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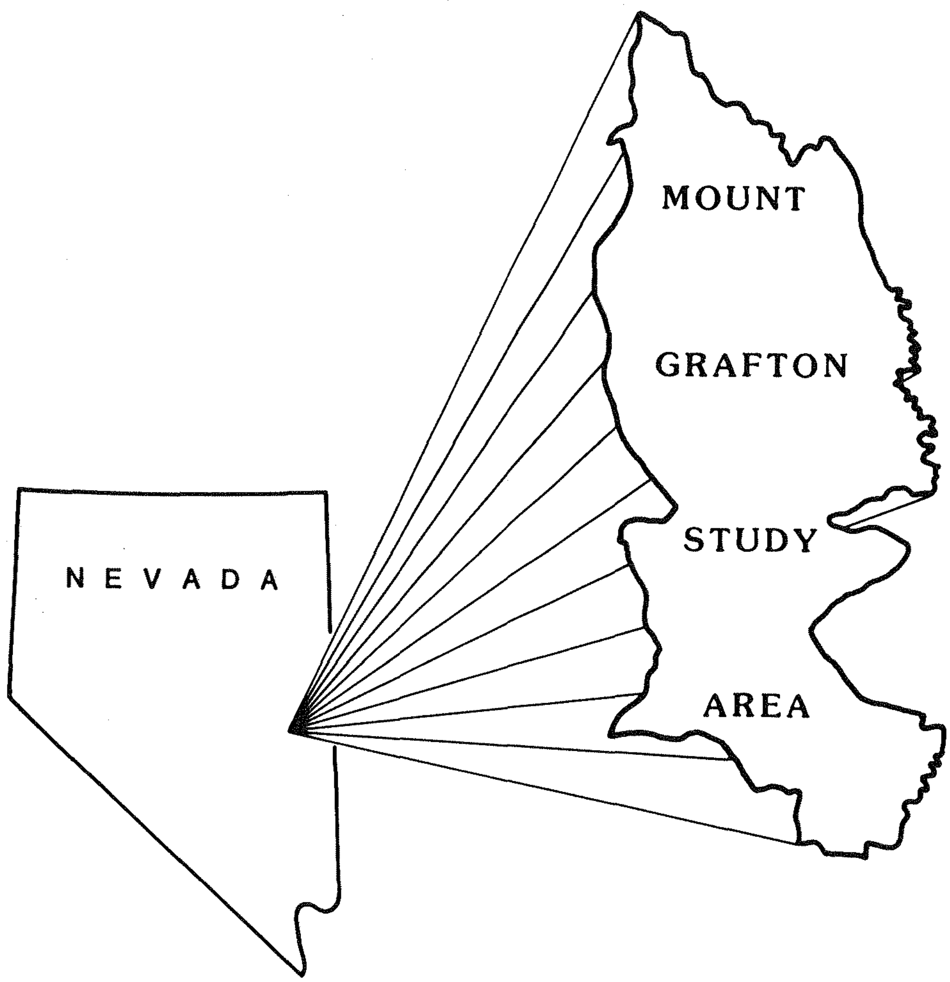
Mineral Resources of a Part of the Mount Grafton Wilderness Study Area (NV-040-169), Lincoln and White Pine Counties, Nevada



BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL RESOURCES OF A PART OF THE MOUNT GRAFTON WILDERNESS STUDY AREA (NV-040-169), LINCOLN AND WHITE PINE COUNTIES, NEVADA

by

Mark L. Chatman

MLA 29-86
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Intermountain Field Operations Center, Denver, Colorado

UNITED STATES DEPARTMENT OF THE INTERIOR
Donald P. Hodel, Secretary

BUREAU OF MINES
Robert C. Horton, Director

PREFACE

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine the mineral values, if any, that may be present. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral survey of a part of the Mount Grafton Wilderness Study Area (NV-040-169), Lincoln and White Pine Counties, Nevada.

This open-file report summarizes the results of a Bureau of Mines wilderness study. The report is preliminary and has not been edited or reviewed for conformity with the Bureau of Mines editorial standards. This study was conducted by personnel from the Branch of Mineral Land Assessment (MLA), Intermountain Field Operations Center, Building 20, Denver, Colorado 80225.

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UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

ft	foot/feet
in.	inch(es)
mtu	metric ton unit
mi	mile(s)
ppm	part(s) per million
lb(s)	pound(s)
ton	short ton, 2,000 lbs
sq mi	square mile(s)
ft^2	square foot/feet
oz/ton	troy ounce(s)/short ton

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SUMMARY

The Bureau of Mines evaluated the mineral resources of 30,115 acres of the Mount Grafton Wilderness Study Area (NV-040-169), a 73,216 acre tract in Lincoln and White Pine Counties, Nevada. The area studied is the part of the wilderness study area preliminarily designated as suitable for wilderness. Evaluation of this BLM-managed wilderness study area was done under the authority of Public Law 94-579. Mines, prospects, and mineralized structures within the study area and on the periphery were examined by the Bureau. The field reconnaissance required 36 man-days in August and September 1984.

The study area, in the southern part of the Schell Creek Range, is a complex series of block faulted and thrusted sedimentary and metasedimentary rocks of Cambrian to Devonian age. Quartz breccias, quartz veins, limestone breccias, and calcite veins developed along the faults carry precious metal, base metal, and tungsten values. Mineral production within the area boundary has been small--134 tons of tungsten ore from the Deer Trail Mine. The mineralized sites within the boundary (Deer Trail Mine, tactite at the head of Swartz Canyon, Lanter Mine) have low-grade concentrations of tungsten, lead, zinc, and minor silver and gold values. Identified resources within the study area are 2,000 tons of material containing 0.1% WO_3 at the Deer Trail Mine, and 1,000,000 tons of material containing 0.4% zinc in tactite above Swartz Canyon. Parts of the Lady Linda and the Lake Valley Silver lode claim groups are within the boundary, but no excavations have been made on those claims inside the area. Most mineralized sites on the study area periphery are in

structures which are not traceable into the area. However, these sites indicate the type and size of mineralized localities that may be encountered in similar fractures within the same stratigraphic horizon in the study area. Metals produced from the area periphery include silver, tungsten, lead, and possibly zinc, copper, and gold. It is doubtful that production from any of these deposits exceeded 500 tons. Extensive parts of the study area underlain by quartzite, carbonate rock, or shale may contain similar mineralized fractures that are at present covered and unevaluated.

Oil and gas leasing in the Cave Valley includes 0.2 sq mi of the Mount Grafton study area, but no hydrocarbon traps or accumulations are known to be present. Warm springs are known within 2.5 mi of the area, but no geothermal resources have been identified to date. Rock products, consisting mostly of quartzite and carbonates, probably will not be utilized because of remoteness from markets.

INTRODUCTION

In August and September 1984, the Bureau of Mines, in a cooperative program with the U.S. Geological Survey (USGS), studied the mineral resources of the Mount Grafton Wilderness Study Area (WSA), Lincoln and White Pine Counties, Nevada, on lands administered by the BLM. The WSA comprises 73,216 acres; the Bureau studied the 30,115 acres deemed preliminarily suitable for inclusion in the National Wilderness Preservation System. "Study area" (SA) as used in this report refers only to the smaller area. The Bureau surveys and studies mines, prospects, and mineralized areas to appraise reserves and identified subeconomic resources. The USGS assesses the potential for undiscovered mineral resources based on regional geological, geochemical, and geophysical surveys. This report presents the results of the Bureau of Mines study that was conducted prior to completion of the USGS work. The USGS will publish the results of their studies. A joint USGS-Bureau report, to be published by the USGS, will integrate and summarize the results of both surveys.

Geographic setting

The Mount Grafton study area, within the Basin and Range Physiographic Province in east-central Nevada, was named after Mount Grafton (el. 10,990 ft), the highest peak in the southern part of the Schell Creek Range (fig. 1). The southern half of the study area is characterized by east-dipping quartzite and limestone hogbacks on the east side, and sheer quartzite and limestone cliffs on the west side. The northern half of the area is characterized by younger, nearly flat-lying limestones and a few shales and quartzites that have formed a topography of lower, rolling hills.

No major drainages are in the study area, which is between Cave Valley on the west, and the Lake Valley on the east. Patterson Pass, a geographic landmark in the range, is 1 3/4 mi south of the area boundary (fig. 1). Several logging and prospecting roads allow vehicular access to the southern part of the area; roads which lead to springs and tanks follow most canyons in the eastern and northern parts of the area; roads are uncommon on the west side. Pioche, Nevada, the nearest town, is about 50 mi south of Patterson Pass via U.S. Highway 93.

Previous studies

Numerous mining, mineral resource, and geologic evaluations have been published concerning various parts of the Mount Grafton study area and the mining districts on the study area periphery. History of development and production at the Patterson district is presented in Hill (1916) and Lincoln (1923); mining at the Cave district is reported in White (1871) and Schrader

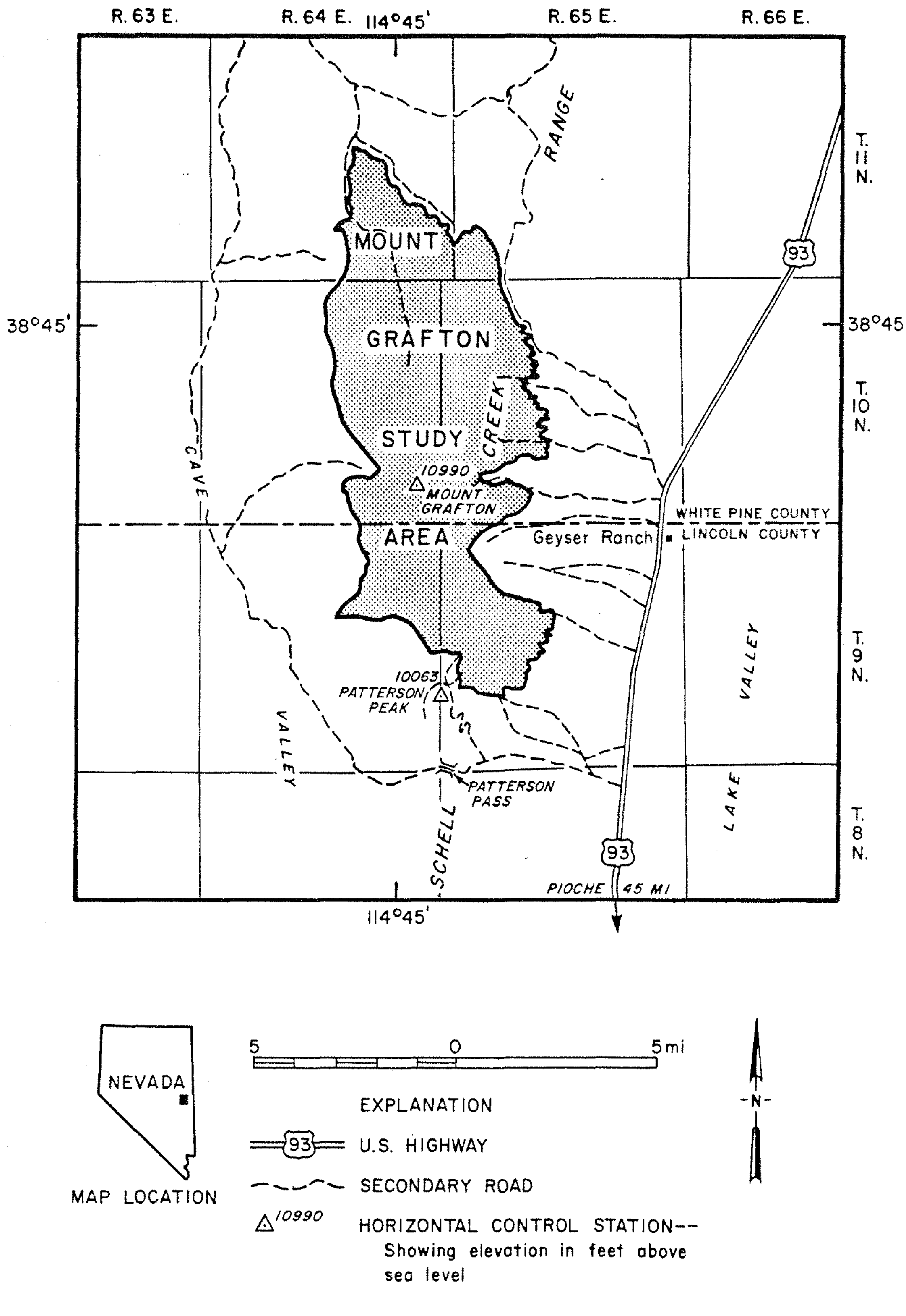

Figure 1.--Index map of Mount Grafton study area, Lincoln and White Pine Counties, Nevada.

(1931). Comprehensive reports concerning the mining and mineral resources of Lincoln and White Pine Counties were published in the 1970's (Tschanz and Pampeyan, 1970; Smith, 1976).

Two reports which address mining and mineral resources specifically within the Mount Grafton area have already been completed under contract with the Bureau of Land Management (Tingley and Bentz, 1982; Great Basin GEM Joint Venture, 1983). Published geologic maps which together provide complete coverage of the study area are those by Kellogg (1964), Tschanz and Pampeyan (1970), and Hose and Blake (1976). A compilation of the study area geology is also presented in the Great Basin GEM Joint Venture report (1983).

Methods of investigation

The Bureau mineral survey consisted of a literature search for data relative to mining, minerals and geology, discussions with holders of mining claims in and near the area, examination of Bureau of Land Management mining claims records and contracted minerals studies, and a field investigation.

The field investigation consisted of examination, mapping, and sampling of all mine and prospect sites in and near the area, and a ground and helicopter reconnaissance for additional mineralized sites. In total, 294 samples were taken; 199 samples of outcropping rock and mineralized structures were collected in and near the mine and prospect sites; 18 additional rock samples were collected during reconnaissance of unmined areas. Seventy-two stream sediment samples and 5 soil samples, all -80 mesh, were taken to try to delineate the extent of known mineralization. Sampled localities are shown on plate 1.

Rock samples were analyzed by the Bureau of Mines Reno Research Center, Reno, Nevada. These samples were tested by semiquantitative optical emission spectrography for 40 elements (appendices A, B). Depending on the type of mineralization suspected, some rock samples were also analyzed for content of arsenic, copper, gold, lead, mercury, molybdenum, rubidium, silver, tellurium, tungsten, and zinc. Analytical methods employed included: atomic absorption for arsenic, rubidium, and tellurium; atomic absorption or inductively coupled plasma for mercury; colorimetry or X-ray fluorescence for tungsten; fire assay/inductively coupled plasma and/or fire assay for gold and silver; and inductively coupled plasma for copper, lead, molybdenum, and zinc.

Stream sediment and soil samples were analyzed by Barringer Resources, Inc. in Wheatridge, Colorado. Atomic absorption was used to test for copper, gold, lead, rubidium, silver, strontium, and zinc; colorimetry was used to test for tungsten.

Geologic setting

This summary of the geology is provided to enhance understanding of the mineral setting. Data were drawn largely from the previously published mapping (Kellogg, 1964; Tschanz and Pampeyan, 1970; Hose and Blake, 1976), and supplemented by field observations made in the Bureau study.

A Cambrian-to-Devonian sequence of sedimentary and metasedimentary rocks covers the study area. There is little folding, but extensive block faulting and thrusting have developed. Quartz breccias, quartz veins, limestone breccias, and calcite veins developed along the faults carry precious metal, base metal, and tungsten mineralization.

Main fault systems in the vicinity of the study area are: the Patterson Pass normal fault, south of the area; the Cave Valley normal(?) fault that strikes generally north and parallels the west side of the area; an unnamed thrust(?) fault that parallels the southeastern side of the area, much like the Cave Valley fault does on the west side; an unnamed normal(?) fault that strikes generally east along North Creek; and a north-trending fault along the northwest boundary of the study area (pl. 1). Mineralization exhibits spatial ties to many of these fault systems.

Stratified rocks in the study area are in two distinct groups, separated by the east-trending fault along North Creek. The southern group is composed of east-dipping hogbacks of Cambrian rocks. Formations, from oldest to youngest, include: Prospect Mountain Quartzite, which is present in the greatest volume and supports the high peaks of the study area; Pioche Shale, composed of lower quartzite, middle shale, and upper limestone; and Pole Canyon Limestone, found along the east part of the study area boundary. These rocks can be considered as one main fault block. The northern group is composed of a complex set of smaller fault blocks which contain Cambrian-to-Devonian limestones, dolomites, shales and quartzites. Configuration of these small fault blocks varies considerably on known geologic maps, so none were shown on plate 1.

Outcropping igneous rocks are uncommon in the SA. A thin basalt dike, which trends north for about 1 mi along the southwest side of the area, coincides with a fault trace mapped by Kellogg (1964, pl. 1) as an extension of the Patterson Pass fault. A granitic intrusive recognized by Hill (1916, p. 123) at the head of Swartz (Schwartz) Canyon probably accounts for a tactite zone developed at the south end of the study area, north of Patterson Peak. The intrusive was not found in outcrop during this study, but some igneous rock was found on dumps of caved workings at the south end of the study area. Other granitic rock is exposed about 1 mi southeast of the study area boundary, about 1/4 mi north of the Cinch Mine (sample no. 113, pl. 1).

The outcrop area is very small, but drilling by Union Carbide Corporation has shown that igneous rock is more extensive at depth (Grigsby, 1981).

Petroleum geology

The presence of basalt and granitic intrusives, and the occurrence of tungsten at several prospect sites suggest a high geothermal gradient in at least the south half of the study area. These high temperatures could be detrimental to the preservation of any hydrocarbons that may have accumulated. In the north half of the area, where the geothermal gradient may be lower, potential petroleum source rocks (Devonian shales) are exposed at the surface and are faulted, leaving little possibility for the formation of shallow hydrocarbon traps.

Interpretation of regional seismic data suggests possibilities for hydrocarbon traps at depth, below a series of decollement zones, wherein hydrocarbons could accumulate independently from the surficial geologic parameters discussed above. Accumulated data are insufficient at present to prove or disprove the existence of such zones beneath the study area. The known data are unavailable and considered proprietary by various petroleum and seismic companies (Norman Foster, Ph.D., independent geologist, Denver, CO, oral commun., 1985). The nearest oil fields are the Eagle Springs, Trap Spring, and Bacon Flat/Grant Canyon fields of the Railroad Valley, about 45 mi west of the study area (Jones and Papke, 1984). Oil traps of these fields are often found in Tertiary volcanics and are generally below 4,000 ft in depth (Garside and others, 1977, p. 5).

A U.S. Geological Survey "qualitative petroleum assessment" of the BLM study areas in Nevada (Sandberg, 1983) assigned a "medium" potential for the existence of petroleum in the Mount Grafton study area (on a scale of "high, medium, low, low-to-zero, zero, and unknown").

MINING DISTRICTS

The southern part of the study area is within the Patterson and Cave (also called "Cave Valley") mining districts. Both districts, which have indefinite boundaries, are within 3 mi of the study area boundary, and are characterized by a sparse scattering of mines. Tschanz and Pampeyan (1970, p. 165) consider the Patterson district and the "Cave Valley" district to be one and the same. Mines and developed sites of the Patterson district that are in or near the study area include the Lake Valley, Cinch, and Pip mines, all workings at and near Patterson Pass and Patterson Peak, the workings at the head of Swartz Canyon, the Lanter Mine, Eagle Rock Mine, Cave Valley Mine, and Streator Mine (pl. 1). The latter four sites are also considered to be in the Cave district. Smith (1976, p. 53) recognizes a third mining area, referred to as the "Geyser Ranch area," which includes the Deer Trail and Lake Valley mines, but this area was never organized as a mining district. Metals produced from the districts include silver, tungsten, and lead, and possibly zinc, copper, and gold.

Patterson district mining began in 1869 after argentiferous "rich oxidized material" was shown to R. G. Patterson by an Indian. Some 200 to 250 claims were then staked to the north of Patterson Pass, but the rich ore "soon gave out" and the district was abandoned. Ore values of $212 to $520 silver/ton and $22 gold/ton were reported[1/], but there are no production

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[1/] These silver ores graded approximately 160 oz/ton to 400 oz/ton based on an average silver price of $1.29/oz from 1866-1870. The gold ores graded approximately 1 oz/ton, based on an average gold price of $20.67/oz from 1866-1870 (Williams, 1883, p. 182). The gold grade could be higher; another valuation of gold mines during this era used gold values of about $14.50/oz (Raymond, 1872, p. 13).

records. (See Hill, 1916, p. 123; Lincoln, 1923, p. 123). Silver mineralization in the Cave district was discovered in 1869 by John Hughes (Smith, 1976, p. 88), probably in conjunction with exploration of the Patterson district. Production was not recorded.

Mining activity and leasing

Mining and prospecting within the study area boundary has not been extensive. Active mining claims which involve study area acreage include the Lake Valley Silver group (and the Lake Valley Mine), under evaluation by J. Wayne Cole (claim holder, Pioche, NV), and the Lady Linda group (pl. 1). Prospecting on these claims has not involved excavation or drilling within the study area boundary as of September 1985. Gold and silver were detected by the claim holder during reconnaissance bedrock sampling in the south-central part of the Lady Linda group in 1985. Additional prospecting was planned but no other details are currently available (Donald W. Miller, claim holder, Baker, Nevada, oral commun., 1985).

Other sites formerly prospected or mined within the study area boundary include a caved working on North Creek (minor Ag, Au), the Deer Trail Mine (W; minor Ag, Au), the Lanter Mine (Pb, Ag, minor Cu, Zn, W, Au), and two small prospect pits (Zn) along the southern part of the study area boundary in tactite at the head of Swartz Canyon (pl. 1). Only the Deer Trail Mine, worked for tungsten in 1956, has recorded production (134 tons of ore/47 tons of WO_3 concentrates). These sites, with the exception of the Lady Linda group, are detailed in tables 1, 4, and 7.

Oil and gas leases cover about 0.2 sq mi of the study area near Lanter Canyon (fig. 2). This area is a part of one of several large oil and gas lease blocks which cover most of the Cave Valley west of the study area. Four

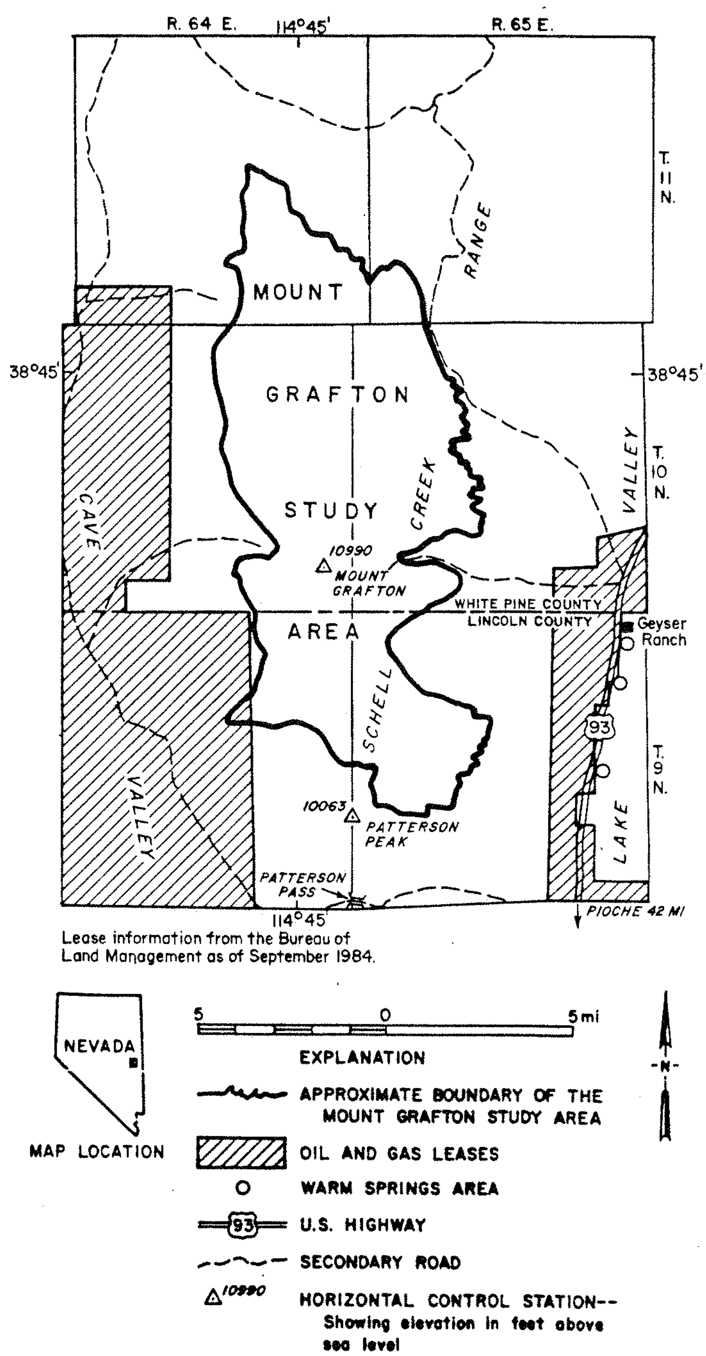

Figure 2.--Energy resources leases and occurrences related to Mount Grafton study area.

test wells drilled in the Cave Valley were dry. One test well was drilled about 3 mi west of the study area; the deepest test well was 7,024 ft (Garside and Schilling, 1977). Some oil and gas leases are in the Lake Valley, within 1 mi to the east of the study area (fig. 2), but no drilling has taken place on those leases. These lease data are from the Bureau of Land Management, Reno, Nevada, as of September 1984.

Geothermal resources are not currently known within the study area, and there are no current geothermal leases. Six warm springs are at the Geyser Ranch, within 3.2 mi to the east of the area boundary (fig. 2). Waters at the springs range from 65 to 75° F. and are used for irrigation purposes (Garside and Schilling, 1979, p. 45-46, pl. 1).

APPRAISAL OF SITES EXAMINED

Igneous intrusion in and near the study area has resulted in mineralization of the Pioche Shale, Pole Canyon Limestone, and Prospect Mountain Quartzite formations. Mineralized sites consist of one large tactite[1/] occurrence on the southern part of the study area boundary (pl. 1), and numerous fracture fillings within fault zones or joints. The mineralization has formed silver, tungsten, lead, zinc, and copper(?) deposits, and minor gold occurrences in the study area and along its periphery. Deposits in and near the study area are grouped into three types which are discussed below.

Resources and mineralized sites in tactite

Tactite in limestone at the head of Swartz (Schwartz) Canyon and the adjacent pass has concentrations of zinc and tungsten with minor silver and

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1/ Tactite is a form of metasomatically-altered carbonate rock.

gold. The mineralized site is partially within the study area boundary at the southern end (pl. 1). The tactite is a 9-ft-thick tabular body, dipping 16° to 25° E. (fig. 3). It crops out south of the area boundary on the nearby pass. The intrusive center which formed the tactite in limestone at the southern end of the study area is the only near-surface igneous center in the vicinity. Intrusive rock, which probably lies directly below the tactite, is not exposed at the surface there. Two samples of cryptocrystalline igneous rock were collected from dumps of two caved adits at the head of Swartz Canyon (samples 197, 201, pl. 1), indicating that the intrusion is present at elevations up to 9,500 ft. See photo, figure 4. The granitic intrusive recognized by Hill (1916, p. 123) at the head of Swartz Canyon was not found in this study, but this location is in or very close to the tactite zone. A granitic intrusive is exposed in a very small outcrop about 3/4 mi southeast of the study area (sample locality 113, pl. 1). Drilling by Union Carbide Corporation has shown that the granitic rock occurs over a more extensive area at depth (Grigsby, 1981). No mineral production has been recorded from this mineralized area. Some part of the workings constitute what is referred to as the "Ad Mine" (Tschanz and Pampeyan, 1970, p. 171). Of all the workings, only two small prospect pits are within the study area--one of them does not expose any bedrock (pl. 1). Workings are summarized in table 1. Minerals identified include scheelite, chalcopyrite, sphalerite, and fluorite (Tingley and Bentz, 1982).

Resources within the entire deposit amount to 6.6 million tons of material containing 1.1% zinc over an estimated 5.9 million ft^2 underlain by tactite (pl. 1). Field evidence shows that the tactite is about 9 ft thick. Resources are of the "indicated" category, using the current established

Figure 3.--Mineralized tactite in limestone, showing a 3-ft-thick limestone parting near the base. Site of samples 181-184.

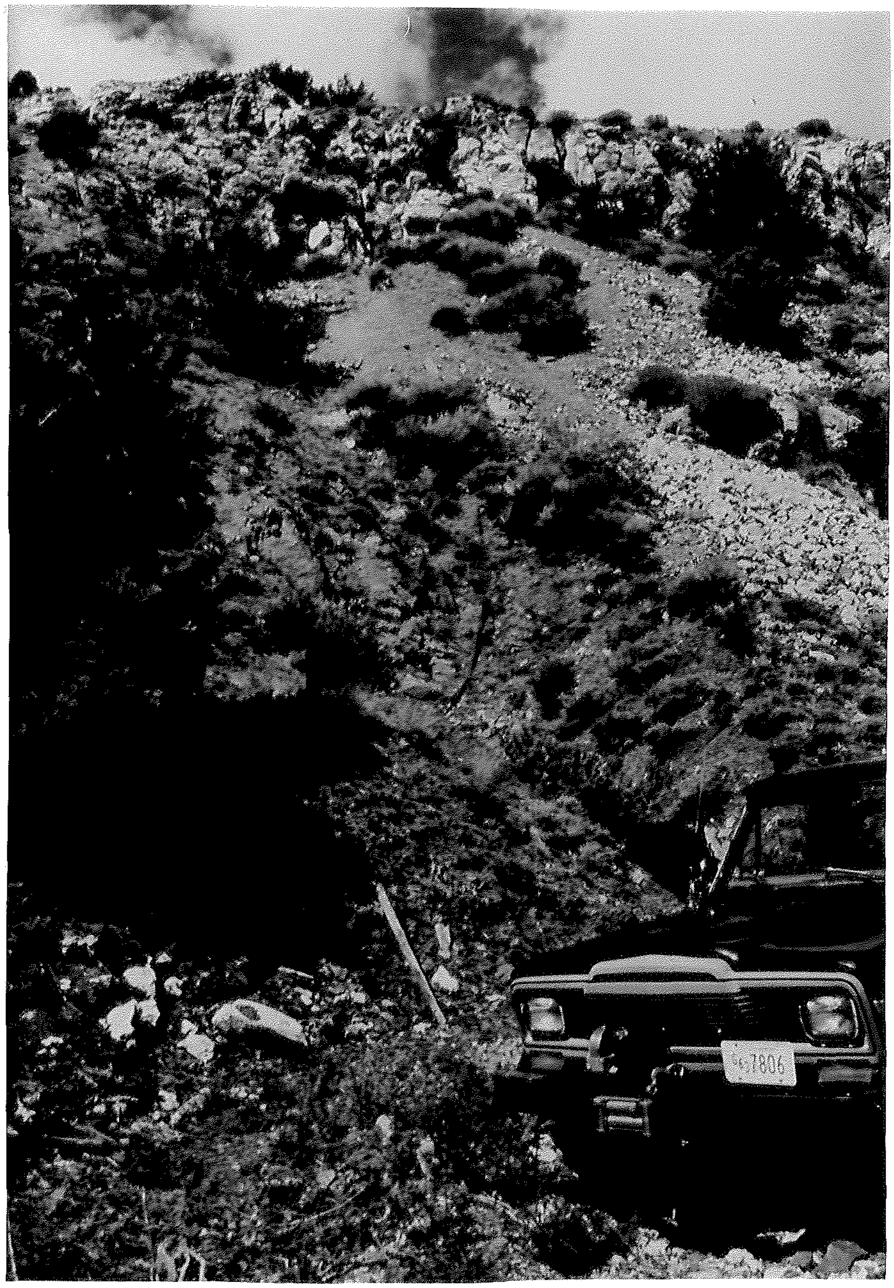

Figure 4.--Dumps of two caved adits in the tactite zone are shown in the upper right (sites of samples 197-201). Rock on the dumps indicates that these adits may have encountered the igneous source rock which caused tactite formation.

classification system (U.S. Bureau of Mines and USGS, 1980, p. 1, 2). Grade is based on values in samples 178-180, 182-204, and 206 (table 2). Samples of rock other than tactite were also used to calculate grade because sampling has shown that limestone and fault gouge not containing tactite can also have high zinc values. This is probably due to the proximity of the source that formed the tactite. This phenomenon is particularly apparent in samples 192-196, collected in a short adit (28 ft long) in limestone. The average silver content of the entire deposit is 0.4 ppm Ag. Silver is too irregularly distributed and low grade to permit resource estimation but some of this silver may be recoverable.

That part of the tactite within the study area occupies 900,000 ft^2, and contains approximately 1 million tons of rock averaging 0.4% zinc, based on samples 203, 204, and 206. This is far below ore grade. These resources are in the "inferred" category (U.S. Bureau of Mines and USGS, 1980, p. 2). The overall deposit grade of 1.1% Zn cannot be applied here, because samples of the tactite in and very near the study area (nos. 203, 204, and 206) show a significant decrease in zinc content. Primary zinc mines in the U.S. mine 3%+ zinc ore. Coproduct zinc mines are mining 1.0 to 1.4% zinc ores, but all have other metals in the ore at much higher concentrations (Jolly, 1984, p. 921-922). Commodity statistics for zinc are in table 3.

Formation of the tactite in carbonate bedrock required the proximity of an igneous body. The metal values in the tactite indicate that the igneous body provided metallizing fluids which impregnated the tactite; some part of the fluids have traveled through existing fracture systems to form metallized areas which are not in proximity with tactite, and are also spatially removed from the igneous source. Mineralized fractures of this type are common in carbonate rocks and shale on the study area periphery, and are described below.

Resources and mineralized sites in carbonate rocks and shale

Fracture fillings in carbonate rock and shale are in the form of quartz veins and breccias, limestone breccias, and calcite veins. Most are within the Pioche Shale and Pole Canyon Limestone Formations. Some of the fracture fillings contain silver in concentrations which have been economically recoverable in the past. Other sites have been successfully prospected for tungsten, lead, zinc, and possibly copper. The fracture fillings are in known fault zones, many of which may be related to the Patterson Pass fault at the south end of the SA. Mines and prospects in carbonates and shale include the Lake Valley Mine, Patterson Pass workings, several workings along the northwest-trending fault between Patterson Pass and Patterson Peak, the Cinch Mine, Pip Mine, Cave Valley Mine, and Streator Mine.

Most of these deposits are outside of the study area and are on fractures which apparently do not extend into the study area. The Marich claims, at the northwest part of the SA, are an exception as they are on a fault which may be present for about 3 mi along strike in the study area. Mineralization at sites along the study area periphery is indicative of the type and grade of deposits which can be expected in fractured parts of the Pioche Shale and Pole Canyon Limestone stratigraphic section. This stratigraphic section is present in the southeastern and northwestern parts of the study area. Descriptions of the deposits are in the following paragraphs. A summary of these deposits is in table 4.

The Lake Valley Mine (fig. 5), also called the "Geyser Mine" (Tschanz and Pampeyan, 1970, p. 171), is about 1,600 ft east of the study area boundary on the Lake Valley side. A north-trending fault zone which dips about 30° west through shale and quartzite on the property was mined for silver on three levels underground. All adits are now caved. Exposure of the fault is limited in outcrop, but it may extend for about 1,500 ft along strike at the ground surface. Mineralized length of the fault has been variously estimated at 500 ft (Smith, 1926) and 1,000 ft (Marshall, 1926). The fault does not cross into the study area along strike. It may project down dip to the west far enough to be inside of the area boundary, but could not be encountered within the study area at depths less than 2,200 ft.

Minerals observed in fault-zone quartz veins when the mine was accessible included fluorite, pyrite, argentite, and wolframite (Smith, 1926; Smith, 1976, p. 53). Argentiferous huebnerite is exposed at the portal of the middle and lowest level adits. A fluorite zone, observed in a prospect pit at the south end of the mine site and in the bulldozer cut, is 4 to 20 ft thick. The fluorite zone contains up to 0.5 oz silver/ton, 0.17% tungsten (W), and 0.002 oz gold/ton (sample nos. 90-95, fig. 5). Assays of 52% fluorite (CaF_2) have been recorded (J. Wayne Cole, Pioche, NV, written commun., 1984).

Underground workings are inaccessible, and the only sample data for the adits come from dump samples and outcropping rock at the portals. Metal values are generally low, but the claimant reports as much as 31.9 oz silver/ton in drill core samples (J. Wayne Cole, Pioche, NV, written commun., 1984). Banner Exploration Co. assays of ore zone samples collected underground during the mining era yielded 13 to 370 oz silver/ton (Marshall, 1926; Smith, 1926). Tschanz and Pampeyan (1970, p. 171) reported 0.9% WO_3 in tungsten "ore" from the mine. Analyses of Bureau samples indicate that any tungsten "ore" zone that might exist may be related to the fluorite zone. Resources may still exist at this mine, but cannot be quantified with available data.

The Cinch Mine (fig. 6) is in carbonate rock in the low hills near the Patterson Pass road, about 1 mi southeast of the study area. Two quartz breccia layers containing scheelite occupy a 500 by 600 ft area, based on Union Carbide drilling in the 1980's (Grigsby, 1981). They have been mined over a small area on three levels underground. The breccias strike N. 80° E., dip 15° SE., and are bound above and below by limestone breccias. The lower layer of quartz breccia is 1 to 4 ft thick; the upper is about 3 ft thick and occupies a smaller area (about 500 by 200 ft).

"Black light" lamping showed scheelite in the quartz breccias, which accounts for at least part of the tungsten values detected by analysis (fig. 6). Powellite has also been identified (Tschanz and Pampeyan, 1970, p. 171). The lower quartz breccia contains an average of 0.34% W (samples 116-121), with a maximum tungsten value of 1.7% (sample 116). The upper quartz breccia (samples 114, 123, and 124) has an average concentration of 0.027% W. Minor gold and silver are present in both quartz breccias.

Inferred tungsten resources are 75,000 tons of 0.41% WO_3 in the lower quartz breccia, based on a mineralized area of 300,000 ft^2 with an average thickness of 3 ft (grade from samples 116-121). Additional inferred tungsten resources are 25,000 tons of 0.033% WO_3 in the upper quartz breccia, based on a mineralized area of 100,000 ft^2 with an average thickness of 3 ft (grade from samples 114, 123, and 124). Some gold and silver may be recoverable. Cutoff grade for tungsten mining under normal economic conditions is approximately 0.3% WO_3, but can be as low as 0.1% under optimum conditions. The current strength of the U.S. dollar abroad has raised the cutoff grade value considerably (P. T. Stafford, Bureau of Mines tungsten commodity specialist, Washington, D.C., oral commun., 1986). Tungsten concentrations such as the 1.1% scheelite ore produced at the Strawberry Mine in California (Engineering and Mining Journal, 1984, p. 169) are considered to be very high-grade ores. Commodity statistics for tungsten are in table 3.

The mineralized breccia at the Cinch Mine may have formed from pre-existing quartz-scheelite veins (Worthington and Schell, 1980, p. 5-7). The breccia is about 30% matrix. Breccia formation could be related genetically to the Patterson Pass fault, which probably cuts through the property, or the north-trending thrust(?) fault along the southeast part of the study area (pl. 1). The Cinch Mine area is approximately at the projected intersection of these two fault zones. If the brecciation is related to the thrust(?) fault mentioned above, then the southeasternmost part of the study area may also contain similar breccias over the 2 mi extent of the fault zone. Breccias have not been identified there, but talus cover is extensive.

The Pip Mine is south of the study area, about 1 mi west of the Cinch Mine and 1,500 ft north of the Patterson Pass fault. Calcite and limestone breccias and calcite veins at the site are in dark grey limestone bedrock with anastamosing calcite veinlets, and in a grey-brown, flat-lying calcite lens which is 3 to 10 ft thick. The breccias contain about 20% matrix. The host rocks are mapped as part of the Pioche Shale Formation (Tschanz and Pampeyan, 1970, pl. 2). Breccia-filled fractures strike N. 10° to N. 60° W. and dip W. 70° to 90°, and may be offshoots of the Patterson Pass fault. It appears that some drifting to the north was started in the three shafts on the mine site, but caving prevented examination.

Sampling was mostly confined to selecting of the various breccia types from dumps of the shafts. All samples contain high silver values--as much as 22.8 ppm in sample no. 130--and one sample contains gold (table 5). Tungsten values are generally low; the highest value, in limestone breccia (sample no. 127), is 0.13% tungsten.

Resources were not estimated for the Pip Mine due to the lack of adequate data. Brecciation cannot be traced on the surface north of the mine due to soil cover and talus. South of the mine, breccias appear to pinch out less than 50 ft away. Breccias and calcite veins can be observed in the shaft walls, but could not be reached for sampling. Silver resources may exist, but estimations were not made because mineralized zones could not be sampled in place underground. The possibility of tungsten resources remains problematic. The high tungsten value is 0.13% in dump sample 127. Tingley and Bentz (1982) report that tungsten was mined in the 1940's (amount not specified), but Tschanz and Pampeyan (1970, p. 171) report that the site was a silver prospect, not a tungsten mine, and that there was no production.

Workings at Patterson Pass consist of four shafts and two shallow pits at the pass and 1,500 ft to the northwest. These have been grouped together because they appear to be silver workings in the initial discovery area of the Patterson mining district. The bedrock, mapped as Pole Canyon Limestone (Tschanz and Pampeyan, 1970, pl. 2), is cut by quartz veins and breccias, and limestone and calcite breccias which strike from N. 0° to N. 25° E. and dip from vertical to 67° E. The breccia zones may be related to the Patterson Pass fault. Breccias contain about 10 to 20% matrix.

Silver values in samples from the workings are consistently high--up to 7.5 oz/ton (sample 143, table 5). Argentiferous copper carbonates were recognized (Hill, 1916, p. 124). Lead and copper values are also high in samples--up to 0.4% lead (sample no. 144) and 0.09% copper (samples 141 and 144). Antimony, present in samples 140, 143, and 144, reaches a maximum concentration of 0.2% Sb (sample no. 144). Resources were not estimated because mineralized structures usually could not be reached for direct sampling in the workings (mostly shafts), and surficial exposure of the structures was very limited or nonexistent. Fractures do not extend far enough (1 mi) to the north to be inside the study area.

Other Patterson district workings are on a fault that extends from the Patterson Pass fault in a northwest direction for over 2 mi (pl. 1). The fault, which passes through Pole Canyon Limestone at the south, also juxtaposes Pioche Shale and Pole Canyon Limestone, and passes into Prospect Mountain Quartzite to the north. Strike of the structure is generally N. 30° W. The fault ends about 1/2 mi southwest of the study area (pl. 1), according to mapping by Tschanz and Pampeyan (1970, pl. 2).

The southernmost group of workings along this fault are shallow pits 1/2 mi north of Patterson Pass in a narrow valley (localities 134-138, and 146). Excavations expose mostly limestone breccias with copper carbonates or pyrite, and quartz veins or breccias. One calcite vein was sampled (no. 137). Most veins and breccias strike northeast (perpendicular to the main fault) and are nearly vertical. Debris filling of the pits prevented direct evaluation of the fractures. Select samples of dump material yielded up to 7.7 oz silver/ton in quartz breccia (sample no. 136). Vein quartz and breccia generally have higher metal values than limestone breccias. High tungsten, copper and lead values are present--as much as 0.2% tungsten, 0.1% copper, and 0.9% lead (table 5). Antimony was detected in sample 136 (0.3% Sb). The mineralized structures do not appear to be extensive and are not within the study area, about 1 1/4 mi to the north. Resources were not estimated, but not all breccias in the fault zone have been prospected (eg., sample no. 147).

A second group of workings, including a shaft, trench, and pit, are along the same fault zone about 4,400 ft southwest of Patterson Peak (samples 150-157, table 5). Excavations here expose vein quartz, quartz breccia, and (rarely) limestone breccia. Silver values are higher here than in the southernmost workings, reaching a maximum concentration of 10.5 oz/ton in a sample of vein quartz (sample no. 150). Lead, copper, zinc, and antimony values are also high. The metal deposition is not known to extend beyond the prospect site. Rock exposure here is good.

A third mineralized site on the fault zone, consisting of a caved shaft and trench, carries the highest values of copper, zinc, and tungsten that were encountered along the fault zone. Up to 6.4% copper, 6.6% zinc, and 0.24% tungsten were detected at the site of samples 158-160 (table 5). Silver values are also high (9.5 oz/ton maximum, sample 158). Maximum lead concentration is 0.18% (sample 158). The shaft exposed a 10-in.- to 2-ft-wide fault zone with copper carbonates and gouge (Hill, 1916, p. 124). The adjacent bulldozer trench apparently obliterated what was a 455-ft-long adit in shale reported in Tingley and Bentz (1982). No mineralized rock can be seen along the trench. The adit probably trended about N. 25° E. The fault dip was measured at 15° S. in the adit (Hill, 1916, p. 124). Quartz float within 1/4 mi east of the shaft (sample 162) contains 4.6 oz silver/ton. Limestone breccia samples (nos. 176, 177, table 5), thought to be a part of the main fault, are not mineralized. Resources were not estimated because the mineralized zone is largely covered. Resources may be present at the site, but would not extend into the study area, about 3/4 mi north.

The Cave Valley Mine was developed on a low ridge in Cave Valley, about 3/4 mi west of the study area (pl. 1). This mine site includes a 120-ft-deep shaft (site of samples 238 and 239, fig. 7) with 600 ft of north-south drifts (Schrader, 1931, p. 11). The shaft is now caved. The ridge on which the mine was excavated is composed of Pole Canyon Limestone and Pioche Shale, juxtaposed by faulting (Tschanz and Pampeyan, 1970, pl. 2). Mining was in the Pioche Shale. Schrader (1931, p. 8) examined the property before it was caved and noted a series of five parallel north-trending mineralized fractures, each dipping west about 60°. No such fractures are readily apparent in outcrop, but reportedly one was encountered at depth during mining in the main shaft (Pat Fraser, Ely, NV., oral commun., 1984).

Mining was for silver, obtained primarily from ores composed of pearcite--a silver-arsenic sulfide. The rest of the silver was suspected of being concentrated in lead carbonate. Traces of gold occur with the silver (Schrader, 1931, p. 11, 13). Galena and stromeyerite also have been identified (White, 1871, p. 92), and some lead was produced from ores shipped in the late 1930's or early 1940's (Pat Fraser, Ely, NV, oral commun., 1984).

Resources were not estimated for the property because the ore zone is inaccessible for direct sampling. Select material was gathered from dumps of slumped-in pits and caved shafts. Quartz and quartz breccias, which contain about 10 to 20% matrix, have the highest metal values. Limestone breccias and calcite veins have low metal values, or are unmineralized. Silver and lead resources may exist on the property, based on high silver and lead values in dump samples, but subsurface sampling would be needed to verify this. The mine is separated from the study area by the Cave Valley fault.

At the Streator Mine in low hills above the Cave Valley, about 2 mi west of the study area (pl. 1), extensive excavations have been made. Here, quartz and hematite cemented breccias are exposed for 500 ft along a fault zone which strikes N. 25° to N. 70° E. through Pioche Shale [stratigraphy from Tschanz and Pampeyan, (1970, p. 171)]. The fault zone has also been described as a contact between strata of the Prospect Mountain Quartzite and Pole Canyon Limestone formations (Kellogg, 1964, pl. 1). Most of the mineralization was reportedly found in the main (northernmost) shaft where a S. 40° E.-trending fissure intersects the main fault (Schrader, 1931, p. 15). The property appears to be separated from the study area by the Cave Valley fault (pl. 1).

Examination of "ore" during the mining era revealed mostly argentiferous galena with psittacinite[1/], lead and copper carbonates, and pearcite (Schrader, 1931, p. 15). Select samples of mineralized quartz breccias and limestone breccias were collected from dumps of the four shafts in the present evaluation. Breccias have about 30% matrix. Maximum values are 1.6 oz silver/ton, 0.02 ppm gold, 0.078% lead, and 0.38% copper. Silver is in all 10 samples, and gold is present in 7 of 10 samples. Tungsten (8 ppm) is in one sample (table 5, samples 245-255). Precious metal values are low but consistently present in nearly all the dump samples, thereby suggesting that resources of these metals may be present. No resources were estimated because the mineralized fractures could not be followed on strike or sampled in place.

The Marich claims are about 1 mi west of the study area, in low hills above the Cave Valley (fig. 8). Bedrock is Pole Canyon Limestone (Hose and Blake, 1976, pl. 1). Limestone breccias and a 1,300-ft-long calcite vein and breccia zone were prospected with 22 shallow pits and 2 shallow shafts. Nine of these pits did not reach bedrock, and were not sampled. Workings are within a northwest-trending fault zone which may extend for 5 mi beyond the

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1/ Chemical formula $Pb(Cu,Zn)(VO_4)(OH)$, also called mottramite.

prospect site, based on interpretation of recent mapping (Hose and Blake, 1976, pl. 1). As much as 3 mi of strike length of this fault zone may be within the study area, along the west side (pl. 1).

Metal concentrations are highest in limestone and limestone breccias with lead and copper carbonates (table 6). Metals shown by chemical analyses are silver, copper, lead, mercury, and, to a minor extent, gold. Most calcite vein samples do not contain high metal values. A limestone sample with lead and copper carbonates contains the maximum of all metal values except gold; values detected in sample 275 include 1.9% lead, 0.52% copper, 210 ppm mercury, and 27.4 oz silver/ton (table 6). Maximum gold concentration in samples from the area was 0.03 ppm (sample nos. 278 and 281).

Resource estimation at the Marich claims is hampered by irregular metal distributions in at least three different fractures. Sample 290 has high silver content (9.6 oz/ton) but orientation and extent of a structure at this site could not be determined in this slumped-in prospect pit. However, there are two quantifiable locales for resources. One is the northwest-trending breccia zone excavated by four prospect pits (sample sites 278, 279, 281-286) in the northeast part of the workings (fig. 8). The breccia zone dips NE. 60°, is 5 to 6 ft wide, and about 275 ft long. It has about 30% matrix. Inferred resources could amount to 20,000 tons, assuming that mineralization along strike extends beyond the measured length by a factor of 1/2, and mineralization extends down dip for 1/2 of the measured strike length. Grade is 0.6 oz silver/ton based on the three samples of in-place breccia zone (sample nos. 281, 284, 285), and not the higher grade samples from dumps (nos. 278, 279, 282, 283, and 286). Commodity data for silver are in table 3.

Additional inferred resources were calculated for a north-trending calcite-filled zone exposed by one shaft and four prospect pits (sites of sample nos. 272-277) in the central part of the workings. The structure in various places is clearly a calcite vein, calcite breccia, or limestone, each with calcite veinlets, and lead and copper carbonates. Inferred resources are based on only the measured strike length (500 ft) and width (4 ft), and an estimated extension of mineralization down dip for 250 ft (1/2 the strike length). Resources of 40,000 tons with 4.5 oz silver/ton might be expected. Grade is based on only in-place samples (nos. 273, 276, and 277); dump-sample values (nos. 274 and 275) are higher. Copper, lead or mercury may be recoverable as by products, based on analytical results (table 6).

Marich claims mineralization has developed on a fault zone which may be present within the study area for as much as 3 mi along strike. The northwest-trending fault zone cuts Wildcat Canyon and the canyons of North Creek along the west side of the study area (pl. 1). There is a possibility that mineralization similar to that at the Marich claims took place along this fault zone within the study area. Brecciation has occurred away from the immediate area of prospecting at the sites of samples 259, 264, 293, and 294 (tables 6 and 9). Sample 259, at the apparent southern extent of this fault zone within the study area contains 0.01 ppm gold. An 8-ft-wide limestone breccia (sample 293) containing 0.07 ppm gold and 2.8 ppm silver was collected on the study area boundary, 4,000 ft east of the Marich excavations (fig. 8). Sample 264, a quartz breccia about 1 mi south of the Marich excavations (pl. 1), contains 0.5 oz silver/ton. Stream sediment samples collected downstream from the fault zone (nos. 256, 260, 262, 263; table 10) all contain silver, but the values are not high relative to the other sediment samples collected from the study area (table 10). These results from the sampling south from the Marich claims suggest that metallization has occurred in or near the fault zone at points in or near the study area. Other fractures that are along the fault zone and within the study area may have provided channels for ore fluids, and deposits similar to those at the Marich claims may be present at depth.

The mineralization at sites in carbonate rock and shale that are described above has a probable igneous source. Tungsten and antimony, two metals indicative of an igneous source, are present at nearly all the deposits sampled. Intrusive igneous rock, which underlies both the tactite zone at the south end of the study area and the Cinch Mine, is a probable source of mineralization at those sites. Conduits apparently were formed by the Patterson Pass fault and related, smaller open fractures. Other sites, such as the Marich claims, are quite distant from this Patterson Pass igneous source and probably were genetically related to different igneous centers. It can be assumed the localities of all fractures have not yet been found, based on the complex tectonic history of the study area. Therefore, extensive parts of the study area may contain similar mineral deposits that would require detailed exploration to locate.

Resources and mineralized sites in Prospect Mountain Quartzite

Quartz veins and breccias in the Prospect Mountain Quartzite contain tungsten in quantities which were considered economically recoverable in the past, and minor gold and silver, some of which may be recoverable. Most of the sites also contain lead values, and some contain high copper and zinc values. The quartz veins and breccias are fracture fillings, and are often in mapped fault zones. Mineralized sites include the North Creek Spring prospect, Deer Trail Mine, Lanter Mine, and Eagle Rock Mine. The first three sites listed are inside the study area. Deposit descriptions are in the following paragraphs. All deposits are summarized in table 7.

The North Creek Spring prospect, on a hillside in the central part of the study area (pl. 1), was reportedly mined for tellurides (Geo. Marich, Ely, NV, oral commun., 1984). The site is within an east-trending fault zone mapped by Tschanz and Pampeyan (1970, pl. 2), and the development apparently follows a 4-ft-thick quartz breccia which strikes N. 75° W. and dips NE. 25° through quartzite bedrock. Minor amounts of gold and silver are in hematitic quartz breccia and iron-oxide stained, shaley quartzite exposed at a shaft collar. The inclined shaft, now caved, trends approximately north. Minor tungsten and zinc are also present. Barium values up to 0.2% were detected. No tellurium was detected.

No resources were defined because of inaccessibility of the underground workings (fig. 9), and lack of surface exposure of the mineralized zone. Talus cover east and west of the shaft collar prevents tracing of the breccia zone beyond the excavation. Details of the site are in table 7; analytical data are in table 8. The fault zone in which this prospect was excavated extends along strike for over 2 mi (Tschanz and Pampeyan, 1970, pl. 2). Other mineralized sites may exist along this fault zone, but none were observed in the field reconnaissance. Stream sediment samples collected along the fault zone (nos. 44, 49, 50, 52, 257, 258, table 10) all contain low amounts of silver. None have detectable tungsten or gold and none have anomalous copper, lead, or zinc.

The Deer Trail Mine is north of Sheep Creek on a hillside in the east-central part of the study area (pl. 1). An adit follows a quartz vein for 120 ft; the vein strikes N. 70° E., and dips SE. 55° (figs. 10 and 11).

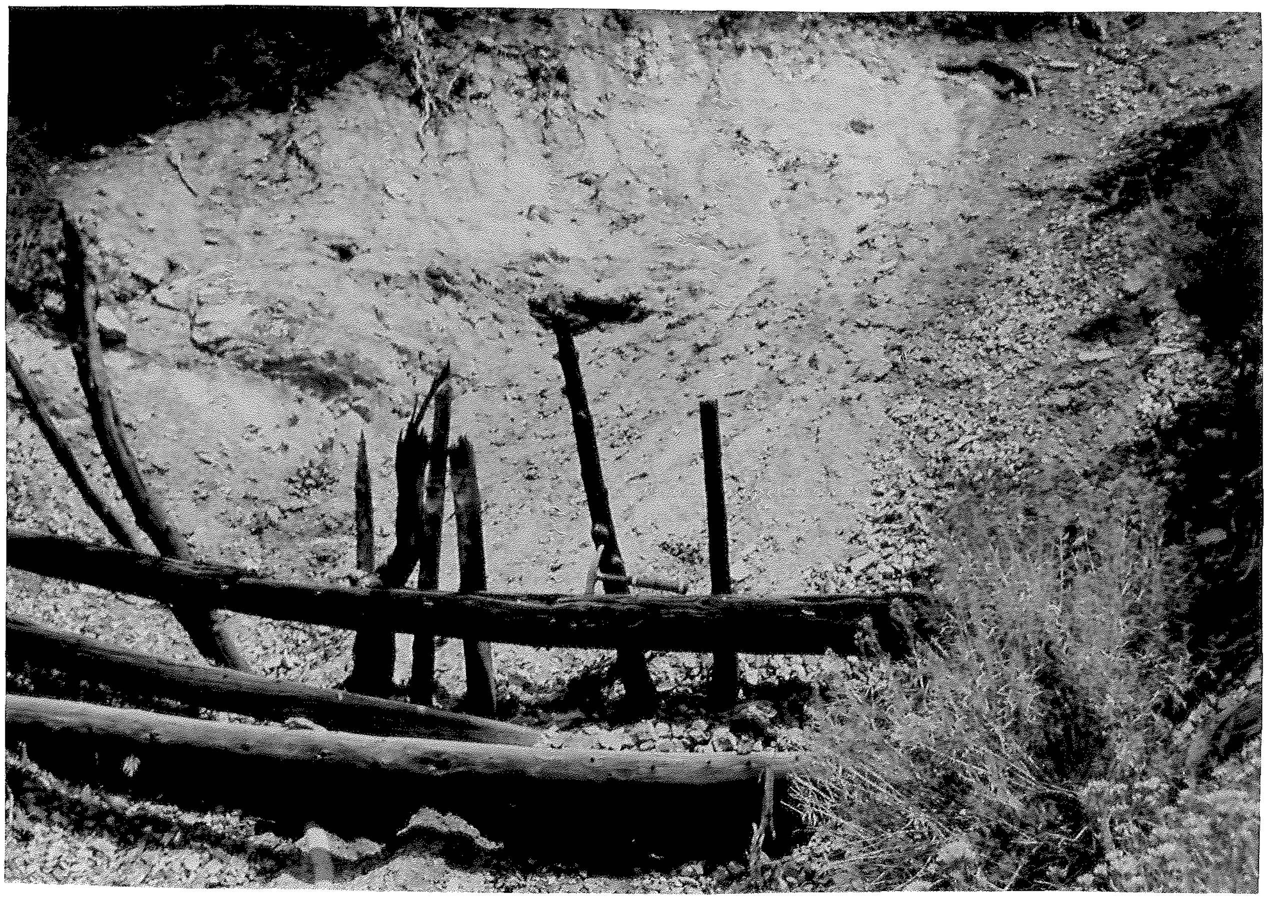

Figure 9.--Caved shaft at the North Creek Spring prospect, looking north. Quartz breccia exposed by slumping is visible in the left and central parts of the scar. Ten-in.-long hammer, on collapsed log support member, provides scale.

Figure 10.--Portal of the Deer Trail Mine, showing southeast (to the left) dip of the mineralized quartz vein. Portal is 5 ft high.

Average thickness of the quartz vein is 2 ft, and maximum thickness is 4 ft. The vein is truncated at 120 ft in the adit by a strike-slip(?) fault which strikes N. 70° W. and dips SW. 80°. The fault zone, filled with quartz breccia, apparently also had some reverse movement. The first 120 ft of adit is in the downthrown block. Quartz float is exposed on the surface above the adit for 100 ft along strike of the quartz vein, and is exposed for 125 ft to the east of (below) the portal, giving a 225 ft observed strike length on the downthrown block. Average thickness of the quartz vein at the surface is estimated at 1 ft. The vein is also exposed at the surface on the upthrown block, 400 ft west of the adit portal in a prospect pit. Talus cover prevented tracing of the vein farther west, and strike-slip movement to the southeast has truncated or offset the vein to the east of the prospect pit.

The 120-ft length of quartz vein exposed in the adit contains huebnerite and as much as 0.2% tungsten, 1.5 oz silver/ton, 0.1 ppm gold, 740 ppm lead, 240 ppm copper, 320 ppm arsenic, 120 ppm zinc, and 0.2% barium. Select samples of vein quartz and quartzite from the mine dump contain up to 0.94% tungsten and 2.4 oz silver/ton, respectively. A sample of vein quartz (no. 71) from the prospect pit 400 ft west of the adit portal has the highest tungsten value (1.0%). (See analytical data, fig. 11.) The quartz breccia, which has much lower metal values than the quartz vein (200 ppm tungsten; 2 ppm silver, maximum), is not exposed at the surface. This breccia has about 10% quartz matrix. Identified resources in the downthrown block are estimated to be 2,000 tons of material containing 0.1% WO_3, from which some silver or gold may be recoverable.[1/] Tungsten values in these resources are about

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1/ Calculations are based on the observed strike length (225 ft) plus an assumed strike extension of 1/2 the observed strike length (112.5 ft); also the observed length of vein down dip (90 ft) plus an assumed extension down dip of 1/2 the observed value (45 ft). Grade of deposit was determined from samples 55-58--the four samples of vein quartz collected in the downthrown (resource-bearing) fault block.

1/3 ore grade (see tungsten discussion, p. 19). No resources were estimated for the upthrown block because the fault truncation to the east and talus cover to the west limit exposed strike length to less than 10 ft.

Observations in the vicinity of the mine suggest that other mineralized quartz veins may exist within about 1 mi of the mine site. On the hillside south of Sheep Creek, 0.3 mi south of the mine, quartz float contains 14 ppm tungsten, 240 ppm arsenic and 0.4 ppm silver. The Lady Linda lode claim group (pl. 1), adjacent to and north-northwest of the Deer Trail Mine, is currently being evaluated for gold and silver, but there are no excavations. Quartz veins similar to those at the Deer Trail Mine may be located in the Lady Linda claim group; details concerning the claims are not available at present.

The Lanter Mine is in the southwest part of study area on a low hillside between Lanter Canyon and a west-flowing tributary south of Lanter Canyon (pl. 1). The development consists of a caved inclined shaft trending S. 75° E. in a 12-ft-wide quartz breccia, which strikes N. 30° E., and dips vertically. The breccia can be traced for 500 ft north of the shaft through intermittent outcrop and float, where it is covered by talus. The breccia cannot be traced south of the shaft, although soil cover is thin and bedrock exposure is good.

Analytical data (table 8) show that some of the breccia exposed at the shaft collar bears minor amounts of tungsten (6 ppm), gold (0.01 ppm), and silver (up to 0.6 ppm) (samples 212, 213). Values in a select sample (no. 215) from the dump were much higher; up to 0.7 oz silver/ton, 0.55% lead, 0.095% copper, 8 ppm tungsten, 40 ppm mercury, and 0.1% antimony. A soil sample collected downslope from the dump (no. 210) has 32 ppm tungsten, which can be considered anomalous in comparison to other soil samples in the area (table 11). Samples of quartz breccia outcrop north of the mine (nos.

217-219) also contain small amounts of silver (up to 1.3 ppm) and one (no. 218) contains 6 ppm tungsten. A thorough examination of the site is hampered by the caved working. Metal values from a hand-sorted "ore" stockpile (sample no. 215) are the only indication that high values of lead, silver, or copper may be encountered at depth. The degree of concentration of metals obtained through segregating this stockpile cannot be estimated. No resources were identified due to the overall low metal values in outcrop samples and lack of access to the underground workings.

The Eagle Rock Mine is about 1 1/4 mi southwest of the study area. It is the most extensively mineralized site observed in Prospect Mountain Quartzite. The mine consists of a prospect pit, and 104 ft of workings with an adit and drift, which were excavated to follow two quartz veins. The major vein, which strikes N. 50° E., and dips NW. 57° is exposed for 75 ft along the adit. The vein is again exposed 200 ft to the west and 60 ft down dip in the prospect pit (fig. 12). The quartz vein is up to 6 ft wide. A second quartz vein exposed over about 37 ft in the drift, strikes about N. 65° E. and dips about NW. 65°. The intersection of the two veins is not exposed. Geologic mapping (Kellogg, 1964, pl. 1; Tschanz and Pampeyan, 1970, pl. 2) suggests that the fault zone in which these veins lie does not extend far enough to the northeast to reach the study area.

Talus cover prevents tracing of either of the two quartz veins upslope from the mine, but the two veins do not appear to pinch out--they are 6 ft and 5 ft thick, respectively, at the adit and drift faces. Because the veins are in the fault zone, there may be other mineralized quartz veins along the strike length of this fault, which is approximately 5,000 ft (pl. 1).

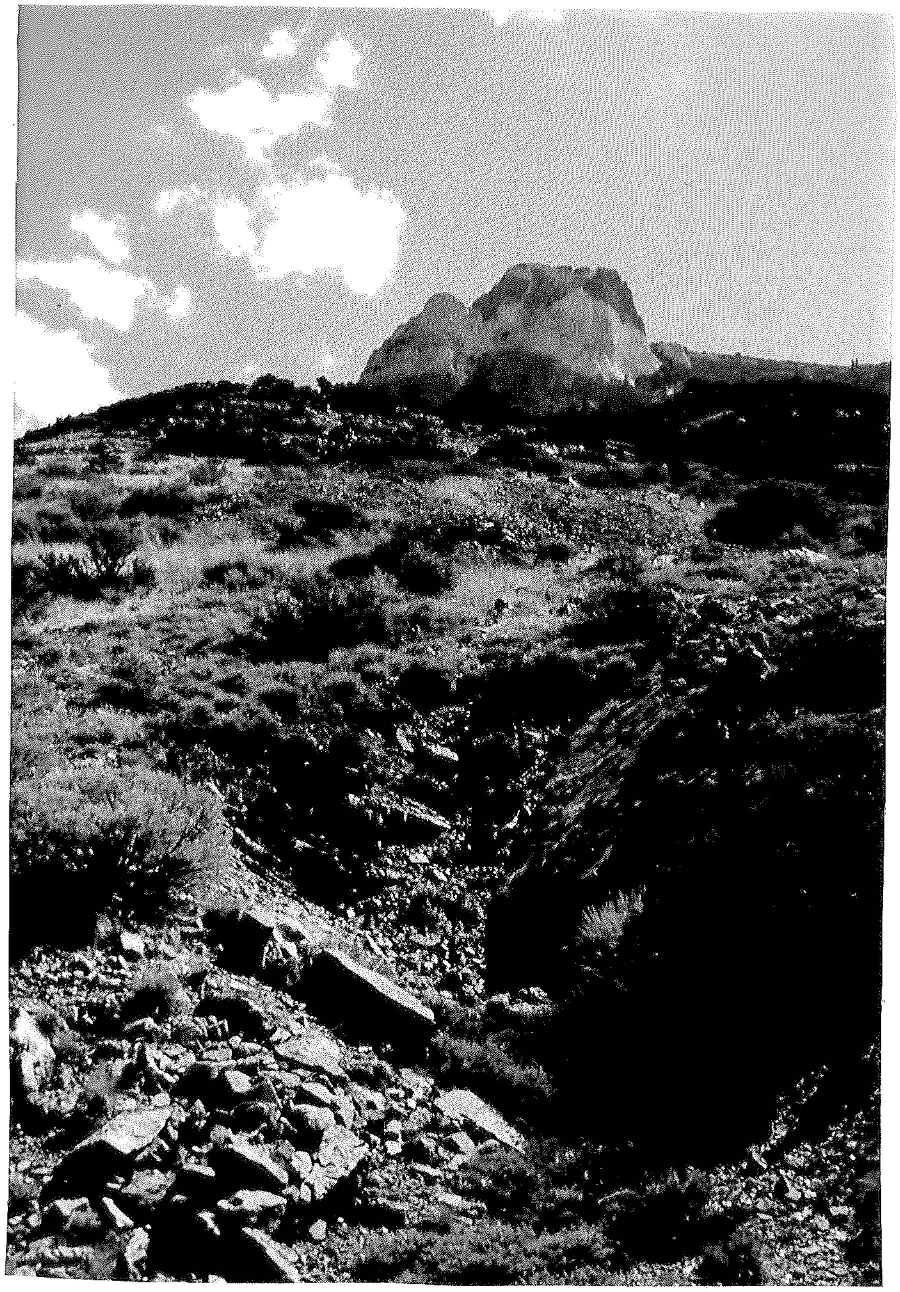

Figure 12.--The Eagle Rock Mine, looking east. The major quartz vein is exposed in the prospect pit in foreground. View is approximately along strike. Dump in mid-photo shows adit location. Above are faulted limestone cliffs of the Schell Creek Range near Patterson Pass.

Minerals identified in the veins and adjacent wallrock include hematite, huebnerite(?), pyrite, arsenopyrite, chalcopyrite, and galena. Sample analyses of the main quartz vein (fig. 13) indicate as much as 0.70% tungsten, silver as much as 5.6 oz/ton, lead as much as 0.13%, and arsenic as much as 0.16% (samples 165, and 166). Sample 165 also contains >5% barium and 0.1% bismuth. The second (smaller) quartz vein has lower metal values; samples do not exceed 0.36% tungsten or 2.1 oz silver/ton (sample no. 171). Lead values are slightly high (0.15% Pb in sample 171); one sample (no. 172) contains 0.02 ppm gold.

Identified resources include 10,000 tons in the major vein with 0.33% WO_3 and 2.4 oz silver/ton. Some lead may be recoverable, but values are too low for resource estimation. Other identified resources are 400 tons of 0.19% WO_3 and 1.5 oz silver/ton in the smaller quartz vein. Some gold and lead may be recoverable from this vein, but the values are too low for resource estimation. The majority of these resources fall in the "inferred" category under the current classification system (U.S. Bureau of Mines and USGS, 1980, p. 2). These tungsten values could be considered ore-grade under normal economic conditions (see tungsten discussion, p. 19). Silver values are low--about 1/3 to 1/4 of the ore grades at some known low tonnage silver mines (Reese, 1985, p. 810, 811). Commodity statistics for silver and tungsten are in table 3.

As with most of the mineralized fractures in carbonates and shale, the probable source of mineralization in the Prospect Mountain Quartzite is the igneous body that formed the tactite. Tungsten is present at three of the four localities (Deer Trail Mine, Lanter Mine, Eagle Rock Mine) and bismuth, another metal with high temperature of formation, is in four samples at the

Eagle Rock Mine. Prospect Mountain Quartzite is present in the south-central part of the study area and has been faulted extensively. Faults in this part of the study area could contain similar mineralized sites. Known deposits are low grade and are not extensive, but deposits closer to the igneous source may be higher in grade and more extensive.

ROCK PRODUCTS

Quartzite and carbonate rocks within the study area can be used as rock products. Prospect Mountain Quartzite, the most common formation in the study area, has been quarried at Caliente in Lincoln County for crushed rock aggregate (Tschanz and Pampeyan, 1970, p. 125). The formation has also been quarried for dimension and flagging stone in White Pine County, on the eastern slope of Mount Moriah (Smith, 1976, p. 57-58). Eureka Quartzite, exposed in the north-central part of the study area, has been noted as a high-purity silica source at numerous localities in Nevada (Ketner, 1976).

A Middle Cambrian limestone at McGill in White Pine County is noted for its high calcium content; several thousand tons have been quarried at that locality (Smith, 1976, p. 51). Middle Cambrian limestone in the northeast quadrant of the study area and along the eastern edge has not been analysed for calcium content. Upper Cambrian limestone has been quarried in western Lincoln County from the Groom Range for use as building stone (Tschanz and Pampeyan, 1970, p. 125); limestone of similar age is exposed in the northeast quadrant of the study area. The Ordovician age Pogonip Group of carbonate rocks, exposed in the north-central part of the study area (Hose and Blake, 1976, pl. 2), may have some sections of high-calcium limestone. Pogonip limestone sampled from the Worthington Mountains in western Lincoln County about 75 mi southwest of the study area, is 98% calcium carbonate (Wood, 1985, p. 28, 29).

Rock products are commodities of high bulk and low unit value. Transportation costs are a major determinative factor in the development of rock resources. Deposits in the Mount Grafton study area are isolated from major markets. The same or similar rocks are present closer to markets. Thus there is little probability the rock resources in the study area will be developed.

CONCLUSIONS

Reported mineral production within the area boundary has been small--134 tons of tungsten ore at the Deer Trail Mine. The mineralized sites within the boundary (Deer Trail Mine, tactite zone at the head of Swartz Canyon, Lanter Mine) are low grade, and do not appear to be extensive. Identified resources within the study area are 2,000 tons of 0.1% WO_3 at the Deer Trail Mine, and 1.0 million tons of 0.4% zinc in the tactite zone at the head of Swartz Canyon.

The probable source of all mineralization at the sites is igneous intrusives. Tactite formed by igneous intrusion at the south part of the study area indicates the approximate locality of the igneous source. Mineralized fractures in quartzite, carbonates, and shale are widely distributed. Based on its complex tectonic history, extensive parts of the study area may contain similar mineralized fracture fillings which are covered and therefore unevaluated. This hypothesis is supported by geochemical data. Analyses of 72 samples of stream sediments collected in and near the study area (table 10) show a notable prevalence of silver in low amounts; 71 samples have 0.2 to 2.2 ppm silver. Covered and unevaluated fracture fillings might contain deposits of silver, lead, tungsten, zinc, or copper which are similar in size, or larger, than known deposits in quartzite, carbonate rock, and shale.

There are no known oil or gas accumulations beneath the study area, but the possibility must be allowed pending collection of additional seismic data for the region. Rock products have not been chemically analyzed, but resources present probably would not be utilized in the foreseeable future because of isolation from potential markets.

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Table 1.--Description of resources and mineralized sites in tactite.

Analytical data for samples on table 2. All workings except for two small prospect pits are outside of the study area boundary.

Development	History and Production	Resources
Workings at the head of Swartz Canyon--includes "Ad Mine" (zinc, tungsten, minor silver, gold), samples 178-206, table 2		
Caved shaft, about 2,000 ft of exploratory bulldozer cuts on W. side of pass; three adits (one accessible), four pits, and 300 ft-long development cross cut on E. side of pass; cross cut strikes N. 25° W. through unmineralized rock; probably designed to intersect tactite and provide haulage; other workings intersect tactite or gossan.	No recorded production; worked in early 1900's (Hill, 1916, p. 124); last staked in 1979 when minor excavation took place (Tingley and Bentz, 1982).	6.6 million tons of 1.1% Zn in tactite deposit; 1 million tons of inferred resources inside study area, but grade is lower--about 0.4% Zn.

Table 2.--Analytical data for samples of mineralized tactite.

Sampled localities on plate 1.

Sample			Analytical data								
No.	Type	Length (ft)	Au (ppm)	Ag (ppm)	As (ppm (unless noted))	Cu (ppm (unless noted))	Pb (ppm (unless noted))	W (ppm (unless noted))	Zn (ppm (unless noted))	Other (%)	Description and remarks
178	Select	xx	<0.007	1.3	1,000*	820	<30	240	1.4%	Mn > 8*	Quartz breccia, limonite.
179	do.	xx	< .007	1.1	<100*	480	<30	800	9.6%	Mn > 10*	Limestone breccia; from dump.
180	Chip	2.5	< .007	< .3	<200*	270	<30	100	5,800	Mn > 4*	Limestone breccia; in bulldozer cut.
181	do.	4.5	< .007	< .3	< 90*	< 2	33	< 5	160	Mg 2*	Limestone; adjacent to tactite.
182	do.	6	< .007	< .3	<200*	36	<30	240	2,000	Mg 1*; Mn >10*	Tactite, fine grained.
183	do.	2	< .007	.9	< 90*	160	56	36	1,000	Mn > 2*	Limestone lens in tactite.
184	do.	3	< .007	.8	<200*	540	<30	360	1.6%	Be 0.04*; Mn >10*	Tactite, coarse grained.
185	Select	xx	.02	1.2	< 90*	550	<30	600	3,900	Mn > 6*	Tactite, float rock.
186	Chip	4	.02	.4	<300*	240	<30	240	1.1%	Mg 1*; Mn >9*	Tactite zone in pit.
187	do.	2	< .007	< .3	< 90*	< 2	<30	6	910	xx	Limestone with tactite; adjacent sample 186.
188	do.	12	< .007	.4	<600*	210	<30	500	1.1%	Mg 1*; Mn >9*	Tactite zone; adjacent sample 187
189	Select	xx	.01	< .3	< 90*	270	<30	280	8,700	Mg 2*; Mn >2*	Tactite; from dump.
190	do.	xx	.01	< .3	<100*	< 2	<30	< 5	240	Ba .3*; Mg 1*	Limestone; disseminated scheelite
191	Chip	2.5	< .007	1.3	< 90*	1,400	31	600	1.2%	Mn > 6*	Tactite; in bulldozer cut.
192	do.	3	< .007	< .3	<500*	510	<30	1,400	8,000	Mg 1*; Mn >9*	Gossan above tactite.
193	do.	1	.01	.4	<800*	260	<30	1,200	1.2%	Mn >10*	Limestone; disseminated sulfides.
194	do.	1.5	< .007	.6	<500*	1,200	<30	1,200	6,400	Mn > 7*	Fault gouge, strikes N. 60° E.
195	do.	3.5	< .007	1.0	< 90*	620	<30	400	1.8%	Mg 1*; Mn >5	Limestone; disseminated scheelite
196	do.	2	< .007	< .3	<600*	45	<30	320	1.6%	Mg 2*; Mn >2	Same fault gouge as sample 194.
197	Select	xx	< .007	< .3	<200*	670	<30	400	1,200	Ba .2*; Mn 2*	Igneous dike; disseminated pyrite, hematite; from dump.
198	do.	xx	< .007	< .3	< 90*	31	<30	10	650	Mg 1*; Mn >4*	Carbonaceous shale; from dump.
199	do.	xx	< .007	< .3	<100*	< 2	<30	320	1,400	Mg 1*	Tactite; from dump.
200	do.	xx	< .007	< .3	<200*	< 2	<30	< 5	190	Mn > 2*	Limestone; calcite crystals; from dump.
201	do.	xx	< .007	1.2	<200*	1,800	<30	500	8,600	Mn > 2*	Igneous dike.
202	do.	xx	< .007	.9	1,000*	650	<30	700	2.2%	Mn > 9*	Gossan; from bulldozer cut.
203	do.	xx	< .007	< .3	300*	140	<30	28	550	Ba .4*	Tactite; float rock.
204	Chip	2.5	.01	< .3	<600*	67	<30	600	9,200	Mn >10*	Tactite.
205	Select	xx	< .007	.8	<100*	< 2	<30	< 5	190	xx	Limestone, hematitic; float rock.
206	do.	xx	.01	< .3	< 90*	64	<30	140	1,500	Mg 2*; Mn >2*	Tactite; float rock.

Symbols used: <, less than; >, greater than; xx, not applicable; *, analysis by semiquantitative optical emission spectrography. Analytical methods (unless marked *): inductively coupled plasma for Cu, Pb, and Zn; fire assay/inductively coupled plasma for Au, Ag; colorimetry for W.

Table 4.--Descriptions of mineral occurrences in carbonate rock and shale.

All sites are outside of the study area boundary.

Development	History and Production	Resources
Lake Valley Mine (silver, tungsten, fluorine, minor gold), samples 80-84, 86-95, fig. 5		
Three W.-trending adits with 800 ft of workings (Smith, 1926); drifts trend N.; prospect pit and development bulldozer cuts; one bulldozer cut obliterated upper adit portal (J. W. Cole, Pioche, NV, oral commun., 1984).	Production unknown; silver ore shipped by Lake Valley Mining Co. (1921) (Lincoln, 1923, p. 123-124); mined intermittently 1920 to early 1930's; caved in 1937; a "50-ton capacity stamp mill" was on property (Smith, 1926).	Not estimated.
Cinch Mine (tungsten, minor silver, gold), samples 112-124, fig. 6		
165 ft underground workings on three levels; inclined shaft; small open cut.	1,000 tons of 0.75% WO_3 in 1941, 1942 (Tschanz and Pampeyan, 1970, p. 171)	75,000 tons of 0.41% WO_3, 25,000 tons of 0.033% WO_3.
Pip Mine (tungsten, minor silver), samples 125-132, table 5		
Three shafts and three small prospect pits; no bedrock exposed in two of the pits; two shafts are 50 to 75 ft deep; one shaft is about 45 ft deep; all are caved to some degree.	Production unknown.	Not estimated.
Workings at Patterson Pass (silver, minor tungsten, lead), samples 139-145, table 5		
Four shafts, two shallow pits; most shafts 20 to 30 ft deep; one is open to 100 ft.	Amount of production not recorded; worked sporadically in 1800's, and as late as 1920.	Not estimated.

Table 4.--Descriptions of mineral occurrences in carbonate rock and shale--Continued

Development	History and Production	Resources
Patterson district workings on a northwest-trending fault (silver, copper, lead, zinc), samples 134-138, 146, 147, 149-162, 176, and 177), table 5		
Five pits, two shafts, two trenches (one was a caved adit).	No production recorded, but some silver, copper, lead, and zinc may have been produced, based on high assay values; southernmost workings may date from early Patterson district mining era; northernmost shaft and adit begun in 1913 (Hill, 1916, p. 124; Schrader, 1931, p. 7).	Not estimated.
Cave Valley Mine (silver, copper, lead, minor zinc, gold), samples 225-244, fig. 7		
Four caved shafts, 150-ft-long, sloughed-in trench, 45-ft-long accessible adit, one caved adit, six prospect pits.	Production amount not recorded; literature suggests only a "few tons" of ore produced (Smith, 1976, p. 88); ore shipments made in 1878, 1925, and the 1930's (Schrader, 1931, p. 9; Smith, 1976, p. 88; Pat Fraser, Ely, NV, oral commun., 1984); most development took place in 1920's (Schrader, 1931, p. 9).	Not estimated.
Streator Mine (silver, lead, copper, minor gold), samples 245-255, table 5		
Four shafts (one caved), two prospect pits; two of the shafts intersected by 45° inclines from surface.	Production amount not reported; Schrader (1931, p. 14) notes 90 tons of "mill ore" on a stockpile; most mining was in 1929 and 1930; intermittent development continued until 1983.	Not estimated.

Table 4.--Descriptions of mineral occurrences in carbonate rock and shale--Continued

Development	History and Production	Resources
Marich claims (silver, lead, minor gold), samples 265, 267-290, table 6		
Twenty-two prospect pits and two shafts (one caved, one 10 ft deep), all shallow.	No production known; development by shovel and wheelbarrow as recently as 1984.	Identified 20,000 tons with 0.6 oz silver/ton, and 40,000 tons at 4.5 oz silver/ton.

Table 5.--Analytical data for samples from mineral occurrences in carbonate rock and shale.

See plate 1 for sampled localities; analyses for Lake Valley Mine, Cinch Mine, Cave Valley Mine samples on figs. 5-7. Analyses for Marich claims samples in table 6 (accompanying fig. 8).

[Symbols used: <, less than; >, greater than; xx, not applicable; *, analysis by semiquantitative optical emission spectrography; **, analysis by fire assay (values in oz/ton); *** analysis by X-ray fluorescence. Analytical methods (unless marked *, **, or ***): inductively coupled plasma for Cu, Pb, and Zn; fire assay/inductively coupled plasma for Au, Ag; atomic absorption for As; colorimetry for W.]

Sample			Analytical data								
No.	Type	Length (in.)	Au ppm (** = oz/ton)	Ag	As ppm (unless noted)	Cu	Pb	W	Zn	Other % (unless noted)	Description
											Pip Mine
125	Select	xx	<0.007	10.4	<100*	< 2	< 30	6	39	xx	Calcite lens(?); from dump.
126	do.	xx	.007	10.5	<200*	< 2	30	32	50	xx	Calcite vein, strikes N. 60° W., 1 ft wide where observed at depth in shaft; sample from dump.
127	do.	xx	< .007	12.7	1,000*	420	560	0.13%***	890	Ba 0.3*; Mn >6*	Limestone breccia, hematite matrix, from dump.
128	do.	xx	< .007	13.6	<200*	< 2	34	110	140	xx	Calcite lens(?), 10 ft thick at shaft collar; sample from dump.
129	do.	xx	< .007	1.9	300*	< 2	< 30	6	73	xx	Limestone, hematite breccia, calcite matrix; from dump.
130	do.	xx	< .007	22.8	< 90*	44	98	< 5	44	xx	Limestone breccia, hematite nodules; from dump.
131	do.	xx	< .007	7.5	<100*	< 2	< 30	< 5	42	xx	Calcite lens(?), porous, baked; from dump.
132	Chip	18	< .007	4.8	<100*	< 2	78	280	110	xx	Limestone breccia, calcite, hematite matrix; strikes N. 10° W., dips W. 70°, follows jointing.
											Workings at Patterson Pass
139	Chip	36	< .007	.9	400*	< 2	< 30	< 5	< 1	xx	Limestone breccia, silica cement; trend N. 28° W.; fracture related to Patterson Pass fault.
140	Select	xx	< .0002**	2.6**	400*	600*	3,000*	< 5	700*	Li 60 ppm*; Sb 800 ppm*	Quartz, vuggy, hematite, copper carbonates; dump sample; vein observed in shaft strikes N. 25° E., dips E. 56°.
141	do.	xx	< .0002**	3.7**	400*	900*	3,000*	< 5	300*	Cr .01*	Limestone breccia, silica cement, hematite, copper carbonates; strikes due N., dips W. 55°; from dump.
142	do.	xx	< .007	8.6	< 90*	< 6*	< 20*	6	70*	Ba .02*	Calcite breccia, hematite; from dump.

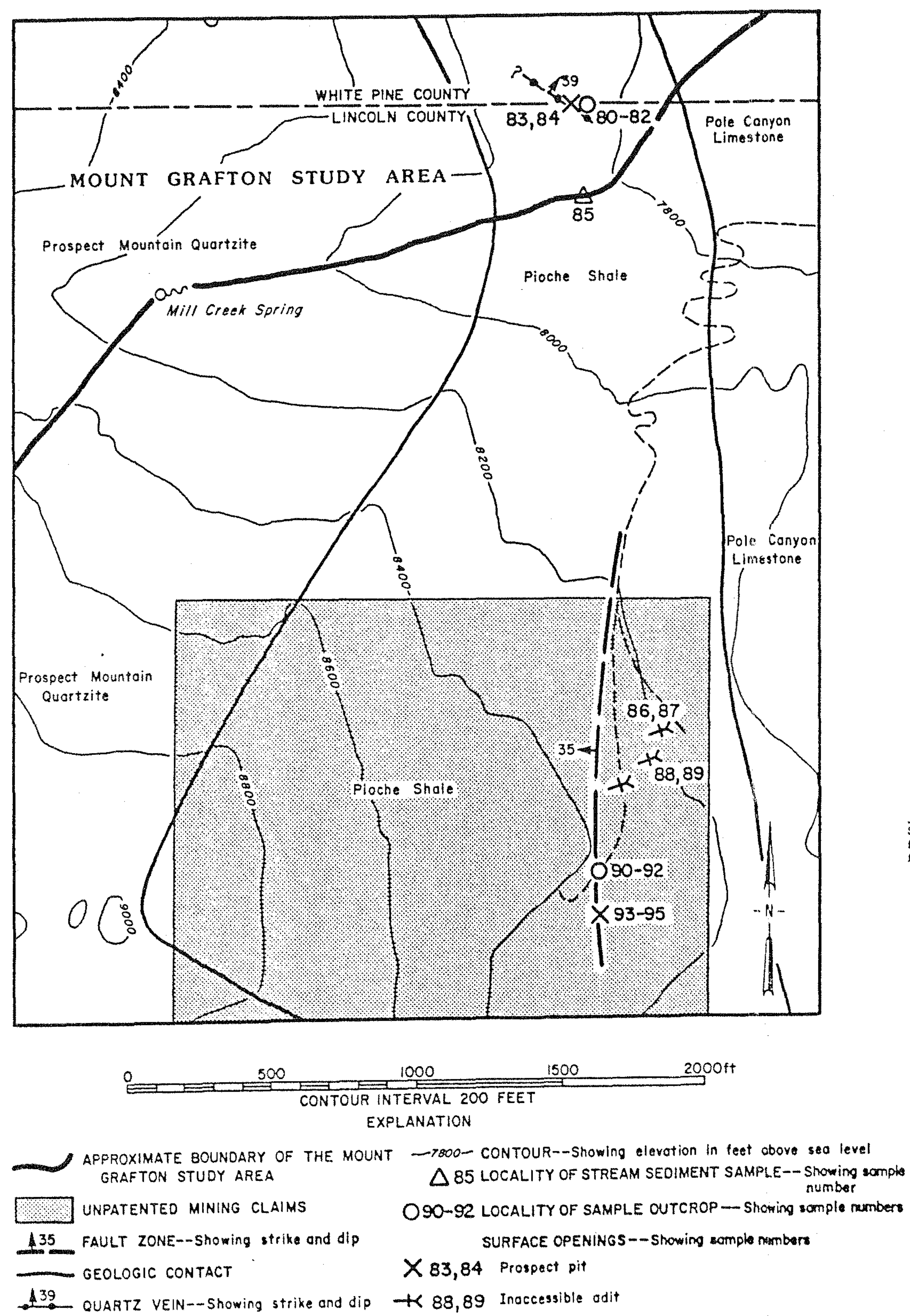
Table 5.--Analytical data for samples from mineral occurrences in carbonate rock and shale--Continued

Sample			Analytical data								
No.	Type	Length (in.)	Au ppm (** = oz/ton)	Ag ppm (** = oz/ton)	As ppm (unless noted)	Cu ppm (unless noted)	Pb ppm (unless noted)	W ppm (unless noted)	Zn ppm (unless noted)	Other % (unless noted)	Description
					Workings at Patterson Pass--Continued						
143	Select	xx	<0.0002**	7.5**	300*	800*	2,000*	< 5	1,000*	Sb 900 ppm*	Quartz veinlet zone, hematite, copper carbonates; strikes N. 10° E., dips 90° in limestone; from dump.
144	do.	xx	< .0002**	3.4**	400*	900*	4,000*	< 5	3,000*	Sb 0.2*	Quartz veinlet zone, hematite, copper carbonates; strikes due N., dips E. 45° in limestone; from dump.
145	do.	xx	< .0002**	1.5**	400*	100*	200*	8	600*	xx	Quartz breccia and veinlets strike N. 5° E., dip E. 67° in limestone; from dump.
					Patterson district workings on a northwest-trending fault						
134	do.	xx	< .007	<0.3	< 90*	10*	< 50*	22	100*	xx	Limestone breccia; pyrite(?) replaced by hematite; from dump.
135	do.	xx	< .0002**	2.6**	<100*	100*	2,000*	140	200*	xx	Quartz, hematite, copper carbonates, pyrite(?) replaced by hematite; from dump.
136	do.	xx	< .0002**	7.7**	600*	1,000*	9,000*	< 5	500*	Sb .3*	Quartz breccia, calcite cement; from dump.
137	do.	xx	< .007	.8	<100*	< 6*	100*	< 5	< 1*	xx	Calcite vein, strikes N. 55° E., dips E. 55°; from dump.
138	do.	xx	< .0002**	1.2**	300*	90*	3,000*	25	300*	xx	Quartz, vuggy; vein in pit strikes E., vertical; from dump.
146	do.	xx	< .007	.5	<700*	76	39	20	2,000	Mn >10*	Limestone replaced by copper carbonates, sphalerite; from dump.
147	do.	xx	.01	.4	< 90*	< 6*	200*	50	40*	xx	Limestone breccia, hematite cement; float rock.
149	do.	xx	.01	< .3	<200*	< 6*	< 20*	< 5	< 3*	Ba .1*	Limestone; scheelite; float rock.
150	do.	xx	< .0002**	10.5**	4%*	1%*	5%*	#	1,000*	Fe 7*; Sb .1* Sn .02*	Quartz, vuggy, hematite, limonite, copper carbonate, sphalerite; vein in shaft strikes N. 50° E., dips W. 80°, 1 to 2 ft wide; from dump.
151	do.	xx	< .0002**	4.3**	3%*	4%*	4%*	12#	2,000*	Fe 6*; Sn .02*	Same as sample 150, except more copper carbonates.
152	do.	xx	< .0002**	5.8**	4,000*	6%*	3%*	16#	2,000*	Fe 7*; Sb .2*; Sn .02*	Limestone breccia, quartz, vuggy; hematite, limonite, copper carbonate, sphalerite(?); vein in pit strikes N. 55° E. in limestone; from dump.

# Denotes spectral interference in tungsten analysis--results invalid.

Table 5.--Analytical data for samples from mineral occurrences in carbonate rock and shale--Continued

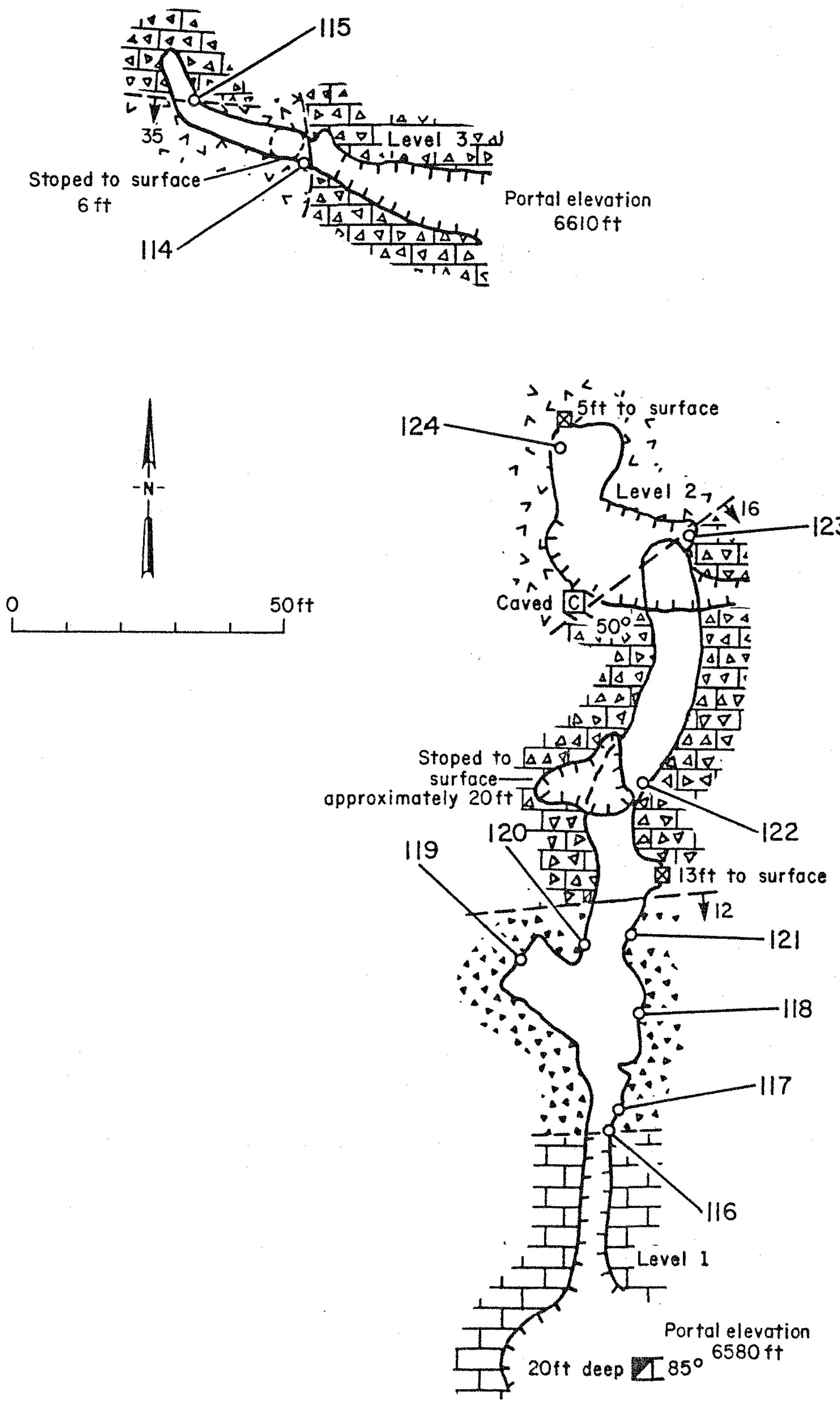
Sample			Analytical data								
No.	Type	Length (in.)	Au	Ag	As	Cu	Pb	W	Zn	Other	Description
			ppm (** = oz/ton)		ppm (unless noted)					% (unless noted)	
					Patterson district workings on a northwest-trending fault--Continued						
153	Chip	24	<0.0002**	5.0**	3,000*	5%*	2%*	8#	< 1*	Sb 0.5*	Quartz breccia, strikes E.; copper carbonates.
154	Select	xx	< .007	< .3	300*	< 6*	< 30*	< 5	< 1*	xx	Limestone adjacent to breccia.
155	do.	xx	< .007	2.2	< 200*	70*	700*	< 5	10*	xx	Calcite breccia, strikes N. 70° W.; from dump.
156	do.	xx	.007	10.8	< 200*	340	630	6	150	Li .01*	Hematite breccia; from dump.
157	do.	xx	< .007	5.2	< 200*	70*	700*	8	200*	Li .01*	Banded hematite; from dump.
158	do.	xx	.005**	9.5**	7	6.4%	1,800	#	1.6%	Mn >2*; Ni .01* Sb 1*	Fault gouge, limonite, copper carbonates; from dump.
159	do.	xx	.1	2.8	< 200*	180	< 30	na	1.7%	xx	Calcium silicates; from dump.
160	do.	xx	.2	8.3	770	4,200	< 30	2,400***	6.6%	Fe 7*; Mn >1*	Fault gouge; yellow carbonate of lead(?).
161	do.	xx	< .007	< .3	400*	< 2	< 30	< 5	130	Ba .3*; Mg 2*; Ga 20 ppm*	Shale, carbonaceous.
162	do.	xx	< .0002**	4.6**	< 200*	2,000*	1,000*	100	400*	xx	Quartz, vuggy, hematite, limonite, copper carbonate, sphalerite(?); float.
176	do.	xx	< .007	< .3	< 90*	< 6*	< 20*	< 5	< 1*	xx	Limestone breccia.
177	do.	xx	< .007	< .3	< 300*	< 6*	< 20*	< 5	20*	Ba .1*	Limestone adjacent to breccia.
					Streator Mine						
245	do.	xx	.02	3.6	98	67	580	< 5	22	xx	Quartz breccia, strikes E., dips S. 36°.
246	do.	xx	< .007	1.3	65	49	400	8	92	Ba .8*	Quartz breccia.
247	do.	xx	.01	5.5	14	< 2	380	< 5	14	xx	Quartz breccia.
248	do.	xx	.01	1.8	44	< 2	320	< 5	33	Ba 1*	Quartz breccia, strikes N. 70° E. dips S. 61°; slickensides.
249	do.	xx	< .007	1.0	12	< 2	66	< 5	96	Ba .1*	Sandstone, banded hematite; from dump.
250	do.	xx	.02	5.3	21	31	2,400	< 5	140	xx	Quartz breccia; from dump.
251	do.	xx	< .0002**	1.6**	310	3,800	7,800	< 5	420	Ba >10*; Sb .1*	Limestone breccia, quartz; from dump.
252	do.	xx	.01	5.1	120	880	3,900	< 5	180	xx	Quartz breccia, lead carbonate film; from dump.
253	do.	xx	.02	1.8	< 10	< 2	910	< 5	180	xx	Quartz breccia, shaft collar.
254	do.	xx	< .007	1.8	13	< 2	210	< 5	140	Ba .1*	Limestone adjacent to breccia.
255	do.	xx	.02	.7	< 100*	< 6*	< 20*	na	< 3*	xx	Quartzite; large dump, main shaft; Pioche Shale Formation(?).



Sample			Analytical data									
No.	Type	Length (ft)	Au ppm (** = oz/ton)	Ag ppm (** = oz/ton)	As ppm	Cu ppm	Pb ppm	W ppm	Zn ppm	Other %	Description
80	Chip	20	0.01	<0.3	15	< 6*	< 20*	6	50*	Ba 0.2*	Shale bed in quartzite.
81	do.	20	.01	< .3	< 10	< 6*	< 20*	< 5	70*	Ba .2*; Li .01*	Shale, faulted out at pit.
82	do.	3	.01	< .3	<100*	< 6*	< 20*	< 5	< 3*	Mn >3*	Quartzite, between thin shale beds.
83	do.	4	.06	3.0	400*	< 6*	< 20*	na	20*	xx	Vein quartz, pyrite molds.
84	do.	3	.06	5.6	32	< 6*	< 30*	100	30*	Li 70 ppm	Clayey fault gouge, strikes N. 10° W, dips SW. 36°.
86	Select	xx	.1	27	1,210	< 6*	< 30*	< 5	< 5*	xx	Quartz, disseminated pyrite; from dump.
87	Chip	3	.02	3.6	1,870	< 2	< 30	700	110	xx	Quartzite, huebnerite, slicken-sides; at portal.
88	Select	xx	< .0002**	6.6**	<300*	30*	200*	10	10*	xx	Fluorite, lead carbonate veinlets; from dump.
89	do.	xx	.04	1.8	2,100	< 6*	< 20*	< 5	10*	Ba .2*; Be 20 ppm*	Quartz, green, disseminated pyrite; from dump.
90	Chip	20	.1	1.0	70	< 6*	< 20*	1,700***	< 1*	xx	Fault zone, in quartzite, strikes N. 15° to N. 35° E., dips W. 35°; has fluorite zone.
91	do.	4	.05	1.5	250	< 6*	< 20*	14	50*	Ba .1*	Fault zone margin; fluorite.
92	do.	4	.04	1.1	420	< 6*	< 40*	3	10*	Ba .2*	Quartzite adjacent fault zone.
93	do.	4	.002**	.5**	820	200*	300*	550	300*	Li .01*; Mn 2*	Quartzite, fluorite, quartz veinlets.
94	do.	1	.4	5.9	680	< 6*	< 30*	120	100*	xx	Fault zone, strikes N., dips W. 40°; adjacent sample 93.
95	do.	3	.2	2.1	390	< 6*	< 20*	140	80*	Ba .2*; Mg 1*	Quartzite bedrock, fluorite stringers; adjacent sample 94.

Symbols used: <, less than; >, greater than; xx, not applicable; *, analysis by semiquantitative optical emission spectroscopy; **, analysis by fire assay (values in oz/ton); *** analysis by X-ray fluorescence. Analytical methods (unless marked *, **, or ***): inductively coupled plasma for Cu, Pb, and Zn; fire assay/inductively coupled plasma for Au, Ag; atomic absorption for As; colorimetry for W.

Figure 5.--The Lake Valley Mine area, showing sample localities 80-95. Table shows analytical data. Samples 80-84 are not part of mine.



Sample			Analytical data									
No.	Type	Length (ft)	Au	Ag	As	Cu	Pb	W	Zn	Other	Remarks
			ppm		ppm (unless noted)					%	
112	Chip	4	<0.007	<0.3	< 90	< 6*	<20*	< 5	< 1*	xx	Dolomite, 3,500 ft NW. of mine.
113	Grab	xx	< .007	< .3	<200*	< 2	<30	< 5	110	Ba 0.1*	Granite intrusive, NW. of mine.
114	Chip	2	.06	2.0	400*	< 6*	<20*	380	600*	Mn >3*	
115	do.	2	.01	< .3	400*	< 6*	<20*	6	600*	Mn >3*	Limestone breccia.
116	do.	4	.3	3.2	400*	< 6*	<50*	1.7%***	500*	xx	Quartz breccia at limestone breccia contact.
117	do.	3.5	.06	3.2	<200*	< 6*	<50*	200	500*	xx	
118	do.	2	.04	2.2	600*	< 6*	<20*	2,100***	700*	Mn >3*	
119	do.	4	.07	1.8	300*	< 6*	<20*	280	300*	xx	
120	do.	3	.04	1.6	< 90*	< 6*	<20*	320	500*	Mn >2*	
121	do.	3	.1	1.8	300*	< 6*	<20*	360	200*	Mn >2*	
122	do.	4	< .007	< .3	< 90*	< 6*	<20*	< 5	< 1*	xx	
123	do.	3	.09	1.7	<300*	10*	<20*	240	900*	Mn >3*	Quartz breccia, from 6- to 8-ft-thick zone; level 2.
124	do.	4	.02	1.3	< 90*	< 6*	<20*	200	60*	xx	

Symbols used: <, less than; >, greater than; xx, not applicable; *, analysis by semiquantitative optical emission spectroscopy; *** analysis by X-ray fluorescence. Analytical methods (unless marked * or ***): inductively coupled plasma for Cu, Pb, and Zn; fire assay/inductively coupled plasma for Au, Ag; atomic absorption for As; colorimetry for W.

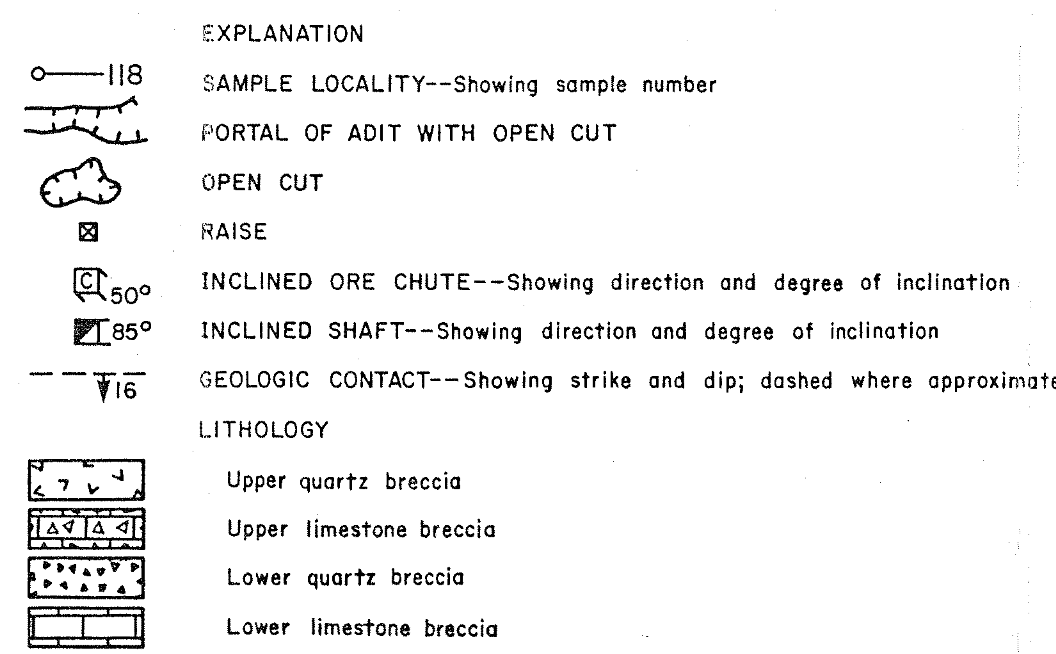
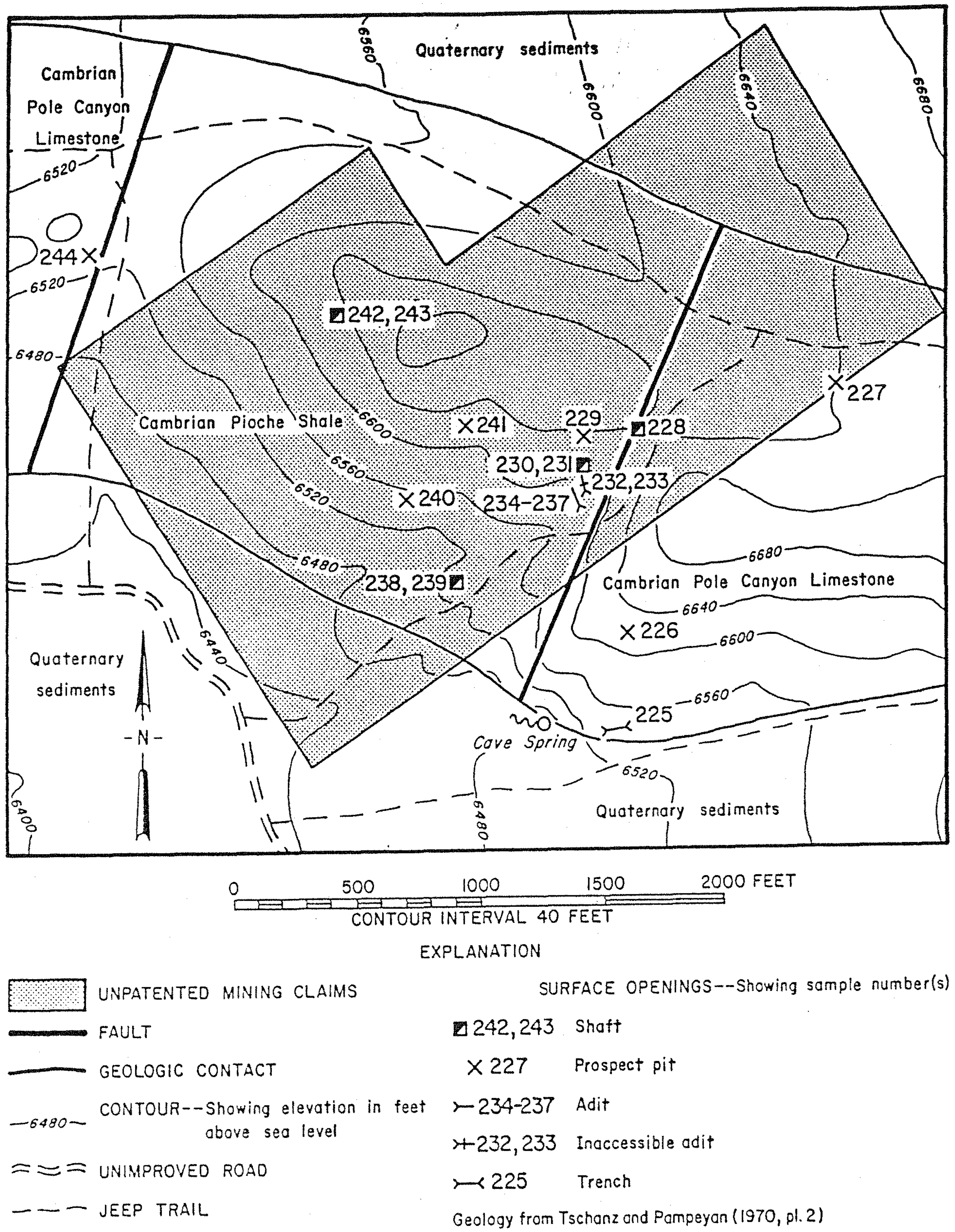
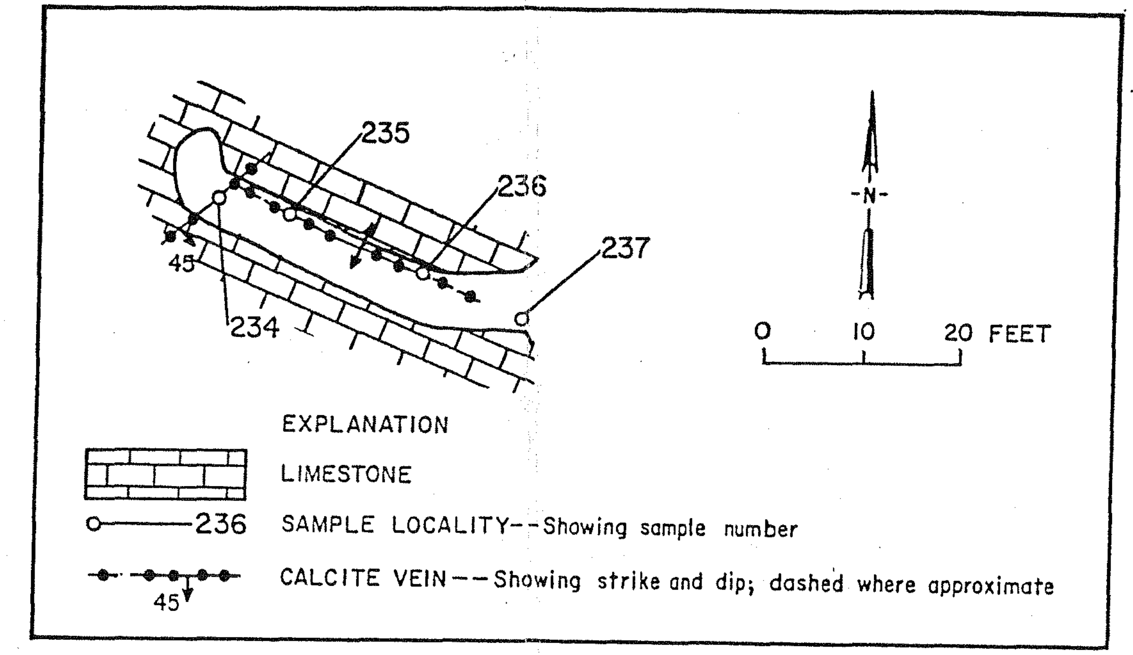


Figure 6.--The Cinch Mine, showing sample localities 114-124. Table shows analytical data, including data for samples 112 and 113, which are not on the figure--see pl. 1 for localities.





Adit, site of samples 234-237

Sample			Analytical data									
No.	Type	Length (in.)	Au ppm (** = oz/ton)	Ag	As ppm (unless noted)	Cu	Pb	W	Zn	Other % (unless noted)	Description
225	Chip	24	<0.007	<0.3	27	< 2	<30	6	< 1	xx	Limestone breccia, fault gouge; strikes N. 85° W., vertical.
226	Select	xx	< .007	< .3	36	< 2	<30	12	35	xx	Limestone breccia, sandstone-shale matrix; from dump.
227	Chip	48	< .007	< .3	17	30	<30	< 5	52	Ba 0.1*; Mg 1*	Shale, green.
228	Select	xx	< .0002**	.6**	90	4,000	1.4%	< 5	1.9%	Hg 22 ppm	Quartz, malachite; from dump.
229	do.	xx	< .0002**	3.2**	160	1,800	1.9%	< 5	260	Hg 29 ppm; Sb .1*	Do.
230	do.	xx	< .0002**	12.6**	720	4,500	2.7%	< 5	210	Hg 120 ppm; Sb .5*	Quartz breccia, malachite; from dump.
231	do.	xx	< .007	12.3	31	680	820	< 5	220	Ba .1*	Sandstone, hematite stain; from dump.
232	do.	xx	< .0002**	2.9**	250	2,600	1.1%	< 5	160	Hg 62 ppm; Sb .2*	Quartz, vuggy, hematite; from dump.
233	do.	xx	< .0002**	1.5**	63	1,100	1,200	< 5	290	Hg 19 ppm	Quartz, malachite; from dump.
234	Chip	12	< .007	1.0	< 2	60	910	< 5	740	xx	Calcite vein, strikes N. 50° E., dips S. 45°.
235	do.	12	< .007	2.7	< 2	120	45	< 5	400	xx	Calcite vein, strikes N. 70° W., dips vertical.
236	do.	12	< .007	8.7	23	230	990	8	400	xx	Do.
237	do.	24	.11	1.4	< 2	< 2	<30	< 5	41	xx	Calcite vein, strikes E., dips vertical; at portal.
238	Select	xx	< .0002**	27.8**	1,570	1.3%	3.2%	< 5	2,000	Ba .1*; Sb 1*; Hg 280 ppm	Quartz, malachite, azurite, galena; from deep shaft dump.
239	do.	xx	< .0002**	7.2**	190	1,900	5,800	< 5	1,400	Sb .4*	Quartzite, malachite; from dump.
240	do.	xx	.03	2.4	41	31	81	< 5	67	xx	Quartz breccia, hematite; from dump.
241	do.	xx	< .007	2.0	42	< 2	80	24	< 1	Hg 24 ppm	Do.
242	do.	xx	.01	1.3	59	76	35	< 5	66	xx	Quartz cobble breccia, hematite cement; from dump.
243	do.	xx	< .0002**	8.0**	320	6,500	6,200	< 5	520	Mg 10*; Sb .7*; Mo 75 ppm; Hg 170 ppm	Quartz, malachite, azurite, galena; from dump.
244	do.	xx	< .007	.7	7	31	56	< 5	51	xx	Limestone breccia; from dump.

Symbols used: <, less than; xx, not applicable; *, analysis by semiquantitative optical emission spectroscopy; **, analysis by fire assay (values in oz/ton). Analytical methods (unless marked * or **): inductively coupled plasma for Cu, Pb, Hg, Mo, and Zn; fire assay/inductively coupled plasma for Au, Ag; atomic absorption for As; colorimetry for W.

Figure 7.--The Cave Valley Mine area, showing sample localities 225-244. Table shows analytical data.

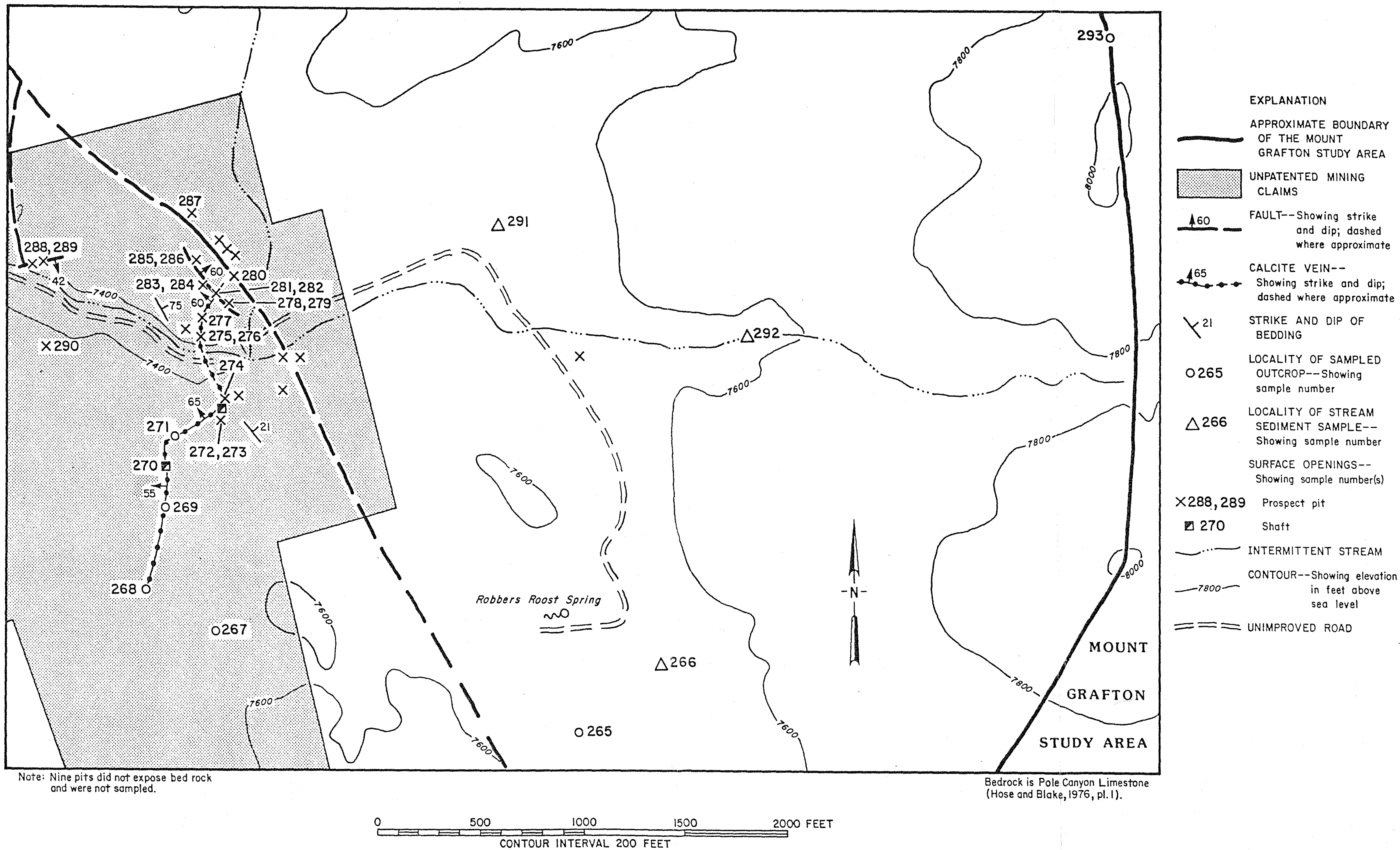


Figure 8.--The Marich claims area, showing sample localities 265-293. Table 6 shows analytical data.

Table 6.--Analytical data for samples from the Marich claims.

[Table accompanies fig. 8.]

Sample			Analytical data								
No.	Type	Length (ft)	Au ppm (** = oz/ton)	Ag	As ppm (unless noted)	Cu	Pb	W	Zn	Other[1/] % (unless noted)	Description
265	Chip	2	0.01	<0.3	< 2	< 2	< 30	< 5	28	xx	Shale outcrop.
267	Select	xx	.01	< .3	< 2	< 2	< 30	< 5	< 1	xx	Gossan, geothite, hematite.
268	Chip	8	< .007	< .3	3	< 2	< 30	< 5	< 1	xx	Calcite vein.
269	do.	8	< .007	< .3	5	< 2	< 30	< 5	< 1	xx	Calcite vein.
270	do.	4	< .007	< .3	< 2	< 2	< 30	< 5	< 1	xx	Calcite vein in shaft.
271	do.	4	< .007	< .3	5	< 2	< 30	< 5	< 1	xx	Calcite vein.
272	Select	xx	< .0002**	2.4**	26	1,300	170	< 5	< 1	Hg 90 ppm; Sb 0.1*	Limestone; calcite veins; copper carbonates; from dump.
273	Chip	5	< .007	6.9	7	67	37	< 5	< 1	xx	Limestone breccia adjacent to calcite vein.
274	Select	xx	.01	19.7	32	580	1,800	< 5	< 1	Hg 33 ppm	Calcite vein; lead carbonates; from dump.
275	do.	xx	< .0002**	27.4**	270	5,200	1.9%	< 5	260	Hg 210 ppm; Sb .2*	Limestone; lead and copper carbonates; from dump.
276	Chip	1	< .0002**	13.3**	90	2,100	7,000	< 5	240	Hg 140 ppm	Limestone; same material as sample 275.
277	do.	3	< .007	.6	3	< 2	< 30	< 5	< 1	xx	Calcite vein, strikes N., dips W. 60°; lead and copper carbonates.
278	Select	xx	.03	2.3	43	35	< 30	< 5	< 1	xx	Limestone breccia; from dump.
279	do.	xx	.01	1.8	36	< 2	< 30	< 5	< 1	xx	Shale; from dump.
280	do.	xx	< .007	< .3	6	< 2	< 30	< 5	41	xx	Fault gouge.
281	Chip	3	.03	7.8	120	370	140	< 5	90	xx	Limestone breccia.
282	Select	xx	< .0002**	10.0**	47	2,100	3,100	6	51	Hg 27 ppm	Limestone breccia, lead carbonate; same as sample 281; from dump.
283	do.	xx	< .0002**	1.3**	76	900	3,500	6	45	Hg 19 ppm	Limestone, lead carbonate.
284	Chip	2	.01	5.6	15	91	390	6	48	xx	Limestone breccia.
285	do.	5	< .0002**	1.3**	46	470	1,700	6	63	xx	Limestone breccia, lead and copper carbonates.
286	Select	xx	< .0002**	4.2**	97	2,200	6,300	6	98	Hg 21 ppm; Sb .08*	Limestone breccia; material like sample 285; from dump.
287	Chip	.5	< .007	.6	7	< 2	< 30	< 5	60	xx	Fault gouge.
288	do.	6	.01	1.9	6	44	620	< 5	< 1	xx	Calcite breccia.
289	Select	xx	.01	9.5	15	71	2,100	< 5	< 1	Hg 18 ppm	Calcite breccia; material like sample 288; from dump.
290	do.	xx	< .0002**	9.6**	150	4,700	4,400	< 5	320	Hg 87 ppm; Sb .1*	Limestone; lead and copper carbonates; from dump.
293	Chip	8	.07	2.8	na	na	na	6	na	xx	Limestone breccia.

Symbols used: <, less than; xx, not applicable; na, not analyzed; *, analysis by semiquantitative optical emission spectroscopy; **, analysis by fire assay (values in oz/ton). Analytical methods (unless marked * or **): inductively coupled plasma for Cu, Pb, Hg, and Zn; fire assay/inductively coupled plasma for Au, Ag; atomic absorption for As; colorimetry for W.

1/ All samples except 293 tested for mercury content.

Table 7.--Descriptions of mineral occurrences in the Prospect Mountain Quartzite.

All sites, with the exception of the Eagle Rock Mine, are inside of the study area.

Development	History and Production	Resources
North Creek Spring prospect (minor silver, gold), samples 45-48, and 51, table 8		
One caved shaft; development apparently E.-W. trending drifts off shaft to follow breccia; dump size suggests 200-300 ft of underground workings were excavated.	No production known; up to 0.02 ppm Au, 0.4 ppm Ag, 20 ppm W, 78 ppm Zn, and up to 0.2% Ba detected in samples.	Not estimated.
Deer Trail Mine (tungsten, minor silver, gold), samples 55-72, 74, 75, 77, and 78, fig. 11		
270 ft adit; small prospect pit 400 ft W. of adit, bulldozer cut extends for 800 ft W. of adit portal.	Discovered 1918; 30-ft adit and pits in 1940 and 1942 (Smith, 1976, p. 53); adit extended in 1956, when mining produced 134 tons yielding 47 tons WO_3 concentrates.	2,000 tons of 0.1% WO_3 identified.
Eagle Rock Mine (tungsten, silver, minor lead, copper, gold), samples 163-175, fig. 13		
104 ft adit; prospect pit.	Mined in 1930's (Schrader, 1931, p. 16); amount of production not known; 1.5% copper reported (Tschanz and Pampeyan, 1970, p. 171); Schrader (1931, p. 16) reports "tungsten ore" assay of $8/ton in gold, with "appreciable" silver.	10,000 tons with 0.33% WO_3 and 2.4 oz silver/ton identified plus 400 tons of 0.19% WO_3 and 1.5 oz silver/ton.
Lanter Mine (lead, silver, minor copper, zinc, tungsten, gold), samples 211-215, 217-219, table 8		
One caved shaft; dump suggests the shaft was 30-ft-deep.	Mined in early 1900's (J. Wayne Cole, Pioche, NV, oral commun., 1984); no production known.	Not estimated.

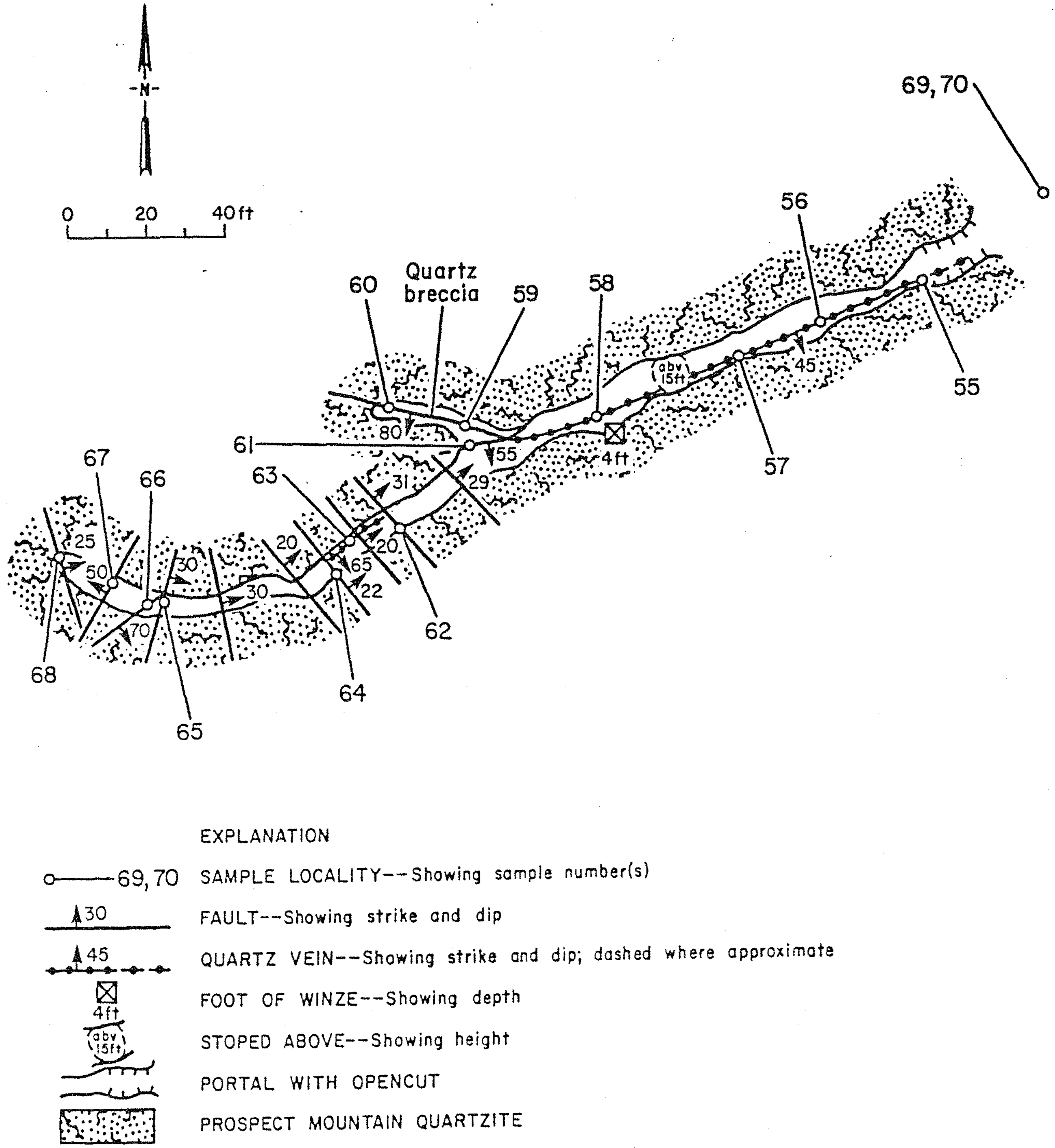
Table 8.--Analytical data for samples from Prospect Mountain Quartzite mineral occurrences.

See pl. 1 for sampled localities; analyses for Deer Trail Mine and Eagle Rock Mine samples on figs. 11 and 13.

[Symbols used: <, less than; >, greater than; xx, not applicable; *, analysis by semiquantitative optical emission spectrography; **, analysis by fire assay (values in oz/ton). Analytical methods (unless marked * or **): inductively coupled plasma for Cu, Pb, Hg, and Zn; fire assay/inductively coupled plasma for Au, Ag; atomic absorption for As, Te; colorimetry for W.]

Sample			Analytical data								
No.	Type	Length (in)	Au ppm (** = oz/ton)	Ag ppm (** = oz/ton)	As ppm	Cu ppm	Pb ppm	W ppm	Zn ppm	Other[1] % (unless noted)	Description
						North Creek spring prospect					
45	Chip	24	<0.007	<0.3	< 2	< 2	<30	< 5	< 1	xx	Quartzite, green; Te <5 ppm.
46	do.	24	< .007	.4	11	< 2	<30	20	46	Ba 0.4*; Mn >6*	Quartzite, shaley; adjacent to breccia; Te <5 ppm.
47	do.	52	< .007	< .3	6	< 2	<30	6	< 1	xx	Quartz breccia; Te <5 ppm.
48	Select	xx	.02	< .3	13	< 2	140	6	78	Ba .2*; Mn >6*; Li 70 ppm*	Quartz breccia from dump; matrix of limonite, hematite; Te <5 ppm.
51	Grab	xx	.01	< .3	5	< 2	<30	< 5	11	Ba .1*	Shale east of shaft.
						Lanter Mine					
211	Chip	72	< .007	0.5	3	< 2	52	< 5	< 1	xx	Quartzite adjacent to breccia.
212	do.	96	< .007	.6	5	< 2	<30	6	< 1	xx	Quartz breccia, boxwork.
213	do.	48	.01	.4	4	< 2	<30	< 5	< 1	xx	Quartz breccia, hematite matrix, adjacent to sample 212.
214	Select	xx	< .007	1.1	34	41	140	16	< 1	xx	Quartz breccia like #212; from dump.
215	do.	xx	< .0002**	.7**	190	950	5,500	8	270	Hg 40 ppm; Sb .1*	Quartz breccia; from sorted pile on dump.
217	Grab	xx	< .007	.5	< 2	< 2	<30	< 5	< 1	xx	Quartz breccia outcrop, NE. of shaft.
218	do.	xx	< .007	1.3	22	< 2	36	6	< 1	xx	Do.
219	do.	xx	< .007	.6	< 2	< 2	<30	< 5	< 1	xx	Do.

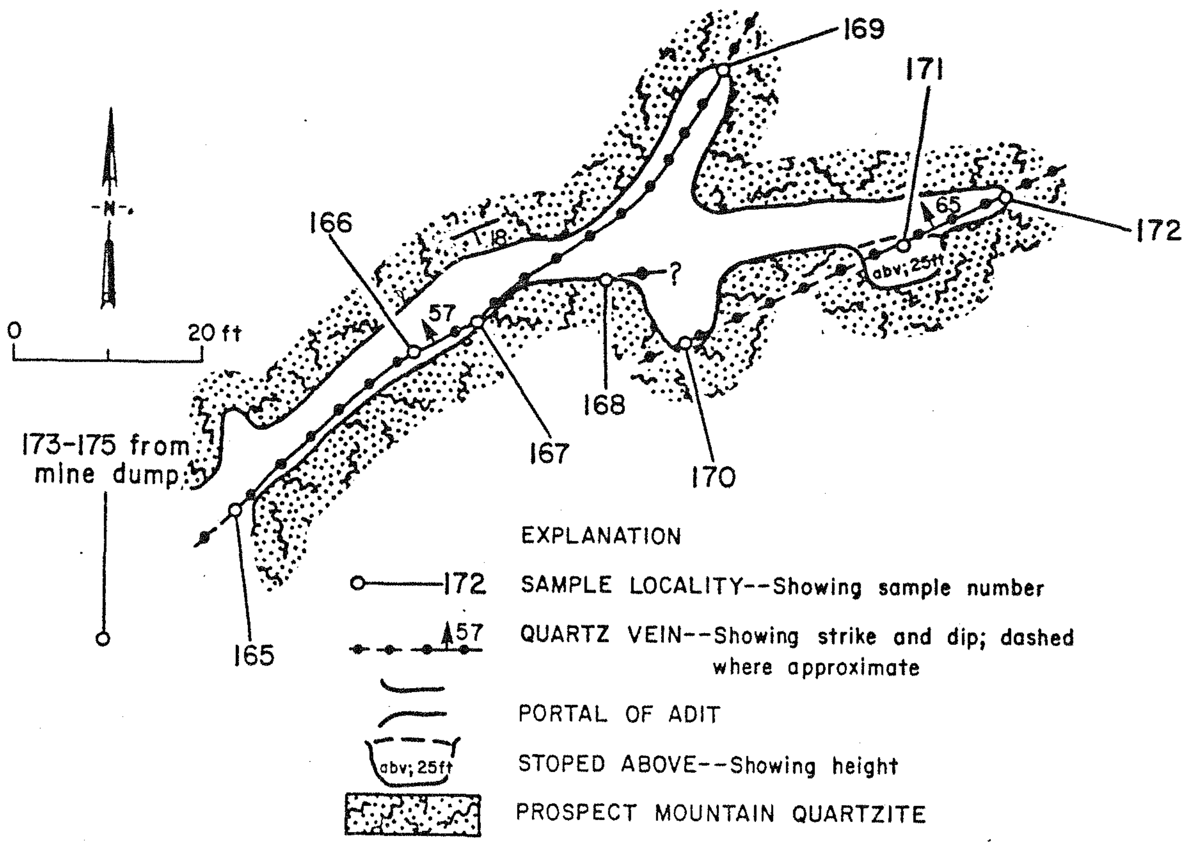
[1] Samples 211-215, 217-219 run for Hg; none detected except for sample 215.



Sample			Analytical data									
No.	Type	Length (in.)	Au ppm (** = oz/ton)	Ag ppm (** = oz/ton)	As ppm (unless noted)	Cu ppm (unless noted)	Pb ppm (unless noted)	W ppm (unless noted)	Zn ppm (unless noted)	Other %	Remarks
55	Chip	24	<0.0002**	0.7**	43	82	170	2,000***	120	xx	Huebnerite.
56	do.	24	< .0002**	1.5**	130	160	100	500	100	Ba 0.2*	Do.
57	do.	24	< .0002**	1.1**	84	240	320	800	91	Ba .2*; Mn >2*	Do.
58	do.	18	.1	13	320	84	740	360	11	xx	Do.
59	do.	13	.04	2	75	< 2	<30	50	72	xx	Quartz breccia.
60	do.	18	< .007	2	17	< 2	<30	200	27	xx	Quartz/clay breccia, huebnerite.
61	do.	15	< .007	2	26	< 2	<30	20	14	xx	Clayey fault gouge.
62	do.	14	< .007	<.3	5	< 2	<30	8	< 1	xx	Clayey fault gouge; 60% quartzite.
63	do.	18	< .007	<.3	8	< 2	<30	6	< 1	xx	Quartz vein, faulted off at both ends.
64	do.	21	< .007	<.3	16	< 2	<30	60	< 1	Ba .8*; Ga .002*	Fault gouge/quartzite layers.
65	do.	30	< .007	.7	<200*	< 2	<30	20	< 1	xx	Do.
66	do.	12	< .007	<.3	17	< 2	<30	32	< 1	Ba .1*	Shaley fault gouge/quartzite.
67	do.	12	.01	<.3	<300*	< 2	<30	16	< 1	xx	Clayey fault gouge/quartzite.
68	do.	18	.02	<.3	6	< 2	<30	<5	< 1	xx	Do.
69	Select	xx	< .0002**	1.5**	<300*	50*	100*	9,400***	< 1*	Mn >2*	Quartz, huebnerite; from dump.
70	do.	xx	< .0002**	2.4**	<200*	260	<30	220	< 1	Ba .6*	Quartzite, green, disseminated pyrite; from dump.
71	Chip	24	< .0002**	1.1**	< 90*	99	660	1.0%***	< 1	Mn >2*	Brecciated vein quartz, strikes N. 60 E., dips S. 80°; from prospect pit.
72	do.	72	< .007	<.3	<200*	28	<30	<5	77	Ba .1*	Shale, sulfides, enclosed by quartzite.
74	Grab	xx	.007	<.3	8	< 2	<30	<5	37	Ba .1*	Shale, east of mine.
75	do.	xx	< .007	<.3	<2	< 2	<30	<5	< 1	xx	Quartz; from dump of prospect pit south of mine.
77	do.	xx	< .007	<.3	20	< 2	<30	<5	49	Ba .1*	Shale bed in quartzite.
78	do.	xx	< .007	.4	240	< 2	<30	14	62	xx	Quartz float, south of mine.

Symbols used: <, less than; >, greater than; xx, not applicable; *, analysis by semiquantitative optical emission spectroscopy; **, analysis by fire assay (values in oz/ton); *** analysis by X-ray fluorescence. Analytical methods (unless marked *, **, or ***): inductively coupled plasma for Cu, Pb, and Zn; fire assay/inductively coupled plasma for Au, Ag; atomic absorption for As; colorimetry for W.

Figure 11.--The Deer Trail Mine, showing sample localitites 55-70. Table shows analytical data. Samples 71, 71, 74, 75, 77, and 78 are shown on plate 1.



Sample			Analytical data								
No.	Type	Length (ft)	Au	Ag	As	Cu	Pb	W	Zn	Other	Remarks
			ppm (** = oz/ton)		ppm					%	
163	Chip	2.5	<0.007	5.8	210	210	68	24	44	Li 0.02*	Vein quartz, hematite.
164	do.	3	< .007	<.3	35	30	<30	< 5	72	xx	Quartzite bedrock, hematite.
165	do.	2	< .0002**	5.6**	1,590	990	1,300	1,600***	1,000	Ba >5*; Bi .1*	Quartz vein, vuggy, hematite, gouge.
166	do.	2	< .0002**	3.3**	410	910	340	7,000***	1,100	Bi .07*	Do.
167	do.	3	< .0002**	2.9**	150	510	790	5,000***	1,000	Ba .1*; Bi .06*	Chalcopyrite, hematite, galena, huebnerite(?), hematite gouge.
168	do.	2	< .007	9.0	79	300	290	28	60	Ba 2*	Copper carbonates.
169	do.	6	< .007	1.7	28	< 2	62	12	62	xx	
170	do.	4	< .0002**	1.8**	180	390	1,300	1,000***	750	Ba .6*	Arsenopyrite(?).
171	do.	3	< .0002**	2.1**	600	400	1,500	3,600***	360	Ba .6*	
172	do.	5	.02	22	230	210	280	200	200	xx	
173	Select	xx	.001**	2.7**	1,100	620	1,200	1,100***	1,100	Ba .6*; Bi .09*	Quartz, with pyrite, hematite, chalcopyrite, galena, sphalerite, huebnerite(?); from dump.
174	do.	xx	< .0002**	3.2**	1,270	610	2,400	1,200***	880	Ba >10*; Sb .2*	Same as #173, only vuggy, brecciated, less sulfides.
175	do.	xx	.02	8.9	74	52	170	60	78	xx	Quartzite; from dump.

Symbols used: <, less than; >, greater than; xx, not applicable; *, analysis by semiquantitative optical emission spectroscopy; **, analysis by fire assay (values in oz/ton); *** analysis by X-ray fluorescence. Analytical methods (unless marked *, **, or ***): inductively coupled plasma for Cu, Pb, and Zn; fire assay/inductively coupled plasma for Au, Ag; atomic absorption for As; colorimetry for W.

Figure 13.--The Eagle Rock Mine, showing sample localities 165-175. Table shows analytical data. Samples 163, and 164 shown on plate 1.

Table 9.--Analyses of reconnaissance rock samples.

[Analyses by Bureau of Mines, Reno Research Center, Reno, Nevada. Symbols used: na, not analyzed; <, less than.]

Sample number (see pl. 1)	Analytical data (ppm, unless noted) Au	Ag	W	Description
18	0.04	<0.3	6	Limestone breccia; float rock.
19	.02	< .3	<5	Limestone; limonite banding; float rock.
39	<.007	< .3	<5	Limestone; hematite banding; float rock.
98	<.007	< .3	<5	Limestone breccia.
102	<.007	< .3	na	Quartzite, sheared.
105	<.007	< .3	<5	Limestone breccia, very porous; limonitic; float rock.
109	.01	< .3	<5	Limestone.
110	.01	< .3	<5	Limestone breccia; adjacent to sample 109.
111	.01	< .3	<5	Mica schist; quartz veinlets; float rock.
133	<.007	.8	8	Shale, sheared; 4-ft chip from 215-ft-thick unit.
148	<.007	< .3	<5	Limestone, red; float rock.
222	<.007	< .3	<5	Basalt dike, strike N. 10° W.; 5-ft chip.
223	<.007	< .3	<5	Conglomerate, "baked" by basalt dike.
259	.01	< .3	na	Quartz breccia from fault zone.
261	<.007	< .3	<5	Carbonate rock; hematite banding; 2-ft chip.
264*	<.0002 oz/ton	0.5 oz/ton	<5	Quartz breccia.
294**	<.007	< .3	<5	Limestone breccia; 1 1/2-ft chip.

* Contains 7 ppm mercury.
** Contains 2 ppm mercury.

Table 10.--Analyses of stream sediment samples.

[Analyses by Barringer Resources, Inc., Wheatridge, Colorado. Samples are -80 mesh. No gold detected above the 0.02 ppm lower detection limit. Detection limits for the other elements: Ag, 0.2 ppm; Cu, 1 ppm; Pb, 1 ppm, W, 4 ppm; Zn, 1 ppm. Symbol used: <, less than.]

Sample number (see pl. 1)	Analytical data				
	Ag	Cu	Pb (ppm)	W	Zn
1	1	19	21	<4	79
2	1	19	30	<4	82
3	0.2	20	20	<4	77
4	.4	20	17	<4	68
5	.2	19	17	<4	73
6	.4	20	20	<4	75
7	.6	17	17	<4	67
8	.6	22	22	<4	70
9	.4	25	31	<4	89
10	1	17	19	<4	66
11	.4	20	20	<4	71
12	.4	21	17	<4	72
13	.4	14	21	<4	64
14	<.2	9	13	<4	30
15	.2	12	15	8	55
16	1	13	14	<4	49
17	.4	11	15	4	50
20	.4	9	12	<4	44
21	.4	11	17	4	38
22	.4	11	14	<4	47
23	.4	11	118	4	45
24	.2	11	10	<4	45
25	.2	13	17	8	48
26	.4	22	30	<4	81
27	.6	19	18	<4	77
28	.4	18	29	<4	73
29	.2	14	19	4	54
30	.2	16	21	<4	47
31	.4	27	28	4	69
32	.2	11	13	<4	40
33	.4	15	18	<4	63
34	.6	19	16	<4	68
35	.8	16	18	<4	63
36	2.2	16	18	<4	66
37	1	21	21	<4	82
38	.4	14	13	4	53
40	.4	24	26	<4	80
41	.6	21	20	<4	75
42	.2	13	17	<4	54
43	.2	21	26	<4	89
44	.4	21	25	<4	79

Table 10.--Analyses of stream sediment samples--Continued

Sample number (see pl. 1)	Analytical data				
	Ag	Cu	Pb (ppm)	W	Zn
49	.8	25	23	<4	97
50	.8	25	27	<4	82
52	1.2	8	10	<4	34
53	.6	19	24	<4	70
54	.2	28	25	<4	77
73	.6	12	22	<4	36
76	1	32	28	<4	75
79	1.4	29	22	<4	75
85	1	33	22	<4	78
96	.4	31	23	<4	95
97	.4	27	24	<4	79
99	.8	33	25	8	108
100	1.2	26	21	<4	85
101	.8	29	25	<4	89
103	.6	18	22	8	64
104	.4	23	24	<4	75
106	.6	22	29	12	79
107	.6	22	25	<4	75
108	.4	27	34	<4	117
207	.6	29	24	8	98
208	.6	28	26	<4	100
224	.4	21	18	4	63
256	.6	23	23	<4	78
257	.8	12	22	<4	45
258	.4	15	20	<4	57
260	.8	23	32	<4	60
262	1	23	27	<4	85
263	.8	19	25	<4	78
266	.2	21	16	<4	76
291	.4	18	14	<4	63
292	1	15	19	<4	54

Table 11.--Analyses of soil samples.

[Analyses by Barringer Resources, Inc., Wheatridge, Colorado. Samples are -80 mesh. No gold detected above the 0.02 ppm lower detection limit. Detection limits for the other elements: Ag, 0.2 ppm; Cu, 1 ppm; Pb, 1 ppm; W, 4 ppm; Zn, 1 ppm. Symbol used: <, less than.]

Sample number (see pl. 1)	Analytical data				
	Ag	Cu	Pb (ppm)	W	Zn
209	0.8	27	24	<4	69
210	.8	36	30	32	114
216	.6	45	29	4	118
220	.6	43	22	<4	97
221	.4	42	22	<4	180

APPENDIX A--Lower detection limits for semiquantitative optical emission spectrographic analyses.

[Analyses by Bureau of Mines, Reno Research Center, Reno, Nevada.]

Element	Lower detection limit (percent)
Ag	0.0005 to 0.02
Al	.001[1/]
As	.009 to .08
Au	.002 to .004
B	.003 to .02
Ba	.002
Be	.0001 to .0003
Bi	.01 to .07
Ca	.05 to 2.
Cd	.0005 to 4.
Co	.001 to .003
Cr	.0003 to .0009
Cu	.0006
Fe	.0006[1/]
Ga	.0002 to .001
K	.6 to 2.
La	.01
Li	.002 to .005
Mg	.0001[1/]
Mn	.0008
Mo	.0001
Na	.3 t0 10.
Nb	.007 to .03
Ni	.0002 to .008
P	.7 to 1.
Pb	.002 to .008
Pd	.0001
Pt	.0006 to .001
Sb	.06 to .3
Sc	.0004
Si	.0006[1/]
Sn	.0006 to .03
Sr	.0001
Ta	.02
Te	.04 to .07
Ti	.03 to .08
V	.005 to .01
Y	.0009
Zn	.0001 to .0008
Zr	.003

[1/] Approximate. No range of detection limit can be determined because this element exceeds the detection limit for all sample analyses.

Note: Detection limits vary with the composition of the material under analysis.

Appendix B--Semiquantitative optical emission spectrographic analyses of rock samples.

[Values in percent.]

Element	Sample numbers																		
	18	19	39	45	46	47	48	51	55	56	57	58	59	60	61	62	63	64	65
AG	<.0005	<.0005	.006	<.0005	<.003	<.0005	<.0005	<.001	<.002	<.008	<.002	<.004	<.0005	<.0005	<.0005	<.0005	<.0005	<.0007	<.0005
AL	.07	.06	.8	>4.	>4.	>4.	>4.	>4.	.5	1.	>3.	>3.	>3.	>3.	>3.	>3.	.5	>5.	>3.
AS	<.009	<.009	<.009	<.01	<.05	<.01	<.009	<.02	<.02	.05	.04	.07	.04	<.02	<.009	<.02	<.02	.04	<.02
AU	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.003	<.002	<.002	<.002	<.002	<.002	<.004	<.002
B	<.003	<.004	<.003	.01	<.003	.01	<.006	.02	.01	.02	.01	.02	.02	.01	.01	.01	.01	.02	.02
BA	<.002	<.002	.008	.06	.4	.08	.2	.1	.03	.2	.2	.05	.06	<.002	.02	.03	.004	.8	.05
BE	<.0001	<.0001	<.0001	.0004	.002	.001	.002	.001	.0009	.001	.001	<.0002	.002	.001	<.0001	.0007	.0006	.002	.001
BI	<.01	<.01	<.01	<.01	<.01	<.01	<.04	<.04	<.01	<.02	<.01	<.02	<.02	<.01	<.01	<.01	<.01	<.03	<.01
CA	10.	10.	>10.	<.05	<.05	.7	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05
CD	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005
CO	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
CR	<.0003	<.0003	<.0003	<.0008	<.0003	<.0003	.002	.002	<.0003	<.0008	<.0008	.003	<.0005	<.0003	<.0003	<.0003	<.0003	.003	<.0003
CU	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	.003	.01	.02	.004	<.0006	<.0006	<.0006	<.0006	.002	<.0006	<.0006
FE	.06	.1	1.	.6	6.	4.	6.	6.	.6	2.	2.	2.	3.	.8	2.	2.	.9	4.	3.
GA	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0006	<.0007	<.0002	<.0002	<.0002	<.0003	<.0002	<.0002	<.0002	<.0002	<.0002	.002	<.0002
K	<.6	<.6	<.6	5.	>10.	10.	10.	>10.	8.	10.	8.	4.	>10.	>10.	8.	6.	8.	>10.	10.
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	<.002	<.002	<.005	<.003	.007	<.002	<.002	<.002	<.002	<.002	<.004	<.002	<.002	<.002	<.002	<.002	<.002
MG	>9.	3.	1.	.1	.8	.5	.4	.7	.03	.2	.2	.2	.5	.9	.1	.08	.02	.8	.2
MN	.005	.005	.03	.02	>6.	.3	>6.	.03	.5	.4	>2.	.08	.08	.08	.01	.01	.04	.04	.02
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3
NB	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.02	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.02	<.007
NI	<.0002	<.0002	<.0005	<.0007	<.002	<.0006	<.002	<.0005	<.0003	.001	<.0005	.001	.001	<.0006	<.0005	<.0006	.0008	.002	<.0006
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7
PB	<.002	<.002	<.002	<.002	<.002	<.002	.01	<.005	.008	<.008	.02	.09	<.004	<.002	<.002	<.002	<.002	.008	<.002
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.001	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006
SB	<.06	<.06	<.06	<.06	<.09	<.06	<.07	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	>10.	5.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.
SN	<.0006	<.0006	<.0006	<.002	<.002	<.002	<.002	<.004	<.0007	.003	<.001	<.004	<.002	<.001	<.0009	<.002	.002	<.008	<.003
SR	<.0001	.0002	.03	<.0001	<.0001	<.0001	.0002	.0002	.02	.01	.2	.0001	.006	<.0001	<.0001	<.0001	<.0001	.0007	<.0001
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.08	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04
TI	<.03	<.03	<.03	.1	.2	.09	.1	.3	<.03	<.03	<.04	.1	.1	<.03	.1	<.07	<.03	.6	.08
V	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.006	<.005
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	<.0001	<.0001	<.0001	<.0003	.007	.001	.01	.004	.03	.008	.01	<.0001	.007	.001	<.0002	<.0005	.001	<.0001	.001
ZR	<.003	<.003	<.003	.01	<.003	<.003	.004	.004	<.003	.006	<.003	.004	<.003	<.003	<.003	.005	<.003	<.003	<.003

Sample Numbers

Element	66	67	68	69	70	71	72	74	75	77	78	80	81	82	83	84	86	87	88
AG	<.0005	<.0005	<.0005	.008	.01	<.001	<.0005	<.0005	<.0005	<.001	<.0005	<.0005	<.0005	<.0005	<.0005	<.002	<.002	<.0005	.04
AL	>3.	>3.	.2	.5	.8	.6	>4.	>3.	.9	>4.	.6	>5.	>4.	.7	>3.	>4.	>3.	>2.	>2.
AS	<.03	<.03	<.009	<.03	<.02	<.009	<.02	<.01	<.009	<.02	<.02	<.02	<.02	<.01	.04	.1	.1	.2	<.03
AU	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
B	.02	.01	.009	.009	.01	.008	.02	<.007	.009	.01	.009	.01	.01	<.007	.01	.01	.01	<.008	.01
BA	.1	.05	<.002	.02	.6	.008	.1	.1	.02	.1	.008	.2	.2	.03	.01	.06	.03	.04	.05
BE	.001	.001	<.0001	.0004	.001	<.0002	.0005	.0004	.0008	.006	.002	.002	.003	<.0003	.001	.002	.0008	.01	.0004
BI	<.01	<.01	<.01	<.02	<.01	<.01	<.02	<.01	<.01	<.01	<.01	<.02	<.03	<.01	<.01	<.03	<.01	<.01	<.02
CA	<.05	<.05	<.05	<.05	<.05	<.05	<.05	3.	<.05	.1	<.05	<.08	<.05	<.05	<.05	<.05	1.	2.	10.
CD	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.002	<.0008	<.02	<.0005
CO	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
CR	<.0003	<.0003	<.0003	.001	<.0003	<.0003	<.0007	<.0003	<.0005	<.0005	.001	<.0006	<.0008	<.0003	<.0003	.001	<.0003	<.0003	<.0003
CU	<.0006	<.0006	<.0006	.005	.01	.004	.001	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	.003
FE	4.	3.	.4	1.	5.	2.	5.	2.	.8	5.	6.	5.	4.	4.	3.	4.	2.	6.	.7
GA	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
K	>10.	>10.	4.	<.6	10.	3.	>10.	3.	>10.	>10.	<2.	>10.	>10.	4.	9.	>10.	>10.	>10.	10.
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	.01	<.002	<.002	.007	<.002	<.003	<.002
MG	.7	.4	.001	.02	.2	.02	.9	.2	.09	.9	.04	.9	1.	.02	.4	.6	.4	1.	.2
MN	.03	.03	.006	>2.	.05	>2.	.3	.01	.03	.05	.1	.4	.4	>3.	.03	.5	.02	.8	.02
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3
NB	<.007	<.007	<.007	<.007	<.007	<.007	<.01	<.007	<.007	<.01	<.007	<.02	<.02	<.007	<.007	<.007	<.007	<.007	<.007
NI	<.0007	<.0005	<.0002	<.0003	<.0004	<.0002	.001	<.0007	<.0003	.002	.001	.001	.001	<.0002	<.0004	.0009	<.0004	.002	<.0007
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<1.	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.9	<.7
PB	<.002	<.002	<.002	.01	<.002	.01	<.003	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.003	<.003	<.002	.02
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006
SB	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.09	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.
SN	<.002	<.002	<.0006	<.001	.004	<.001	<.004	<.0006	<.0006	<.005	.005	<.003	<.001	<.002	<.002	<.002	<.001	<.008	<.001
SR	<.0001	<.0001	<.0001	<.0001	.0003	<.0001	<.0001	.0002	<.0001	.0005	.0001	.0003	.0005	.001	<.0001	.001	.002	.002	.003
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04
TI	.2	.09	<.03	<.03	<.03	<.03	.2	<.07	<.03	.2	<.03	.3	.3	<.03	<.04	.1	<.03	<.03	<.03
V	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	<.0003	<.0004	<.0001	<.0001	.003	<.0003	.002	<.0007	<.0006	.009	.002	.005	.007	<.0003	.002	.008	<.0005	.03	.001
ZR	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	.006	.003	<.003	<.003	<.003

Sample Numbers

Element	89	90	91	92	93	94	95	98	102	105	109	110	111	112	113	114	115	116	117
AG	<.0005	<.004	<.0007	<.0009	<.004	<.0005	<.0005	.005	<.0005	<.0009	<.001	<.002	<.0005	<.003	<.0005	<.0005	<.0005	<.0005	<.0005
AL	>4.	>4.	>4.	>4.	>4.	>3.	>3.	.7	.4	.5	.6	.7	>4.	.1	>4.	.2	.2	.3	.2
AS	.3	<.01	<.02	.09	.1	.1	<.02	<.01	<.01	<.01	<.009	<.009	<.01	<.009	<.02	.04	.04	.04	<.02
AU	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
B	.01	<.008	<.008	.01	.01	.009	.009	<.005	.01	.01	<.006	<.004	.009	<.003	.01	<.005	<.005	.01	<.005
BA	.2	.02	.1	.2	.09	.04	.2	.005	.004	.04	<.002	.003	.1	<.002	.1	.04	.04	<.002	<.002
BE	.002	.04	.03	.004	.007	.001	.07	<.0001	.0003	.0008	<.0001	<.0001	.0008	<.0001	.0005	.0005	.0005	<.0003	<.0001
BI	<.01	<.01	<.01	<.03	<.03	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.02	<.01	<.01	<.01	<.01
CA	<.06	8.	8.	9.	10.	5.	>10.	>10.	<.05	<.05	>10.	>10.	<.05	>10.	4.	10.	10.	7.	8.
CD	<.003	<.0005	<.0005	<.0005	<.0007	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005
CO	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
CR	<.0003	<.0003	<.0003	<.0004	<.0005	<.0003	<.0003	<.0003	.01	<.0008	<.0003	<.0003	<.0004	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003
CU	<.0006	<.0006	<.0006	<.0006	.02	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006
FE	3.	2.	3.	3.	3.	2.	1.	.6	1.	.7	.6	2.	4.	.02	5.	2.	2.	1.	2.
GA	<.0002	<.0002	<.0002	<.0002	<.0003	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
K	>10.	9.	>10.	>10.	>10.	10.	6.	<.6	<1.	>10.	<.6	<.6	>10.	<.6	>10.	<.6	<.6	<1.	<.6
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.004	<.002	<.002	<.002	.01	<.002	<.002	<.002	<.002	<.002	<.002	<.002	.01	<.002	<.002	<.002	<.002	<.002	<.002
MG	.9	2.	2.	1.	.9	.5	1.	.4	.009	.1	1.	1.	2.	>10.	1.	2.	2.	.9	2.
MN	.02	.7	.3	.1	>2.	.09	.1	.01	.02	.01	.08	.1	.2	.007	.3	>3.	>3.	.3	.7
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	3.	<.3	<.3	<.3	<.3
NB	<.007	<.007	<.007	<.01	<.02	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.008	<.01	<.02	<.007	<.007	<.007	<.007
NI	<.0005	.0008	<.0005	.0009	<.0006	<.0005	<.0003	.0009	<.0004	<.0003	.0009	<.0007	.0009	<.0003	<.0007	<.0005	<.0005	<.0003	<.0002
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7
PB	<.002	<.002	<.002	<.004	.03	<.003	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.003	<.002	<.002	<.005	<.005
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006
SB	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	>10.	>10.	>10.	>10.	>10.	>10.	2.	>10.	>10.	2.	4.	>10.	3.	>10.	>10.	>10.	>10.	>10.
SN	<.002	<.002	<.0008	<.003	<.002	<.001	<.0006	<.0008	<.0007	<.0006	<.001	<.0006	<.001	<.0006	<.002	<.0006	<.0006	<.0006	<.0006
SR	.0001	.003	.001	.0005	.02	.009	.07	.003	<.0001	<.0001	.04	.003	.0002	<.0001	.01	.002	.002	.0005	.0003
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04
TI	.1	<.04	<.04	.1	.2	<.03	<.03	<.03	<.03	<.03	<.03	<.03	.1	<.03	.2	<.03	<.03	<.03	<.03
V	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	.001	<.0001	.005	.001	.03	.01	.008	<.0001	<.0001	.003	<.0001	<.0003	.01	<.0001	.02	.06	.06	.05	.05
ZR	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003

Sample Numbers

Element	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
AG	<.001	<.0005	<.0005	<.0005	<.001	<.0005	<.001	<.002	<.004	<.004	<.001	.003	<.003	<.0005	<.002	<.002	<.004	<.01
AL	.3	.2	.1	.1	.09	.3	.2	.6	.2	.5	.8	.5	.2	.1	.6	>3.	>2.	.5
AS	.06	.03	<.009	.03	<.009	<.03	<.009	<.01	<.02	.1	<.02	.03	<.009	<.01	<.01	<.009	<.009	<.01
AU	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
B	<.004	<.008	<.003	<.004	<.003	<.004	<.007	<.005	<.007	<.003	<.006	<.006	<.003	<.003	<.003	<.008	.01	.02
BA	.03	<.002	.006	.008	<.002	.03	.003	.003	<.002	.3	.007	.01	.002	<.002	.02	.06	.02	<.002
BE	.0005	<.0001	<.0001	<.0001	<.0001	.0004	<.0001	<.0001	<.0001	.004	.001	.0005	<.0001	<.0001	.001	.001	.0004	<.0001
BI	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.02	<.01	<.01	<.02	<.01	<.01	<.01	<.01	<.01	<.01
CA	10.	4.	10.	9.	10.	9.	10.	>10.	>10.	9.	>10.	>10.	10.	10.	>10.	<.05	<.05	1.
CD	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005
CO	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
CR	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0006	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0007	<.0003
CU	<.0006	<.0006	<.0006	<.0006	<.0006	.001	<.0006	<.0006	<.0006	.01	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	.001	.01
FE	3.	1.	2.	2.	.05	3.	1.	.6	.3	6.	2.	2.	.3	.1	2.	3.	4.	1.
GA	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0003
K	<.6	3.	<.6	<.6	<.6	<2.	<.6	<.6	<.6	<.6	<.6	<.6	<.6	<.6	<.6	>10.	>10.	<.6
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
MG	2.	1.	2.	2.	>10.	2.	2.	1.	.6	1.	.7	.9	3.	2.	.9	.7	.1	.5
MN	>3.	.3	>2.	>2.	.07	>3.	.5	.1	.2	>6.	.03	.09	.1	.08	.2	.09	.2	.06
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3
NB	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007
NI	<.0005	<.0002	<.0002	<.0002	<.0003	<.0004	<.0005	<.0005	<.0005	<.004	<.0006	.002	<.0003	<.0002	<.0006	.001	<.0007	.0008
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7
PB	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	.04	<.002	<.005	<.002	<.002	<.002	<.002	<.005	.2
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006
SB	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	>10.	>10.	>10.	.7	>10.	>10.	>10.	>10.	>10.	>10.	3.	>10.	>10.	>10.	>10.	>10.	>10.
SN	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.001	<.0006	<.0006	<.003	<.0006	<.002	<.0006	<.0006	<.0006	<.001	<.004	.004
SR	.0006	<.0001	.0007	.0006	<.0001	.0005	.0003	.004	.01	.0003	.0005	.007	.0002	.0008	.0004	<.0001	<.0001	<.0001
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04
TI	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	.1	<.04	<.03
V	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	.07	.03	.05	.02	<.0001	.09	.006	.003	.003	.1	.02	.004	.002	.002	.006	.06	.01	.02
ZR	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	.004	<.003	<.003

Sample Numbers

Element	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153
AG	.03	<.002	<.003	<.0005	.01	.02	<.0005	.03	.02	.01	<.009	<.002	<.0005	<.0005	.06	.04	.04	.02
AL	.2	.06	.6	>3.	.2	.9	.8	.2	.3	.4	>4.	.3	.1	>4.	.1	.2	.2	.4
AS	.06	<.01	.03	.04	.04	.04	<.009	.03	.04	.04	<.07	<.009	<.009	<.02	4.	3.	.4	.3
AU	<.002	<.003	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.004	<.002	<.002	<.002	<.002	<.002	<.002	<.002
B	.01	.01	.01	.01	.01	.01	<.004	<.006	.01	.01	<.02	<.003	<.003	.02	<.008	.01	.009	<.007
BA	<.002	<.002	<.002	.09	.002	.08	.2	<.002	<.002	.004	.003	<.002	<.002	.1	<.002	<.002	.007	.003
BE	.0005	<.0001	.0008	.0007	.0005	.0005	<.0001	<.0001	.0007	.0008	.002	<.0001	<.0001	.001	.0006	<.0001	.0008	<.0002
BI	<.01	<.01	<.01	<.01	<.02	<.02	<.01	<.01	<.01	<.03	<.01	<.01	<.01	<.02	<.04	<.02	<.01	<.01
CA	.3	>10.	2.	<.05	.2	1.	>10.	5.	.3	1.	10.	>10.	>10.	<.05	<.05	<.05	1.	.6
CD	<.002	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0008	<.0005	<.0005	<.0005	<.0005	<.0005	<4.	<.0008	<.0005	<.0005
CO	<.001	<.001	<.001	<.001	<.002	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
CR	<.0003	<.0003	.002	.001	.002	.01	<.0003	.002	.003	<.0004	<.0007	<.0003	<.0003	<.0006	<.0008	<.0003	.002	<.0003
CU	.1	<.0006	.009	<.0006	.06	.09	<.0006	.08	.09	.01	.004	<.0006	<.0006	<.0006	1.	4.	6.	5.
FE	1.	.2	.6	4.	.2	.8	.9	.1	.2	.5	9.	1.	.03	4.	7.	6.	7.	2.
GA	<.0002	<.0003	<.0002	<.0002	<.0005	<.0003	<.0002	<.0002	<.0002	<.0002	<.001	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
K	<.6	<.6	<1.	<.6	<.6	<.6	<.6	<.6	<.6	<.6	<.6	<.6	<.6	>10.	>10.	10.	7.	8.
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	<.003	<.005	.006	<.003	<.002	<.002	<.005	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
MG	.003	.3	.1	.1	.08	.1	1.	1.	.1	.4	2.	1.	2.	1.	.003	.01	.03	.3
MN	.03	.08	.2	.01	.01	.01	.03	.02	.007	.07	>10.	.05	<.0008	.03	.003	.04	.1	.009
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3
NB	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.01	<.007	<.007	<.01	<.007	<.007	<.007	<.007
NI	<.0004	.0009	<.0003	.001	<.0006	.001	<.0004	<.0004	<.0003	<.0005	<.003	<.0006	<.0002	.001	<.0002	<.0005	<.0006	<.0006
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7
PB	.9	.01	.3	<.002	.3	.3	<.002	.2	.4	.02	.02	.02	<.002	<.002	5.	4.	3.	2.
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.001	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006
SB	.3	<.06	<.07	<.06	.08	<.06	<.06	.09	.2	<.06	<.06	<.06	<.06	<.06	.1	<.06	.2	.5
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	.05	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	.2	.2	>10.	>10.	>10.	>10.	>10.
SN	<.001	.003	<.0006	<.005	.002	.003	<.0006	<.0006	<.0006	<.0006	<.006	<.0006	<.0006	<.002	.02	.02	.02	.005
SR	<.0001	.004	<.0001	.0003	.0004	.0002	.01	<.0001	<.0001	<.0001	.001	.004	.001	.0001	.001	.0002	.007	.0002
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.04	<.04	<.07	<.07	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04
TI	<.03	<.03	<.03	.1	<.03	<.03	<.03	<.03	<.03	<.03	.2	<.03	<.03	.3	<.03	<.03	<.03	<.03
V	<.008	<.005	<.005	<.01	<.01	<.006	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	.01	<.005
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	.05	<.0001	.03	.004	.07	.03	.007	.1	.3	.06	.05	.004	<.0001	.008	.1	.2	.2	.1
ZR	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	.006	<.003	<.003	<.003	<.003	<.003	<.003	<.003

Sample Numbers

Element

	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172
AG	<.008	<.008	<.005	<.002	.07	<.0005	<.0005	<.0005	.03	<.003	<.002	.06	.02	.04	<.001	<.004	.008	.008	.02
AL	.05	.1	1.	>2.	>2.	.6	.2	>5.	.3	>3.	>3.	.8	.6	.3	.5	.2	.4	.4	.6
AS	.03	<.02	<.02	<.02	2.	<.02	.09	.04	<.02	.08	<.03	.3	<.05	.2	<.02	.05	<.03	.05	.08
AU	<.003	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.003	<.002	<.003	<.002	<.003	<.002	<.002	<.002	<.002	<.003
B	<.006	<.005	.01	.01	.02	.009	<.007	.02	.01	.01	.02	.04	<.007	.01	<.008	.01	<.007	<.006	.01
BA	.008	<.002	.01	.003	.03	<.002	<.002	.3	<.002	.02	.09	>5.	.04	.1	2.	.04	.6	.6	.07
BE	<.0001	<.0001	.0006	.0005	.002	<.0003	.005	.0004	.004	.0009	.001	.0006	.0006	.002	.0005	.0008	.0007	.0009	.001
BI	<.01	<.01	<.03	<.01	<.04	<.01	<.01	<.04	<.01	<.04	<.03	.1	.07	.06	<.01	<.05	<.03	<.01	<.05
CA	>10.	>10.	<.09	<.1	<.05	8.	1.	<.1	.3	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05
CD	<.0005	<.0005	<.0005	<.0005	<.0005	.0006	<.004	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0007	<.0006
CO	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.002	<.001	<.003	<.001	<.001	<.001	<.001	<.001
CR	<.0003	<.0003	<.0009	<.0003	<.0003	<.0003	<.0003	.003	.004	<.0008	<.0003	.003	<.0008	.002	.001	<.0009	<.0007	<.0003	.003
CU	<.0006	.007	.03	.007	10.	.01	.2	.004	.2	.02	.0006	.09	.06	.04	.02	<.0006	.02	.03	.01
FE	.07	.2	1.	1.	10.	2.	7.	6.	2.	3.	3.	8.	7.	10.	1.	.7	4.	5.	2.
GA	<.0002	<.0002	<.0002	<.0002	<.0009	<.0002	<.0002	.002	<.0002	<.0005	<.0002	<.001	<.0002	<.0007	<.0002	<.0002	<.0002	<.0002	<.0005
K	<.6	<.6	6.	7.	6.	<.8	10.	>10.	4.	<.6	>10.	<.6	<.6	<.6	<.6	6.	<.6	<.6	<.6
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	.01	.01	<.002	<.002	<.002	<.002	<.002	.02	<.002	<.002	<.002	<.002	<.002	<.002	<.003	<.002	<.004
MG	>10.	.3	.2	.3	.1	.2	.2	2.	.004	.1	.6	.1	.1	.009	.02	.004	.008	.02	.07
MN	.06	.1	.05	.03	>2.	.2	>1.	.2	.07	.02	.05	.01	.09	.1	.006	.2	.01	.04	.01
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	<.3	<.3	<.3	<4.	<8.	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3
NB	<.01	<.007	<.007	<.007	<.007	<.007	<.007	<.03	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007
NI	.001	<.0007	.0009	<.0007	.01	<.0006	.003	.001	.0008	.0009	.002	.003	.003	<.004	<.0003	<.0006	<.0006	<.0005	.001
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.9	<.7	<.7	<.7	<.8	<.7
PB	<.003	.07	.07	.01	.1	<.002	<.002	.04	.1	.01	<.002	.2	.01	.1	.02	<.004	.1	.2	.03
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.001	<.0006	<.0006	<.0006	<.0008	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.001	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0009
SB	<.06	<.06	<.06	<.06	1.	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	.04	4.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.
SN	.002	<.0006	.003	<.002	<.04	<.0009	.008	<.005	<.002	<.005	<.004	.02	.02	.05	<.0006	<.0007	.003	.004	.007
SR	.0003	.0005	<.0001	<.0001	<.0001	.0002	<.0001	<.0001	<.0001	<.0001	<.0001	.001	<.0001	<.0001	.003	<.0001	.0002	.001	<.0001
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.08	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.05	<.04	<.04	<.04	<.04	<.06
TI	<.03	<.03	<.04	<.03	<.03	<.03	<.03	.4	<.03	.3	.3	.2	<.06	<.03	<.03	<.03	<.03	<.03	<.07
V	<.005	<.005	<.005	<.005	<.006	<.005	<.005	<.005	<.005	.01	<.005	.02	<.01	<.01	<.005	<.005	<.008	<.005	.01
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	<.0001	.001	.02	.02	.09	1.	1.	.007	.04	.01	.008	.04	.02	.06	.009	.01	.06	.05	.02
ZR	<.003	<.003	<.003	<.003	.004	<.003	<.003	<.003	<.003	.01	<.003	.007	<.003	.004	<.003	<.003	<.003	<.003	<.003

Sample Numbers

Element

	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
AG	.05	.02	<.0009	<.0005	<.002	<.02	<.01	<.001	<.0005	<.001	<.0005	<.004	<.007	<.003	<.0006	<.009	<.0007	<.0005	<.005
AL	.5	.3	.5	1.	>4.	>2.	1.	>3.	.3	.9	.6	.4	>3.	>3.	.7	>3.	>3.	>4.	1.
AS	.2	.1	<.009	<.009	<.03	.1	<.01	<.02	<.009	<.02	<.009	<.02	<.009	<.03	<.009	<.06	<.009	<.01	<.009
AU	<.003	<.002	<.002	<.002	<.002	<.002	<.003	<.002	<.002	<.002	<.002	<.002	<.003	<.002	<.002	<.002	<.002	<.002	<.002
B	.01	<.007	.01	<.004	.01	<.003	<.01	.01	<.003	<.006	<.003	<.01	<.003	<.01	<.003	<.01	<.004	.009	<.003
BA	.6	>10.	.03	.01	.1	.07	.04	.06	<.002	<.002	<.002	<.002	.006	.03	.004	.005	.08	.3	<.002
BE	.0006	.0005	<.0003	<.0001	<.0002	.005	.03	.01	<.0001	.01	.0005	.04	.02	.03	.004	.03	.01	.002	.04
BI	.09	<.03	<.01	<.01	<.01	<.04	<.05	<.01	<.01	<.01	<.01	<.01	<.02	<.01	<.01	<.01	<.01	<.01	<.01
CA	<.05	<.05	<.05	>10.	10.	<.07	<2.	5.	>10.	<2.	>10.	<.9	10.	8.	>10.	6.	2.	2.	10.
CD	<.001	<.001	<.0005	<.0005	<.0005	<.003	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005
CO	<.002	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
CR	.002	<.0006	.001	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0005	<.0003	<.0003	<.0003	<.0003	.001	<.0003
CU	.06	.03	.0007	<.0006	<.0006	.05	.03	.008	<.0006	<.0006	.002	.03	.03	.01	<.0006	.01	.01	<.0006	.03
FE	10.	7.	2.	1.	3.	7.	9.	4.	.5	4.	2.	6.	7.	7.	2.	8.	7.	4.	9.
GA	<.0009	<.0002	<.0002	<.0002	<.0002	<.0005	<.0004	<.0004	<.0002	<.0002	<.0002	<.0002	<.0005	<.0002	<.0002	<.0003	<.0002	<.0002	<.0002
K	10.	<.6	>10.	<.6	>10.	6.	2.	>10.	<.6	3.	<.6	7.	<.6	3.	<.6	<2.	>10.	>10.	<.6
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
MG	.01	.01	.03	1.	2.	.06	.8	.8	2.	1.	1.	.4	.9	1.	.5	1.	2.	1.	.9
MN	.02	.02	.006	.02	.1	>8.	>10.	>4.	.1	>10.	>2.	>10.	>6.	>9.	.6	>9.	>2.	.4	>6.
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	<.3	<.3	<.3	<.9	<10.	<.3	<.3	<.3	<.3	<.9	<.3	<.4	<.3	<.3	<.3	<.3	<.3
NB	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.01	<.007
NI	.003	.003	<.0003	<.0005	.001	<.002	<.004	<.0009	<.0003	<.004	<.0002	<.0002	<.005	<.004	<.0004	<.006	<.001	.0008	<.002
P	<.7	<.7	<.7	<.7	<.7	<.7	<.8	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7
PB	.3	.2	<.005	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.004	<.002	<.002	<.002	<.002	<.002	<.002
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0007	<.0006	<.0006	<.0006	<.0006	<.0006	<.001	<.0006	<.0006	<.0006	<.0006	<.0006	<.0007	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006
SB	<.06	.2	<.06	<.06	<.06	<.3	<.1	<.2	<.06	<.09	<.06	<.4	<.1	<.2	<.06	<.2	<.1	<.06	<.1
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	>10.	>10.	3.	>10.	>10.	>10.	>10.	.3	>10.	2.	>10.	>10.	>10.	3.	>10.	>10.	>10.	>10.
SN	.03	.01	<.001	<.0006	<.001	<.01	<.005	<.009	<.0006	<.0006	<.0006	<.008	<.02	<.02	<.0006	<.02	<.005	<.001	<.007
SR	<.0001	.01	<.0001	.02	.005	.0003	.0004	.002	.03	.0002	.02	<.0001	.002	.001	.04	.001	.0004	.004	.0007
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04
TI	<.08	<.03	<.03	<.03	.3	<.06	<.06	<.05	<.03	<.03	<.03	<.03	.1	<.05	<.03	.1	<.07	.3	<.03
V	.01	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0005	<.0009	<.0009	<.0009
ZN	.05	.03	.003	<.0001	.002	.4	1.	.2	.002	.06	.03	.6	.2	.6	.1	.6	.7	.04	.5
ZR	.004	<.003	<.003	<.003	<.003	.006	.005	<.003	<.003	<.003	<.003	<.003	.005	<.003	<.003	<.003	<.003	<.003	<.003

Sample Numbers

Element

	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	211	212	213
AG	<.007	<.008	<.004	<.004	<.003	<.0006	<.004	<.004	<.001	<.001	<.008	<.0005	<.009	<.004	<.0006	<.0005	<.0005	.01
AL	>3.	>3.	1.	>3.	>3.	>4.	>4.	.4	>3.	>3.	.8	>5.	>2.	.9	>4.	.2	.5	.4
AS	<.05	<.08	<.05	<.009	<.06	<.02	<.009	<.01	<.02	<.02	.1	.03	<.06	<.01	<.009	<.009	<.05	.06
AU	<.002	<.002	<.003	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.003	<.002	<.002	<.002	<.002	<.003
B	<.007	<.009	<.01	<.003	<.003	.01	<.003	.01	<.003	<.003	<.01	.01	<.01	<.004	<.003	<.008	<.007	.02
BA	<.002	.02	.005	.003	.006	.2	.004	.005	.01	.01	.06	.4	.004	.007	.09	<.002	<.002	.01
BE	.04	.03	.02	.01	.02	.002	.04	<.0001	.02	.02	.05	.003	.06	<.0001	.02	<.0003	<.0002	.0005
BI	<.02	<.02	<.01	<.02	<.02	<.03	<.02	<.01	<.01	<.01	<.01	<.03	<.01	<.01	<.01	<.01	<.01	<.05
CA	10.	5.	10.	10.	5.	.4	10.	>10.	7.	7.	<.5	3.	10.	>10.	>10.	<.05	<.05	<.05
CD	.0006	<.0005	.03	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005
CO	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
CR	<.0003	<.0003	<.0003	<.0003	<.0003	.001	<.0003	<.0003	<.0003	<.0003	<.0003	.001	<.0003	<.0003	<.0003	<.0003	.002	<.0009
CU	.01	.09	.03	<.0006	.02	<.0006	<.0006	<.0006	.1	.1	.05	.008	.001	<.0006	.002	<.0006	<.0006	<.0006
FE	8.	10.	8.	7.	10.	5.	7.	.6	9.	9.	10.	4.	9.	.7	4.	.4	.9	1.
GA	<.0002	<.0004	<.0004	<.001	<.0005	<.0007	.002	<.0002	<.0002	<.0002	<.0004	<.0003	<.0006	<.0002	<.0002	<.0002	<.0002	<.0003
K	<.8	<.6	<.6	<.6	>10.	>10.	<.6	<.6	6.	6.	<1.	>10.	<.6	<.6	10.	3.	2.	<2.
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
MG	1.	.8	.9	1.	2.	2.	1.	1.	.6	.6	.2	.8	.6	.9	2.	.003	.02	.007
MN	>9.	>10.	>7.	>5.	>2.	.2	>4.	.2	>2.	>2.	>9.	.4	>10.	.07	>2.	.003	.006	.02
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.7	<.3	<6.	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<5.	<.3	<.5	<.3	<.3	<.3	<.3	<.3
NB	<.007	<.007	<.007	<.007	<.007	<.03	<.02	<.007	<.007	<.007	<.007	<.02	<.007	<.007	<.007	<.007	<.007	<.007
NI	<.003	<.004	<.002	<.002	<.0002	.001	<.002	<.0007	<.0002	<.0002	<.008	.001	<.007	<.0007	<.0002	<.0002	<.0004	.001
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<1.	<.7	<.7	<.7	<.7	<.7	<.7	<.7
PB	<.002	<.002	<.002	<.002	<.002	.02	<.002	<.002	<.002	<.002	<.002	<.003	<.003	<.002	<.002	<.002	<.002	<.005
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0008
SB	<.1	<.09	<.1	<.06	<.1	<.06	<.07	<.06	<.1	<.1	<.3	<.06	<.5	<.06	<.06	<.06	<.06	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	>10.	>10.	>10.	>10.	>10.	>10.	1.	>10.	>10.	>10.	>10.	>10.	5.	>10.	>10.	>10.	>10.
SN	<.004	<.03	<.007	<.004	<.006	<.002	<.01	<.0006	<.02	<.02	<.007	<.003	<.03	<.0006	<.002	<.0006	<.0008	.002
SR	.0007	.0002	.0008	.008	<.0001	<.0001	.004	.02	.0003	.0003	.0003	.004	.0002	.02	.03	<.0001	<.0001	<.0001
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04
TI	<.03	<.03	<.03	<.06	<.03	.2	<.05	<.03	<.03	<.03	<.03	.3	<.03	<.03	.1	<.03	<.03	<.04
V	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.01
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	1.	.4	1.	.1	.2	.2	.1	.01	.2	.2	1.	.08	.4	.003	.2	<.0001	<.0001	<.0003
ZR	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	.003	<.003	<.003	<.003	.004	<.003	<.003	<.003

Sample Numbers

Element

	214	215	217	218	219	222	223	225	226	227	228	229	230	231	232	233	234	235
AG	<.0005	.008	.007	<.004	<.0006	<.0007	<.0005	<.003	<.0005	<.002	.02	.01	.04	<.0009	.02	.007	<.0007	<.0005
AL	.2	.1	.3	.2	.3	>4.	.4	1.	>3.	>3.	.4	.7	.6	>3.	.1	.8	.3	.6
AS	<.009	<.03	.07	<.009	<.009	<.009	<.01	<.009	<.009	<.01	<.03	<.03	.09	<.01	.05	<.01	<.009	<.009
AU	<.002	<.002	<.004	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
B	<.006	.009	.02	<.008	.01	<.005	<.005	<.005	.01	.009	<.007	.009	<.008	.01	<.007	.009	<.003	<.003
BA	.005	.05	.02	.04	.004	.06	.004	.004	.07	.1	.005	.008	.04	.1	.01	.02	<.002	.004
BE	.0003	.0008	.0006	.0004	.0004	.0005	.0004	<.0001	<.0002	.0006	.0004	.0003	.0004	.0004	.0005	.0008	<.0001	<.0001
BI	<.01	<.02	<.05	<.01	<.01	<.01	<.01	<.01	<.01	<.03	<.02	<.01	<.01	<.02	<.05	<.01	<.01	<.01
CA	<.05	<.05	<.05	<.05	<.05	3.	<.05	>10.	>10.	4.	2.	.4	.2	.2	1.	<.07	>10.	>10.
CD	<.0005	<.0007	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.008	<.0005	<.001	<.0005	<.0005	<.0005
CO	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
CR	<.0005	<.0003	.005	<.0003	.002	<.0005	<.0006	<.0003	<.0003	<.0003	<.0003	<.0003	<.0009	<.0003	.002	<.0003	<.0003	<.0003
CU	<.0006	.07	.0007	<.0006	<.0006	.005	.007	<.0006	<.0006	<.0006	.2	.1	.2	.04	.2	.1	.002	.002
FE	3.	3.	1.	2.	.3	7.	2.	1.	3.	3.	3.	3.	.8	3.	.3	2.	.3	.5
GA	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
K	<1.	<1.	<.6	9.	<.6	10.	<.6	<.6	<.6	>10.	<.6	<.6	<.6	>10.	<1.	4.	<.6	<.6
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.003	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
MG	.01	.003	.003	.01	.003	2.	.4	.9	.9	1.	.1	.03	.02	.6	.02	.04	.3	.2
MN	.03	.006	.02	.05	.006	.9	.1	.03	.1	.2	.08	.1	.02	.05	.005	.04	.8	.07
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	<.3	<.3	<.3	3.	<.3	<.3	<.3	<.3	<.8	<.3	<.3	<.3	<.3	<.3	<.3	<.3
NB	<.007	<.007	<.007	<.007	<.007	<.02	<.007	<.007	<.008	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007
NI	<.0002	<.0006	.001	<.0006	<.0004	.005	<.0004	<.0006	.0009	.001	<.0006	<.0007	<.0002	.001	<.0007	<.0006	<.0002	<.0002
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7
PB	.009	1.	<.007	<.003	<.002	<.002	<.002	<.002	<.002	<.002	2.	3.	3.	.08	1.	.1	.2	<.002
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0006	<.0006	<.0008	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006
SB	<.06	.1	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.07	.1	.5	<.06	.2	<.07	<.06	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	>10.	>10.	>10.	>10.	>10.	>10.	3.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	.6	2.
SN	<.0006	<.002	.003	<.001	<.001	<.008	<.0006	<.0006	<.001	<.0008	<.001	<.002	<.0006	<.001	<.0006	<.0008	<.0006	<.0006
SR	<.0001	<.0001	<.0001	<.0001	<.0001	.003	<.0001	.02	.02	.0004	.003	.0008	.001	<.0001	.0003	.0001	.0001	.002
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04
TI	<.03	<.03	<.04	<.03	<.03	.6	<.03	<.04	.2	.2	<.03	<.03	<.03	.1	<.03	<.03	<.03	<.03
V	<.005	<.005	<.005	<.005	<.005	.02	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	.002	.05	.002	<.0008	<.0002	.04	.002	<.0001	.001	.009	.7	.04	.03	.05	.04	.05	.09	.03
ZR	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003

Sample Numbers

Element

	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253
AG	<.0005	<.001	.1	.05	<.002	<.002	<.004	.05	<.0005	<.0005	<.003	<.002	<.002	<.002	.005	.01	<.02	<.002
AL	>3.	>3.	.4	.9	.7	.6	.2	.2	.08	1.	.6	.5	.7	>4.	.5	.5	.5	>3.
AS	<.009	<.009	.3	.1	<.02	<.03	.04	.06	<.009	<.02	<.1	<.009	<.009	.03	<.03	.05	<.04	<.01
AU	<.002	<.002	<.002	<.002	<.002	<.002	<.003	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
B	<.007	<.003	.01	.01	<.006	.009	.01	.009	<.003	.01	.01	.01	<.008	.02	.01	.01	.01	<.007
BA	.05	.06	.1	.08	.009	.01	.09	.02	<.002	.006	.8	.01	1.	.1	.01	>10.	.08	.05
BE	.0008	<.0001	.0006	.001	<.0003	.0006	.0006	.0007	<.0001	.0003	<.0002	.0004	<.0002	<.0002	.0005	.0005	.0004	<.0001
BI	<.01	<.01	<.03	<.02	<.03	<.02	<.03	<.01	<.01	<.01	<.01	<.01	<.01	<.02	<.03	<.01	<.05	<.01
CA	10.	>10.	.2	2.	1.	.2	.3	.3	10.	1.	.7	<.1	6.	9.	6.	4.	3.	>10.
CD	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005
CO	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.002	<.001
CR	<.0003	<.0003	.002	<.0003	<.0004	<.0003	.004	<.0003	<.0003	<.0004	.003	.002	<.0003	<.0003	.001	<.0008	.001	<.0003
CU	.006	.0006	2.	.2	<.0006	<.0006	.003	.8	<.0006	.002	.002	<.0006	<.0006	<.0006	<.0006	.4	<.0006	<.0006
FE	2.	2.	1.	3.	3.	1.	3.	.3	.2	4.	4.	3.	2.	2.	3.	2.	4.	2.
GA	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0003	<.0002	<.0002	<.0002	<.0002	<.0002	<.0009	<.0002
K	>10.	<.6	<.6	4.	<2.	<1.	<.6	<.6	<.6	<2.	<.6	<2.	6.	10.	3.	2.	<2.	<.6
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.005	<.002	<.003	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
MG	.5	.6	.007	.2	.9	.1	.03	.003	>10.	.1	.06	.03	.4	.2	.5	.4	.04	.6
MN	.1	.02	.02	.1	.2	.02	.2	.007	.04	.1	.09	.05	.07	.09	.1	.1	.03	.2
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0002	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3
NB	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.01	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007
NI	<.0003	<.0006	.001	.001	.0008	<.0006	.0009	<.0002	<.0002	<.0003	.001	.0009	<.0003	<.0007	.0009	.0008	.002	.0008
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7
PB	.08	<.004	3.	2.	<.002	<.004	.009	1.	<.002	.06	.04	.05	.02	.01	.5	3.	.09	.03
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0009	<.0006
SB	<.06	<.06	1.	.4	<.06	<.06	<.06	.7	<.06	<.06	<.06	<.06	<.06	<.06	<.06	.1	<.06	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	4.	>10.	>10.	>10.	>10.	>10.	>10.	.1	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.
SN	<.0006	<.0006	.004	.004	<.0006	<.001	.003	<.0006	<.0006	<.0009	.005	.003	<.0006	<.002	.003	<.001	.007	<.0009
SR	.0004	.004	.002	.001	.0003	<.0001	<.0001	.0001	<.0001	.0008	.0002	<.0001	.001	.002	.0004	.06	.0006	.02
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.05	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.05	<.04	<.04	<.04	<.04	<.04	<.04
TI	.09	<.07	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.04	<.03	<.03	.08	<.03	<.03	<.05	<.06
V	<.005	<.005	<.007	<.005	<.005	<.005	<.005	<.006	<.005	<.005	<.008	<.005	<.005	<.005	<.008	<.005	<.01	<.005
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	.06	.002	.1	.2	.01	.004	.01	.09	<.0002	.003	.009	.004	.005	.004	.02	.1	.01	.03
ZR	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	.003	<.003

Sample Numbers

Element	254	255	259	261	264	265	267	268	269
AG	<.001	<.005	<.0005	<.001	<.0005	<.004	<.005	<.0005	<.0005
AL	>4.	.9	.3	>3.	.7	>3.	.6	.04	.03
AS	.04	<.01	<.009	<.009	<.009	<.009	<.02	<.009	<.009
AU	<.002	<.002	<.002	<.002	<.002	<.002	<.004	<.002	<.002
B	.02	<.004	.009	<.006	<.007	<.007	.01	<.003	<.003
BA	.1	.006	.04	.02	.002	.01	.004	<.002	<.002
BE	.0005	<.0001	<.0002	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
BI	<.03	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
CA	1.	>10.	<.05	>10.	<.05	>10.	>10.	>10.	>10.
CD	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005
CO	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
CR	<.0005	<.0003	.002	<.0003	<.0003	<.0003	<.0004	<.0003	<.0003
CU	<.0006	<.0006	<.0006	<.0006	.002	<.0006	.005	<.0006	<.0006
FE	3.	.7	2.	3.	2.	2.	2.	.07	.02
GA	<.0003	<.0002	<.0002	<.0002	<.0002	<.0002	<.0003	<.0002	<.0002
K	>10.	<.6	<.6	<.6	4.	<.6	<.6	<.6	<.6
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	<.002	.009	<.002	<.002	<.002	<.002	<.002
MG	.4	1.	.006	.8	.08	1.	.7	>10.	3.
MN	.08	.07	.3	.04	.07	.05	.1	.07	.02
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3
NB	<.008	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007
NI	.0008	.0008	<.0004	.0009	<.0002	.0009	.002	<.0002	<.0002
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7
PB	<.004	<.002	<.002	<.002	.009	<.002	.02	<.002	<.002
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.001	<.0006	<.0006
SB	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	2.	>10.	5.	>10.	>10.	5.	.5	.008
SN	<.002	<.0007	<.001	<.0007	<.0006	<.001	.004	<.0006	<.0006
SR	.0005	.02	<.0001	.03	.001	.02	.001	<.0001	<.0001
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04
TI	.2	<.03	<.03	.08	<.03	<.07	<.03	<.03	<.03
V	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	.006	<.0003	<.0001	<.0001	.002	<.0001	<.0001	<.0001	<.0001
ZR	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003

Element	270	271	272	273	274	275	276	277	278
AG	<.0005	<.001	.008	<.002	<.004	.09	.07	<.01	<.0006
AL	.04	.03	.3	.7	.4	.3	.2	.2	1.
AS	<.009	<.009	<.03	<.03	<.02	<.03	<.01	.04	<.01
AU	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.003	<.002
B	<.004	<.005	.01	<.004	.009	<.006	<.004	.01	.01
BA	<.002	.004	<.002	<.002	<.002	1.	.1	.009	.07
BE	<.0001	<.0001	.0004	<.0001	<.0001	<.0001	<.0001	<.0001	.0009
BI	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.03	<.01
CA	>10.	>10.	3.	7.	>10.	5.	>10.	>10.	.5
CD	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005
CO	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
CR	<.0003	<.0003	.001	<.0003	.002	<.0006	<.0003	<.0003	<.0003
CU	<.0006	<.0006	.1	.001	.05	.3	.2	<.0006	<.0006
FE	.06	.05	.4	.5	.8	.3	.1	.2	2.
GA	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
K	<.6	2.	8.	10.	<2.	5.	<2.	<.6	4.
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	.009
MG	>10.	>10.	.06	.4	.2	.4	1.	.9	.5
MN	.07	.05	.01	.008	.02	.005	.01	.03	.01
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3
NB	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007
NI	<.0002	<.0003	<.0003	<.0003	<.0006	<.0003	<.0003	.001	<.0006
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7
PB	<.002	<.002	.02	<.002	.3	2.	2.	.02	<.002
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.002	<.0006
SB	<.06	<.06	.1	<.06	<.06	.2	<.06	<.06	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	.03	.006	>10.	>10.	>10.	>10.	>10.	5.	>10.
SN	<.0006	<.0006	<.0006	<.0006	<.0009	<.0006	<.0006	.002	<.001
SR	<.0001	.0002	<.0001	.0004	.0005	.007	.005	.005	.0002
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04
TI	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.04
V	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	<.0001	<.0001	.003	.001	<.0003	.02	.02	<.0001	.005
ZR	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003

Sample Numbers

Element	279	280	281	282	283	284	285	286	287	288	289	290	293	294
AG	<.01	<.0005	.04	.006	<.0005	.01	.03	<.003	.008	<.01	<.002	.03	.02	<.003
AL	>2.	>4.	.6	.3	>2.	>2.	>3.	>4.	>4.	.2	.4	.1	.07	.5
AS	.06	<.02	<.02	<.02	<.009	<.03	.05	<.02	.04	.07	<.009	<.01	<.04	<.009
AU	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.003	<.002	<.002	<.002	<.002	<.002
B	.01	.02	.01	<.007	<.004	.01	.01	.01	.01	.01	<.006	<.003	.01	<.003
BA	.09	.02	.005	.002	.04	.06	.1	.5	.2	.01	.003	<.002	.004	<.002
BE	.0006	.002	.0004	<.0001	<.0001	.001	.0003	.0004	<.0001	<.0001	<.0001	<.0001	.001	<.0001
BI	<.07	<.01	<.01	<.01	<.01	<.01	<.01	<.03	<.05	.1	<.01	<.01	<.01	<.01
CA	.2	.3	.7	4.	>10.	.2	.9	10.	>10.	3.	>10.	8.	2.	>10.
CD	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005
CO	<.002	<.001	<.001	<.001	<.001	<.001	<.003	<.001	<.001	<.001	<.001	<.001	<.001	<.001
CR	.002	<.0003	.001	.001	<.0003	<.0004	.003	<.0009	.001	.002	.001	<.0004	<.0003	<.0003
CU	.03	<.0006	.2	.08	.003	.03	.2	.0008	<.0006	.002	.003	.2	.01	<.0006
FE	4.	2.	.4	.2	1.	1.	2.	4.	4.	.3	.4	.2	10.	.9
GA	<.0008	<.0006	<.0002	<.0002	<.0002	<.0002	<.001	<.0002	<.0009	<.0009	<.0002	<.0002	<.0002	<.0002
K	<1.	>10.	2.	<.6	<.6	10.	<.6	10.	<.6	<.6	<.6	<.6	10.	<.6
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	.01	<.002	<.002	.01	.02	.02	<.002	<.002	<.002	<.002	<.002	<.002
MG	.1	.5	.02	.04	1.	.4	.1	2.	.9	1.	2.	2.	1.	2.
MN	.007	.4	.004	.005	.04	.008	.02	.08	.1	.04	.03	.01	<.007	.04
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	3.	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3
NB	<.007	<.01	<.007	<.007	<.007	<.007	<.007	<.01	<.008	<.007	<.007	<.007	<.007	<.007
NI	.003	<.0004	<.0005	<.0003	<.0005	.001	.002	.002	.002	.002	<.0006	<.0002	.009	<.0005
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7
PB	.01	<.002	.4	.6	.05	.3	1.	<.005	<.006	.01	.8	.5	.03	<.002
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.001	<.0006	<.0006	<.0006	<.0006	<.0006	<.0007	<.0006	<.001	.004	<.0006	<.0006	<.001	<.0006
SB	<.06	<.06	.08	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	.1	<.06	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	3.
SN	<.006	<.002	<.001	<.0006	<.0006	<.002	<.005	<.002	<.005	.002	<.0006	<.0006	.06	<.0006
SR	.002	<.0001	.0002	.0006	.002	<.0001	.0002	.01	.04	<.0001	.003	.0001	<.0001	.0007
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.04	<.04	<.04	<.05	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04
TI	.09	.1	<.03	<.03	<.03	<.07	.1	.2	.2	.09	<.03	<.03	<.03	<.03
V	.02	<.005	.03	<.005	<.005	.02	.1	<.005	<.008	<.009	<.007	<.005	<.005	<.005
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	.003	.02	.007	.003	.002	.01	.004	.008	<.0003	<.0001	<.0001	.02	.005	<.0001
ZR	.004	.007	<.003	<.003	<.003	<.003	.006	<.003	<.003	<.003	<.003	<.003	<.003	<.003

MINE AND PROSPECT MAP SHOWING SAMPLED LOCALITIES, MOUNT GRAFTON STUDY AREA, LINCOLN AND WHITE PINE COUNTIES, NEVADA

BY

MARK L. CHATMAN, U.S. BUREAU OF MINES

1986