Pyrite Deposits At Horseshoe Bay Latouche Island Alaska

GEOLOGICAL SURVEY BULLETIN 1024-E

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By FRANCIS A. STEJER

MINERAL RESOURCES OF ALASKA

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A description of sulfide-bearing deposits in the southwestern part of Prince William Sound area

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By Francis A. Stejer

ABSTRACT

The sulfide-bearing zone at Horseshoe Bay, on Latouche Island in the southwest part of Prince William Sound, Alaska, was explored in the early days as a copper prospect, and although large bodies of copper-bearing pyritic "ore" were found on the Duchess, Duke, and Iron Mountain No. 4 claims, a mine was never brought into production. The property has been idle and deserted since November 1916. The deposits are currently (1955) of interest as a possible source for sulfur.

The mineral deposits occur on the northwest flank of a northeastward plunging anticlinorium in a thick sequence of marine sedimentary rocks which are considered to be part of the Orca Group of late Mesozoic(?) age. Replacement lenses of massive and disseminated sulfides, conforming to the stratification of the enclosing graywacke-type sedimentary rocks, occur in a mineralized zone whose maximum extent is not yet known because of limited mine development and exploratory work. As exposed in present workings, lenses of massive sulfides, ranging up to 60 feet in width and at least 490 feet in length, are apparently longer and wider at depth. This feature suggests that the present land surface may be near the top of the mineralized zone.

Pyrite is the principal sulfide mineral and at places makes up essentially 100 percent of the "ore." Other primary sulfide minerals are chalcopyrite, cubanite, sphalerite, pyrrhotite, arsenopyrite, and galena. Gold and silver are present in small amounts, but the form in which these metals occur is not known. The paragenetic sequence is pyrite, arsenopyrite, sphalerite, cubanite, chalcopyrite, and galena. Pyrrhotite was not present in the polished specimens examined but from field relationships appears to have been deposited at about the same time as the sphalerite.

Spectrographic analyses of selected specimens did not reveal economically important quantities of minor or trace elements.

INTRODUCTION

Horseshoe Bay (see fig. 11) is in the southwest part of Prince William Sound at latitude 60°01′ N and longitude 147°57′ W. It is on the west side of Latouche Island about 2 miles southwest of the old mining camp of Latouche. Pyrite deposits crop out about one-half mile from the head of the bay (see fig. 12) and in the lower part of a broad basinlike valley at altitudes between 125 feet and 650 feet. The valley, which is a mile wide and 2 miles long, is open to the sea on the

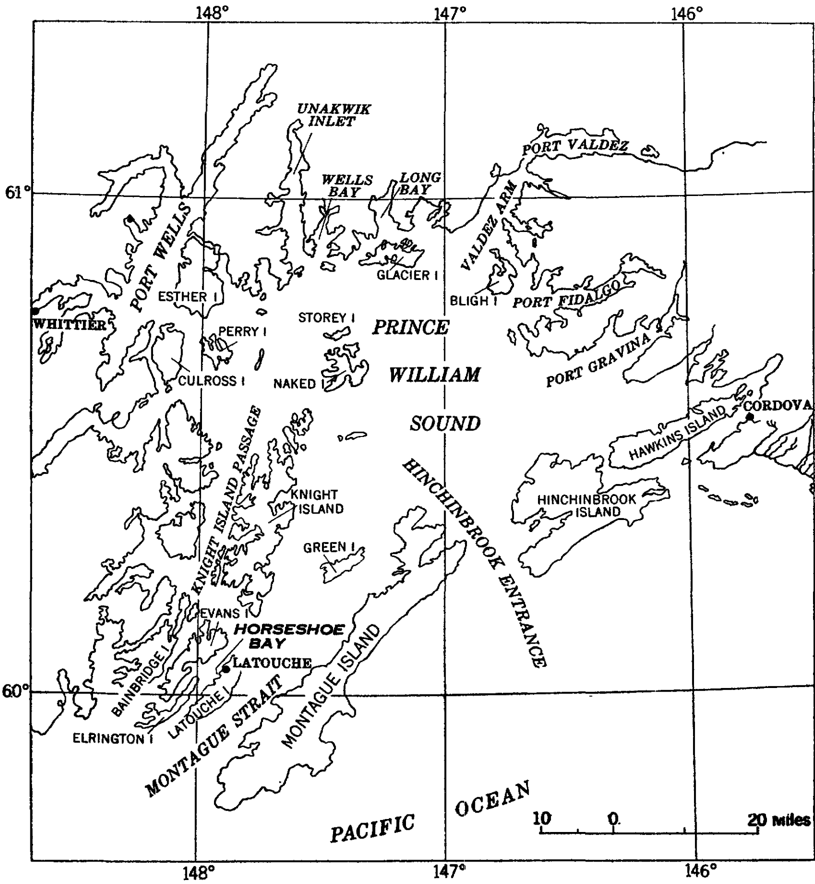

FIGURE 11.—Index map of the Prince William Sound area, Alaska, showing location of Horseshoe Bay.

northwest side and is bordered on the northeast, southeast and southwest by a high sharp-crested ridge that reaches a maximum altitude of 2,255 feet. The area can easily be reached by small boat or float plane from Cordova or other towns in this part of Alaska. The property at Horseshoe Bay has been idle and deserted since November of 1916, and all of the surface improvements are in ruins.

The climate is cool-temperate and wet and a heavy growth of vegetation mantles much of the area. The annual mean temperature is about 42° F with the summer highs in the low eighties and the winter lows near zero. The annual precipitation is about 184 inches. The annual snowfall is about 153 inches. (Climatic Atlas for Alaska, Sept. 1943). Muskeg covers much of the lowland area along the coast and in the valley bottom. Alder, willow, berry-bushes, and other shrubs form dense thickets at many places along the streams and on the lower hill slopes. The higher mountain slopes commonly are well covered by a thick mat of heather, alpine flowers, grasses, and herbs.

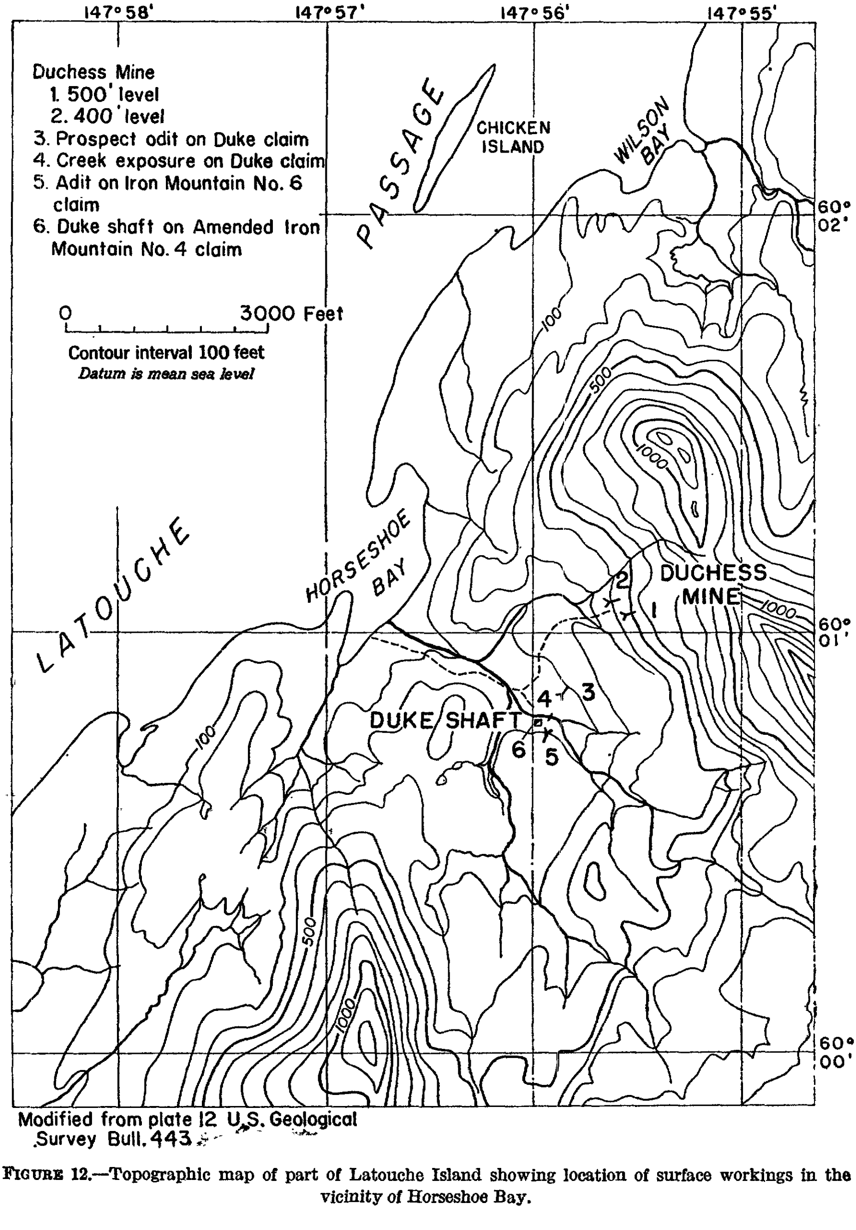

FIGURE 12.—Topographic map of part of Latouche Island showing location of surface workings in the vicinity of Horseshoe Bay.

Spruce and hemlock grow to moderate size along the coast and the lower courses of the streams.

The present investigation was undertaken in 1952 when, because of a world shortage of sulfur, it was deemed advisable to learn more about deposits of pyrite that could be considered potential sources for sulfur. The deposits at Horseshoe Bay were selected for study because Latouche Island is known to be well mineralized and its geology has been more thoroughly studied than any adjacent area. The deposits at Horseshoe Bay are fairly large and very similar to the deposits at the famous Beatson mine, 2 miles northeast of Horseshoe Bay. The Beatson mine was the largest copper producer in Prince William Sound area prior to its shutdown in 1934.

The present report is based largely upon field studies made during July and August 1952 when the author assisted by R. O. Linscott and R. M. Corn, geologic field assistants, studied the geology of Latouche Island and made detailed examinations of the accessible mine workings at Horseshoe Bay.

During the course of the field work the U. S. Forest Service helped the Geological Survey in many ways particularly by loaning equipment and providing transportation. M. F. Butler, president, RADCO Incorporated, has been very helpful during the preparation of this report by furnishing valuable information about inaccessible parts of mine workings.

GEOLOGY

The rocks at Horseshoe Bay are generally considered to be a part of the Orca group of late Mesozoic (?) age and in this vicinity consist of a thick marine sequence of interbedded graywacke and slate with occasional beds of conglomerate, limestone, and chert. The beds range in thickness from a fraction of an inch to as much as 40 feet, and the color is commonly a shade of medium light to medium dark gray. The beds generally are lacking in distinctive features by which they may be recognized and are difficult to correlate.

No attempt has been made in this report to distinguish by name the many gradational phases that exist among the sedimentary rocks that make up this sequence, and the terms such as graywacke and slate are used in the broadest sense.

The major part of the sequence consists of graywacke type sedimentary rocks which are typically hard, compact, dull-gray rocks. These rocks are composed largely of grains of quartz and feldspar and detritus from fine-grained rocks such as chert, quartzite, and argillite or slate in a matrix of finely comminuted rock and mineral fragments with calcareous or siliceous or sometimes ferruginous cements. The rocks have an arenaceous texture in which the grains commonly range in size from about 1.0 mm (coarse sand size) to less than 0.062 mm (clay size). Some of the graywacke units in the Orca group approach quartzite in texture, structure, and composition, and other units because of abundant feldspar grains perhaps could be termed arkoses. A common type of calcareous graywacke, such as occurs in Sleepy Bay at the northeast end of Latouche Island, effervesces freely in cold dilute hydrochloric acid, and is seen under the microscope to consist of about 25 percent quartz, 10 percent feldspar, 12 percent siltstone or argillite and chert fragments, 3 percent muscovite mica, and 50 percent carbonate matrix of which about 30 percent is finely comminuted rock and mineral fragments. Several graywacke beds in this vicinity contain zones several inches thick that are essentially limestone. A siliceous type of graywacke from the southwest end of the island, viewed under the microscope, was seen to consist of about 40 percent quartz, 10 percent feldspar, 15 percent chert, quartzite and slate fragments, 10 percent muscovite mica, and 25 percent siliceous cement with which there is a small amount of finely comminuted rock and mineral detritus and sericite mica. Some of the slate beds are calcareous, but typically the slate is hard, compact, and siliceous. Beds of light-gray siliceous limestone and a little chert are present in the sedimentary sequence at the Duke shaft (Johnson, 1918, p. 207). There are two distinctive kinds of conglomerate in the area. One consists of well-rounded pebbles and cobbles of sedimentary and igneous rocks cemented by a matrix of fine-grained medium-dark-gray graywacke. The other consists of scattered angular to subangular pieces of slaty rock imbedded in a matrix of graywacke. The fragments are generally about one-half inch in thickness and range in length from less than 1 inch to about 6 inches. Many of the graywacke beds contain thin zones of this intraformational conglomerate.

Igneous rocks have not been found in the vicinity of the mineral deposits at Horseshoe Bay, and the nearest of the three known occurrences on Latouche Island is at the Beatson mine where Bateman (1924, p. 346) reported an "unusual lamprophyre dike." Bateman does not discuss the petrology of this dike nor does he give its dimensions. The other igneous bodies on the island consist of a small mass of serpentinized diallage gabbro on the northeast shore (Grant and Higgins, 1910, p. 49–50) and a few small mafic dikes on the southeast shore. The gabbro and the mafic dikes appear to be very closely related. They have essentially the same composition, and the principal difference is that the dike rock is finer grained, is possibly more thoroughly serpentinized, and does not contain sulfide minerals as does the larger gabbro body. There is no apparent connection between any of the known bodies of igneous rocks and the mineralization at Horseshoe Bay.

Unconsolidated deposits of Quaternary age overlie much of the bedrock. Glacial deposits mantle large parts of the valley floor, alluvium occurs in patches along the streams, and talus forms thick blankets along the lower slopes of the high ridge that borders the valley.

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STRUCTURE

The rocks of the area have been strongly folded and faulted, and the dominant structural feature is a large northeastward-plunging anticlinorium. The axial zone of the anticlinorium is located somewhere in Montague Strait, and Latouche Island is on the northwest limb of the fold.

At Horseshoe Bay the strike of the bedding is commonly about N. 30° E., and dips range from 55° to 70° NW. This general attitude prevails on Latouche Island and the islands to the west. On Montague Island the strike of the bedding is similar, but the dips are steep to the southeast.

On Latouche Island there are many folds of moderate size (Moffit, 1954, p. 263–264; Grant and Higgins, 1910, p. 29–30) that reflect the major anticlinorial structure. At Horseshoe Bay, however, the beds have a monoclinal dip to the northwest, and the local differences in strike and dip that have been noted near the pyrite deposits represent minor open flexures, and nowhere within the mineralized area has evidence of complete folds been found. In some areas of the slate at Horseshoe Bay, especially in the bed that forms the footwall of the ore zone, a minor crenulation is conspicuous. The attitude of the axial planes of these tiny folds is closely parallel to that of the bedding, and they plunge northward at about 15°.

The structural pattern is complicated by many faults which in general are closely parallel to the bedding. A large part of the fault movement has taken place along slate beds that separate the stronger graywacke units, and the primary faults are reverse faults along which the northwest or hanging-wall side has moved upward relative to the southeast or footwall side. At a few places on the island vertical displacements of from 1 to 10 feet have been measured. Along most of the faults, however, the maximum displacement is unknown. It is difficult to trace even the strongest of the fault zones between outcrops with any degree of assurance because of the heavy cover of soil and vegetation and the general lack of topographic expression of the fault zones. There appears, however, to be one persistent zone of faulting on the west side of Latouche Island that has been traced by Moffit (1954, p. 256–266) from Latouche southward to Pleasant Bay, a distance of 9 miles. This is not a simple fault but includes minor fractures that may differ in strike and dip from the strike and dip of the main fault zone. The amount of displacement along this fault has not been determined.

Several sets of joints are well developed throughout the area, some of which form conjugate systems that can be related to the major structure. This is particularly well illustrated by a very conspicuous set that strikes N. 45° W. The joints of this set are vertical and spaced at about 100 foot intervals.

Much of the slate has a well-developed cleavage. The strike is parallel to the major northeasterly structural trend. The dip ranges from 65° to 80° NW.

PYRITE DEPOSITS

HISTORY AND DEVELOPMENT

Initial claim locations are said to have been made at Horseshoe Bay in 1898. Soon after the sulfide-bearing bodies were discovered, the Reynolds-Alaska Development Company began to explore the deposits; and although large bodies of copper-bearing pyritic ore were found on the Duchess, Duke, and Iron Mountain No. 4 claims, a mine was never brought into production; and all work ceased in November of 1916. The property has been idle and deserted since that date, and all of the surface improvements are in ruins. In 1940 the Reynolds-Alaska Development Company was reorganized, and its successor, RADCO Incorporated, is the present owner of the Iron Mountain group of 16 patented claims. (*See* pl. 12). The early interest in the property was in the copper content of the deposits. Today the deposits are of interest as a potential source of sulfur.

During the early period of exploration the mineralized zone was examined by geologists of the U. S. Geological Survey in 1905, 1909, and 1916, and brief accounts of the geology have been published by U. S. Grant (1906, p. 85), U. S. Grant and D. F. Higgins (1910, pp. 66–67), and B. L. Johnson (1918, pp. 206–208). At the time of Grant's first examination in 1905, there were a 50-foot adit on the Blue Fox claim (Iron Mountain No. 6 claim) and a branching adit 300 feet in length on the Duchess claim. In 1907 a shaft was put down on the property. In 1908 this shaft was reported to be 100 feet deep with a crosscut at its bottom to an ore body. An average force of 10 men was employed during 1916; and, when Johnson visited Horseshoe Bay, the shaft had been pumped out; and the mine workings at the shaft and on the Duchess claim had been extended to about their present extent. At this time, mine development consisted of the 110-foot shaft with about 356 feet of crosscut and drift, about 3,400 feet of crosscut and drift from 5 adits, and a small amount of surface trenching. Small shipments of ore are reported to have been sent to the smelter at Tacoma, Wash., but neither RADCO Incorporated nor the smelter have any record of them, and the value of the shipments is not known

DESCRIPTION

The sulfide-bearing bodies at Horseshoe Bay are replacement deposits and consist of tabular lenses of massive and disseminated sulfides in a slate-graywacke country rock. The deposits have been formed by the partial to complete replacement of a unit of the sedimentary sequence by sulfide minerals, and the lenses of ore conform to the stratification of the enclosing rocks. A thick bed of slate forms the footwall of the mineralized zone and is believed to have been a controlling factor in localizing the zone of sulfide deposition. The mineralogy is relatively simple. The primary sulfides are pyrite, chalcopyrite, cubanite, sphalerite, pyrrhotite, arsenopyrite, and galena. Assays show that small amounts of silver and gold are also present, but the form in which these metals occur has not been determined. The sulfide-bearing bodies have been only slightly oxidized since the comparatively recent glaciation of the area, and only small amounts of secondary minerals are present. The following species have been recognized: "Limonite," melanterite (?), chalcanthite (?), azurite, malachite, covellite, and native copper. The paragenetic sequence as determined from polished specimens is pyrite, arsenopyrite, sphalerite, cubanite, chalcopyrite, and galena. Pyrrhotite was not present in the specimens examined, but from field relationships it appears to have been deposited at about the same time as the sphalerite. The hydrothermal gangue minerals are calcite and quartz and were the last minerals to be deposited.

Pyrite is by far the most abundant mineral, and in many places the massive sulfide is essentially pure pyrite. The copper-bearing minerals, cubanite and chalcopyrite, are about equally abundant and commonly are very intricately intergrown. Small amounts of sphalerite and tiny grains of arsenopyrite and galena are widely distributed throughout the sulfide-bearing bodies. The mineral aggregate commonly is very fine grained. Most of the mineral grains are less than 0.10 millimeter in diameter, although, in some lenses, the grains of pyrite may be as large as 1.0 millimeter in diameter. There is practically no fracturing or brecciation of the mineral grains, and all textural and structural relationships indicate continuous and uninterrupted deposition of the sulfide minerals.

Sixteen samples taken from the 400-foot level on the Duchess claim by engineers of the U. S. Bureau of Mines[1] were found by assay to contain copper, trace to 1.48 percent; zinc, 0.10 to 0.80 percent; lead, trace to 0.21 percent; gold, trace to 0.02 ounce per ton; and silver, 0.40 to 0.70 ounce per ton. Five of these samples were cut from massive sulfide zones and eleven from zones of disseminated sulfides.

Spectrographic analyses of samples of the massive sulfides from the Duchess claim were made in the Washington, D. C., laboratories of the Geological Survey. The results are listed in the accompanying table.

[1] Webber, B. S., and Rutledge, F. A., May 1944, Horseshoe Bay Deposits, Latouche Island, Prince William Sound: U. S. Bureau of Mines Unpublished War Minerals Report.

Spectrographic analysis of eight ore samples from the Duchess claim, Latouche Island, Alaska

[Janet D. Fletcher, analyst. Looked for but not found: Au, Pt, Mo, W, Ge, Sb, Cd, In, Tl, Ni, V, Sc, Y, Yb, La, Zr, Th, Nb, Ta, U, P, B]

Sample	Percent (X equals a significant figure, 1 through 9)															
	Cu	Ag	Sn	Bi	Pb	As	Zn	Mn	Co	Fe	Ga	Cr	Ti	Ca	Sr	Ba	Mg
52–2241S	0.X	0.00X	0.00X	0.00X	0.X	0.X	X	0.00X	0.00X	X0	0	0	0.00X	0.000X	0	0.00X	0.0X
52–2242S	.0X	.00X	0	0	.X	.X	.0X	.00X	0	X0	0	0	0	.0X	0	.00X	.0X
52–2243S	.X	.00X	.0X	0	.X	.X	X	.0X	.00X	X0	0	0	.000X	.0X	0	.00X	.0X
52–2244S	.X	.00X	.00X	0	.X	.X	X	.00X	.00X	X0	0	0	.0X	.0X	0	.0X	.X
52–2245S	.X	.00X	.00X	0	.X	.0X	X	.0X	.0X	X0	.00X	.00X	.0X	X	.00X	.000X	.X
52–2246S	.0X	.00X	.00X	0	.X	.X	.0X	.00X	0	X0	0	0	.000X	.000X	0	.000X	.0X
52–2247S	X	.00X	.00X	0	.X	.X	X	.0X	.00X	X0	.00X	.000X	.0X	.00X	0	.0X	.X
52–2248S	.0X	.00X	0	0	.X	.0X	0	.00X	.00X	X0	0	0	.0X	.000X	0	.00X	.0X

Sulfide-bearing bodies have been found on the Duchess, Duke and Iron Mountain No. 6 claims, and, although mine development is inadequate to prove either their size or relationship to one another, they appear to outline a mineralized zone that is at least 3,100 feet long.

DUCHESS CLAIM

The mineralized zone on the Duchess claim trends N. 30° E., parallel to the bedding of the slate-graywacke country rock, and dips steeply to the northwest. Mine development consists of two major levels whose portals are at altitudes of 380 feet and 470 feet (see pl. 12) and a 10-foot prospect adit at an altitude of 630 feet. The underground workings, which aggregate about 3,000 feet of drift and crosscut, explore the mineralized zone for a distance of about 500 feet along its strike.

Lenses of massive sulfide occur throughout the mine (see pl. 12) and range in width from a few inches to as much as 60 feet and in length from less than one foot to at least 490 feet. However, the maximum size of these sulfide-bearing bodies is not known as none of the workings reach the limits of the mineralized zone. Zones of disseminated sulfides also occur throughout the mine. The usual mode of occurrence is as halos surrounding lenses of massive sulfide. At a few places, however, (see pl. 12 DN 501 and XCW 560) zones of disseminated sulfides are present that have no visible connection with massive sulfide bodies. The size of these bodies of disseminated sulfide cannot be determined at this time because the boundaries of what is commercial ore must be determined by assay and the amount of material that will be classed as ore will depend upon the many economic factors that prevail at the time of mining.

The country rock is a sequence of interbedded slate and graywacke, and the thick bed of slate that forms the footwall of the mineralized zone apparently guided the course of the mineralizing solutions by effectively damming their migration and dispersion in that direction. Because of this channeling effect of the slate, mineralization is strongest on the footwall side of the mineralized zone.

The boundaries between bodies of massive and disseminated sulfide are almost invariably sharp and distinct, and the contact is commonly marked by a paper-thin claylike selvage. On the footwall side of the massive sulfide lenses, this selvage marks the boundary between solid sulfide and disseminated sulfide. On the hanging wall side, however, the transition from solid sulfide to disseminated sulfide is not so abrupt, and at many places the outer 3 or 4 inches of the massive sulfide lenses contain small residuals of unreplaced country rock.

The boundaries between disseminated sulfides and barren country rock are gradational. On the footwall side of the massive sulfide lenses, the zone of disseminated sulfides is narrow, and the transition from massive sulfide to barren country rock commonly takes place within 2 or 3 feet of the massive sulfide-disseminated sulfide contact. On the hanging wall side of the massive sulfide lenses, the mineralizing solutions migrated much farther into the country rock but in a very erratic manner; and although geologic control is poor because of the lack of mine openings, it appears that the zone in which disseminated sulfide mineralization occurs may be as much as 100 feet wide.

The nature of the rock that has been replaced by the sulfide minerals is obscure, especially in the areas that are now occupied by massive sulfides. Because of the texture and structure of the massive sulfides, the author believes that the rock was originally thinly bedded graywacke-type sandstone and that the course of mineralization was guided by the bedding planes, the primary intergranular permeability of the sediments, and theii probable original calcareous and feldspathic composition. In the disseminated sulfide zones which contain a considerable volume of unreplaced slaty country rock, the author believes that the mineralizing solutions preferentially replaced the coarser grained "graywackish" sediments first and then the slaty sediments as mineralization continued.

For the most part the unreplaced country rock is slate or graywacke, but not without exception for at a few places in the areas of disseminated sulfides, notably in drift DN 503 (see pl. 12), there is a small amount of a very fine-grained dark-gray chert. A thin section of this rock shows it to have been an original member of the sedimentary sequence.

Within and near the zone of mineralization the country rock has been altered by the mineralizing solutions and now shows varying degrees of silicification, sericitization, and kaolinization. The massive sulfide lenses contain an occasional pod or lens of intensely altered and partially replaced country rock which is soft and friable and which consists mainly of sulfide minerals loosely cemented by sericite and clay. At many places the massive sulfide bodies are bordered by narrow zones of strongly bleached and whitened rock that contains large amounts of sericite and clay.

The problem of wall-rock alteration has not been studied thoroughly, but it appears that sericite is the principal mineral in the zone of most intense alteration within and adjacent to the massive sulfide bodies. The zone of sericite alteration is followed, with considerable overlap in many places, by an intermediate zone of alteration in which the rock is argillized and finally, and again with considerable overlap in many places, there is an outer zone in which the rock is silicified. In the zones of disseminated sulfides the country rock commonly is strongly silicified although in a few areas where alteration was relatively strong the country rock is strongly bleached and apparently contains a large percentage of argillic alteration products. In other areas of disseminated sulfide mineralization the only apparent alteration is a slight silvery whitening of residual slate fragments.

The mineralized zone is relatively free of faults, and none of the massive sulfide lenses are cut off or displaced. At many places, massive sulfide bodies are bordered by narrow zones of highly bleached and altered rock that at places appear to be somewhat mashed and sheared. Some of these zones may represent incipient faults, but the amount of movement along them since mineralization is believed to have been insignificant. Faults, which appear to be of the reverse type, are present in both the hanging wall and footwall of the mineralized zones; but because of the scarcity of exposures, knowledge of them is limited. Most of them strike N. 20°–40° E. and dip 50°–60° W. A few, however, deviate from this pattern and dip steeply to the east.

A prominent fault zone 70 to 100 feet west of the massive sulfide lenses is fairly well defined near the portal of the 400-foot level and in crosscut XCW 555 and drifts DN 501 and DN 504 on the 500-foot level. It trends parallel to the bedding and dips 60°–80° W. At most places the fault zone consists of a number of fault surfaces, but in drift DN 501 it is a narrow well-defined break with as much as 1 foot of gouge and breccia. A considerable volume of water enters the workings along this zone, and most of the mine openings along it require timber support. It has been suggested that the fault zone at the Duchess mine may be a component of the fault zone that Moffit traced from Latouche southward to Pleasant Bay. This relationship remains to be proved, but if correct the fault may have had considerable influence on the mineralization at Horseshoe Bay, since at Latouche the Bonanza fault had an important influence on ore deposition and mining operations (Moffit, 1954, p. 298–299) at the Beatson mine. At the present stage of development at Horseshoe Bay, however, there is no apparent connection between the fault zone and the mineralization or between the fault zone at the Duchess and the fault zone at Latouche.

Joints are present in both the country rock and the sulfide bodies. They are commonly spaced at intervals of several feet, and the joints that existed prior to mineralization apparently have had very little influence on ore deposition. At a few places on the hanging wall side of the mineralized zone, veinlets of massive sulfide 1 to 2 inches wide extend a few feet into the country rock along preore joint surfaces. However, most of the joints transect both the country rock and the sulfide bodies and are clearly the result of stresses applied subsequent to mineralization.

400-foot level.—Exploration on this level consists of a 310-foot adit crosscut and a 510-foot winding drift along the mineralized zone.

(See pl. 12.) Eight crosscuts from the drift total 403 feet in length. The mineralized zone is considered tentatively to contain two lenses of massive sulfides. One lens is almost continuously exposed along the footwall side of the drift for 490 feet and ranges in thickness from 5.8 feet to 24 feet. The second lens is exposed only in crosscut No. 208. This lens, which is 60 feet wide, may be a separate body, or it may be an apophysis from the lens exposed in the main drift.

Four samples taken from crosscut No. 203 by U. S. Bureau of Mines engineers [2] gave copper assays of 1.44, 1.00, 0.59, and 0.68 percent with about 0.40 percent of zinc and 0.6 ounce of silver per ton.

500-foot level.—Two adits give access to the workings on this level. (See pl. 12.) In 1952 the portal of the main entryway was caved, and water ponded by the fallen debris had flooded the workings as far as crosscut XCW 558. In those parts of the level covered by the water, a thick deposit of "iron-mud" had accumulated on the sill and the walls.

The sulfide-bearing zone on this level has been explored for a distance along its strike of 505 feet by nearly 1,800 feet of drifts and crosscuts. Three short inclined raises total about 75 feet and there is one small stope.

This zone contains a number of lenses of massive sulfides. The largest lens is exposed in drifts DN 505 and DS 506. It is 17 feet wide at one point and is 150 feet long. A small tonnage of sulfides is said to have been mined from the stope and shipped to the Tacoma, Wash., smelter, but neither RADCO Incorporated nor the smelter has any record of the shipment.

DUKE, IRON MOUNTAIN NO. 6, AND AMENDED IRON MOUNTAIN NO. 4 CLAIMS

The zone of sulfide mineralization on these three claims is explored by a 110-foot shaft, two short adits, and surface trenches. The collar of the shaft is at an altitude of 125 feet. The other workings are at slightly higher altitudes. Massive sulfide bodies similar to those on the Duchess claim are present at four different places, and although there is no proved connection between them, they may lie along the same mineralized zone. Individual lenses range in thickness from 4 feet to 27 feet, and the maximum proved length along the strike is 151 feet.

Prospect adit No. 1.—The portal of this short exploratory adit is about 450 feet N. 45° E. from corner post no. 4 of the Duke claim and is at an altitude of about 150 feet. The portal was caved and the adit flooded in 1952, but the water was lowered to wading depth, and a tape and compass survey was made of the workings. (See fig. 13.) Where intersected by the workings the mineralized zone is about 4 feet

[2] Webber, B. S., and Rutledge, F. A., May 1944, Horseshoe Bay Deposits, Latouche Island, Prince William Sound: U. S. Bureau of Mines Unpublished War Minerals Report.

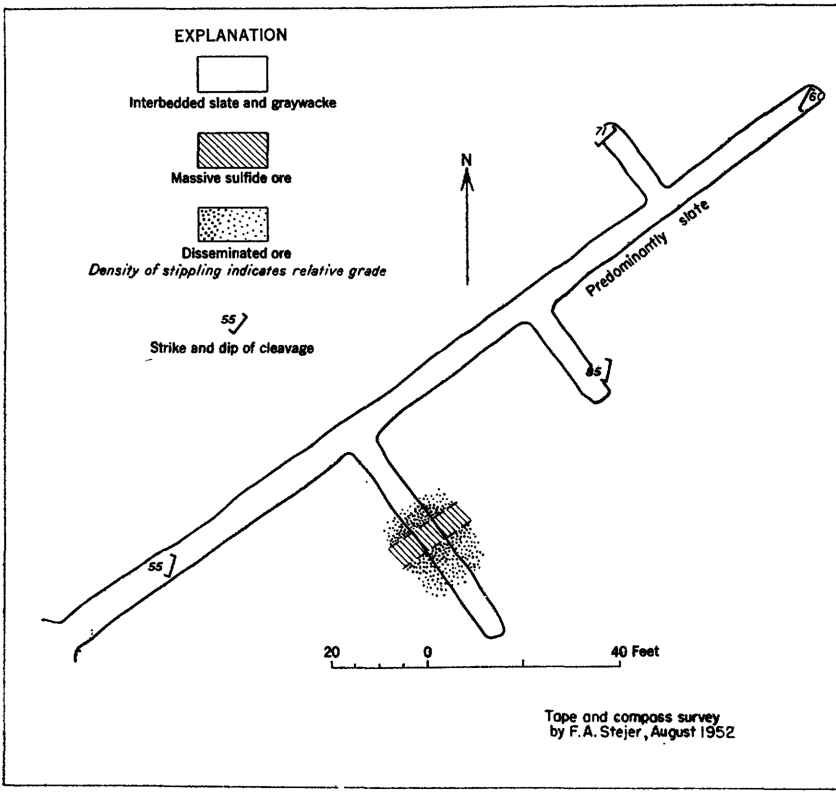

FIGURE 13.—Sketch map of prospect adit No. 1, Duke claim.

wide and contains a considerable volume of massive sulfides. The country rock is mostly slate. A few thin beds of graywacke are present.

Creek exposure.—A lens of massive sulfides crops out in the bed of the creek 225 feet N. 83° E. of the Duke shaft. The lens is about 7 feet wide and strikes N. 25° E. and dips steeply to the west.

Duke shaft.—In 1952 the shaft was full of water, so the following description has been compiled from earlier reports. (See fig. 14.) The 110-foot 2-compartment shaft is on the hanging wall side of the mineralized zone. At a depth of 100 feet a crosscut was driven 205 feet eastward into the footwall. A hundred feet from the shaft a lens of massive sulfides 27 feet wide was intersected. On the footwall side of the lens, drifts were driven 91 feet north and 60 feet south along the sulfide body. In addition to graywacke and slate, the sedimentary sequence also contains some beds of light-gray siliceous limestone, and a little chert. The bedding strikes N. 16°–38° E., and the dip is mostly to the west, but ranges from 55° W. to 83° E. There is some faulting more or less parallel to the bedding. One gouge-filled fault, cut by the lower workings, strikes N. 30° E. and dips 50° W.

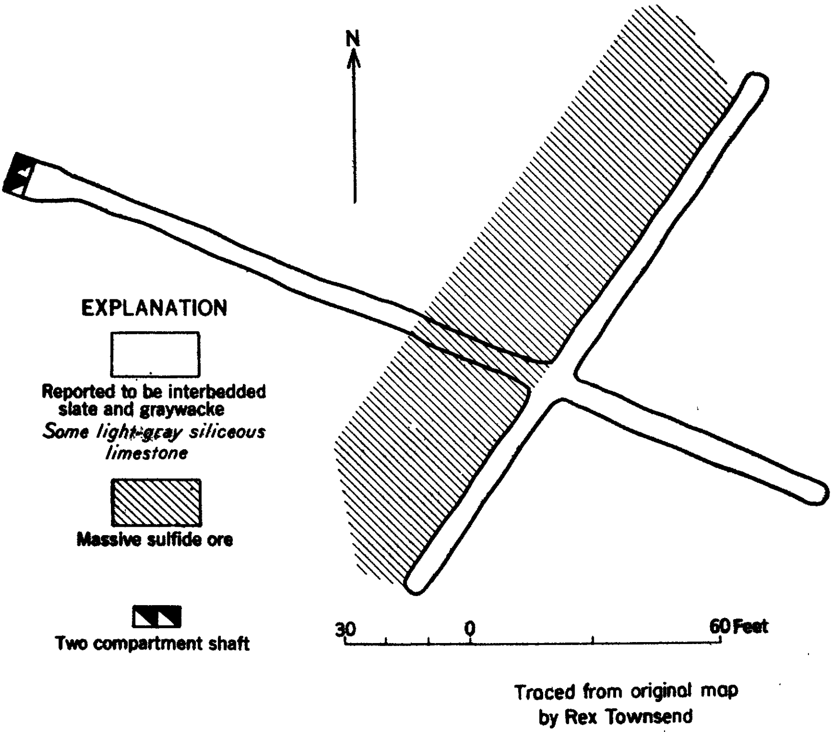

FIGURE 14.—Sketch map of Duke shaft, Amended Iron Mountain No. 4 claim.

Prospect adit No. 2.—Near the north end line of the Iron Mountain No. 6 claim, an adit has been driven southward along a lens of massive sulfides. This adit is caved, but according to Johnson (1918, p. 208) it was driven for 60 feet along a 5-foot sulfide lens that strikes N. 20°–45° E. and dips 60°–75° W. An outcrop of ore at the caved portal indicates a lens of massive sulfides similar to the other sulfide-bearing bodies at Horseshoe Bay.

ECONOMIC CONSIDERATIONS

The zone geologically favorable for the occurrence of ore on the Iron Mountain group of claims (see pl. 12) is at least 3,100 feet long. Exploration work to date has outlined two ore shoots, and although the mine workings are not interconnected and no ore has been blocked out, it seems reasonable to assume that a considerable tonnage of inferred ore is present along the mineralized zone.

The Duchess zone at the north end of the favorable area has a proved length along the strike of about 500 feet, and more important, the mine workings terminate in the sulfide body and have not delimited the ore shoot either in length or depth.

The Duke zone at the south end of the favorable area has a proved length along the strike of about 500 feet. Here, as at the Duchess, none of the mine workings reach the limits of the ore shoot.

The Duchess and the Duke zones are separated by a heavily mantled and unprospected interval 2,100 feet long. The greatest potential for ore reserves on the Iron Mountain group of claims may lie along this unexplored interval.

The lenses of massive sulfides are wider and longer at depth than they are at the surface, which suggests that the present land surface may be near the top of the ore shoots. If this is true the lenses of sulfides may extend a considerable distance below the 400-foot level at the Duchess and also a considerable distance below the crosscut level at the Duke.

LITERATURE CITED

Bateman, A. M., 1924, Geology of the Beatson Mine, Alaska: Econ. Geol. v. 19, p. 338–368.

Grant, U. S., 1906, Copper and other Mineral Resources of Prince William Sound: U. S. Geol. Survey Bull. 284.

Grant, U. S., and Higgins, D. F., 1910, Reconnaissance of the Geology and Mineral Resources of Prince William Sound: U. S. Geol. Survey Bull. 443.

Johnson, B. L., 1918, Copper deposits of Latouche and Knight Island districts: U. S. Geol. Survey Bull. 662.

Moffit, F. H., 1954, Geology of the Prince William Sound Region, Alaska: U. S. Geol. Survey Bull. 989–E.

U. S. Weather Bureau, 1943, Climatic Atlas for Alaska, Rpt. 444.

U. S. GOVERNMENT PRINTING OFFICE: 1956