

THE GEOLOGY AND ORE DEPOSITS OF THE
SEAFOAM MINING DISTRICT
CUSTER COUNTY, IDAHO

by
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CONTENTS

Introduction	1
Scope	1
Acknowledgements	1
Previous Work	2
Geography	2
Location and Access	2
Climate, Vegetation and Animal Life	3
History	3
Geomorphology	4
Drainage	4
Valleys	6
Summit Areas	6
Physiographic Development	6
General Geology	7
Structure	7
Petrography and Petrology	8
Metamorphic Rocks	8
Sedimentary Rocks	9
Igneous Rocks	10
Economic Geology	14
General Statement	14
Ore Deposits	15
Seafoam Mine	15
Mountain King Mine	16
Future Prospects	18
Reference List	19

ILLUSTRATIONS

Figure 1. Index map showing location of area	Following Page
Plate 1. Geologic map of the Seafoam Mining District, Custer County, Idaho	1
Plate 2. Geologic map of the Mountain King Mine	7
	16

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INTRODUCTION

SCOPE

During the summer of 1952, a geological investigation was carried on in the Seafoam Mining District, Custer County, Idaho by the Idaho Bureau of Mines and Geology. The Greyhound, Seafoam, and Mountain King mines, and several prospects were visited, pace and compass traverses were made to obtain data for the geological map, and notes were taken on the general geology.

In the following pages a discussion of the geography, geomorphology, petrography and petrology, and economic geology of the district is presented. On the geological map which accompanies this report, some generalizations have been made where the heavy forest cover obscured exposures or where the size of individual rock units, dikes, etc., made it impossible to incorporate them into the final map.

ACKNOWLEDGEMENTS

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While in the field the party was visited by Dr. A. L. Anderson, T. H. Kiilsgaard, and J. F. McDivitt, all of whom made many valuable suggestions. Special appreciation is due to T. H. Kiilsgaard, geologist, Spokane Branch, U. S. Geological Survey, who spent several days in the field with the party and made available his maps of the Mountain King Mine.

The courtesies extended by Messrs. Fred and Earl Shirts, and Mr W. B. Swigert and his sons, and Mr. Marvin Larson, Ranger at the Seafoam Ranger Station and his staff were highly appreciated and served materially to facilitate the study.

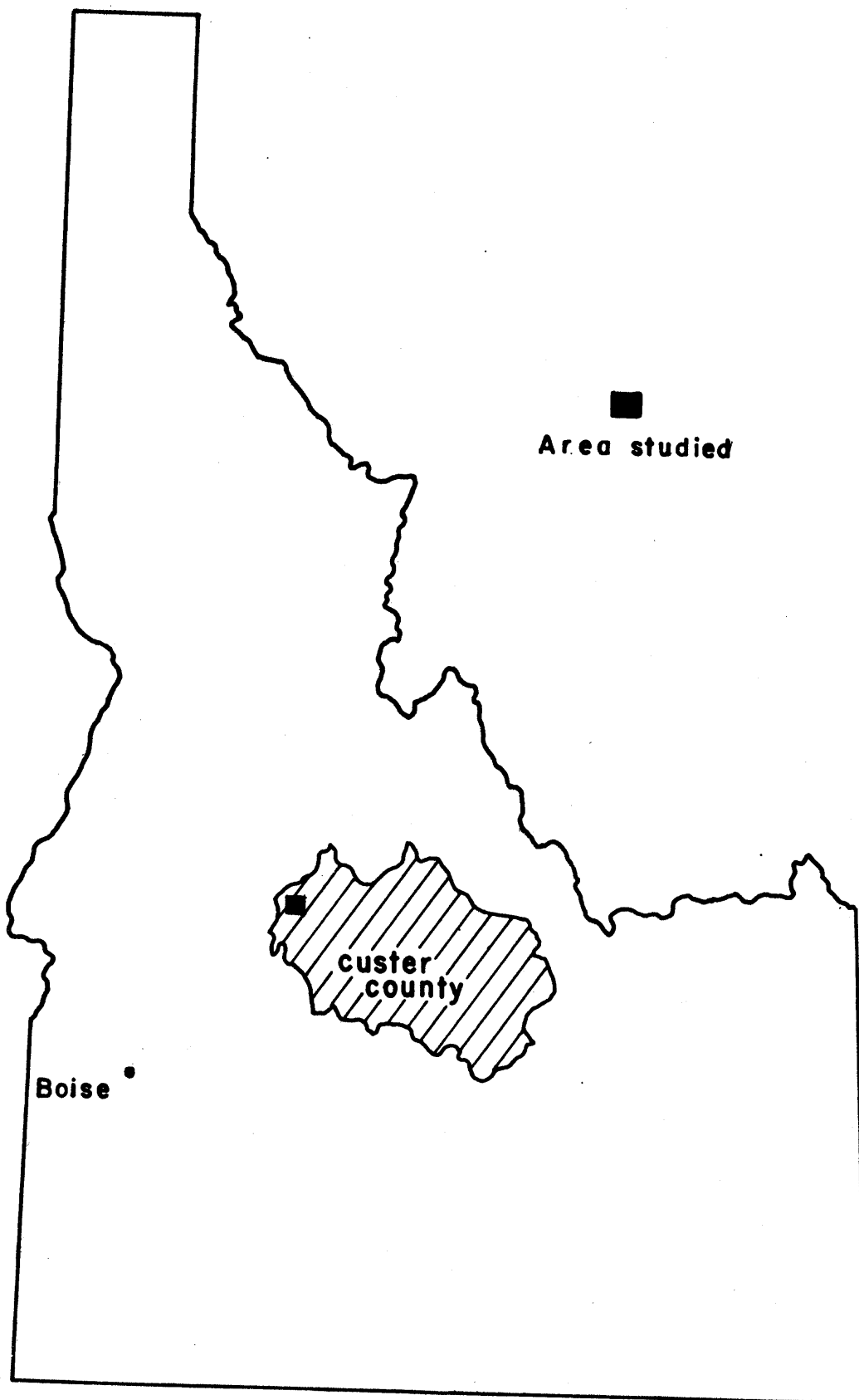


Fig. 1 Index map showing location of area.

Finally the authors wish to thank the staff members of the Geology and Geography Department, University of Idaho, for their valuable assistance.

PREVIOUS WORK

Prior to this investigation the geology of the area had been known only through reconnaissance surveys, the district having been included in broad studies made in south-central Idaho. Notable among those studies are the following published reports:

Umpleby, J.B. and Livingston, D.C., "A reconnaissance in south-central Idaho, embracing Thunder Mountain, Big Creek, Stanley Basin, Sheep Mountain, and Seafoam Districts, Idaho." Idaho Bureau of Mines and Geology Bull. 3. 1920. Briefly describes the geology of the districts listed in the title.

Ross, C.P., "Geology and ore deposits of the Seafoam, Alder Creek, Little Smoky, and Willow Creek Mining Districts, Custer and Camas Counties, Idaho." Idaho Bureau of Mines and Geology Pamphlet 33, 1930. Says the area is underlain by the Idaho batholith and ore deposits are sideritic lodes and irregular replacements in limestone; includes geologic sketch map.

GEOGRAPHY

LOCATION AND ACCESS

The Seafoam Mining District is located in the northwest corner of Custer County and as defined by Ross (1930a, p.1)/1 includes the Sheep Mountain area, sometimes considered a separate district. The area lies between 115 degrees and 114 degrees 10 minutes west longitude, and 44 degrees 30 minutes and 44 degrees 40 minutes north latitude. Its area of approximately 100 square miles is essentially contained within the drainage basin of the Rapid River, one of the larger tributaries of the Middle Fork of the Salmon River and is entirely within the confines of the Salmon River Division of the Challis National Forest.

Access to the area is by a graded road which runs past the Cape Horn Lodge and terminates at Josephus Lakes, about five miles within the borders of the district. The Seafoam Ranger Station, served by this road, is 35 miles from the closest town, Stanley. The nearest railhead is at Ketchum, 102 miles by road from the Seafoam Ranger Station, where a terminus of a branch of the Union Pacific Railroad is located. The region is accessible only during the summer months because the road north of Stanley, across Vanity Summit, is not kept open during the winter.

1References list on p. 19.

CLIMATE, VEGETATION, AND ANIMAL LIFE

Summer weather in the district is characterized by warm, pleasant days and cool nights. The average July temperature is about 55 degrees Fahrenheit. Winter temperatures show a wide range, from plus 60 to a minus 50 degrees Fahrenheit. The average January temperature is about 12 degrees Fahrenheit. Average annual precipitation is approximately ten inches, mostly attributable to spring and fall cyclonic storms and snowfall. Snowfall is heaviest in the high mountain, where ten feet is the average depth (Bunch).

A dense growth of medium-sized evergreens and shrubs covers the floors of the valleys, becoming thinner toward the ridge tops. The various tree types found in the district are Ponderosa pine, Douglas fir, Lodgepole pine, Englemann spruce, and Alpine fir. The estimated timber stand in the district is 70 million feet, Board Measure. The shrub cover is made up of Ceanothus, bitterbrush, sagebrush, rabbitbrush, and mountain mahogany. Flowering plants such as Indian paintbrush, lupine, and wild violets are also found in the area (Bunch).

Deer, elk, and grouse are quite abundant. Also found but scarcer, are black bear, cougar, and goats. On Seafoam Creek, beavers are so abundant as to constitute a nuisance to the Forest Service. Typical Canadian-Hudsonian rodents, chipmunks, gray squirrels, field mice, gray rabbits, etc., are found here. Trout are plentiful; Dolly Varden and Cutthroat are the most abundant varieties.

HISTORY

The history of this area is essentially the history of local mining. The district has been known since the eighties (Ross 1930a, p.1), at which time it was the scene of considerable placer mining, chiefly in the area near the present ranger station. As the workable gravels were of limited extent and contained many glacial erratics, the placer rush soon was over, but small shipments of both picked-lode and float lead-silver-gold ore continued to be shipped to Ketchum for processing. In the early 1900's the Greyhound Mining and Milling Company developed a property, now known as the Greyhound Mine, on Sulphur Creek and installed smelting and milling equipment. The complexity of the ore and the high cost of transporting fluxing materials and fuel to the smelter site served to make the smelting unprofitable and very little metal was marketed. On November 6, 1906 the Seafoam area was declared a portion of the Challis National Forest. From 1910 to 1926 interest in the district lagged. Production was limited to small lots of high grade ore from several claims. In 1926, the Seafoam Mining Company began development of a property on Harlan Creek. By 1928 they had installed a 50-ton amalgamation and concentration plant and in this year shipped some bullion to Boise. Work was halted in July, 1928, due to financial difficulties and production in the district fell off. About this time Messrs. Shirts and Larson leased the Mountain King Mine and bulldozed a road in to the property. In 1945 they shipped 114 tons of lead-zinc silver ore to smelters in Midvale,

Utah. From 1945 to the present time production has been mainly from the Mountain King Mine. The peak production year was 1948, when the lessees shipped 467 tons of ore.

Available production figures for the district are listed on Table 1.

GEOMORPHOLOGY

The area herein described is located in the Salmon River Mountains, a geographical division of the Northern Rocky Mountain Province. Geomorphologically, the region may be classified as mature. The present topographic expression is mainly the result of the work of normal erosional forces and recent glaciation.

Summit areas in the district stand at about 9000 feet, while the beds of the major streams lie at elevations ranging from 5000 to 6000 feet above sea level. The summit and valley areas are approximately equal; the slopes connecting the two, however, comprise most of the total area. The highest point in the district is Sheep Mountain, which reaches an elevation of 9195 feet.

DRAINAGE

The Rapid River, a tributary of the Middle Fork of the Salmon, is the main drainage artery of this district. Except for small westward-flowing segments near its source and near its junction with the Middle Fork, the course of the river is northward. Downstream from the headwaters, the river is shallow and graded. A short distance north of the ranger station the cobbled river bed of the graded segment gives way to bedrock.

The tributaries of the Rapid River join it essentially at right angles. They are graded for most of their extent. Youthful segments are found near the headwaters and at junctions with the youthful parts of the Rapid River. Some of the streams originate in small glacial lakes whereas others are dependent on intermittent melt-water streams for their flow. Most of the year the tributaries carry very little dissolved or suspended material, but during periods of heavy runoff enough sediment is introduced to render the streams muddy along their whole course.

Except for the Josephus Lakes, all of the lakes of the district are tarns nestled in small cirques. Differential glacial erosion and local variations in rock resistance due to a high concentration of dikes probably are the factors which determine the loci of these lakes. Rock falls accumulations mar the tarns shorelines. This is the result of glacial sapping which has undercut the cirque walls and rendered them unstable.

Table 1.

PRODUCTION OF THE SEAFOAM MINING DISTRICT, CUSTER COUNTY, IDAHO
(From the Minerals Yearbook, 1933-1950)

Year	Mines Producing	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Value (dollars)
1933	1	56	13.11	1557	0	17270	0	1455
1934	3	25	4.78	427	0	7811	0	732
1935-36	1	1	0.20	11	0	0	0	15
1937	1	22	1	1691	0	22322	0	2660
1939*	3	226	54	8085	289	29021	0	8772
1940	8	120	50	2617	124	7760	0	4013
1941	4	166	116	1004	0	5300	0	5076
1945*	1	141	4	2866	600	30500	41000	9597
1946	4	309	11	6292	1000	67000	36000	17326
1947	4	322	16	7905	800	65500	23000	20097
1948	4	524	79	6920	2000	84600	118700	40392
1949	2	182	17	3560	1000	43800	49900	17122
1950	2	9	0	147	0	3600	200	647

* Production for 1938, 1944, 1943, and 1942 not listed in Mineral Yearbook.

The Josephus Lakes are located in a basin formed by a local change in slope of the valley floor. The size of the upstream lake is being rapidly reduced by a deltaic accumulation at the mouth of Float Creek which breaks into a number of distributaries as it flows across this delta. The encroachment of marsh grasses and reeds on the shoreline offers further evidence of filling.

VALLEYS

Two types of valleys are found in this area--the V-shaped valley of the Rapid River and the U-shaped glaciated valleys of the main tributary streams.

The U-shaped valleys, in their present form, represent the work of both glacial and normal erosional forces. The valley floors are strewn with glacial debris, some of the boulders having a diameter of ten feet. Also found on the valley floors are hummocky accumulations of landslide material. Valley walls rise gently from the floor but steepen as the summits are approached. Landslide courses and talus slopes are readily observable along the valley walls.

The V-shaped valley of the Rapid River shows no evidence of glaciation. The present shape of the valley may be entirely attributed to normal erosional forces. Where the river passes over resistant dikes, small falls and rapids are formed.

SUMMIT AREAS

Summit areas show a general accordence in elevation over most of the district. Near the valley mouths these summits are characterized by gently-sloping shoulders which narrow to sharp arete-like ridges as one travels cirqueward. Areas in which there is a high concentration of dikes tend to stand above the general summit elevation.

PHYSIOGRAPHIC DEVELOPMENT

Only a small part of the physiographic history of this area, dating from the emplacement of the Idaho batholith to the present, can be reconstructed from the geological and topographical features of the district.

Regional elevation probably accompanied the emplacement of the Idaho batholith in Mesozoic time. This elevation served to rejuvenate the streams and inaugurated a period of rapid erosion (Umpleby 1913b, p. 17). Umpleby (1913a, pp. 23-30) and Ross (1930b, pp. 643-47) say that this period of erosion had by the early Tertiary reduced the surface of south-central Idaho to a broad gently undulating peneplain, dipping to the north in this area, and thus they explain the general elevational accordence of the summit areas. Subsequent rejuvenation initiated another period of erosion, the normal course of which was interrupted during the Pleistocene, when small mountain glaciers developed at higher elevations. The present topography of south-central Idaho is largely attributable to this latter cycle of erosion.

Recent landslides are the latest local physiographic feature to develop in the district. Landslide areas are readily defined by the definite changes in the age of the cover. Two suggestions as to the cause of these slides are here presented:

- (1) Mass gravity slumping of material saturated with water
- (2) Landslides triggered by earthquakes

Four earthquakes, since 1850, (Heck 1947, pp. 48-62) with an intensity of 5 or more (Rossi Forelli Scale) have occurred in or near the district. As is generally the case, slides attributable both to earthquakes and gravity slumping probably occurred in the area. Age determinations of the flora in the slide scar areas would serve to approximate the date of the slides.

GENERAL GEOLOGY

The Seafoam district lies just inside the eastern border of the Idaho batholith. Remnants of the original rock cover of Paleozoic sediments and Pre-Cambrian schists found in the district indicate that the batholithic rock found here is the roofward portion of the batholith. The high concentration of sediments in the eastern part of the district and the corresponding lack of these sediments in the western part indicate that the roof of the batholith dips to the east in this locality.

STRUCTURE

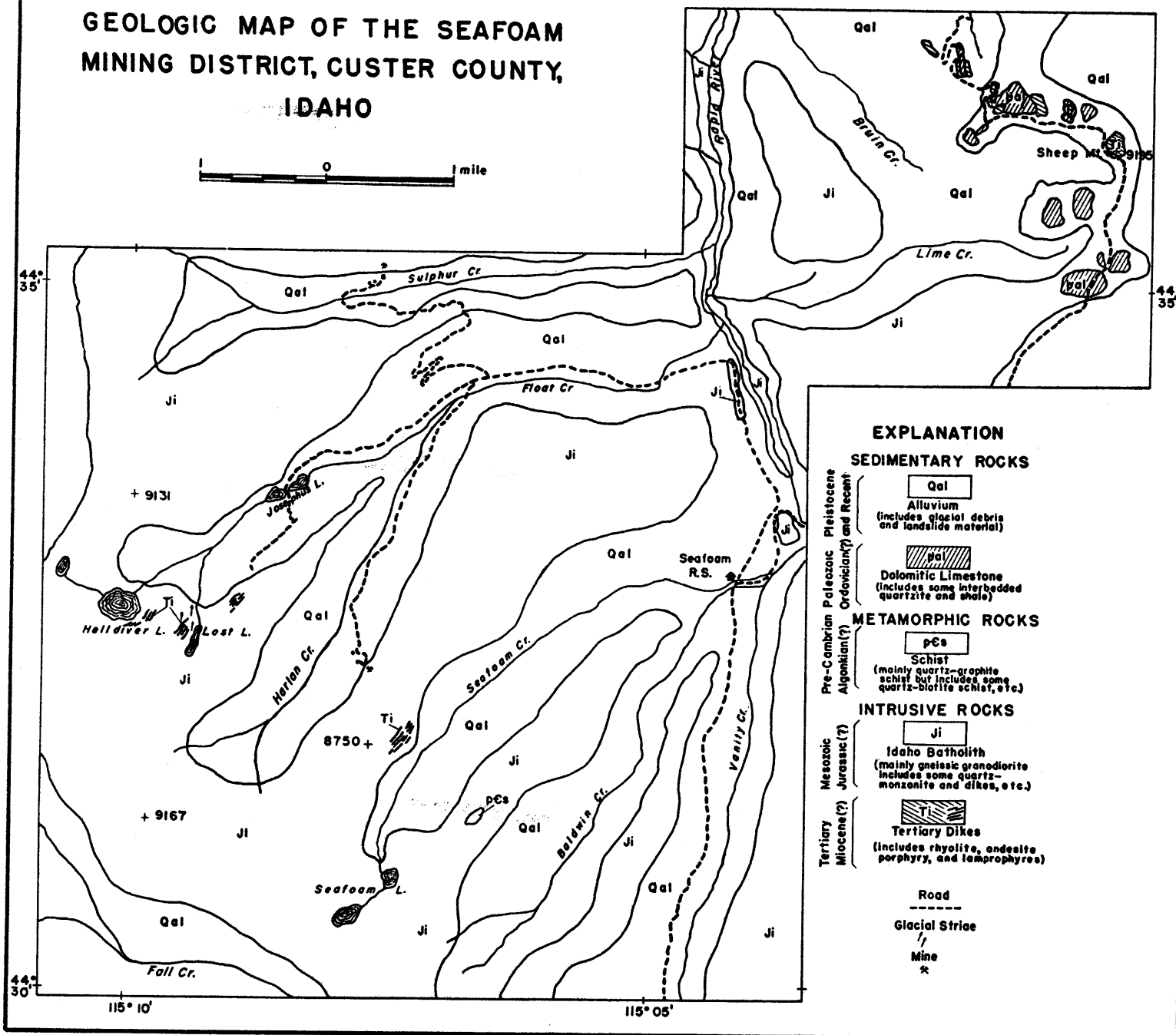
East of the district along the border of the batholith the sedimentary strata are closely folded, overturned and faulted. The average strike of the folds near the batholith contact is N 15 degrees W (Anderson 1948, p. 97), which conforms to the larger flexures of the contact. Farther east from the contact zone the strike of the folds is N 35-40 degrees W. The strike of thrust faults and normal faults in the border zone is also generally northwest. The northwest structural trend has been attributed (Anderson 1948, p. 98) to Laramide forces which were transmitted through the batholith into the adjacent rock. Structural features in the Seafoam district conform in part to the regional structural pattern, but striking deviations from this norm were noted in lineaments showing a definite northeasterly strike.

Two well-defined sets of joints were mapped in the area. The first set strikes northwesterly with steep to intermediate dips to the northeast and southwest; the second set strikes northeasterly with steep dips to the northwest and southeast. A less well-defined, steeply dipping, east-west joint set was also noted. For the most part the strike of the dikes conforms to that of the joint pattern, although some north-south dikes were noted.

Figure 1

GEOLOGIC MAP OF THE SEAFOAM MINING DISTRICT, CUSTER COUNTY, IDAHO

0 1 mile



EXPLANATION

SEDIMENTARY ROCKS

Qal
Alluvium
(includes glacial debris
and landslide material)

Qal
Dolomitic Limestone
(includes some interbedded
quartzite and shale)

METAMORPHIC ROCKS

pCa
Schist
(mainly quartz-graphite
schist but includes some
quartz-biotite schist, etc.)

INTRUSIVE ROCKS

Ji
Idaho Batholith
(mainly gneissic granodiorite
includes some quartz-
monzonite and dikes, etc.)

Ti
Tertiary Dikes
(includes rhyolite, andesite
porphyry, and lamprophyres)

Road

Glacial Striae

Mine

*

Compiled from pace and compass traverses.

The dominant trends in the area are northwest and northeast, showing up not only in the main joint sets and dikes, but also in the lineation of the schistose rocks, the bedding of the limestone, the mineralized shear zones in the batholithic rocks, and in the general drainage pattern of the district. A weaker north-south trend also has influenced the drainage pattern.

The accordance between the structural trends of the batholith and the older sedimentary and metamorphic rocks suggests that the batholithic lineaments are not primary consolidation features but may be relic features or were perhaps developed in response to orogenic forces. The latter view is supported, in part by Anderson (1948, pp. 85-99), who attributes the northeasterly and northwesterly trending faults of the batholith to fracturing during the transmission of Laramide orogenic forces. The solution provided by application of the strain ellipse to the lineaments of the district suggests that the pattern may be due to east-west compressive forces caused by the Laramide or Nevadian orogenies.

The east-west trend has been observed in many parts of the batholith and is considered to be associated with the closing stages of the emplacement of the batholith.

PETROGRAPHY AND PETROLOGY

Within the Seafoam district the principal rock is granodiorite of the marginal facies of the Idaho batholith, shot through with dikes. Sedimentary and metamorphic rocks are found but in minor amounts.

Since it was impossible to assign other than relative ages to the rocks found in the district, age assignments are tentatively based on correlations with units found beyond the limits of the area. Rocks were named according to the parameters defined by Wahlstrom (1947); the division of the batholithic rock into marginal and inner facies was based on the criteria presented by Anderson (1942, pp. 1100-1113); and the color designations were made according to the rock-color chart of the National Research Council (1948).

METAMORPHIC ROCKS

Pre-Cambrian Schist

Small bodies of schist were encountered along every ridge mapped. The schist is everywhere highly foliated and contorted. In places, near the contact with the quartz monzonite, the schist has been converted to migmatite.

The schist is black to dark gray, and the grain size is about 0.3 mm. In most places it is well consolidated and forms prominent outcrops. The individual exposures are never very extensive.

The schist is composed largely of quartz, biotite, and graphite and usually contains muscovite, chlorite, and a small amount of potash feldspar. The mineral composition and texture vary somewhat, producing three varieties of schist:

(1) In some places the schist is composed of almost equal amounts of biotite and quartz, with small amounts of graphite and pyrite. The texture is even and fine grains, and there is no apparent banding into separate mineral layers. In this case the rock is a quartz biotite schist.

(2) In other places the schist is composed of about 25 per cent quartz, 25 per cent microcline, and 50 per cent biotite. The microcline and quartz are segregated together and form alternating bands with biotite, producing a banded schist.

(3) Some of the schistose rocks contain a large amount of quartz, 75 to 80 per cent, and only minor amounts of biotite and graphite. These are the schistose quartzites.

There is no mineralization in the schist other than a small amount of pyrite in places.

Paleozoic Quartzite

The only bed of quartzite encountered in the district was found near Sheep Mountain. It is a massive white rock that has been stained to a light yellow in many places. It is a hard, well consolidated rock composed almost entirely of interlocking grains of quartz with small amounts of muscovite. The average grain size is about 2 mm. and the range is from 1 mm. to 4 mm.

There is no bedding discernible in the quartzite, although there is slight banding that may correspond to bedding. No contacts with other rocks were observed.

No mineralization of any importance has been found in the quartzite.

SEDIMENTARY ROCKS

Paleozoic Dolomitic Limestone

Outcrops of the limestone occur principally in the area around Sheep Mountain. It appears to overlies the quartzite, although no contacts were seen. The rock is a dense, dark blue to black dolomitic limestone containing many small veins of calcite. It has been extensively weathered and does not form prominent outcrops. Small lenses of interbedded argillite and shale that resemble the limestone in color and texture were noted. The rock has been intruded by andesite porphyry and by quartz monzonite and locally converted to a dolomitic marble.

The dolomitic limestone is composed of about 50 per cent calcite, 35 per cent dolomite, and 15 per cent quartz with small amounts of graphite, biotite, and muscovite. The quartz is a primary mineral except near the intrusions and

the ore bodies where secondary quartz has been added. The rock has been recrystallized locally and near the contacts with the quartz monzonite, it has been silicified. Near the contact with the andesite porphyry, the rock has been baked to a black, graphitic rock.

The average grain size of the limestone is about 0.5 mm. and the range is from 0.1 mm. to 1.5 mm. The differences in grain size and the abundance of impurities plus the lenses of argillite indicate that the rock is of detrital origin.

The dolomitic limestone and equivalent marble is in many places highly mineralized. The Mountain King Mine and many smaller claims are located on it. The ore found in the rock is argentiferous galena and sphalerite.

Quaternary Alluvium

The material mapped as quaternary alluvium includes many undifferentiated units which were not separately mapped. Included under this designation are heavy overburden and residuum, alluvium, glacial debris, and landslide material.

IGNEOUS ROCKS

Marginal Granodiorite

The Idaho batholith is not uniform in composition but is thought to be composed of two principal rock types, a marginal and an inner facies, whose emplacements were separated by a short interval of time. The marginal facies of the batholith was probably emplaced in late Jurassic time during the closing stages of the Sierra Nevada orogeny (Anderson 1952, pp. 263-64) and therefore is the older of two large divisions. The rock of the marginal zone is characterized by the minerals andesine, epidote, and sphene (Anderson 1942, p. 1104); its composition ranges from quartz diorite to granodiorite.

The mineral composition of the marginal facies in the district varies considerably over small areas, but most of the rock has an average composition of granodiorite. Characteristically, the rock is moderately dark gray and faintly gneissic, due to the sub-parallel orientation of biotite and hornblende. Texturally, the average rock is a medium-grained phanerite, but variations were noted ranging from a medium-grained phanerite to a coarse porphyritic phanerite studded with phenocrysts of potash feldspar, some of which were 40 mm. long. The average grain size is about 8 mm. and the range is from 2 mm. to 15 mm. The average mineral composition of the granodiorite is given in Table 2.

The rock of the marginal facies is not composed of a mixture of euhedral, subhedral, and anhedral grains. Individual minerals, characteristically, lack crystal faces and are embayed and penetrated by other minerals. Other noteworthy features are the presence of what appears to be two ages of quartz; the apparent replacement of andesine by microcline; and dual degree of alteration exhibited by orthoclase and biotite; and the myrmekitic andesine. Some of the

GRANODIORITE

<u>Mineral</u>	<u>%</u>
Andesine	35
Quartz	28
Orthoclase-microcline	25
Biotite	10
Hornblende	1
Muscovite	trace
Sphene	"
Zircon	"
Magnetite	"
Apatite	"

RHYOLITE PORPHYRY

<u>Mineral</u>	<u>%</u>
Orthoclase	52
Quartz	23
Plagioclase	22
Biotite	5
Muscovite	trace
Chlorite	"
Sericite	"

QUARTZ MONZONITE

<u>Mineral</u>	<u>%</u>
Quartz	41
Orthoclase	27
Oligoclase	26
Biotite	3
Muscovite	1
Zircon	trace
Magnetite	"

ANDESITE PORPHYRY

<u>Mineral</u>	<u>%</u>
Plagioclase	64
Hornblende	16
Biotite	13
Quartz	4
Muscovite	trace
Magnetite	"
Chlorite	"
Sericite	"

Table 2. Average volumetric mineral composition of the granodiorite, quartz monzonite, rhyolite, and andesite in the Seafoam District.

above features may be attributed to late deuteric alteration; some are explainable in terms of hydrothermal or pneumatolytic processes. Post-consolidation emanations from depth or endomorphism might have also been responsible for the observed features. In a broader sense, the marginal facies may also be explained in terms of a basic front.

The field features of the granodiorite in the Seafoam district suggest that the rock may have been formed by the metamorphism of sediments. The relation between metamorphism and those field features is fully explained by Grout (1941) and Goodspeed (1950). In the Seafoam district those features include: (1) a great variation in grain size over a small area, with feldspar crystals ranging up to 40 mm., (2) a great variation in mineral composition over small areas, (3) structural accord between the "igneous," metamorphic and sedimentary rocks, (4) irregular and gradational contacts between the granodiorite and the metamorphic rocks, (5) no decrease in grain size towards the contacts, (6) no baking of the metamorphics at the contacts with the granodiorite, (7) numerous very small metamorphic bodies completely surrounded by the granodiorite, with no appearance of having been absorbed, and (8) suggestions that the gneissic structure may be relict metamorphic structure.

Inner Quartz Monzonite

The inner facies of the Idaho batholith according to Anderson (1952, pp. 263-64) is the younger division of the batholith and was probably emplaced during the closing stages of the Laramide orogeny near the end of Cretaceous time. This division of the batholith is characterized by oligoclase (Anderson, 1942, p. 1111).

The average rock of the inner facies found in the district is a quartz monzonite. It is, characteristically, light gray, weathering pale yellow gray or pale brown. It shows no gneissose structure, contains varietal muscovite, and tends to be finer grained than the granodiorite. The average rock is a medium-grained phanerite which has an average grain size of about 3 mm.

The plagioclase of the quartz monzonite is predominantly oligoclase. The oligoclase of the inner facies exhibits much the same features as the andesine of the granodiorite. It lacks crystal faces, is embayed by quartz and penetrated by muscovite, occurs both as highly altered and comparatively fresh grains, and is being replaced by microcline. Unlike the andesine (marginal), it shows no strain effects and does not appear to be zoned.

Outcrops of the quartz monzonite in the district are small and it was impossible to incorporate them into the final map. The field features indicate that it is intrusive into the marginal facies. The features include: (1) sharp contacts between the quartz monzonite and granodiorite, with apophyses of the quartz monzonite extending into the granodiorite; (2) quartz monzonite cutting across the gneissic structure of the granodiorite; (3) a decrease in grain size of the quartz monzonite in small bodies and along contacts; (4) baking of sediments along the contact with the quartz monzonite; and (5) absence of the gneissic structure which is well developed in the granodiorite.

Tertiary Intrusives

Intrusives of Tertiary age, probably Miocene (Ross 1930a, p. 2 and 1934, pp. 35-65) of varying sizes and compositions cut the older rocks of the district. Most of these bodies are dikes of small size. They were only included on the map where they constituted swarms or where their individual size permitted them to be mapped at the scale used. Many of the larger bodies are porphyritic while the smaller dikes are aphanitic. They are all dense rocks that form prominent outcrops.

Three rock types constitute the bulk of the Tertiary rocks of the area. They are, from youngest to oldest, rhyolite (both aphanitic and porphyritic), andesitic porphyry, and lamprophyre (andesitic). The average mineral composition of the rhyolite and andesite are given in Table 2. Three dikes composed entirely of glass, some dacite and quartz latite dikes, which resemble the rhyolite and andesite dikes, and some small diabase dikes were noted.

Rhyolite

The rhyolite occurs both as aphanites and porphyries, depending on the size of the dike. The rock may be red, white, or gray and may exhibit flow banding. It contains euhedral phenocrysts of quartz which are rimmed by radial reaction rims of orthoclase and quartz. Feldspar phenocrysts of orthoclase and oligoclase are much altered. The groundmass is commonly a fine granular aggregate of orthoclase and quartz. Some glass, spherulitic intergrowths, and occasional micrographic patches were noted.

Andesite

The andesite is a dark greenish-gray rock. It is aphanitic and in some places is conspicuously porphyritic. In the porphyries the phenocrysts, which may compose up to 40 per cent of the volume of the rock, range in length from 2 mm. to 4 mm. Some of the plagioclase is zoned and shows corroded borders. The groundmass is predominantly plagioclase laths and the phenocrysts are also predominantly plagioclase with some few hornblende phenocrysts being noted.

Lamprophyres

The lamprophyres are dark greenish-gray, dark gray, and medium bluish-gray rocks. They range in texture from fine non-porphyritic to conspicuously porphyritic aphanites with phenocrysts of hornblende. The groundmass of the porphyries and the aphanites is usually composed of a mixture of andesine laths, hornblende needles, and biotite flakes. Magnetite and secondary chlorite and sericite are found scattered throughout the rock. The small scattered phenocrysts are dominantly brown or dark green hornblende which commonly shows some chloritic alteration.

The Tertiary dikes are normal igneous rocks which were emplaced in joints and fractures. The various degrees of alteration observed in even the freshest rocks are probably attributable to deuteric or end-stage hydrothermal action.

It is interesting to note that the sequence of dikes from rhyolite to andesitic is suggestive of the dike series that would be formed by palingenesis of a granodioritic rock (Tilley, 1950, p. 140 and Tyrell, 1929, p. 121).

ECONOMIC GEOLOGY

GENERAL STATEMENT

Two types of deposits occur in the Seafoam district; cavity filling deposits in shears, exemplified by the Greyhound and Seafoam Mines, and replacement deposits in limestone pendants, of which the Mountain King Mine is an example. In the former, although lead percentages were often high, gold and silver were the sought metals, while in the latter lead and zinc are the sought metals with silver, copper, and gold values serving to enhance the value of the ore.

According to Ross (1930a, p. 2) and the ranger, the gravels along the streams yield gold on panning, but no placer mining has been done in the district in several years.

The Greyhound Mine, located on Sulphur Creeks, and the Seafoam Mine, situated near the head of Harlan Creek, were once the site of extensive activity which, in addition to development work, included the constructing of elaborate housing facilities, mills and, in the case of the Greyhound a small smelter. Very little ore was shipped from either property and they have both been idle for several years. The mills and the smelter have been largely stripped of their equipment, the buildings are in various states of disrepair, and although the workings of the Seafoam are generally accessible, the Greyhound workings, except for a few hundred feet from the portal, have been rendered inaccessible by cave-ins.

The Mountain King Mine, located near Sheep Mountain, was the only property that was being worked while the field party was in the district. The mine has been known since the eighties. No accurate records of early production are available, but rumor and hearsay vary the amount from 80,000 to 500,000 dollars. It is also claimed that there was a mill on the property. According to the records available to the authors no important production can be ascribed to the mine until 1944, when the lessees, Fred and Earl Shirts, after bulldozing a road into the property, reopened the mine. They have been operating the property ever since. A combination of climatic and economic factors make it necessary for them to take only the highest grade ore, leaving or rejecting mill-grade ore.

The only active prospecting being carried on in the area was bulldozing by Fred and Earl Shirts on Lucinda Creek north of the Mountain King Mine. Prospecting was initiated by the find of rich float boulders of lead-zinc ore, similar to the ore being mined at Mountain King, along the upper reaches of the stream bed of Lucinda Creek. It was hoped that bulldozing would reveal another mineralized limestone block. Some of the trenches revealed limestone but in all cases it proved to be unmineralized. T. H. Kiilsgaard, DMEA geologist, expressed the opinion that the float along the creek was probably glacial debris plucked from the Mountain King vein, higher up on the ridge, and dropped along the stream bed.

ORE DEPOSITS

SEAFOAM MINE

The Seafoam property comprises 16 patented claims and is one of the best known mines in the district. The principal workings are on the Silver King claim where the lode is exposed for a length of about 600 feet and for a vertical range of 300 feet. The lode is on a shear zone that trends about N 25 degrees W and dips 60 degrees E. The granodiorite has been intricately intruded by quartz monzonite, and both are cut by a shear zone. Both granodiorite and quartz monzonite have been intruded by several small lamprophyre dikes, which are also cut by the shear zone.

Mineralogy

Quartz, pyrite, sphalerite, and galena fill openings that formed along the shear zone. Quartz and pyrite are the most abundant minerals. Galena and sphalerite could not be seen megascopically. Arsenopyrite and chalcopyrite were not found in the Seafoam workings, but they occur in similar deposits in the district. Assays from the Seafoam show a small amount of arsenic and copper as well as gold and silver. The gold and silver are probably carried in the pyrite, for no free gold was found.

Quartz was the first and most extensive mineral deposited. Movement along the faults fractured the quartz and provided openings that were filled by pyrite. The pyrite and quartz were fractured and the openings were filled by quartz, sphalerite, and galena in that order.

The sheared granitic rock has been silicified and sericitized, and along the lodes the country rock has been leached and is earthy in appearance. The alteration was effective four to five feet away from the deposit. The dark minerals were bleached and altered almost completely to sericite, and kaolin was locally developed. Quartz is the only mineral to escape alteration.

Control of Ore Deposition

The ore is located along a shear zone in the granitic rocks. It occurs as many small stringers and veinlets along the shear and is disseminated in the quartz. The form of the ore body is difficult to determine because the sulphides are so fine-grained and disseminated that little or no evidence of mineralization can be seen. Ross (1930a, p. 1) found that the lodes are made up of lenticular masses, generally arranged en echelon.

The controlling factor in the deposition of the ore appears to have been the shear zone. The shears are somewhat irregular and movement along them would form areas of lower pressure where the ore could be deposited. Postmineral faulting offsets the ore but movement has not been great enough to cause much difficulty in following the ore.

Genesis

The batholith, which is late Jurassic or early Cretaceous (?) in age is intruded by Miocene dikes. The dikes in turn are cut by the ore deposits. Thus, the deposits are Miocene or younger and were formed long after the emplacement of the granitic rocks and are probably not related to them. The results of the present investigation indicate that the lamprophyre dikes so closely related to the deposits in space, are probably related to them in time and origin.

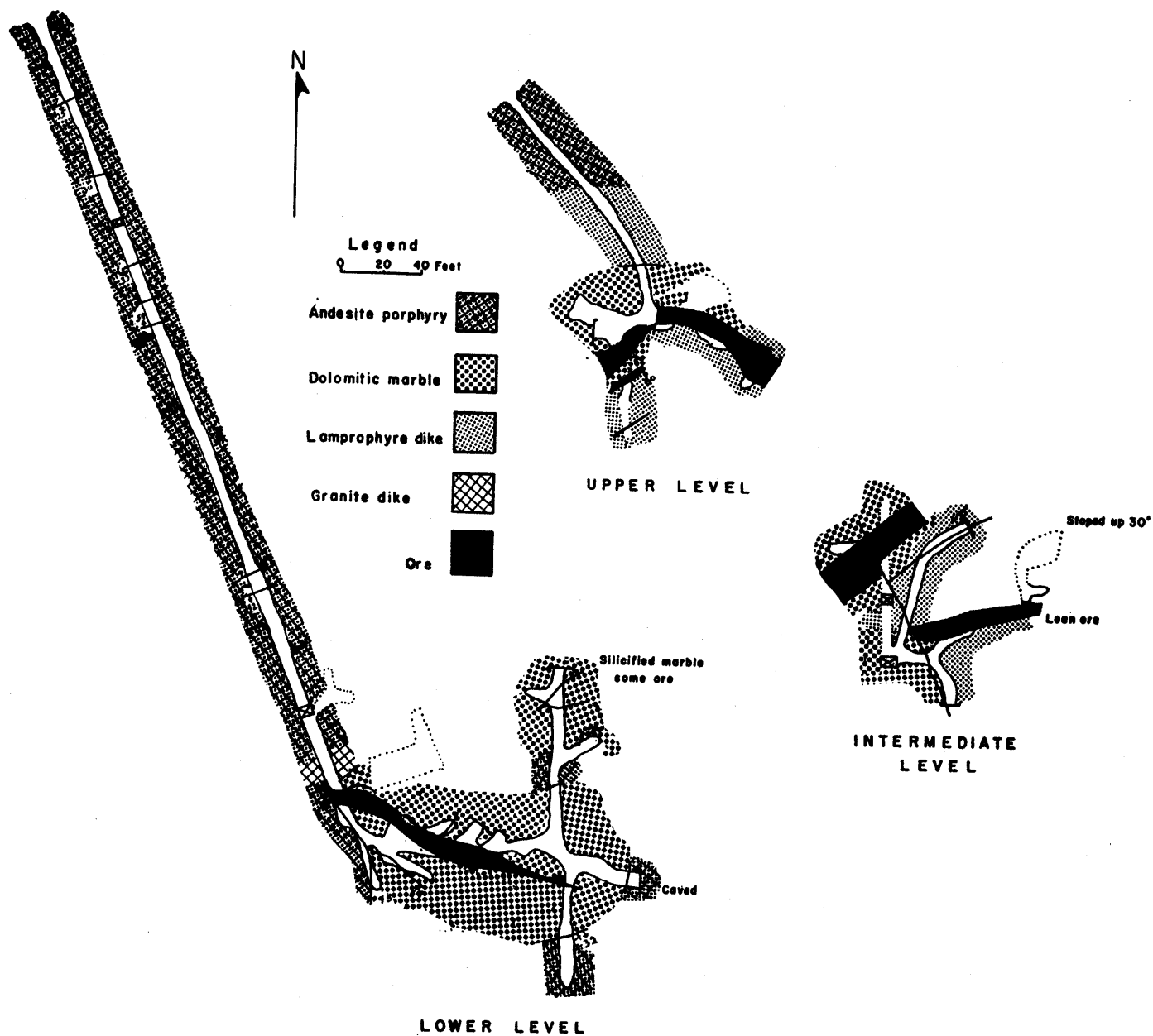
Evidence seems to indicate that the ore was deposited at moderate depths with moderate temperature and pressure prevailing.

MOUNTAIN KING MINE

The Mountain King Mine (See Plate 2), which was the only operating mine in the district, is typical of the replacement deposits. The deposit is in the largest body of impure dolomitic limestone in the district. the limestone has been intricately intruded by quartz monzonite, andesite, and other igneous bodies.

The workings consist of two irregular tunnels and an intermediate level. In the lower level the marble is intruded by andesite porphyry. In the upper level the ore appears to cut a lamprophyre dike that is intruded into the limestone and marble and porphyry. The dike has been altered, probably as a result of ore deposition. The ore is faulted several times by both pre-and post-mineralization faults. The pre-mineralization faults generally carry ore. The later faults do not offset the deposits enough to cause any difficulty in following the ore.

Plate 2



GEOLOGIC MAP OF THE MOUNTAIN KING MINE

Mineralogy

Quartz, galena, pyrite, sphalerite, and chalcopyrite have replaced the calcite of the limestone and marble close to or along the contacts with the intrusives. Quartz with a minor amount of calcite comprises the gangue. Silver and gold are carried in the galena.

Quartz was deposited first, and this initial quartz is the most abundant mineral in the deposit. Quartz deposition was followed by a small amount of pyrite deposition. Quartz, sphalerite, chalcopyrite, and galena were then deposited in that order. The later minerals replaced the earlier minerals and also the country rock along the fractures.

The dolomitic limestone and marble has been silicified but otherwise is only slightly affected by the deposition of the ore. The dark colored rock has been changed to a dense, gray siliceous rock that in some places is almost a tactite. Near the ore the porphyry has been silicified and the feldspar phenocrysts have been altered to sericite. The groundmass is only slightly affected. The lamprophyre dikes are locally bleached and softened. Small stringers of calcite were found in places where the lamprophyres were fractured.

The ore mined from the Mountain King Mine averages about 12 per cent lead, 10 per cent zinc, and 20 ounces of silver. Only the high grade ore is mined, however.

Control of Ore Deposition

The ore occurs only in the dolomitic marble and limestone, although the granitic rocks are faulted and fractured throughout the area. There is no evidence of mineralization in the nearby schist or quartzite. This indicates that the body of limestone was the controlling factor in the location of the ore deposits. The ore appears to be located mostly along or near the contacts with the intrusives. In some places good ore is localized along faults which cut the ore body in the marble.

In the upper level the vein appears to be dipping to the southwest at about 50 degrees, whereas in the lower level it seems to flatten out and is faulted against the andesite porphyry.

Genesis

The small lamprophyre dikes that are closely associated with the vein are Miocene intrusives and may be older than the vein. The ore is the same age as the cavity filling deposits and probably has the same origin. The ore was probably deposited at moderate depths and at moderate temperatures.

FUTURE PROSPECTS

Although several of the claims and properties appear to be good prospects, which would be worthy of further development under normal conditions, the present declining price of lead and zinc, and the fixed price of gold, coupled with increasing cost of labor, equipment and transportation, renders these claims unworthy of further development at the present time. In addition to the above factors, which plague the whole mining industry, properties in the Seafoam District are only accessible during the summer months; ore must be trucked about a hundred miles to the railhead at Ketchum; and there are no nearby milling facilities. These factors force the operators to ship only the highest grade ore, consequently to high-grade their properties. The above considerations serve to classify this area as a marginal district, the development of the full potentialities of which must be deferred until a more favorable economic situation obtains.

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