generally anhedral grains <1 mm.
(~1%) Opaque-magnetite and minor hematite, generally anhedral grains <1 mm., commonly in clusters, sometimes rimmed by sphene and zircon.
(~1%) Zircon-uniaxial (+), high relief, v. high bire., anhedral grains <.25 mm. assoc. with sphene and magnetite.
(~1%) Sphene-biaxial (+), 2V~40°, high relief, v. high bire., slight anomolous blue to yellow tints in some grains, anhedral grains <.25 mm. assoc with zircon and magnetite.
(<1%) Biotite-biaxial (-), 2V~5°, pleochroic from neutral to dk. brown.
(<1%) Chlorite-biaxial (-), 2v~5°, pleochroic from lt. brown to green toblue green, anomolous blue to lavander interf. tints, intergrown with and altering from biotite.
(<1%) Allanite-biaxial (-), 2V~50°, pleochroic from neutral to olive green to brown, simpl twins, commonly assoc. with biotite and magnetite, anhedral grains up to .5 mm.

Textures: holocrystalline, xenomorphic granular coarse grained rock, with smaller grains of opaques and mafics tending to occur in clusters, minor symplectic intergrowths.

Origin: metamorphosed alkali rich guartzo-feldspathic igneous rock to the greenschist facies (?).

Rock Name: quartz-kspar-plagioclase gneiss.

#12

Hand Specimen Description: generally pinkish gray medium to coarse grained rock composed of plagioclase and quartz, no preferred orientations, highly altered, highly effervescent, brown patches are calcite.

Mineralogy
(~56%) Plagioclase-biaxial (-), 2V~80°, generally anhedral to subhedral grains up to 5 mm., albite and pericline twinning, altering to sericite, calcite and chlorite(?).
(~15%) Calcite-uniaxial (-), high relief, v. high bire., generally as anhedral interstitial masses up to 2 mm., some euhedral qtz. inclusions and chlorite and minute hematite inclusions.
(~10%) Quartz-generally as recrystallized pods and patches, fine grained mosaics, someplaces v. fine granular granophyric-like growths.
(~7%) Muscovite-colorless, high bire., occurs as fine grained patches commonly intergrown with qtz. and leucoxene.
(~5%) Chlorite-anhedral patches up to 1.5 mm. of v. fine grained granular chlorite, slightly pleochroic brownish green, low bire, commonly as blebs in and assoc. with plagioclase.
(~4%) Leucoxene-opaque, euhedral grains (yellowish white under reflected light), pseudomorphic after sphene.
(~2%) Opaque-mostly hematite, some magnetite, generally larger grains of magnetite with hematite rims and smaller grains of hematite, and minute hematite inclusions in calcite and staining in rock.
(~1%) Apatite-uniaxial (-), sometimes biaxial (-) with a 2V~10°, high relief, v. low bire., subhedral to euhedral grains assoc. with muscovite.

Textures: holocrystalline, generally xenomorphic granular coarse grained rock. No preferred orientations. Rock has under gone extensive alterations Recrystallization of qtz., alteration of mafics to granular chlorite, patches of intergrown muscovite, qtz., and leucoxene may be replacing feldspar.

Origin: altered lime-rich quartzo-feldspathic igneous rock.

Rock Name: altered lime-rich diorite.

#13

Hand Specimen Description: grayish white medium to coarse grained rock composed predominantly of qtz., plagioclase and mafics. Foliation and gneissic banding is seen macroscopically.

Mineralogy
(~45%) Quartz-anhedral interstitial grains up to 2 mm. co monly exhibiting undulating extinction.
(~35%) Plagioclase-biaxial (-), 2V~80°, common albite and pericline twinning, generally anhedral grains up to 1.5 mm. altering in places to sericite.
(~5%) Hornblende-biaxial (-), 2V~40°, pleochroic from neutral to blue green to dk. green, anhedral to subhedral grains 1 mm. low bire.
(~5%) Anorthoclase-biaxial (-), 2V~40°, generally anhedral grains 1 mm.
(~2%) Biotite-biaxial (-), 2V~5°, pleochroic from lt. brown to green-brown to dk. red brown, grains 1 mm.
(~2%) Opaque-anhedral magnetite grains up to .5 mm. common apatite inclusions, minor hematite.

(~2%) Chlorite(pennine)-biaxial (-), 2v~5°, pleochroic from neutral to green to brown green, anomolous blue to lavander interf. tints. altering from biotite.
(~1%) Epidote-biaxial (-), 2V~70-80°, max. bire.~.035, pleochroic from neutral to yellow green, high relief, anhedral grains intergrown with chlorite near altering plag.
(~1%) Sphene-biaxial (+), 2V~40°, high relief, v. high bire., assoc with zircon.
(~1%) Zircon-uniaxial (+), high relief, v. high bire., generally anhedral grains <.25 mm. assoc. with sphene, magnetite and mafics.
(~1%) Apatite-uniaxial (-), moderate relief, v. low bire., anhedral rounded grains assoc. with magnetite and hlb.

Textures: holocrystalline, xenomorphic granular coarse grained rock, slight foliation and mineralogical banding.

Origin: metamorphosed quartzo-feldspathic igneous rock to the amphibolite facies.

Rock Name: quartz-plagioclase-hornblende-kspar-biotite gneiss.

#14

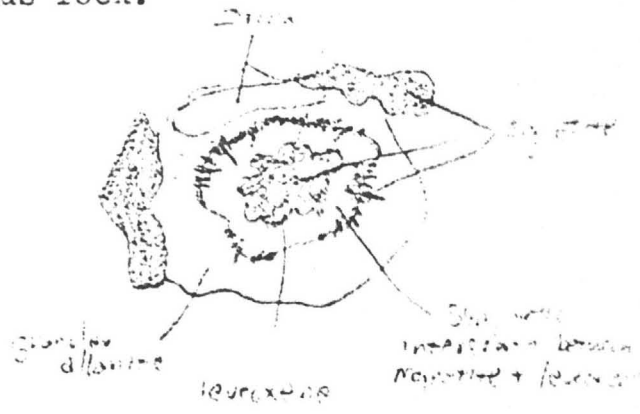
Hand Specimen Description: pink to gray coarse grained rock composed predominantly of kspar, qtz. with plag. and magnetite. Equigranular texture.

Mineralogy
(~45%) Anorthoclase-biaxial (-), 2V~20-30°, anhedral grains up to 6 mm. exhibiting undulating extinction, square clevages and perthitic texture, oriented sinuous fractures.
(~33%) Quartz-anhedral interstitial grains up to 4 mm. undulating extinct.
(~10%) Plagioclase-biaxial (-), 2V~80°, subhedral grains up to 2 mm. albite twinning, grains altering to sericite.
(~3%) Allanite-biaxial (-), 2V~70°, pleochroic from neutral to green brown to brown, subhedral prismatic grains up to 1 mm. and anhedral masses with altered cores with magnetite and leucoxene, and allanite rims, minor epidote grains assoc. with allanite.
(~3%) Opaque-mostly magnetite with minor hematite, magnetite as anhedral grains up to 3 mm. assoc. with sphene, zircon and allanite, some inclusions of same.
(~2%) Chlorite-biaxial (-), 2V~5°, pleochroic from neutral to brown green to blue green, low bire., anomolous interf. tints, as extreme replacement of biotite.
(~1%) Biotite-biaxial (-), 2V~5°, pleochroic from neutral to brown, highly intergrown with and altering to chlorite.
(~1%) Zircon-uniaxial (+), high relief, v. high bire., anhedral grains <.75 mm. assoc. with sphene and magnetite.
(~1%) Sphene-biaxial (+), 2V~40°, high relief, v. high bire., anomolous blue to yellow interf. tints, anhedral to subhedral grains <.75 mm. assoc. with zircon and magnetite.
(~1%) Leucoxene-as dk. alteration of centers of allanite, appears white in reflected light.

Textures: holocrystalline xenomorphic granular to subhypidomorphic granular coarse grained rock. No preferred orientations. Plag. highly altered to sericite, biotite highly altered to chlorite.

Origin: alkalic-quartzo-feldspathic igneous rock.

Rock Name: alkalic rich qtz. diorite



#15

Hand Specimen Description: greenish to orangish medium grained rock, composed predominantly of calcite and chlorite.

Mineralogy
(35%) Calcite-uniaxial (-), moderate relief, v. high bire., rhombic clevage, occurs as anhedral grains up to 2.5 mm. and grain clusters.
(25%) Quartz-uniaxial ( ), low relief, low bire., occurs as v. fine-grained granular matrix, ~~possibly~~ some feldspar but less than 10% (K-feldspar)
(25%) Chlorite-pleochroic lt. greenish, v. fine-grained micaceous, low bire., assoc. with sericite as intergrown patches.
(5%) Sericite-colorless, moderate bire., v. fine-grained micaceous intergrowths with chlorite as alteration products of mafic (?).
(5%) Leucoxene after Sphene-pseudomorphic leucoxene (white under reflected light) completely replacing sphene, generally euhedral rhombic grains up to 1.5 mm., common magnetite/hematite inclusions.
(2%) Apatite-uniaxial (-), moderate relief, v. low bire., parallel extinction, commonly assoc. with opaques and calcite, generally as subhedral to euhedral grains up to .5 mm.
(2%) Opaque-includes leucoxene already discussed, and magnetite and hematite, generally anhedral grains up to 1.5 mm.
(1%) Zircon-v. small euhedral elongated prisms, v. high relief, v. high bire., parallel extint., length slow, generally euhedral laths less than .1 mm. one grain up to .25 mm.

Textures: generally altered texture, rock composed predominantly of larger anhedral calcite grains, altered patches of intergrown chlorite and sericite, and altered sphene, with very fine-grained interstitial granular quartz (K-spar). Rock probably was generally xenomorphic-granular medium-grained rock which has subsequently undergone alteration, chlorite-sericite patches probably represent altered mafic minerals (possibly clinopyroxene, biotite or allanite ?), and qtz. has probably recrystallized to the fine-grained granular patches.

Petrographic Designation: appears to have carbonatite affinities-but in general the calcite percentage should be higher (55% to 90%) and free quartz should be very minor or absent in order to be classified as a carbonatite. Tentatively classified as quartz rich (?) altered Sovite' (coarse-grained calcite-carbonatite).

APPENDIX B

GEOCHEMICAL ANALYSES

FLUO RESCENT
X RAY
SPEC TROGRAPHIC
Analytical Laboratory

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Merlyn L. Salmon, Manager

B-1

XXXX QUALITATIVE
XXXX SEMI-QUANTITATIVE
_____ QUANTITATIVE

ANALYTICAL REPORT

Job Number 21156
Page 1 of 1 Pages
Date 7 Apr 1977

TO: Skyline Labs, Inc

NOTE: The values below are estimated concentrations in ppm for the metal equivalent of the indicated elements. No check was made for elements with atomic numbers less than 22 (below titanium).

SAMPLE: M4556A JH-1-1

Copper	140	Iron	41000	Lanthanum	9400
Silver		Cobalt		Cerium	18000
Gold		Nickel	180	Praseodymium	370
Zinc	150	Cesium		Neodymium	1900
Cadmium		Rubidium	80	Samarium	
Mercury		Barium	1800	Europium	
Gallium		Strontium	420	Gadolinium	
Indium		Titanium	3600	Terbium	
Thallium		Zirconium	3200	Dysprosium	
Germanium		Hafnium		Holmium	
Tin		Thorium	47	Erbium	
Lead	78	Vanadium		Thulium	
Arsenic		Columbium	180	Ytterbium	
Antimony		Tantalum		Lutetium	
Bismuth		Chromium		Yttrium	560
Selenium		Molybdenum			
Tellurium		Tungsten			
Bromine		Uranium			
Iodine		Manganese	750		

By Merlyn L. Salmon

NOTE: A PORTION OF THE REPORTED SAMPLES WILL BE RETAINED ON FILE FOR A PERIOD OF FIVE YEARS FROM THE ABOVE DATE. THE REMAINDER OF THE SAMPLE WILL BE RETAINED FOR THIRTY DAYS PENDING RECEIPT OF WRITTEN INSTRUCTIONS FOR DISPOSAL FROM THE ADDRESSEE ABOVE.

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XXXX QUALITATIVE
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_____ QUANTITATIVE

ANALYTICAL REPORT

Job Number 21158
Page 3 of 5 Pages
Date 7 Apr 1977

TO:
Skyline Labs, Inc

NOTE: The values below are estimated concentrations in ppm for the metal equivalent of the indicated elements. No check was made for elements with atomic numbers less than 22 (below titanium).

SAMPLE: 4600 JH-2-2

Copper	180	Iron	89000	Lanthanum	2500
Silver		Cobalt		Cerium	5900
Gold		Nickel	290	Praseodymium	
Zinc	240	Cesium		Neodymium	740
Cadmium		Rubidium		Samarium	
Mercury		Barium	1100	Europium	
Gallium		Strontium	72	Gadolinium	
Indium		Titanium	3100	Terbium	
Thallium		Zirconium	1800	Dysprosium	
Germanium		Hafnium		Holmium	
Tin		Thorium	160	Erbium	
Lead	160	Vanadium		Thulium	
Arsenic		Columbium	120	Ytterbium	
Antimony		Tantalum		Lutetium	
Bismuth		Chromium		Yttrium	490
Selenium		Molybdenum			
Tellurium		Tungsten			
Bromine		Uranium			
Iodine		Manganese	1000		

By Merlyn L Salmon

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B-3

XXXX QUALITATIVE
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_____ QUANTITATIVE

ANALYTICAL REPORT

Job Number 21158
Page 1 of 5 Pages
Date 7 Apr 1977

TO: Skyline Labs, Inc

NOTE: The values below are estimated concentrations in ppm for the metal equivalent of the indicated elements. No check was made for elements with atomic numbers less than 22 (below titanium).

SAMPLE: 4600 JH-1-9

Copper	550	Iron	45000	Lanthanum	1700
Silver		Cobalt	14	Cerium	4500
Gold		Nickel	62	Praseodymium	
Zinc	190	Cesium		Neodymium	370
Cadmium		Rubidium	110	Samarium	
Mercury		Barium	2700	Europium	
Gallium		Strontium	440	Gadolinium	
Indium		Titanium	3100	Terbium	
Thallium		Zirconium	2100	Dysprosium	
Germanium		Hafnium		Holmium	
Tin		Thorium	140	Erbium	
Lead	82	Vanadium		Thulium	
Arsenic	41	Columbium	160	Ytterbium	
Antimony		Tantalum		Lutetium	
Bismuth		Chromium		Yttrium	170
Selenium		Molybdenum			
Tellurium		Tungsten			
Bromine		Uranium			
Iodine		Manganese	840		

By Merlyn L. Salmon

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B-4

XXXX QUALITATIVE
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_____ QUANTITATIVE

ANALYTICAL REPORT

Job Number 21158
Page 2 of 5 Pages
Date 7 Apr 1977

TO: Skyline Labs, Inc

NOTE: The values below are estimated concentrations in ppm for the metal equivalent of the indicated elements. No check was made for elements with atomic numbers less than 22 (below titanium).

SAMPLE: 4600 JH-1-10

Copper	130	Iron	15000	Lanthanum	610
Silver		Cobalt	36	Cerium	1500
Gold		Nickel	92	Praseodymium	
Zinc	79	Cesium		Neodymium	100
Cadmium		Rubidium	65	Samarium	
Mercury		Barium	340	Europium	
Gallium		Strontium	430	Gadolinium	
Indium		Titanium	1100	Terbium	
Thallium		Zirconium	840	Dysprosium	
Germanium		Hafnium		Holmium	
Tin		Thorium	31	Erbium	
Lead	27	Vanadium		Thulium	
Arsenic	44	Columbium	37	Ytterbium	
Antimony		Tantalum		Lutetium	
Bismuth		Chromium		Yttrium	64
Selenium		Molybdenum			
Tellurium		Tungsten			
Bromine		Uranium			
Iodine		Manganese	330		

By Merlyn L Salmon

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