GALENA-BEARING GOSSANS, BEAVER CREEK, RUBY DISTRICT, YUKON REGION, WEST-CENTRAL ALASKA

by Bruce I. Thomas

* open-file report

UNITED STATES DEPARTMENT OF THE INTERIOR
Stewart L. Udall, Secretary

BUREAU OF MINES
Marling J. Ankeny, Director

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by

Bruce I. Thomas[1/]

ABSTRACT

Galena-bearing gossans at Beaver Creek, 14 miles south of the town of Ruby, west-central Alaska, are roughly tabular bodies of irregular thickness composed of limonite and goethite containing galena, quartz, sparse anglesite and cerussite, and inclusions of schist. They occur in two zones, 800 feet apart, enclosed by intensely jointed and fractured schist and phyllite containing siliceous and calcareous bands. The size and shape of the deposits are controlled by premineral faults which nearly parallel bedding and schistosity. Postmineral faults disrupt continuity of the eastern zone. Both deposits strike N 35° E and dip steeply to the northwest. Gossan in the eastern zone has an indicated trace length of 500 feet and rages from ½ to 6 feet wide. The largest concentration of metal along this zone was indicated by a channel sample 2.85 feet long containing, by analysis, 16.13 troy ounces of silver per ton, 15.3 percent lead, 0.89 percent zinc, 0.02 percent copper, and a trace of gold. In the western zone, the gossan is 3 to 10 feet wide, and the trace is about 300 feet long; the largest

1/ Mine examination and exploration engineer, Area VIII Mineral Resource Office, Bureau of Mines, Juneau, Alaska.

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concentration of metal was indicated by a channel sample 2.6 feet long containing by analysis, 1.47 troy ounces of silver per ton, 8.7 percent lead, 0.08 percent zinc, and a trace of gold. Gossans are covered by perennially frozen silt and a mixture of silt and angular pieces of bedrock from 4 to more than 20 feet deep.

The Bureau of Mines investigated the galena-bearing gossans during the summer of 1960; work included bulldozer trenching, sampling, and topographic and geologic mapping. About 3,100 linear feet of trench were excavated at 11 trenching sites; 41 channel samples were cut from the gossan, and 6 grab samples were taken from float.

INTRODUCTION

The investigation of the galena-bearing gossans in the Ruby district, Yukon region, west-central Alaska, is part of the Bureau of Mines continuing program to encourage development and conservation of the nation's mineral resources. During the past 50 years, rich gold placer deposits, with sporadic concentrations of stream tin, have been mined throughout the district. Most work was on the high-grade placers; the low-grade silver-lead lodes, being less attractive, were considered to be of no potential value. Silver-lead lodes at Beaver Creek were prospected during the early 1920's, but only fragmentary information about the size, tenor, and geologic characteristics of the deposits were preserved for reference. From June to early September 1960 the Bureau of Mines examined the silver-lead-bearing gossans at Beaver Creek. Work consisted of bulldozer trenching, sampling, and mapping. Self-potential

and resistivity geophysical surveys were attempted but produced no interpretable results in the perennially frozen ground.

ACKNOWLEDGMENTS

The kind cooperation of the property owners, William Ahrens, Atillio Kenet, and John May, all of Ruby, in facilitating Bureau of Mines work at Beaver Creek is gratefully acknowledged.

Acknowledgment also is made to Lester Sweetser, Mrs. Mayme Olson, Jack Koski, Louis Philback, and John Walters, all of Ruby, for their helpfulness in making available special tools and equipment needed during emergencies.

HISTORY AND OWNERSHIP

The Ruby district is notable for the rich gold placer deposits that were worked vigorously in the early part of the century. The first discovery of placer gold in the district was made in 1907 on Ruby Creek, near the town of Ruby. This deposit was not large nor rich, therefore, very little attention was given to the region until July 1910 when rich discoveries were made on Bear Pup, a tributary to Long Creek. Many miners and prospectors stampeded to the region, and other discoveries were made in the vicinity of Long Creek. The first mining machinery was brought into the district in 1912, and this started a thriving placer mining industry which lasted for many years. Known bonanzas are depleted, and economic conditions have curtailed placer mining to three small operations.

The lead-bearing gossans at Beaver Creek were discovered and staked prior to 1920 by Harry Boland, and were prospected intermittently by him and by his associates, Mr. Dan McFadden and Mr. Hendrickson. Mr. Boland, being aware of the geologic significance of the gossans, endeavored to trace the surface extent of the Beaver Creek deposits by trenching. He also sank a prospect shaft to a depth of 40 feet at one location, and at another location, drove a short adit. All work was done by hand, and there is no record of ore being shipped from the deposits. Mr. Boland relinquished his claim to the deposits in 1940 because he was unable to resume assessment work. Since that time, the gossans have been staked and restaked by various individuals; William Ahrens, Atillio Kenet, and John J. May, the present owners, acquired them in 1959 and hold the property with two unpatented lode claims, Discovery and Below Discovery.

LOCATION, ACCESSIBILITY, AND CLIMATE

The Beaver Creek gossans are 14 miles south of Ruby at latitude 64°35' N, longitude 155°23' W, in the Ruby district, Yukon region, west-central Alaska. They are at the base of the north valley wall of Beaver Creek about 1½ miles east of the Ruby-Poorman road and midway between Thirteen Mile Creek and Little Joe Creek (fig. 1).

Ruby, on the south bank of the Yukon River, is the trading center for mines in the vicinity of Long and Poorman. A general store, post office, radio station, bulk fuel oil plant, roadhouse, schoolhouse, and church serve the needs of Ruby and vicinity. Ruby has a permanent population of approximately 60; most of whom seek employment outside the district as the mines hire only a few people.

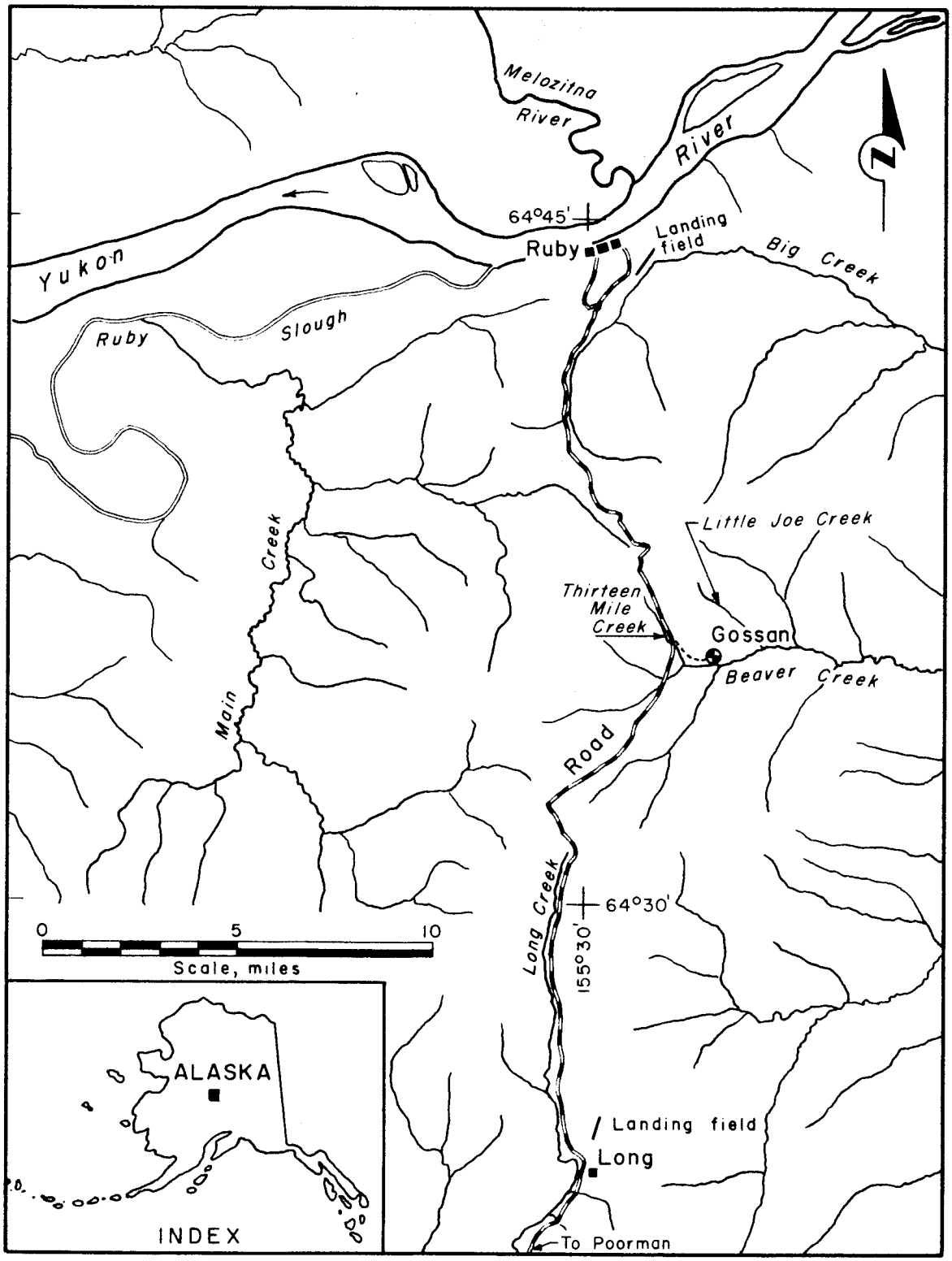

FIGURE 1.- Ruby District, Alaska.

A dirt arterial road system, extending 52 miles southward to Poorman connects the mining areas with Ruby. In the summer this road is traversable by truck to mines between Long and the Sulatna River bridge; beyond the bridge tractors are used to reach the mines at Poorman. A tractor trail 2 miles long connects the gossans at Beaver Creek with the arterial road at Thirteen Mile Creek.

Heavy freight brought in from the coast by the Alaska Railroad is barged down the Tanana and Yukon Rivers from Nenana and is discharged at Ruby for redistribution to the mines. Small boats ply the Yukon River during the open summer season to serve the needs of the people living along the river in the vicinity of Ruby.

Airfields at Ruby, Long, and Poorman are used by small planes which transport passengers and light freight the 240 miles from Fairbanks, Interior Alaska's main distribution center. Most travel in both summer and winter is by airplane.

The climate is typical of Interior Alaska with short warm summers and long cold winters. Precipitation averages 15 to 18 inches a year. Truck gardens supply fresh produce during the growing season. Salmon caught in fishwheels along the Yukon River provide a staple summer food. The placer mines work from May to late September; the operating seasons vary from 115 to 130 days a year.

TOPOGRAPHY AND VEGETATION

The topography of the district is comprised of low hills, 600 to 1,700 feet high, with gentle slopes and rounded or flat topped ridges.

Broad valleys, many of which are asymmetrical in cross section, are characteristic of the mature topography of the district. The hills and valley bottoms are covered with perennially frozen silt which is overlain with deep moss and dense thickets of small trees and underbrush. Vegetation is sparse on rock outcrops and along the crests of ridges where frost-heaved rubble is plentiful. Tufts of grass, called nigger heads, grow profusely in the valley bottoms and in places along the slopes and summits of flat topped hills and ridges.

There is a scattered growth of dark spruce trees everywhere, but deciduous trees such as birch, poplar, aspen, and tamarack are more plentiful. Willow and alder brush grows along stream courses; blueberry, juniper, currant, and wild rose, as well as various creeping vines and small plants, form a substantial undergrowth amidst larger trees.

GENERAL GEOLOGY

Eakin,[2/] Mertie,[3/] and Harrington[3/] of the Geological Survey, group the predominant rocks of the Ruby district in a metamorphic complex of Paleozoic age. Most of these rocks are ancient sediments that have been

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2/ Eakin, Henry M. The Iditarod-Ruby Region, Alaska. Geol. Survey Bull. 578, 1914, pp. 29-30.

3/ Mertie, J. B., Jr., and G. L. Harrington. Mineral Resources of the Ruby-Kuskokwim Region, Alaska. Geol. Survey Bull. 624-H, 1915, pp. 230-231.

_____. Ruby-Kuskokwim Region, Alaska. Geol. Survey Bull. 754, 1924, pp. 12-14.

recrystallized by long-continued metamorphism, and are comprised of schist, crystalline limestone, quartzite, slate, and phyllite. Their principal structural trend approximates N 39° E, and the beds dip westward at varying angles. There is considerable folding and faulting along axes parallel to the main trend of the rocks. Outcrops show intense jointing and fracturing accompanied by deep seated weathering. Quartz and calcite veins and veinlets are numerous. In places, rocks are either highly siliceous or calcareous. Associated with the metamorphic complex are a number of metamorphosed igneous rocks, of late Palezoic age, consisting of greenstone altered from basalt and andesite extrusives and diorite, diabase, gabbro, and pyroxenite intrusives.

Late Cretaceous or early Tertiary granite, diorite, and quartz monzonite intrude the metamorphosed rocks. Outcrops of intrusive and other rocks in the district are sparse (fig. 2).

WORK BY THE BUREAU OF MINES

The Bureau of Mines examination at Beaver Creek began June 14, 1960, and terminated September 4, 1960. Work at the gossan deposits included bulldozer trenching, sampling, and topographic and geologic mapping. A total of 3,117 linear feet of trench was excavated with a bulldozer at 11 trenching sites. Forty-one channel samples were cut from the gossan exposed in trenches, and 6 grab samples were taken from float recovered during trenching operations. Chemical, spectrographic, and petrographic analyses of samples were made at Bureau of Mines laboratories in Juneau, Alaska and Albany, Oregon. Topographic and geologic maps were prepared from surveys made of the area under investigation.

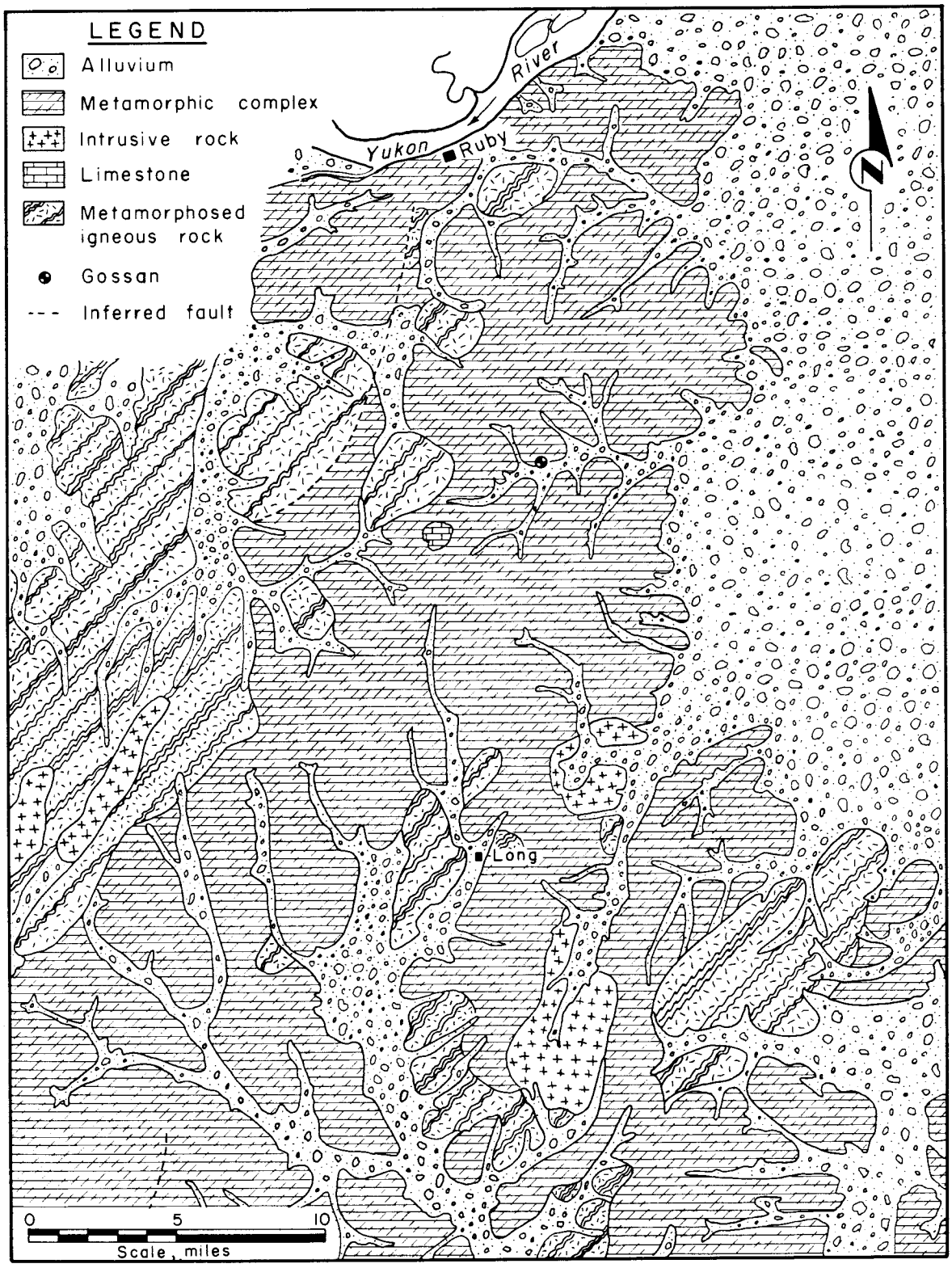


FIGURE 2-Geology, Ruby District. *Modified from Geological Survey map I-289 by John T. Cass.*

Description of Deposits

The gossans near the base of the north slope of Beaver Creek are roughly tabular bodies of irregular thickness composed of limonite and goethite with inclusions of galena, quartz, occasional anglesite and/or cerussite, and schist. They occur in two zones, 800 feet apart (fig. 3), enclosed by intensely jointed and fractured schist and phyllite containing siliceous and calcareous bands. The size and shape of the deposits appear to have been controlled and/or modified by both premineral and postmineral faults which nearly parallel bedding and schistosity. Postmineral transverse faults disrupt continuity of the eastern zone. Both deposits strike N 35° E and dip steeply to the northwest.

With minor exceptions, the same minerals occur in varying amounts in both the gossans, but the gossans differ in color and structural form. Mineral constituents of the gossans are shown in table 1. Traces of azurite and malachite have been detected megascopically in select specimens. The gossan in the East Zone is predominately various shades of red and yellow with some shades of brown; the gossan in the West Zone is essentially brown to brownish black. Indigenous and transported limonite are present along both zones; indigenous limonite is more common in the western than the eastern zone.

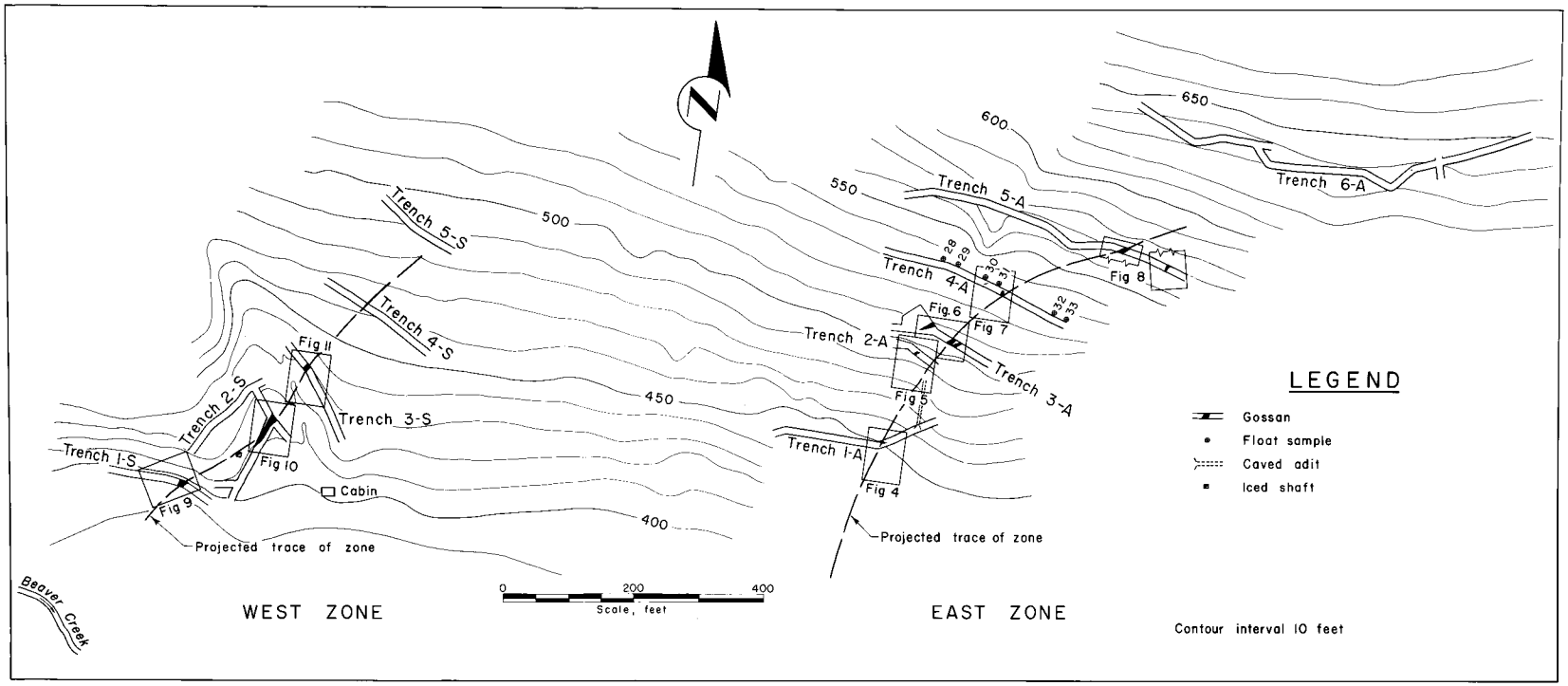


FIGURE 3.-Galena - Bearing Gossans, Beaver Creek.

TABLE 1. - Mineral constituents of gossans[1/]

Minerals	East Zone	West Zone
Anglesite	T	
Azurite	T	
Cerussite	S	M
Chlorite		S
Galena	S	F
Goethite	A	A
Graphite		M
Limonite	A	A
Malachite	T	
Muscovite	M	S
Quartz	A	A

1/ P - Predominant, over 50 percent
A - Abundant, 10 to 50 percent
S - Subordinate, 2 to 10 percent
M - Minor, 0.5 to 2 percent
F - Few, 0.1 to 0.5 percent
T - Trace, less than 0.1 percent

In the West Zone, cellular, or boxwork, and botryoidal structure is pronounced; whereas in the East Zone, earthy to granular structure prevails, and cellular structure is not readily recognizable.

Minute to coarse crystals of galena disseminated in limonite and goethite typify sulfide mineralization of the gossans. In places, the gossan is enriched by small irregularly shaped bodies of coarsely crystalline and fine-grained galena with sparse anglesite and cerussite. Schist and phyllite are prevalent in the gossan along walls, and in places, these rocks occur in the central portions of the deposits. Iron sulfides are not present in recognizable quantities.

Schist and phyllite are gray to grayish black, and in places, are extremely micaceous or graphitic. There are numerous siliceous and

calcareous bands that are roughly parallel; these bands probably indicate original bedding. Strike and diagonal joints are numerous. Gossaniferous material fills openings along joint planes in rocks adjacent to the deposits. Exceptionally light colored wall rocks are probably caused by kaolinization resulting from hydrothermal alteration. Numerous small lenses and stringers of quartz parallel schistosity. Most of the country rock is slightly iron stained with iron staining becoming intense near the gossan. Three metamorphosed dacite dikes are the only igneous rock found close to the gossan. These dikes are exposed near the southern extremity of the West Zone.

The gossans are covered by silt and a mixture of silt and angular pieces of bedrock from 4 to more than 20 feet deep. Deepest overburden is on gentle slopes and along the base of the valley wall. Perennially frozen overburden is sporadic on steep slopes where silt is 4 to 8 feet deep, but is continuous along the base of the hill and over areas where depth of overburden approximates 20 feet. The silt is not appreciably iron stained, and there is little difference in the color of the silt at the surface and silt directly above the gossan.

East Zone

The East Zone is composed of earthy to granular and some cellular limonite and goethite with inclusions of galena, quartz, some anglesite, and cerrusite. The zone is 0.5 to 6 feet wide, and the indicated trace length is 500 feet. The gossan has been crushed by strike faulting and displaced into disconnected segments by transverse faults. Bedrock is intensely jointed. Local surficial features are difficult to interpret

due to frost action accompanying sidehill creep. Along the trace of the zone, the gossan has different colors and structure. From the southwest to the midsection, the gossan is dark brown and red-yellow; cellular structure is discernible in the dark brown material, however, the red-yellow gossan is loose and granular. Coarsely crystalline and fine-grained galena occur in both the dark and light colored gossan, but are more abundant in the dark material. From the midsection of the zone to the northeast the gossan is red, red-yellow, and red-brown, loose and granulated; cellular structure is indistinct, and in places, not recognizable. Adjacent to fault planes, the gossan has been cemented with iron oxide to form breccia. The zone appears to terminate near the vicinity of trench A-5. The southwestern limit of the zone is not determined by trench A-1 (fig. 3).

Some chunks of coarsely crystalline and fine-grained galena float found in the vicinity of the gossan have not been traced to a bedrock source. This float is slightly weathered and is not iron stained. Galena float that is iron stained or has gossan attached is traced to gossan in-place.

A dump, mine timbers, and a depression in the hill mark the site and course of an old adit. The adit is caved and inaccessible, but according to Brown,[4/] galena and gossan were encountered. Several tons

4/ Brown, J. S. The Nixon Fork Country and Silver-Lead Prospects Near Ruby. Geol. Survey Bull. 783-D, 1926, pp. 147-148.

of gossan, galena, cerussite, anglesite, and quartz on the dump confirm the characteristics of the deposit crosscut by the adit.

The location and analyses of channel and grab samples from the gossan along the East Zone are shown in figures 4 to 8 inclusive. The location of grab samples from float are shown in figure 3, and analyses of samples are in table 2.

TABLE 2. - Analyses of grab samples from float

Sample	Percent			Troy oz per ton	
	Lead	Zinc	Copper	Gold	Silver
28...	10.0	0.84	0.09	Trace	29.72
29...	8.9	1.14	.10	do..	26.25
30...	9.1	.60	.18	do..	29.30
31...	11.4	.68	.14	do..	27.71
32...	15.1	.41	.08	do..	15.65
33...	8.5	<.03	.07	do..	13.32

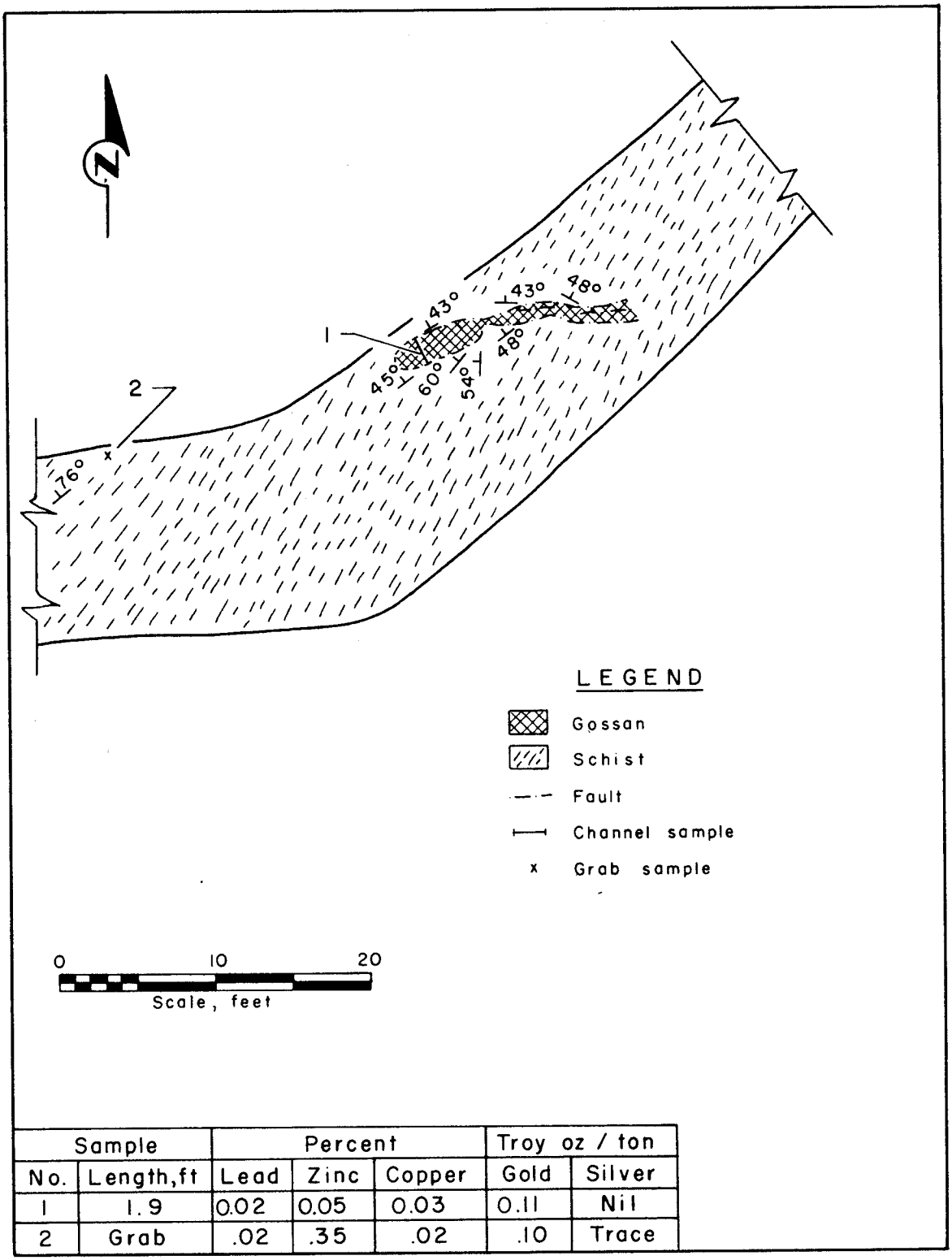
Spectrographic analyses of sample 9 from trench 3-A and a composite of channel samples 17 and 18 from trench 4-A (fig. 7) are reported in table 3.

TABLE 3. - Spectrographic analyses[1/]

Sample	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Ge	Hf	Hg	In	Ir	Li	Mg
9	F	D	-	-	F	E	-	-	F	E	F	F	F	A	-	-	-	-	-	-	-	E
17 & 18	G	A	-	-	E	E	G	-	E	-	F	E	F	B	-	-	-	-	-	-	-	D

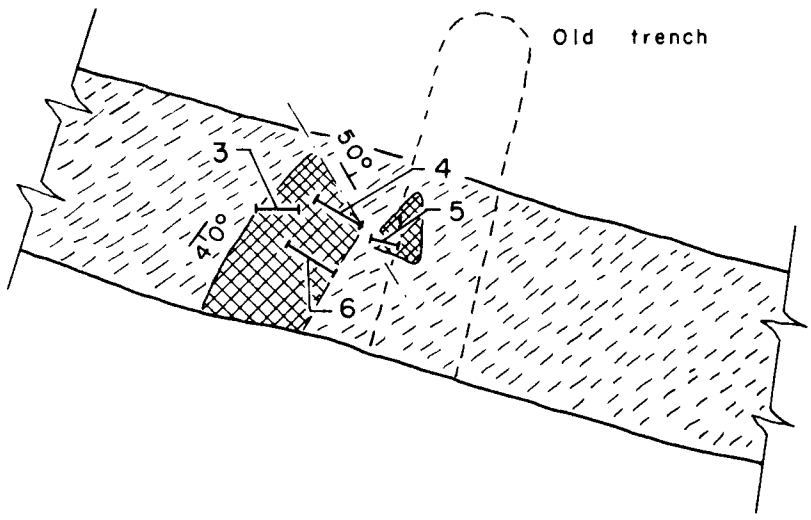
Mn	Mo	Na	Nb	Ni	Os	P	Pb	Pd	Pt	Re	Rh	Ru	Sb	Si	Sn	Sr	Ta	Te	Ti	Tl	V	W	Zn	Zr	Sc	Y
C	-	E	-	E	-	-	D	-	-	-	-	-	-	A	-	-	-	-	E	-	F	-	C	E	-	F
D	-	E	-	-	C	-	G	-	-	-	-	-	-	A	-	-	-	-	D	-	E	-	D	E	F	F

1/ A - Over 10 percent
B - 5 to 10 percent
C - 1 to 5 percent
D - 0.1 to 5 percent
E - 0.01 to 0.1 percent
F - 0.001 to 0.01 percent
G - Under 0.001 percent
- Not detected



Sample		Percent			Troy oz / ton	
No.	Length, ft	Lead	Zinc	Copper	Gold	Silver
1	1.9	0.02	0.05	0.03	0.11	Nil
2	Grab	.02	.35	.02	.10	Trace

FIGURE 4.- Gossan, Trench 1-A, East Zone.



LEGEND

Gossan

Schist

Fault

Channel sample

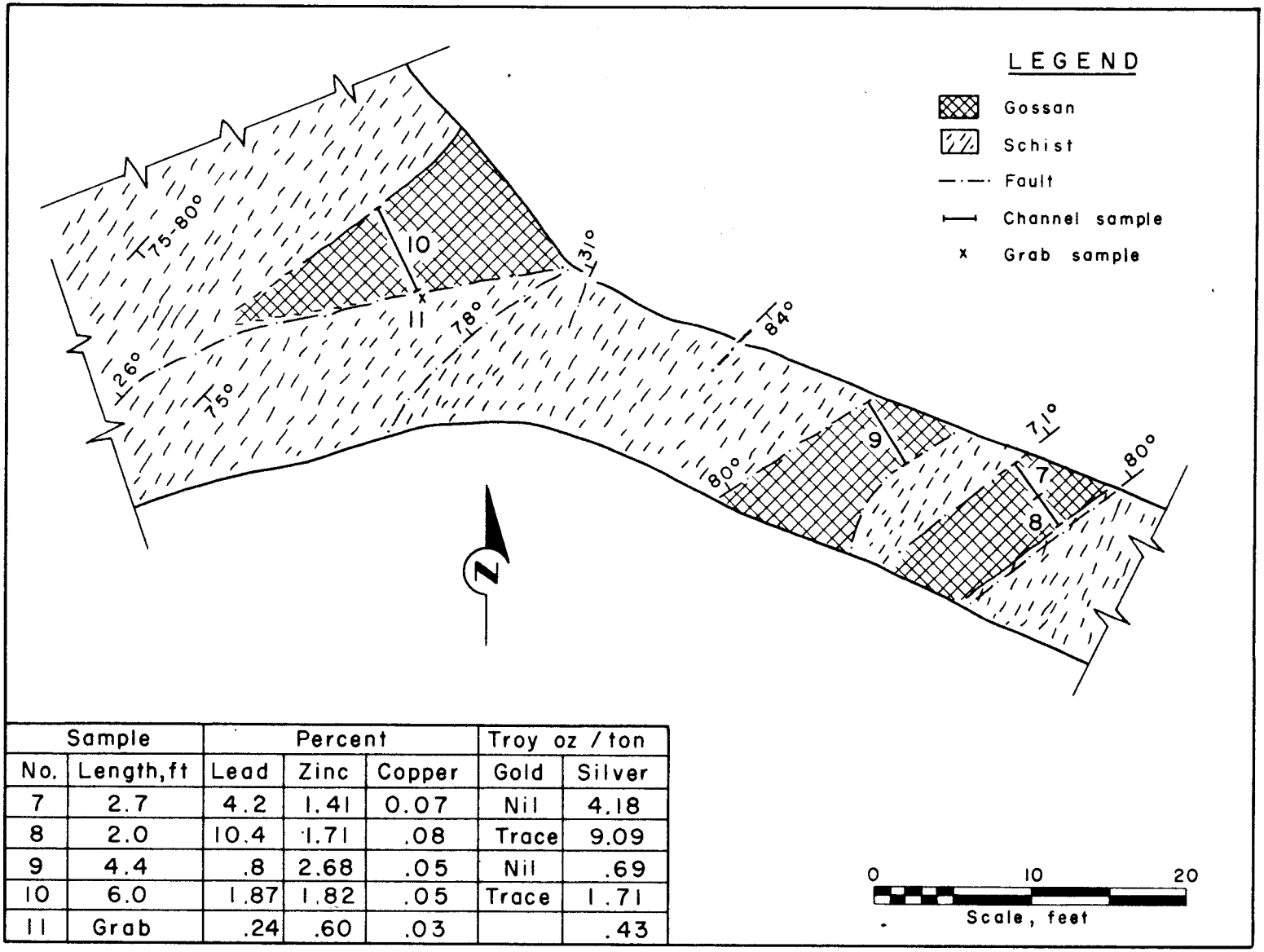
N

0 10 20

Scale, feet

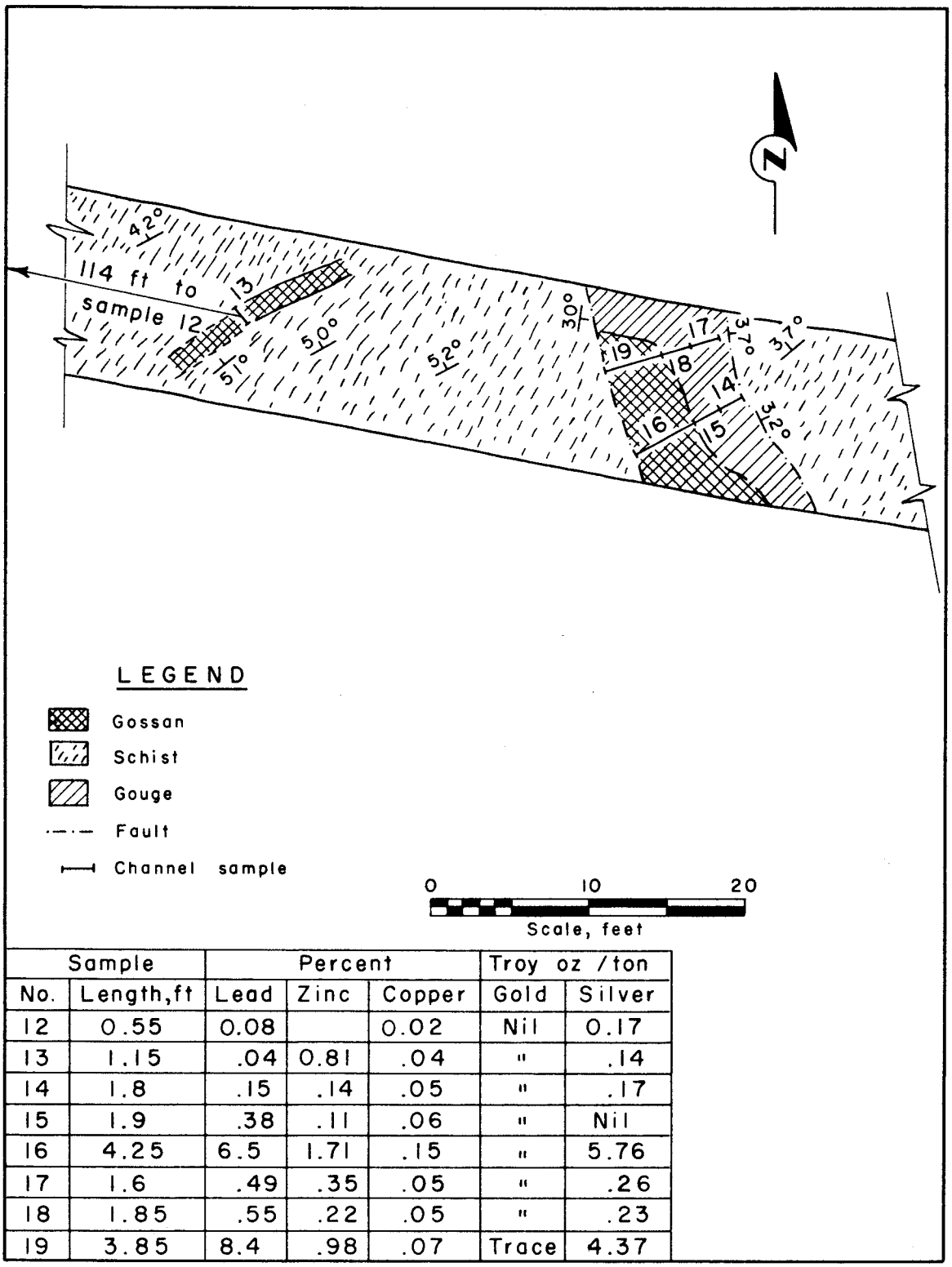
Sample		Percent			Troy oz / ton	
No.	Length,ft	Lead	Zinc	Copper	Gold	Silver
3	2.25	7.9	1.76	0.05	Trace	13.4
4	2.8	9.6	1.3	< .02	"	7.99
5	1.45	14.9	1.25	.03	"	14.4
6	2.85	15.3	.89	.02	"	16.13

FIGURE 5.- Gossan, Trench 2-A, East Zone.



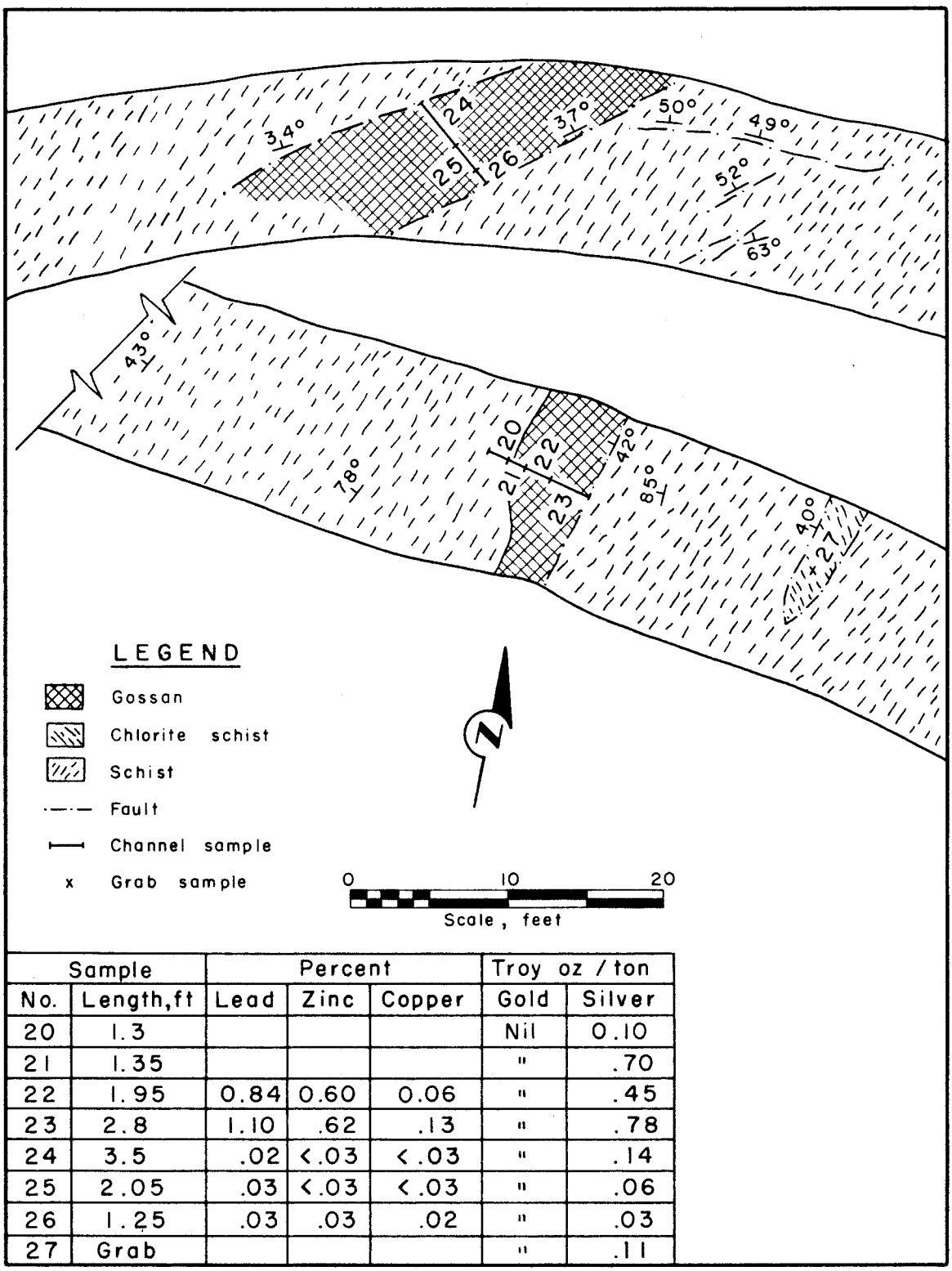
Sample		Percent			Troy oz / ton	
No.	Length, ft	Lead	Zinc	Copper	Gold	Silver
7	2.7	4.2	1.41	0.07	Nil	4.18
8	2.0	10.4	1.71	.08	Trace	9.09
9	4.4	.8	2.68	.05	Nil	.69
10	6.0	1.87	1.82	.05	Trace	1.71
11	Grab	.24	.60	.03		.43

FIGURE 6.- Gossan, Trench 3-A, East Zone.



Sample		Percent			Troy oz /ton	
No.	Length,ft	Lead	Zinc	Copper	Gold	Silver
12	0.55	0.08		0.02	Nil	0.17
13	1.15	.04	0.81	.04	"	.14
14	1.8	.15	.14	.05	"	.17
15	1.9	.38	.11	.06	"	Nil
16	4.25	6.5	1.71	.15	"	5.76
17	1.6	.49	.35	.05	"	.26
18	1.85	.55	.22	.05	"	.23
19	3.85	8.4	.98	.07	Trace	4.37

FIGURE 7.- Gossan, Trench 4-A, East Zone.



Sample		Percent			Troy oz / ton	
No.	Length, ft	Lead	Zinc	Copper	Gold	Silver
20	1.3				Nil	0.10
21	1.35				"	.70
22	1.95	0.84	0.60	0.06	"	.45
23	2.8	1.10	.62	.13	"	.78
24	3.5	.02	<.03	<.03	"	.14
25	2.05	.03	<.03	<.03	"	.06
26	1.25	.03	.03	.02	"	.03
27	Grab				"	.11

FIGURE 8.–Gossan, Trench 5-A, East Zone.

West Zone

The West Zone ranges from 3 to 10 feet in width, and present exposures indicate a strike length of 300 feet. Minute crystals of galena are disseminated in cellular, botryoidal, and earthy limonite and goethite. Irregular masses of fine-grained and coarse crystalline galena occur sporadically in the zone. Inclusions of schist are plentiful along the footwall and hanging wall but are scarce in the central part. The deposit strikes N 35° E and dips 60° to 70° NW and conforms to the attitude of a shear zone paralleling schistosity and bedding. Slickensides on large pieces of loose gossan indicate postmineral faulting along the strike of the zone. Schist wall rock is slightly iron stained and kaolinized.

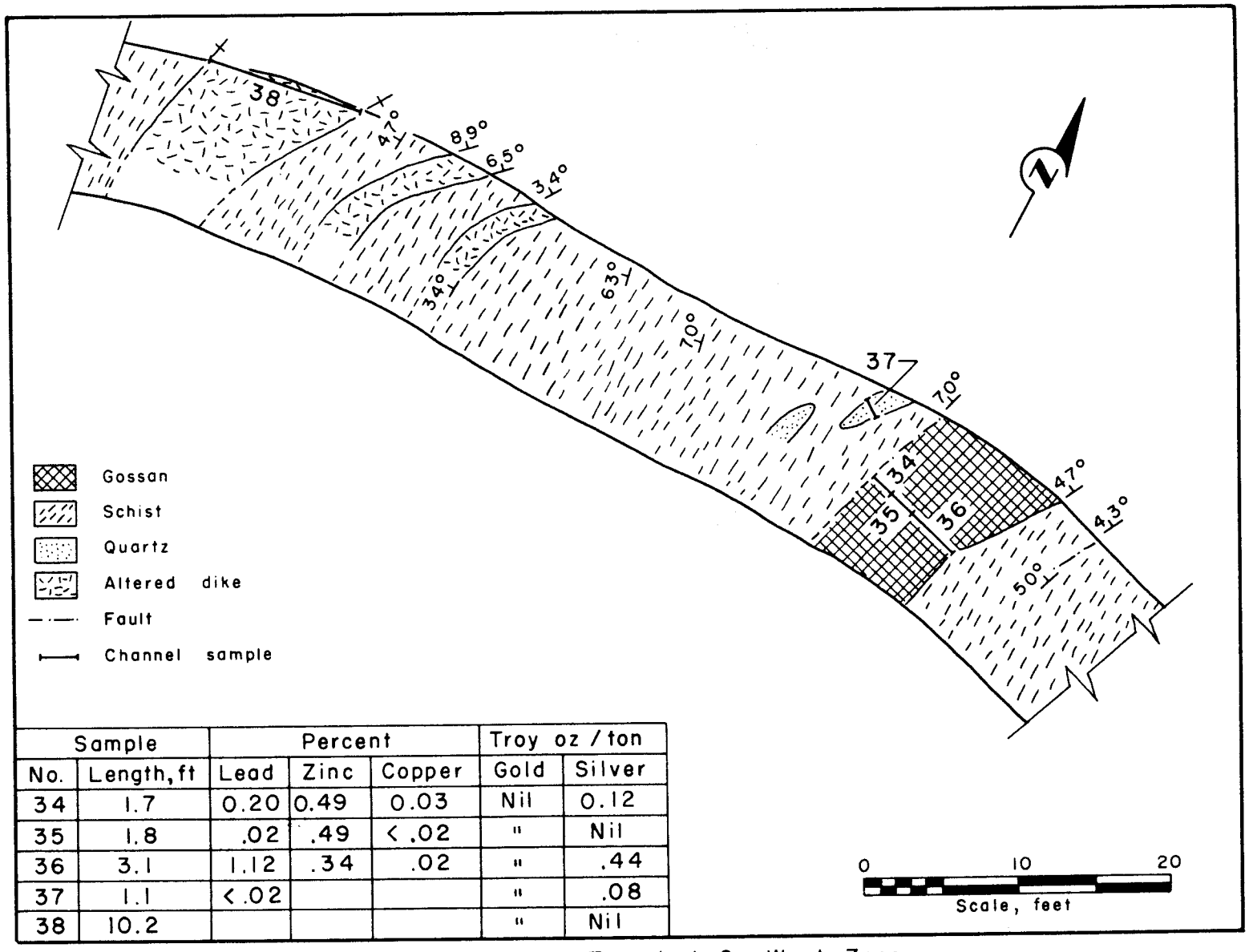
The locations and analyses of channel samples are reported on figures 9 to 11 inclusive. Spectrographic analyses of sample 36 from trench 1-S and composites of channel samples 41, 42, and 43 from trench 2-S, and samples 44 and 45 from trench 3-S (fig. 11) are reported in table 4.

TABLE 4. - Spectrographic analyses[1/]

Sample	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Ge	Hf	Hg	In	Ir	Li	Mg	Mn	Mo
36	G	C	-	-	F	E	G	-	F	-	F	F	F	A	-	-	-	-	-	-	-	E	D	-
41, 42 & 43	F	C	-	-	F	E	G	-	F	-	F	F	F	A	-	-	-	-	-	-	-	E	D	-
44 & 45	F	C	-	-	F	E	G	-	E	-	F	F	F	A	-	-	-	-	-	-	-	D	D	-

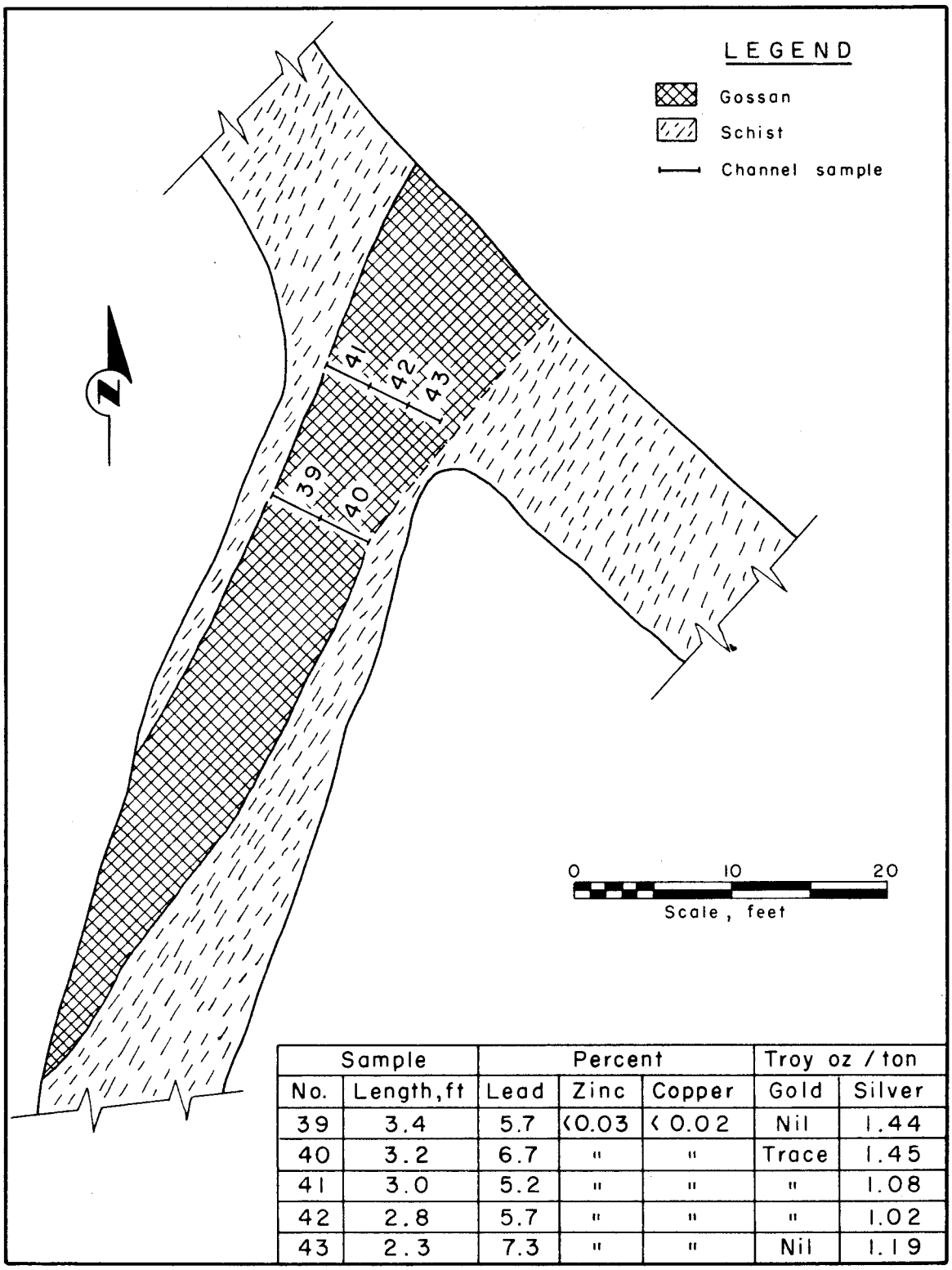
Na	Nb	Ni	Os	P	Pb	Pd	Pt	Re	Rh	Ru	Sb	Si	Sn	Sr	Ta	Te	Ti	Tl	V	W	Zn	Zr	Sc	Y
E	-	E	-	-	C	-	-	-	-	-	-	A	-	-	-	-	D	-	F	-	D	E	-	F
E	-	E	-	-	B	-	-	-	-	-	-	A	-	-	-	-	E	-	F	-	D	E	-	F
E	-	E	-	-	B	-	-	-	-	-	-	A	-	-	-	-	E	-	F	-	D	E	-	F

1/ A - Over 10 percent
B - 5 to 10 percent
C - 1 to 5 percent
D - 0.1 to 1 percent
E - 0.01 to 0.1 percent
F - 0.001 to 0.01 percent
G - Under 0.001 percent
- Not detected



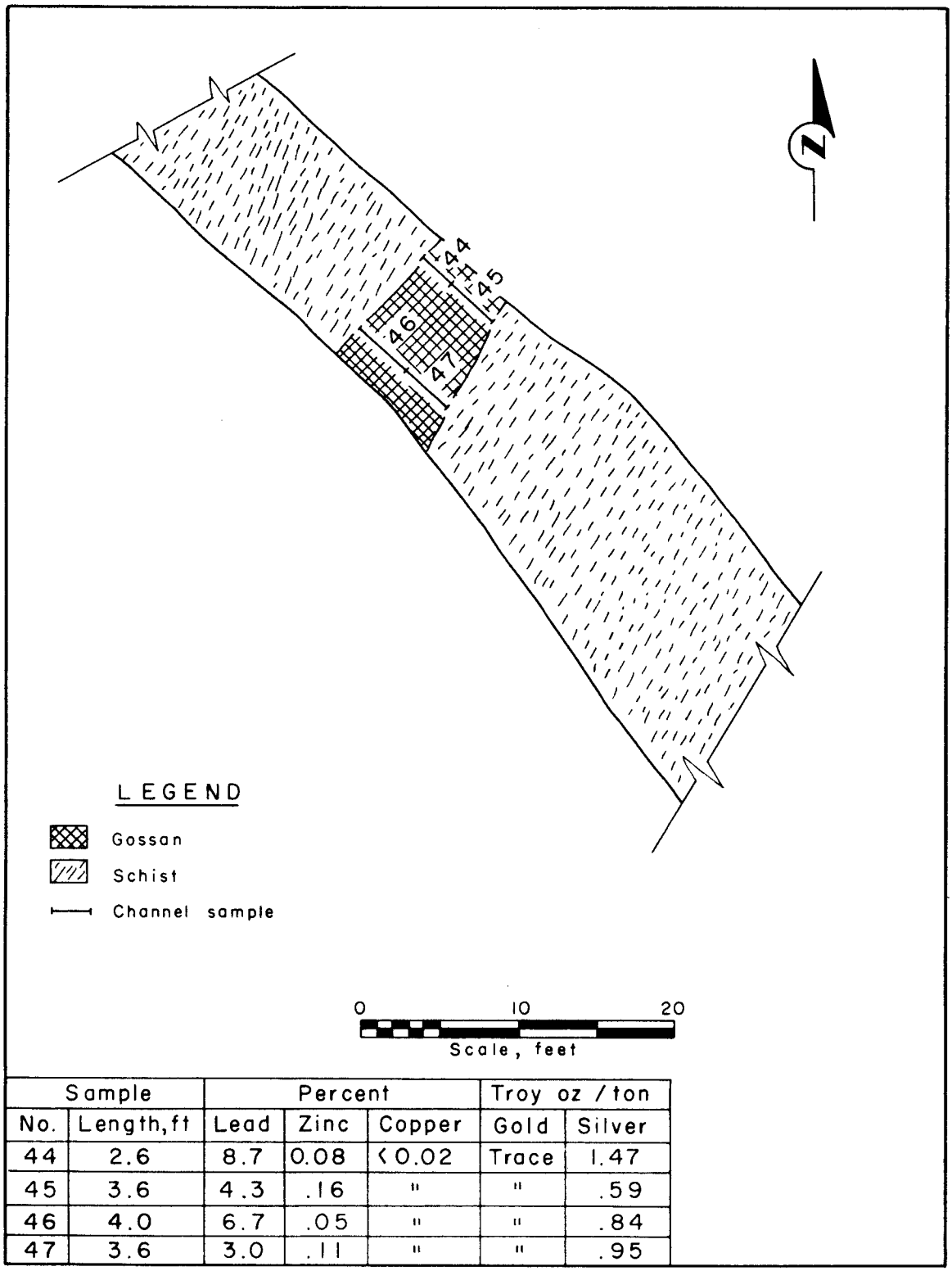
Sample		Percent			Troy oz / ton	
No.	Length, ft	Lead	Zinc	Copper	Gold	Silver
34	1.7	0.20	0.49	0.03	Nil	0.12
35	1.8	.02	.49	< .02	"	Nil
36	3.1	1.12	.34	.02	"	.44
37	1.1	< .02			"	.08
38	10.2				"	Nil

FIGURE 9. – Gossan, Trench 1-S, West Zone.



Sample		Percent			Troy oz / ton	
No.	Length, ft	Lead	Zinc	Copper	Gold	Silver
39	3.4	5.7	<0.03	< 0.02	Nil	1.44
40	3.2	6.7	"	"	Trace	1.45
41	3.0	5.2	"	"	"	1.08
42	2.8	5.7	"	"	"	1.02
43	2.3	7.3	"	"	Nil	1.19

FIGURE 10. – Gossan, Trench 2-S, West Zone.



Sample		Percent			Troy oz / ton	
No.	Length, ft	Lead	Zinc	Copper	Gold	Silver
44	2.6	8.7	0.08	< 0.02	Trace	1.47
45	3.6	4.3	.16	"	"	.59
46	4.0	6.7	.05	"	"	.84
47	3.6	3.0	.11	"	"	.95

FIGURE 11. - Gossan, Trench 3-S, West Zone.

An old prospect shaft in the vicinity of trench 2-S (fig. 3) was reported by Brown[5/] to have been 40 feet deep, and a galena-bearing gossan

5/ Work cited in footnote 4.

8 feet wide was encountered at the bottom. This shaft was filled with ice, and the collar was caved. It was retimbered, and ice was removed to only a depth of 22 feet. At this depth, galena-bearing gossan, comparable to that exposed in trench 2-S, was uncovered on the sides of the shaft, but the width was not determined.