Geochemical Reconnaissance In the Wiseman and Chandalar Districts and Adjacent Region, Southern Brooks Range, Alaska

By W. P. BROSGÉ *and* H. N. REISER

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CONTENTS

	Page
Abstract	1
Introduction	1
Geologic Setting	1
Mining history	3
Placer-gold sources	3
Geochemical sampling	3
Discussion of anomalous areas	8
Wiseman district	8
Chandalar mining area	13
Other metal occurrences in the Chandalar area	16
Other anomalous areas	19
Summary	20
References cited	20

ILLUSTRATIONS

		Page
FIGURE 1.	Index map of Alaska showing location of Wiseman and Chandalar quadrangles and of areas of figures 2, 4, and 9	2
2.	Map showing stream-sediment sample localities and generalized geologic map	4
3.	Map showing gold in stream-sediment, rock, and soil samples from Wiseman-Chandalar region	6
4–8.	Map of the Nolan-Hammond River area showing—	
	4. Sample localities and unconsolidated deposits	9
	5. Gold in stream-sediment, rock, and soil samples	10
	6. Arsenic and antimony in stream-sediment, rock, and soil samples	11
	7. Anomalous concentrations of antimony in stream-sediment samples in and near the Nolan-Hammond River area	12
	8. Silver and zinc in stream-sediment, rock, and soil samples	13
9–12.	Map of the Chandalar area showing —	
	9. Sample localities and geologic map	14
	10. Gold, silver, molybdenum, arsenic, antimony, lead, and zinc in rock, soil, and stream-sediment samples near gold deposits	15
	11. Gold and silver in stream-sediment, rock, and soil samples	16
	12. Zinc, lead, arsenic, antimony, copper, and molybdenum in stream-sediment, rock, and soil samples	17
13.	Map showing silver and lead in stream-sediment samples and silver in rock and soil samples from the Wiseman-Chandalar region	18

GEOCHEMICAL RECONNAISSANCE IN THE WISEMAN AND CHANDALAR DISTRICTS AND ADJACENT REGION, SOUTHERN BROOKS RANGE, ALASKA

By W. P. BROSGÉ and H. N. REISER

ABSTRACT

Reconnaissance geochemical sampling in the Wiseman-Chandalar region shows that gold and silver anomalies are usually accompanied by base-metal anomalies and occur in three areas—the Wiseman mining district, the Chandalar mining district, and an unexplored zone in carbonate rocks north of the mining districts. The preservation of gold placers in mountain valleys least affected by glaciation suggests a local bedrock source of gold. Near Wiseman, detailed sampling in the apparent source area of the richest gold placers shows that gold occurs in small veins of quartz and quartz-stibnite. The highest gold content found in the stibnite veins is 9.2 ppm, and in the quartz veins 5.8 ppm. In the Chandalar district, gold and base metals are concentrated in an area of northwest-trending shear zones. The known gold lodes are in these shear zones; gold also occurs along extensions of one and possibly two of the shear zones a mile or more west of the lode mines. In both the Chandalar and the Wiseman areas, arsenic is a good pathfinder for gold, and zinc is associated with the highest concentrations of gold and silver.

INTRODUCTION

Placer deposits near Wiseman and Chandalar have yielded nearly 300,000 ounces of gold. The Chandalar area (fig. 1) includes the only active lode-gold mining district in the Brooks Range. Although gold has been known from this region since before 1900, the geology is known mostly from reconnaissance studies, and the lode sources of many placer deposits, as well as the extent of the lode deposits, are still uncertain. As part of the investigation for heavy metals by the U.S. Geological Survey, samples were collected in 1967 to determine whether there is a lode-gold source near the placer deposits at Wiseman and whether the lode gold at Chandalar extends beyond the known deposits. Samples were also collected in the larger region around the two mining districts to help complete reconnaissance traverses across the southern Brooks Range in the Chandalar and eastern Wiseman quadrangles (fig. 2) begun during the geologic mapping in 1958-60 (Brosgé and Reiser, 1960 and 1964). This regional sampling indicates that the principal gold mineralization is in the quartz-mica schist and phyllite of the two known mining areas and that silver mineralization may occur in carbonate rocks farther north.

The geology, gold deposits, and mining history of the region were described by Schrader (1900), Maddren (1913), Mertie (1925), Reed (1938), White (1952), and Marshall (1933). Cobb's (1962 and 1964) maps show locations of and give references for the individual lode and placer deposits. Chipp (1970) mapped and sampled the area around the Chandalar lode mines in detail and refined the stratigraphy shown by the regional mapping.

Access to the mining areas is mostly by air. Dirt roads connect Nolan and the Hammond River mines with a landing strip for multiengine airplanes at Wiseman. A tractor road connects the Chandalar mines with a strip at Chandalar Lake, and the ice on Chandalar and Squaw Lakes furnishes a seasonal landing area. Strips for light planes give direct access to the Chandalar placer mines and to several of the mines along the Middle Fork of the Koyukuk. The access road for an oil pipeline planned along the Middle Fork and Dietrich Rivers would bring heavy equipment into the area from Fairbanks.

During our work the miners helped us in many ways. For furnishing housing and transportation, we are especially grateful to Frank Birch and Wayne Adney of Chandalar, Andrew Miscovich of Porcupine Creek, and Smith Wanamaker and Harry Leonard of Wiseman.

GEOLOGIC SETTING

The southern flank of the Brooks Range, including the Chandalar and Wiseman districts, is underlain mainly by schist of Paleozoic age intruded by Mesozoic granitic rocks (figs. 1, 2). Paleozoic sedimentary rocks that lie immediately to the north of the granite and schist are mainly limestone and calcareous shale. A broad lowland south of the schist and granite is underlain by Paleozoic and Mesozoic

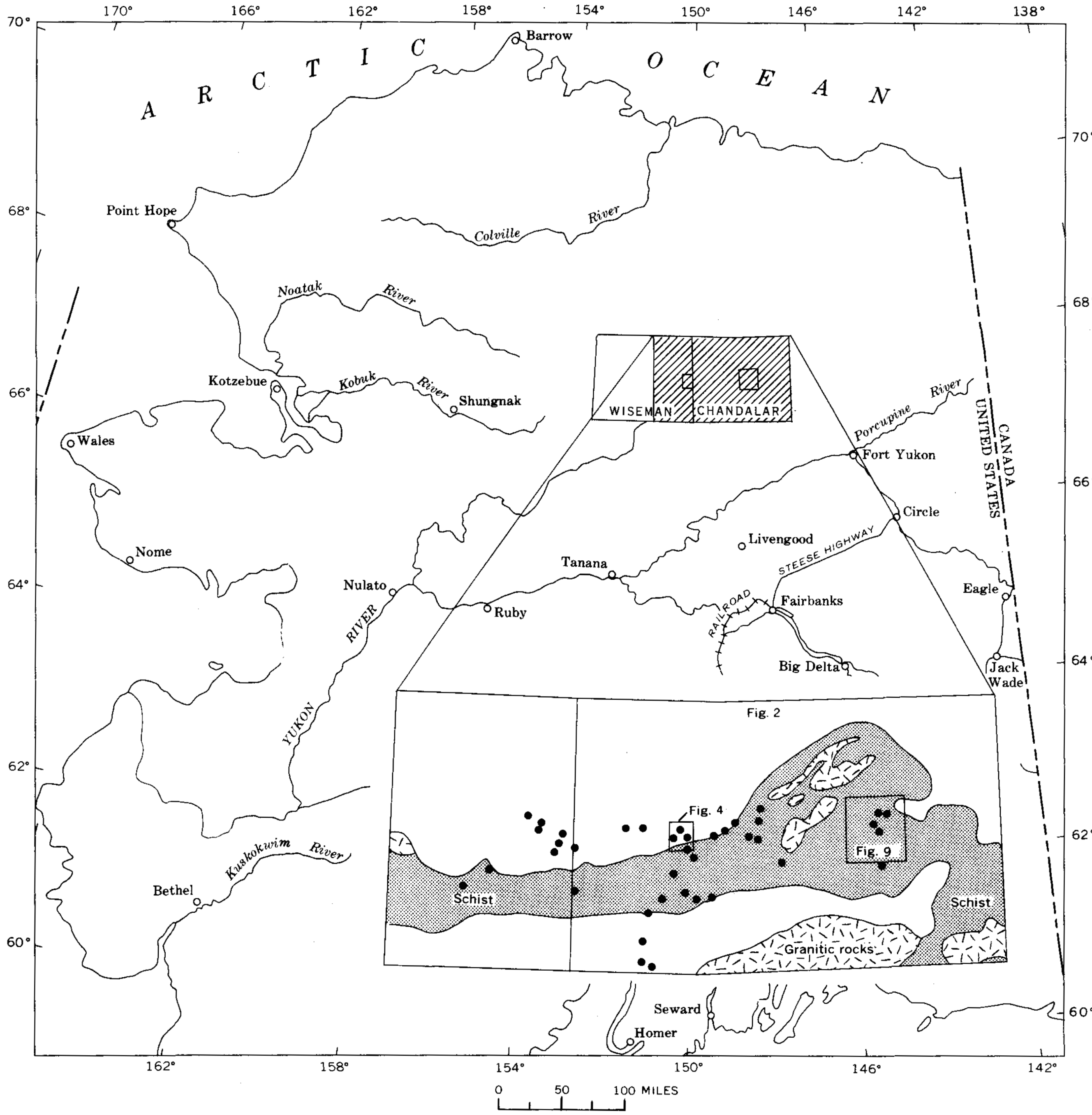


FIGURE 1.—Index map of Alaska showing location of Wiseman and Chandalar quadrangles. Areas of figures 2, 4, and 9 are shown in relation to the areas of schist and granite and to the gold placers (black dots).

phyllite and clastic rocks. Mafic intrusive and extrusive rocks occur in the phyllite and clastic rocks of this lowland and also in the schist and Paleozoic sedimentary rocks in the Brooks Range to the north.

Glaciers of at least three advances have trenched and filled the main through-going valleys of the southern Brooks Range and have left the lowland south of the range largely covered by drift and outwash. Erratic boulders indicate that ice of an early advance overrode the lower mountains, whereas cirque glaciers occurred in the high mountains near the Brooks Range divide and in the southern part of the metamorphic belt. High alluvial terraces that probably are related to the two younger glacial advances extend up some of the major rivers and their tributaries.

The relation of the various glacial advances to the gold placers is uncertain, but some of the placer deposits are older than at least the latest advance. Mertie (1925) described placers stratigraphically above and below the glacial deposits near Chandalar Lake, and deep placers near Nolan are buried by alluvium that is graded to the level of glacial fill in Wiseman Creek valley.

MINING HISTORY

Since 1899, when gold was discovered on the Middle Fork of the Koyukuk River, most of the Koyukuk's tributaries for a distance of about 35 miles from Gold Creek to Tramway Bar have produced placer gold. The greatest production was before 1917; at present only a few one- or two-man open-cut mines are in operation. The richest producers have been in the small area north of Wiseman shown in figure 2; there approximately 200,000-250,000 ounces has been produced from Nolan Creek, the Hammond River, and their tributaries. Placer gold in these streams and the stibnite prospects in the small area between them suggest that lode-gold deposits also might be present.

Placer-gold deposits in the Chandalar area are clustered around the known lode-gold deposits (fig. 9). More than 29,000 ounces of placer gold has been produced since the discovery of gold deposits on Big Creek in 1906 (U.S. Bureau of Mines, written commun., 1968). Exploration of the gold-bearing quartz veins also began about this time. The known gold-bearing veins are in a narrow zone that extends about 3 miles northeastward across the strike of the country rock. Most exploration has been on the Mikado and Little Squaw lodes; the Mikado mine is now in production (Alaska Div. Mines Bull., 1969).

PLACER-GOLD SOURCES

Most of the placer gold produced in the southern Brooks Range has been mined from deposits found in a belt of low rounded mountains and hills that trends westward along the northern limit of the schistose rocks from Big Lake through Wiseman to Wild Lake (figs. 1, 2). The parallelism of this placer belt with the regional strike suggests that the gold has a local source—in fact gold is found in the veins near Wiseman. The preservation of the older and deeper gold-bearing alluvial sediments within this belt of low hills may have resulted from the absence of local glaciers; the most recent glaciation there seems to have been restricted to the main valleys.

Other shallow gold placers extend far upstream on creeks that rise in the higher mountains well within the area of schistose rocks, particularly on the cirque-free southern slopes. The gold in each of these probably comes from a local source in the schist, and a local source is evident at Chandalar, where the placers surround known gold lodes.

Placer gold that occurs in the lowland south of the mountains may in part have been reworked from glacial drift of the Middle Fork of the Koyukuk (Reed, 1938). Glacial erratic boulders occur in the gold-bearing gravel deposits of a former high-level channel of the Middle Fork at Tramway Bar. Erratics also occur in placer deposits on the low pass between the Middle and South Forks (Reed, 1938), and the placers along the South Fork of the Koyukuk (just south of fig. 2) are directly below the mouths of former glacial spillways from the Middle Fork.

GEOCHEMICAL SAMPLING

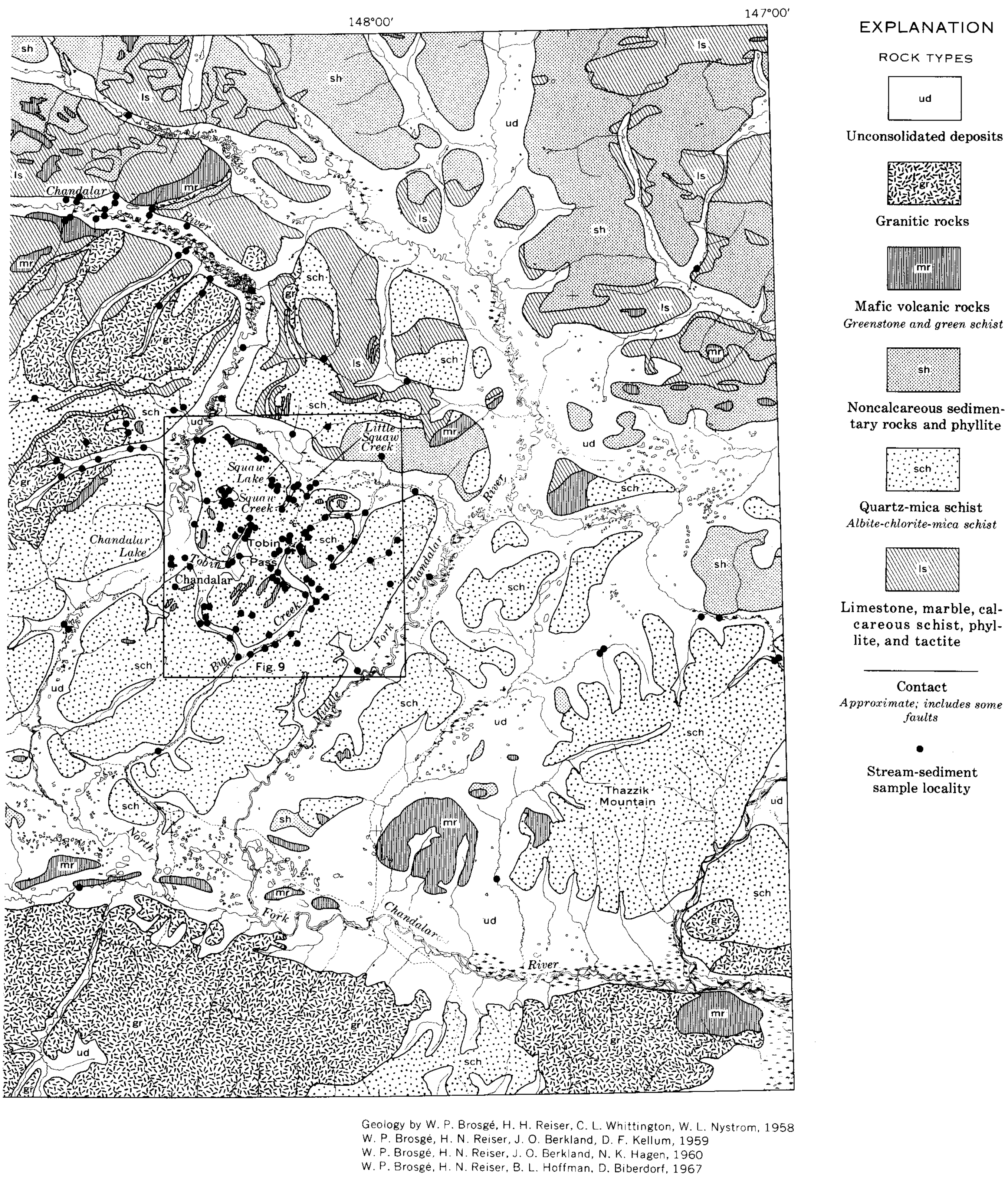
Most of the 309 stream-sediment samples are of predominantly silt-size material. About half of these are from the two small areas of detailed sampling near Wiseman and Chandalar, and the other half from the regional reconnaissance. The regional samples were collected along a traverse across the sedimentary, volcanic, and metamorphic rocks in the upper Koyukuk area, and a traverse across the granitic rocks along the North Fork of the Chandalar. A few scattered samples were collected mainly from areas of metamorphic rocks. In addition, panned concentrates of stream gravel were collected along the North Fork of the Koyukuk.

Most of the 207 samples of rocks and residual soils are grab samples collected on traverses across the known or suspected mineralized areas of Wiseman and Chandalar. Those samples collected outside the mining districts are from quartz veins and mineralized rock collected during regional mapping.

The analyses and frequency-distribution statistics for all stream-sediment samples and the analyses of the rock and soil samples from the Wiseman and Chandalar districts have been placed on open file by the U.S. Geological Survey (Brosgé and Reiser, 1970a, b). The analyses by atomic absorption and colorimetric methods were done by H. H. Mehnert, J. B. McHugh, W. W. Janes, W. L. Campbell, J. Frisken, E. E. Martinez, R. L. Miller, K. R. Murphy, S. Rickard, T. A. Roemer, Z. Stephenson and R. Vaughn. The spectrographic analyses were made by M. DeValliere, A. Farley, Jr., E. E. Martinez, and Chris Heropoulos.

The locations of samples with detectable gold and of those with high or anomalous concentrations of silver or some base metals are shown by maps

FIGURE 2.—Stream-sediment sample



localities and generalized geologic map.

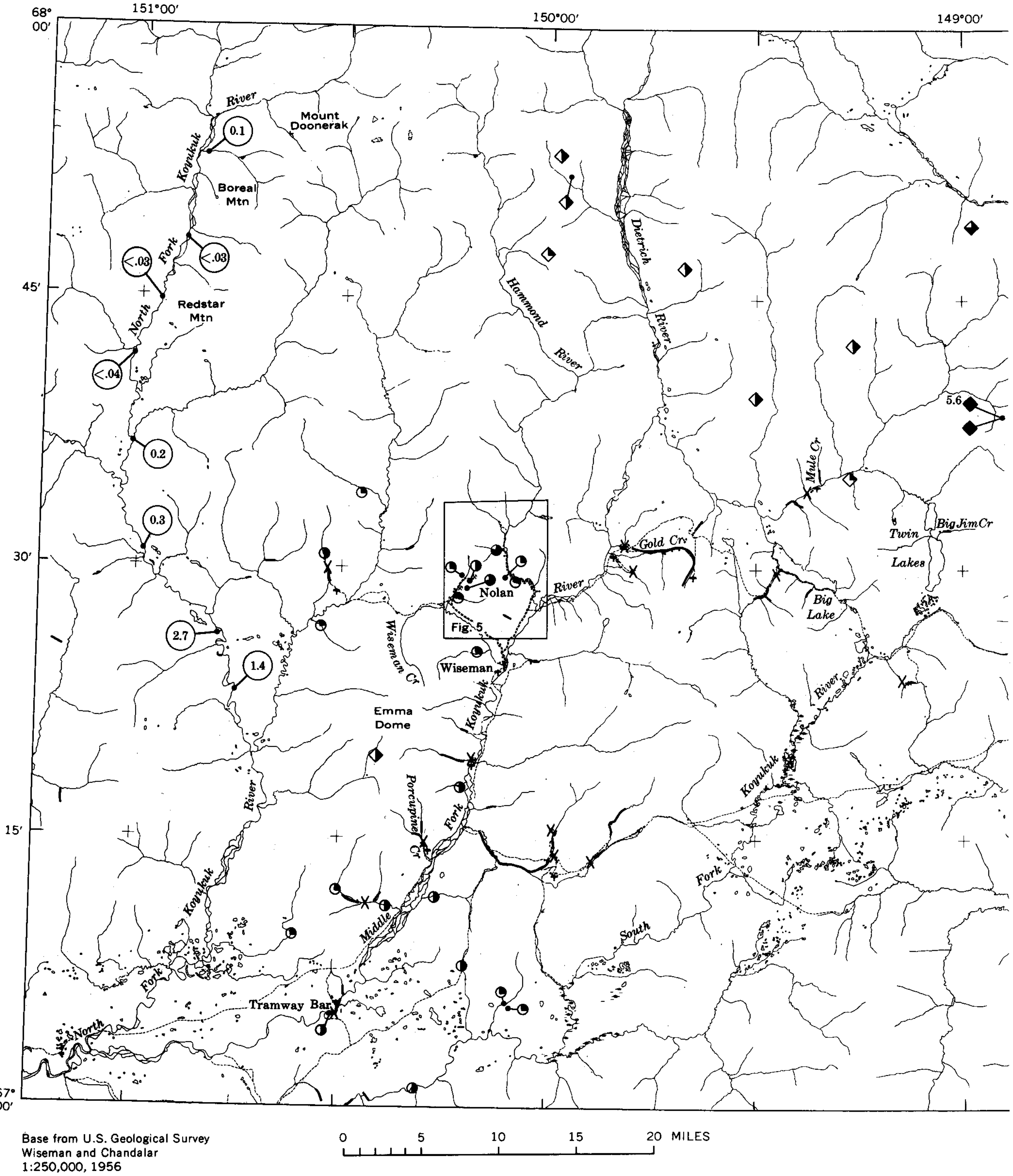
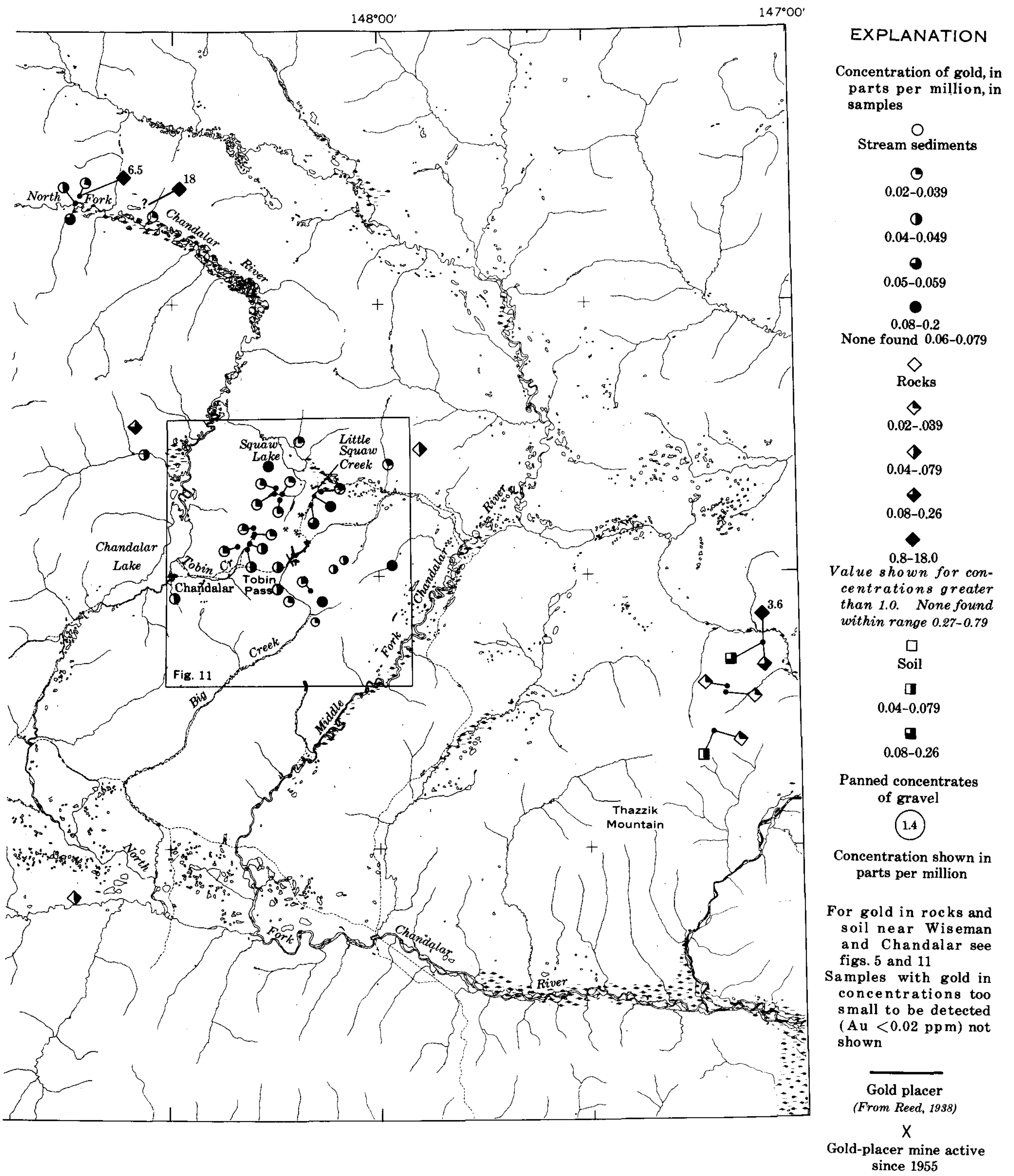


FIGURE 3.—Gold in stream-sediment, rock, and soil samples from Wiseman-Chandalar



region. For details near Wiseman and Chandalar, see figures 5 and 11.

(figs. 3, 5-8, 10-13). The cutoff values for the concentrations described as anomalous or high are interpretive, but are at approximately the 97½ and 95th percentile levels of the continuous part of the frequency distribution for each metal.

Although analyses of stream-sediment samples have detected some gold, even in localities outside the known placer areas, samples of the type collected seem generally inadequate to detect placer gold. Of the 48 samples taken from streams at or just below known placers, gold was detected in only 14.

In the discussion of silver, the data for the 79 stream-sediment samples collected before 1967 are omitted because the analytical values of these samples seem about four times too high when compared with those of the later samples.

DISCUSSION OF ANOMALOUS AREAS

Gold in detectable amounts seems to be fairly widespread in the Wiseman-Chandalar region, for it is found in many of the quartz vein samples and in most of the panned samples taken along the North Fork of the Koyukuk (fig. 3). It occurs not only in and near the schist and granitic rocks, but also in the area of sedimentary rocks to the north. Gold concentrations greater than 0.1 ppm (parts per million) in rock samples are present, however, only in or close to the metamorphic belt, and gold in panned samples increases abruptly where the North Fork enters the placer belt along the north margin of the metamorphic rocks.

The most prominent anomalous areas indicated by steam-sediment samples are the Chandalar and the Nolan-Hammond River areas. These areas contain a disproportionate share of the samples with detectable gold and of samples with high to anomalous concentrations of one or more base metals—lead, arsenic, and molybdenum at Chandalar; antimony, in the Nolan-Hammond River area (figs. 3, 7, 12). The association of gold and base-metal anomalies in stream sediments from these areas reflects the mineral association in the vein and rock samples. If the two mining districts are typical, then significant gold mineralization in this region is marked by associated base-metal anomalies.

WISEMAN DISTRICT

The bedrock in the Nolan-Hammond River area consists mainly of black phyllite and gray schistose quartz siltstone with some calcareous beds. Disseminated pyrite is common in both the phyllite and the quartzose rocks. Quartz occurs in crenulated stringers and knots and locally, with stibnite, in veins and fracture fillings that postdate metamorphism and folding. A buried pluton south of Wiseman is suggested by heavily tourmalinized vein quartz on the west flank of Emma Dome and by silicated limestone at the base of the east flank of Emma Dome.

Placer deposits are of three ages: present stream deposits, old buried channel fillings, and probably still older high bench deposits. Glacial debris and erratics indicate that an early stage of glacial ice covered part of the Nolan Creek-Hammond River divide and could have been the source of the reworked erratic boulders in the high bench placer gravels on the Nolan Creek and lower Hammond River drainages. The buried bedrock valley of Nolan Creek is a V-shaped gulch (Maddren, 1913), and the lower Hammond valley is in part a buried canyon; both were probably incised after the retreat of ice of this early stage and partly refilled with gold-bearing gravel before the next recognizable glacial advance. The gravel fill in Nolan Creek consists mainly of chips of locally derived black phyllite.

Drift of unknown thickness covers the main valley floors of Wiseman Creek, the Middle Fork Koyukuk River, and the upper Hammond River; Pleistocene muck and gravel buries the placers in the old bedrock channel of Nolan Creek to depths about 210 feet near the mouth to about 20 feet near the head. Ice of the later advance seems to have scoured the main valleys, but not the gold-bearing tributaries. Reed (1938) reported that the buried bedrock channels of the Hammond River and Gold Creek (fig. 3) extended out about three-fourths of a mile into the Middle Fork Koyukuk valley at depths of 115 and 100 feet, but steep dropoffs of bedrock beyond this point suggest that these tributary channels have been cut off by glacial scouring of the Middle Fork Koyukuk.

Traces of gold are common in stibnite and quartz veins in the Nolan-Hammond River area; these veins are therefore thought to be part of a system whose erosion yielded the placer deposits. (See figs. 4, 5).

Small amounts of gold (0.02-0.05 ppm) were detected in most of the area examined. The highest concentrations were found in a small stibnite prospect at the head of Fay Creek, where one sample contained 9.2 ppm gold, and in a thin quartz vein at the head of Thompson Pup, where 5.8 ppm and 0.97 ppm gold were measured by duplicate analyses of one sample. The next highest concentrations found are only 0.06-0.08 ppm gold—concentrations no greater than are found in some of the samples outside the mining districts (fig. 3).

Gold in the veins is closely associated with antimony and arsenic (fig. 6). All samples of quartz-stibnite veins from lower Smith Creek, Midnight Dome, and the head of Fay Creek contain detectable gold, and with one exception, all gold concentrations

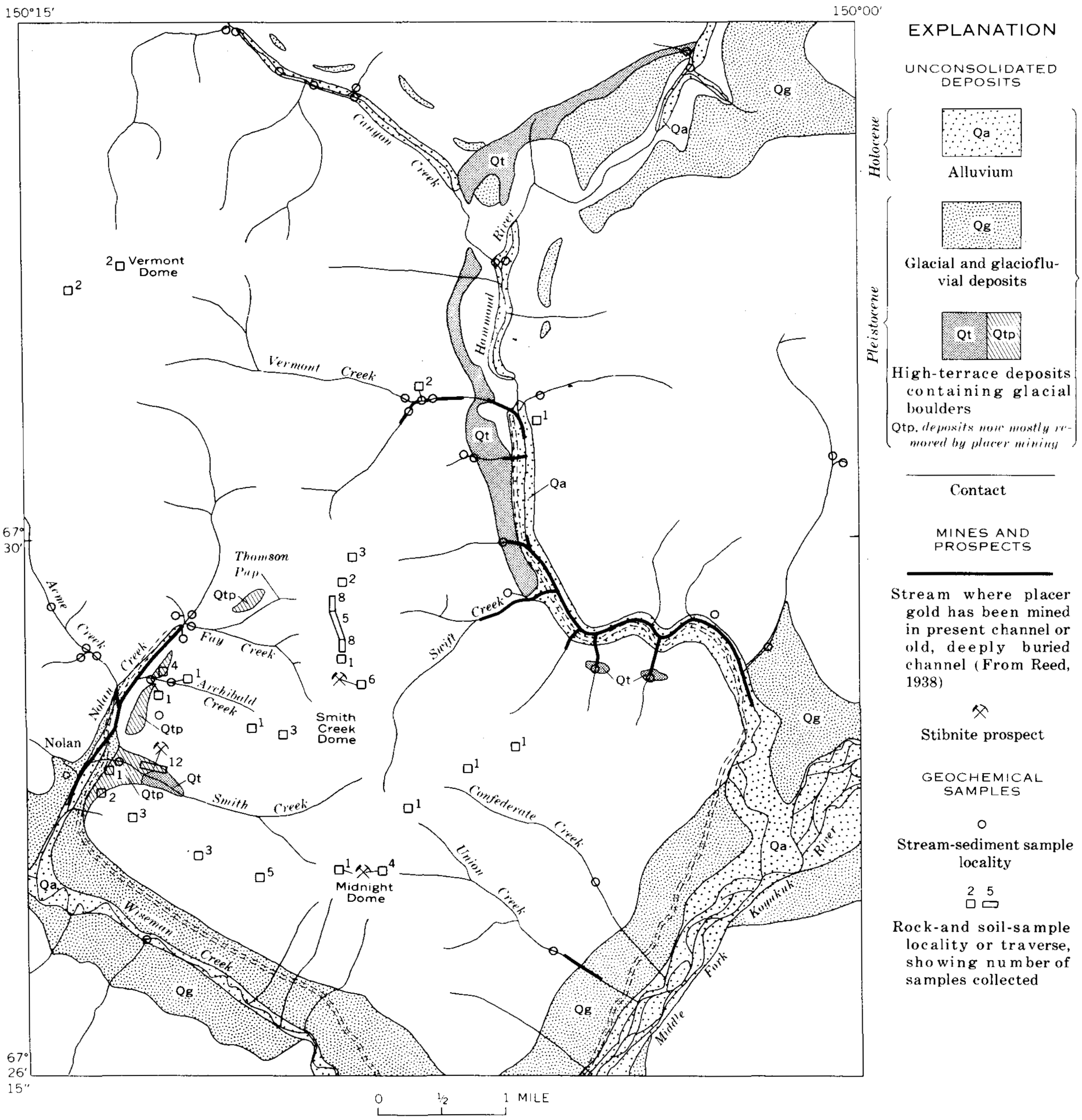


FIGURE 4.—Sample localities and unconsolidated deposits in Nolan-Hammond River area.

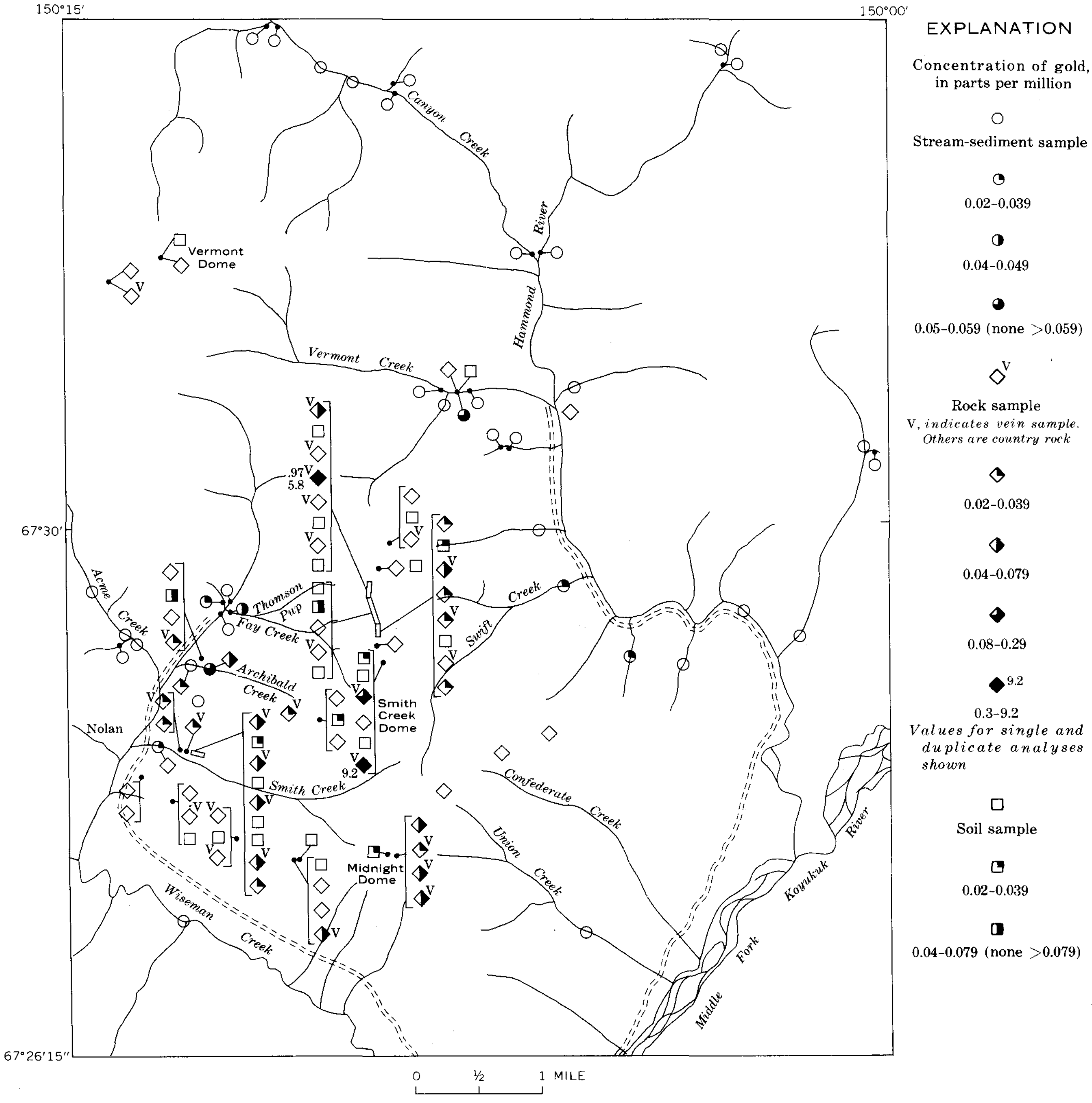


FIGURE 5.—Gold in stream-sediment, rock, and soil samples from Nolan-Hammond River area.

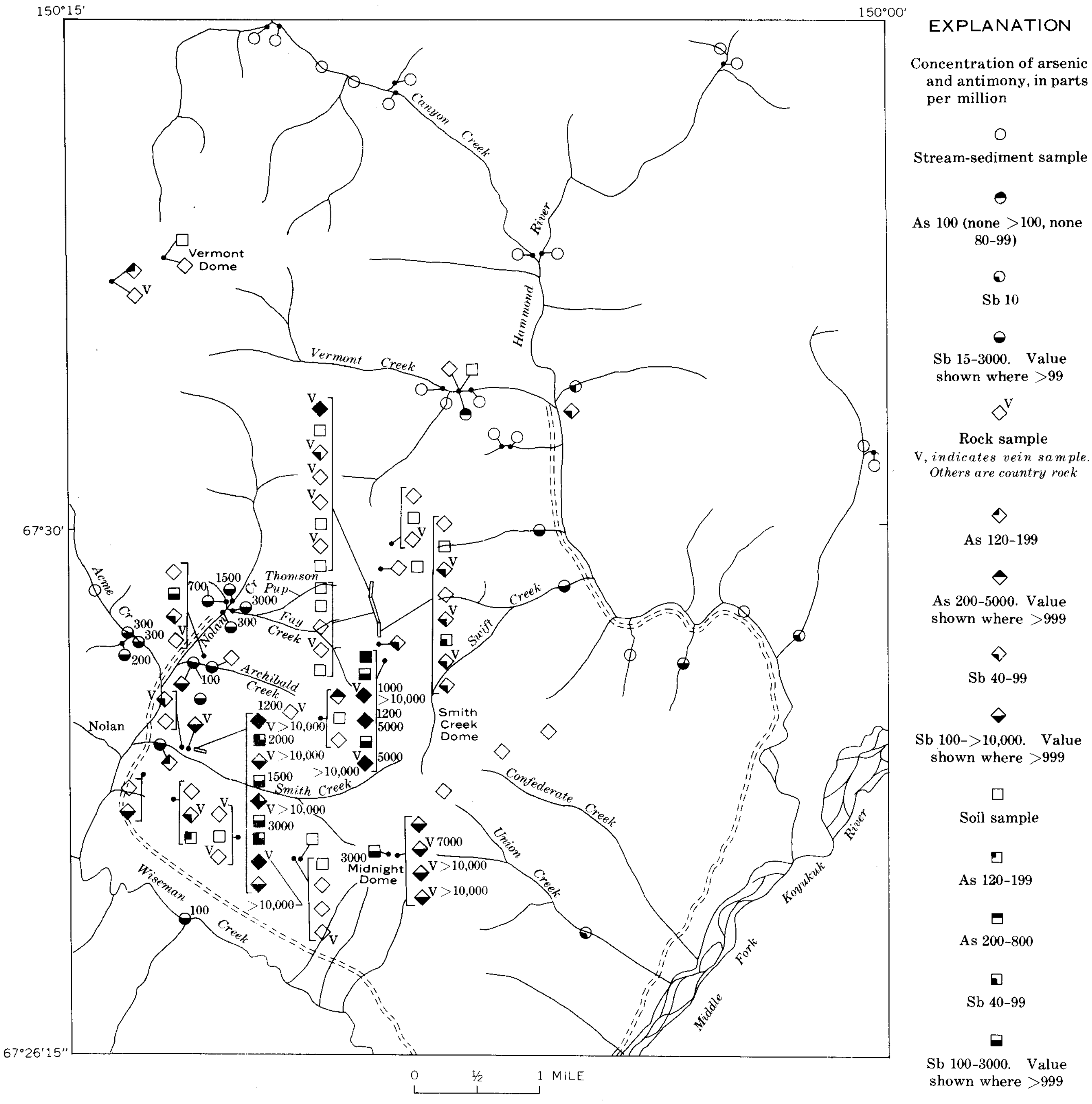


FIGURE 6.—Arsenic and antimony in stream-sediment, rock, and soil samples from Nolan-Hammond River area. Some concentration symbols are combined in the figure.

greater than 0.05 ppm are in rocks that contain anomalous antimony and arsenic. The exception is the richer of the two veins at the head of Thompson Pup, and this vein is close to the only antimony anomaly detected north of the stibnite prospects.

Antimony anomalies are present in stream sediments on the west flank of Smith Creek Dome but absent on the east flank. Anomalous concentrations of antimony also occur farther west in sediments from Acme Creek, Washington Creek, and unnamed creeks near Pasco Pass, as well as to the south in Jap Creek and Minnie Creek (figs. 6, 7). In these creeks, gold was detected analytically only in sediments of Jap Creek, but it is reported to occur in Washington Creek and Minnie Creek, and some of the gold in the buried channel of Nolan Creek may have come down Acme Creek (Reed, 1938). Stibnite pebbles were also reported from the placers on Gold Creek about 5 miles east of the Nolan-Hammond River area (Schrader, 1904). The general association of gold and antimony suggests that the source of the antimony anomalies in stream sediments should be investigated.

Zinc is associated with gold in the area between the heads of Fay Creek and Thompson Pup where most of the high vein and bedrock concentrations of gold were found (fig. 8), and may therefore be a useful pathfinder element. The zinc content does not always correlate directly with the gold; the zinc is more concentrated in soil than in rock and occurs in the bedrock as well as in the veins. A small amount of silver (2.9 ppm) occurred with gold in a milky quartz vein at the head of Thompson Pup. Generally, though, the low content of silver in rock, soil, and stream-sediment samples suggests that silver is not a useful pathfinder element for gold in this area.

Maddren (1913) suggested that gold occurs in the pyritic country rock. Although some pyritic bedrock samples contain relatively high (0.4-0.65

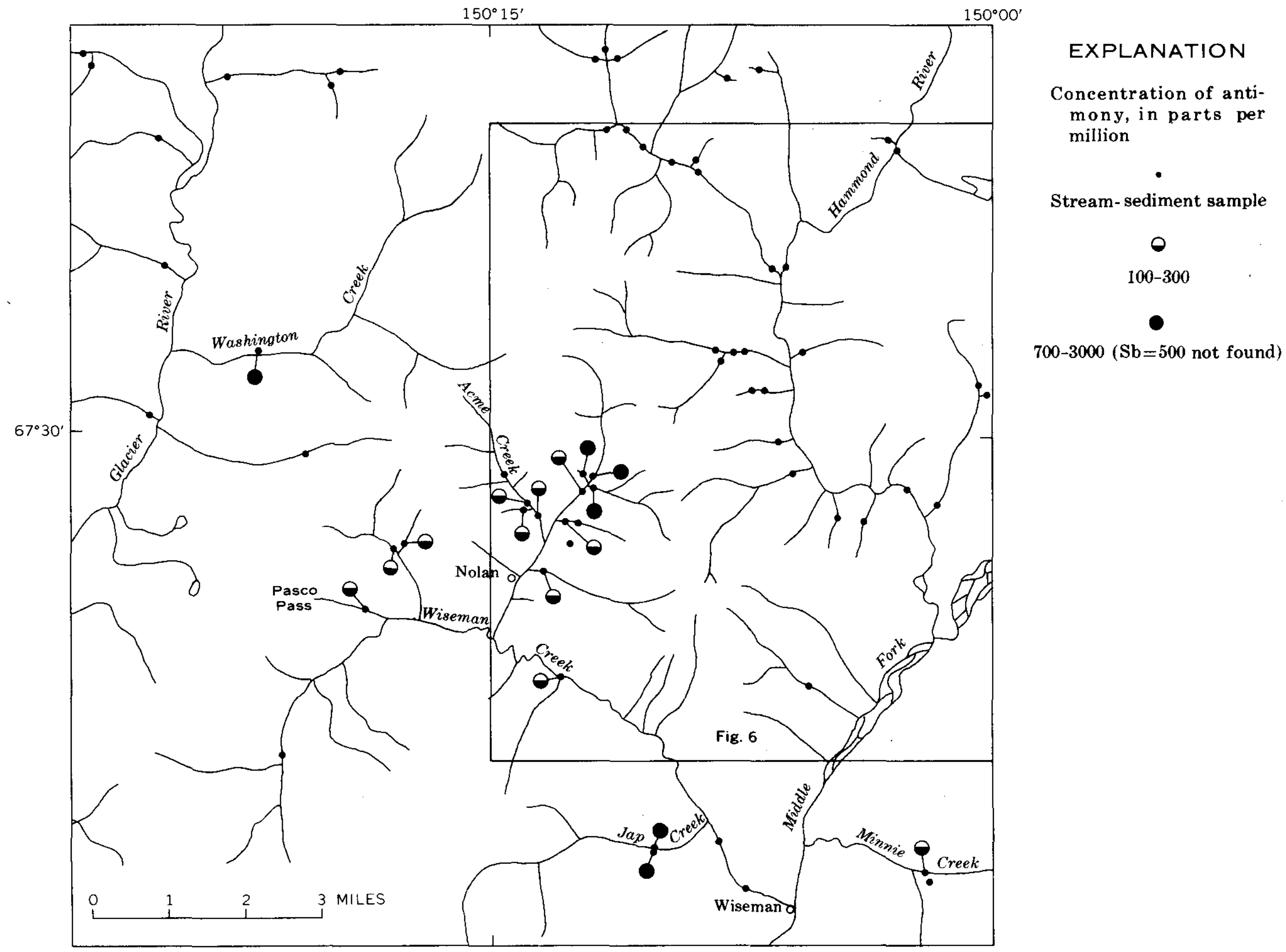


FIGURE 7.—Anomalous concentrations of antimony in stream-sediment samples in and near the Nolan-Hammond River area, the highest in the Wiseman-Chandalar region.

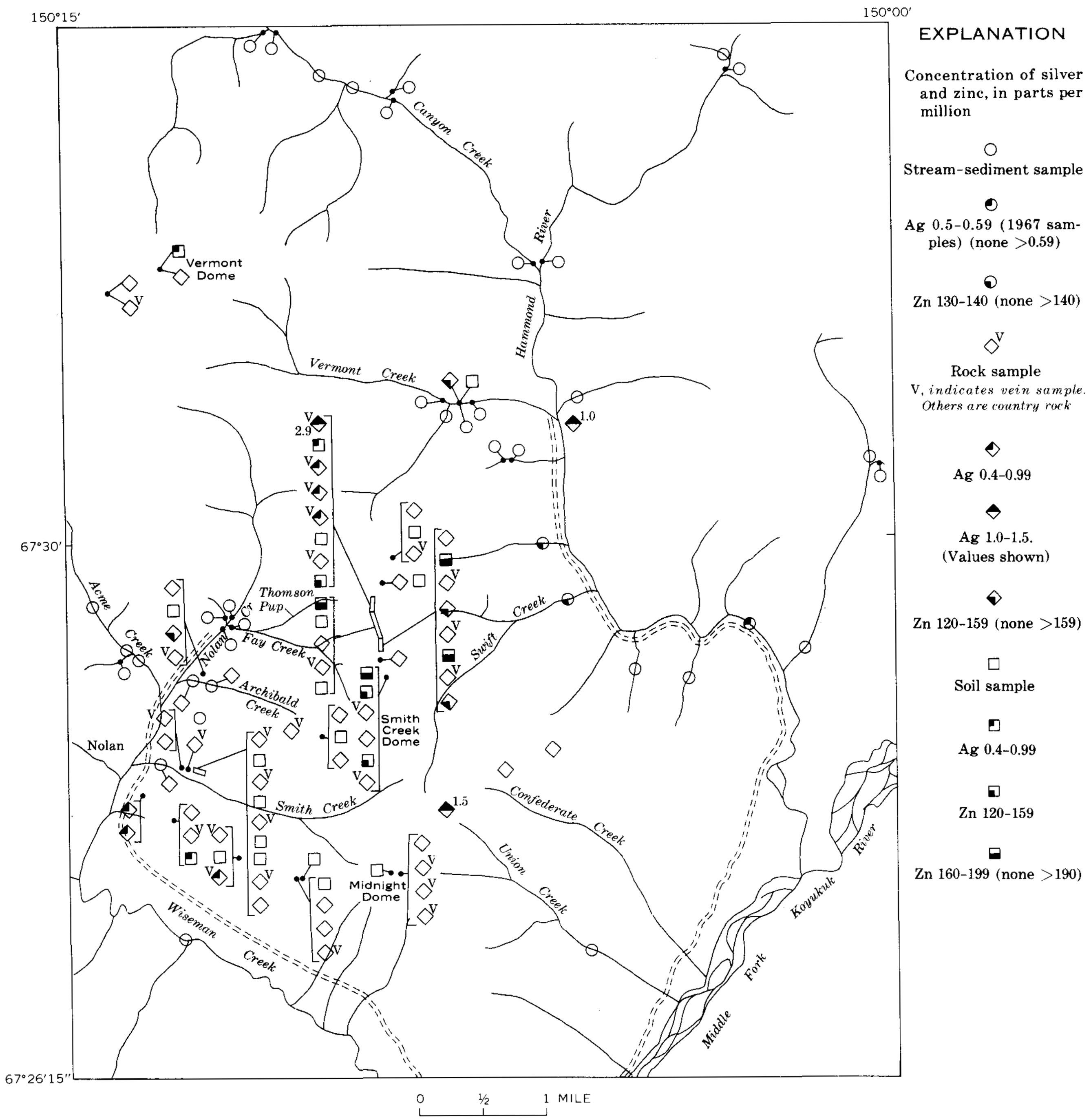


FIGURE 8.—Silver and zinc in stream-sediment, rock, and soil samples from Nolan-Hammond River area.

ppm) concentrations of silver, the only gold detected in bedrock was from samples near gold-bearing veins or from surfaces likely to have been contaminated by placer gold.

CHANDALAR MINING AREA

The bedrock of the Chandalar mining area is mainly gray quartz-muscovite schist with sills of mafic greenschist and some calcareous and quartzose beds (fig. 9). Black finely crystalline schist and phyllite containing greenstone sills underlies this schist along upper Big Creek and Tobin Creek. Chipp (1970) showed the contact with the black schist as a thrust fault.

The major structural feature of the Chandalar area is a broad northeast-plunging antiform. The dominant structural trend in the area east and south of the mining area is northeast; however, near

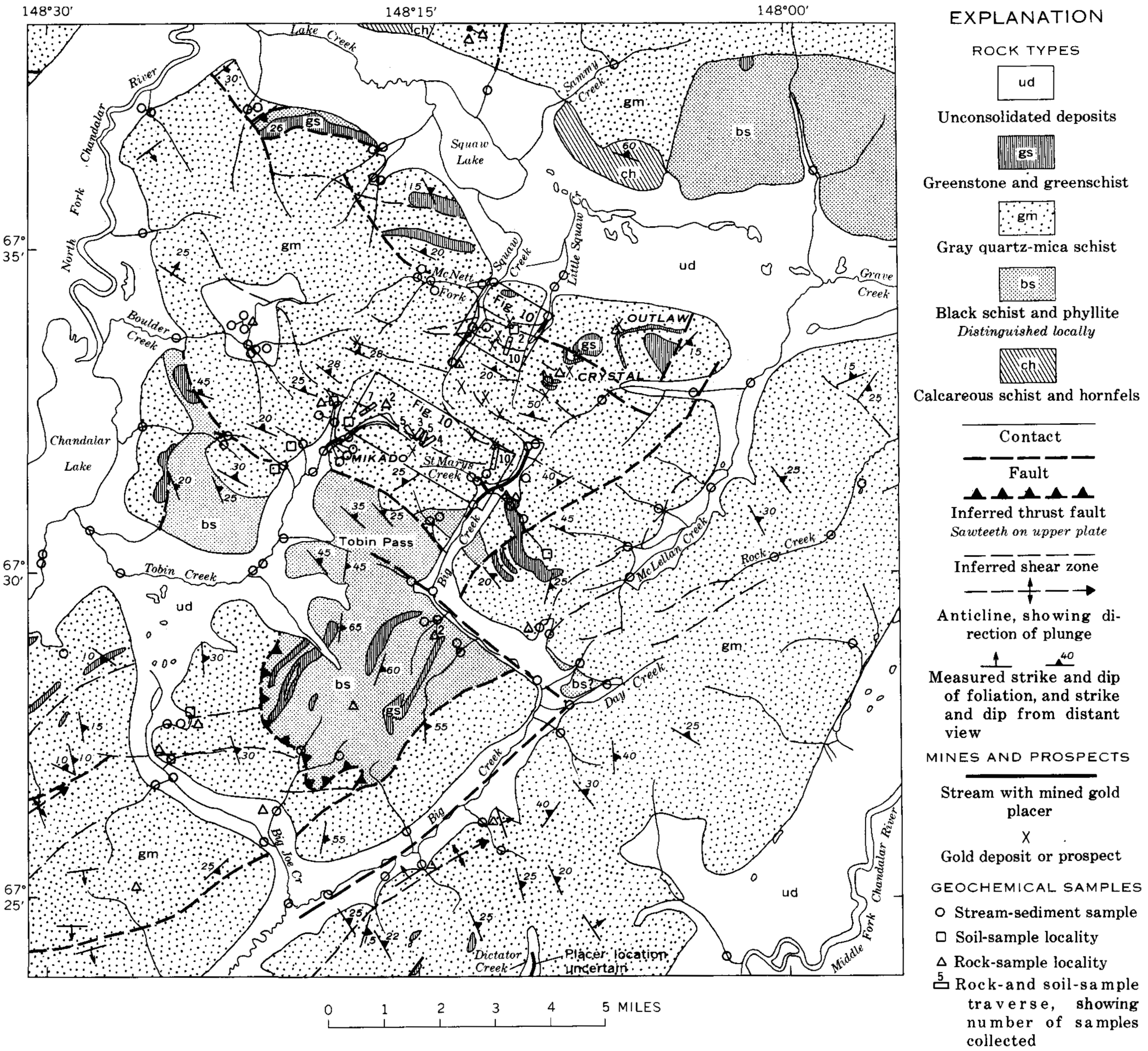


FIGURE 9.—Sample localities and geologic map, Chandalar area. (Enlarged from regional geologic map. For detailed map of northern part see Chipp (1970).)

the known gold deposits, the linear elements trend northwest. A northeast-striking high-angle fault parallel to upper Big Creek and a northwest-striking fault in Tobin Pass bound this area of dominant northwest trends. The most conspicuous northwest-trending element is a shear zone that has been exposed in the Mikado mine. On the ridge crest east of the mine, this shear zone is marked by discordant dips. In the tunnel and trenches at the mine, the zone is about 50 feet wide and dips steeply, generally to the northwest (Frank Birch, written commun., 1968). Schist within this zone is obliquely sheared and contains subparallel sheared and brecciated gold-bearing quartz veins and lenses. The larger veins are near the two walls of the shear zone.

Glacial drift makes up most of the unconsolidated deposits in the main valleys and extends up Squaw and Little Squaw Creeks to the gold placers (Mertie, 1925, p. 254). However, the alluvial deposits in upper Tobin and Big Creeks seem to be entirely of local rocks.

Samples of mineralized rock from the worked deposits show an association of metals that may be a guide to other lode deposits in the area. Arsenopyrite, sphalerite, and minor galena and stibnite are present in ore from the Mikado mine (Maddren, 1913), and high concentrations of silver, arsenic, lead, antimony, and zinc were measured in the samples (fig. 10). The copper content of mineralized rock is generally low.

Soil samples show a similar association of metals. Samples near the Little Squaw and Mikado deposits generally contain above average amounts of lead, molybdenum, and either antimony or arsenic, and high zinc content is associated with high gold and silver content at the Mikado mine and Star prospect. The copper content of soils near the prospects is generally low. The highest concentration of gold

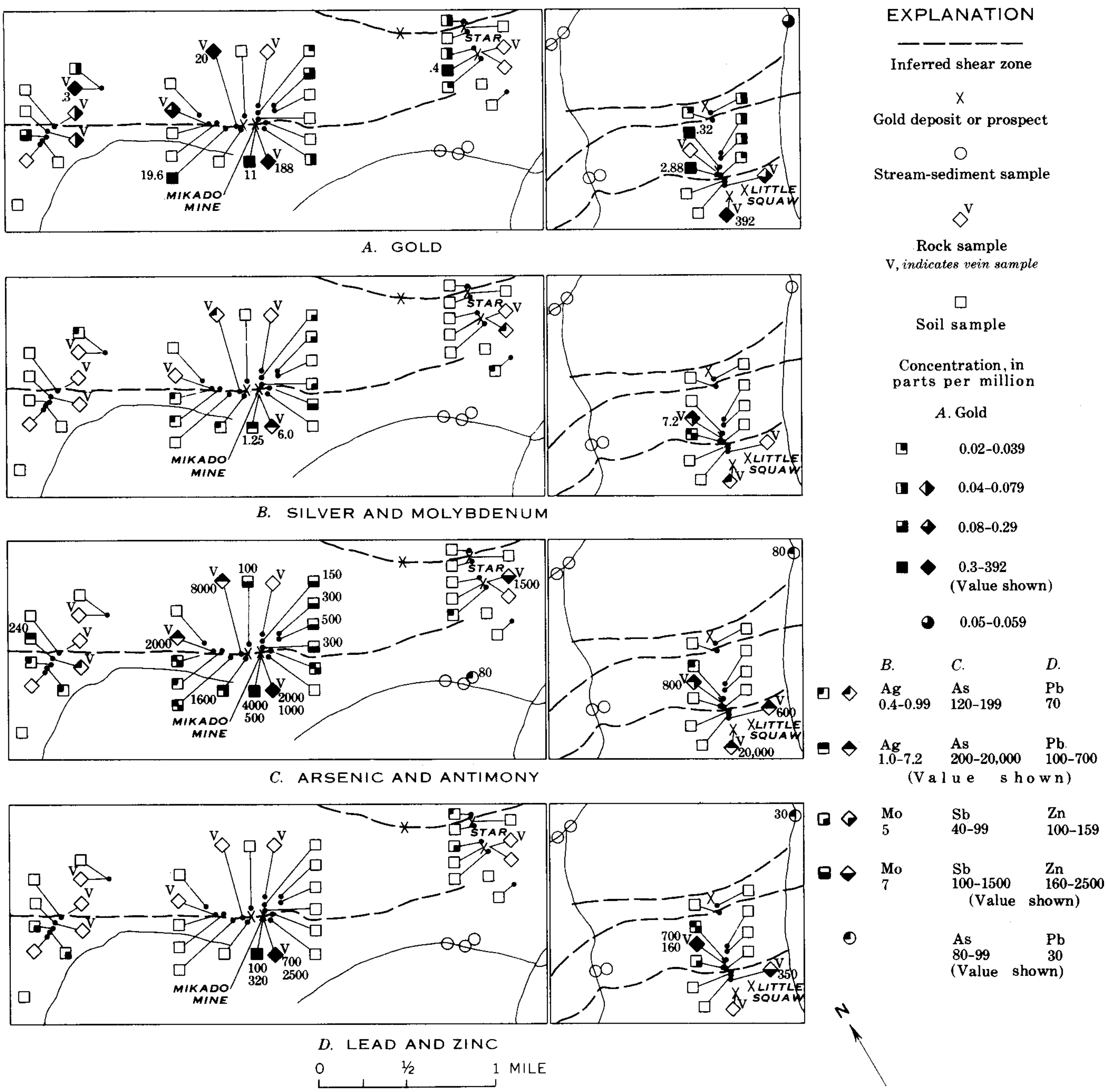


FIGURE 10.—Gold, silver, molybdenum, arsenic, antimony, lead, and zinc in rock, soil, and stream-sediment samples near gold deposits in the Chandalar area. For location see figures 11 and 12. Some concentration symbols are combined in the figure.

in the soil was found about 100 yards west of the Mikado portal, and most of the samples with high concentrations of silver and arsenic were also west of the portal. Conversely, the highest concentrations of antimony and molybdenum are east of the portal. The Mikado shear zone is also mineralized a mile west of the portal; there gold occurs in quartz veins and in soil on the topographic trace of the shear zone, and the soil contains anomalous amounts of arsenic and above average amounts of silver, lead, and zinc.

Sediments in streams that drain the lode prospects contain gold and above average amounts of zinc, lead, or silver. Most of the high concentrations of arsenic and copper in stream sediments are at localities near the lodes (figs. 11, 12). Chipp (1970) also found that concentrations of copper, and possibly silver, are significantly higher in these streams near the lodes.

OTHER METAL OCCURRENCES IN THE CHANDALAR AREA

Base-metal mineralization seems to be largely within the area of northwest-trending shear zones. Base-metal anomalies in stream sediment samples

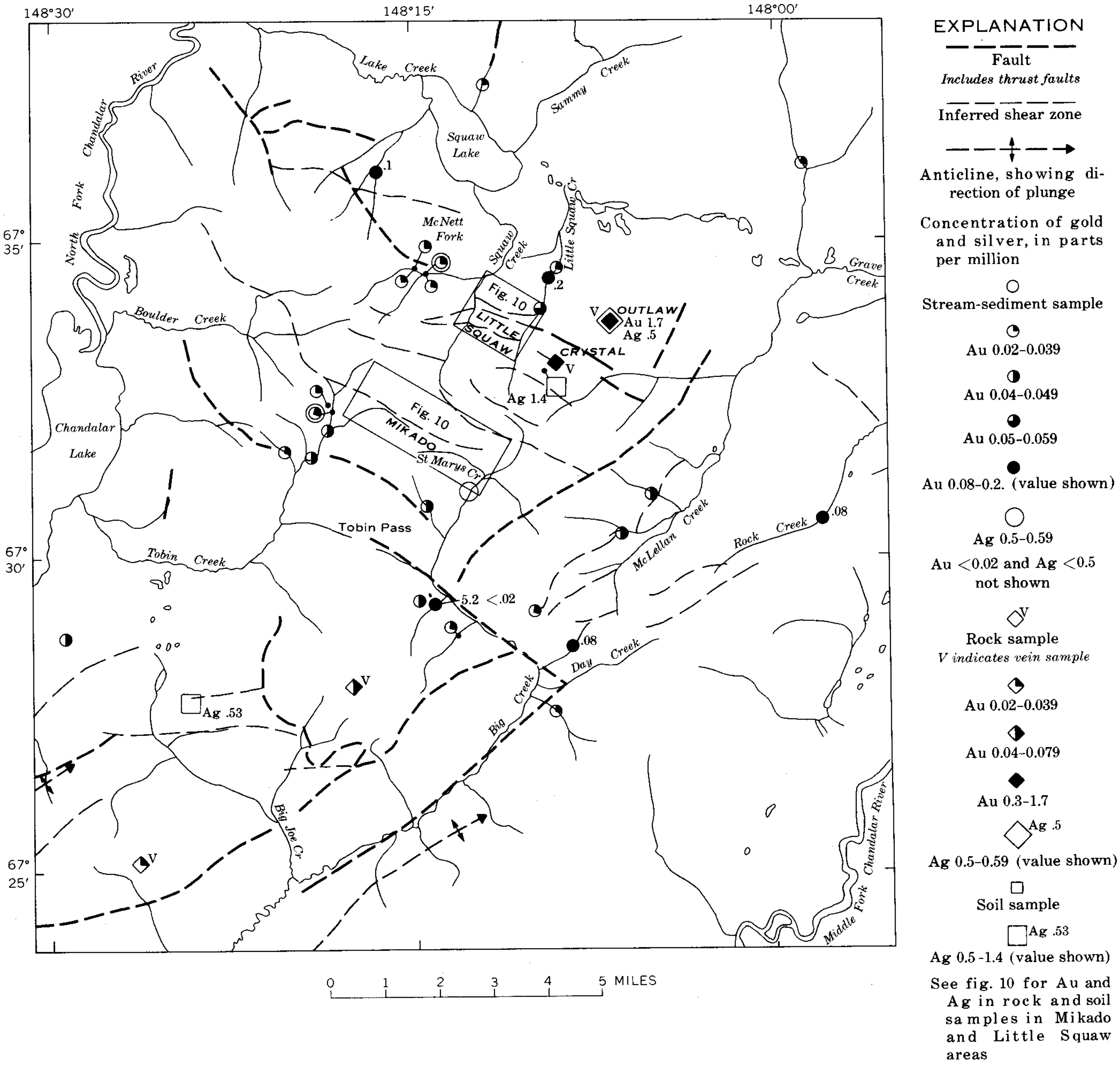


FIGURE 11.—Gold and silver in stream-sediment, rock, and soil samples from the Chandalar area.

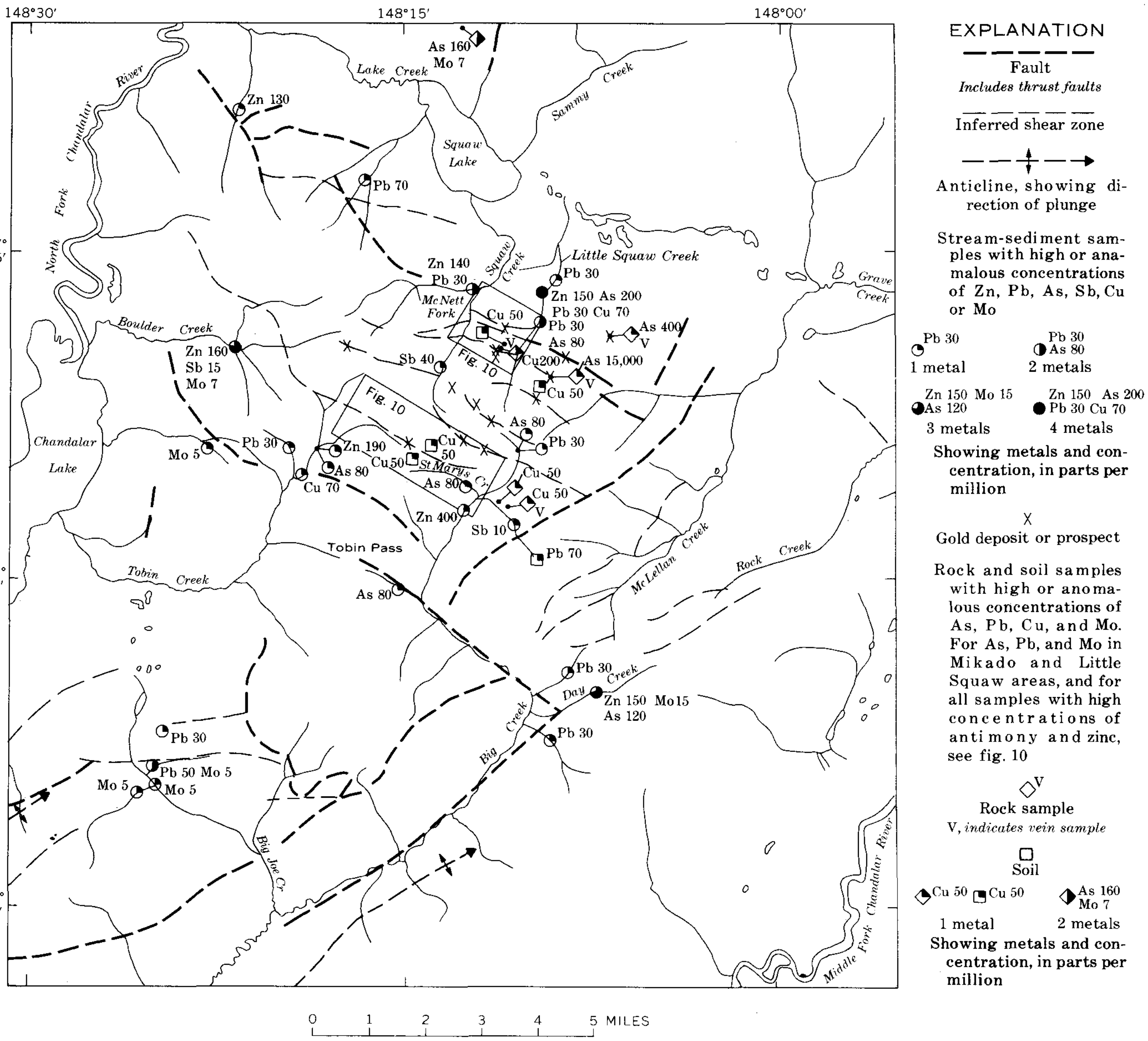


FIGURE 12.—Zinc, lead, arsenic, antimony, copper and molybdenum in stream-sediment, rock, and soil samples from the Chandalar area.

are concentrated within this area, and, with one exception, the samples of rock and soil from outside this area have low base-metal contents. Gold, however, occurs in many stream sediments east of the area and on the north side of Lake Creek-Grave Creek valley. Some of this gold may have been dispersed by glaciation, but most of the gold detected probably is locally derived, for it occurs mostly in headwaters and small tributaries above the level of glacial deposits.

The greatest concentration of anomalies in stream sediments outside the drainage from known lodes is on McNett Fork and the unnamed stream to the northwest, where gold occurs with silver or lead and with above average copper and zinc. Chipp's (1970) samples did not show base-metal anomalies in these two streams, but did show them in the next stream northwest. An inferred northwest-trending shear zone close to the sample localities, mapped only from aerial photographs, merits examination.

Gold is also present outside the mining area in sediments from streams that cross inferred northeast-trending shear zones near McLellan Creek, Day Creek, and Rock Creek and south of the inferred northwest-trending fault along Big Creek. High contents of molybdenum, lead, arsenic, and zinc are present locally in sediment samples near Day Creek and south of the inferred Big Creek fault. The high gold content (5.2 ppm) of a sediment sample from a small tributary south of Big Creek was not con-

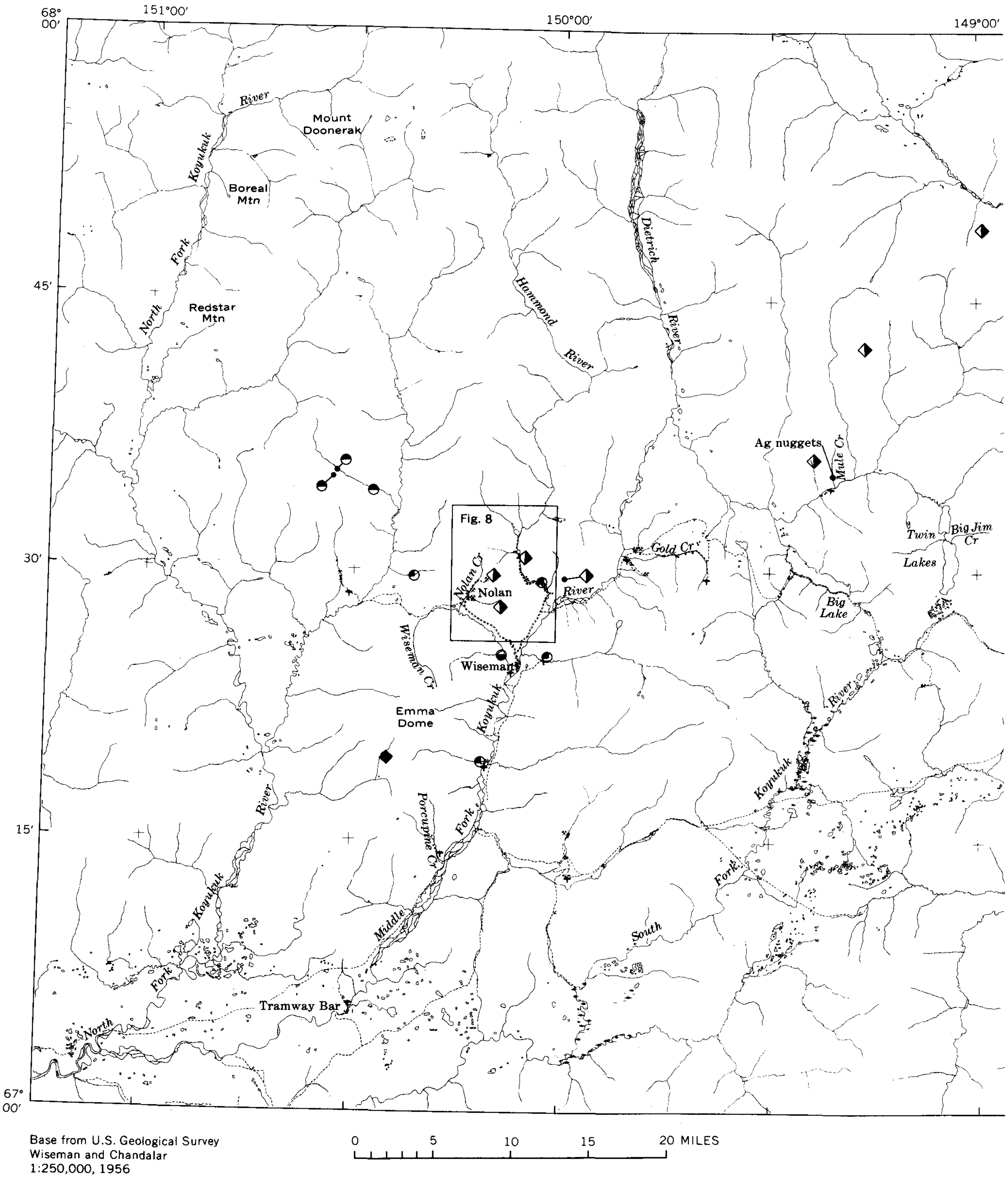


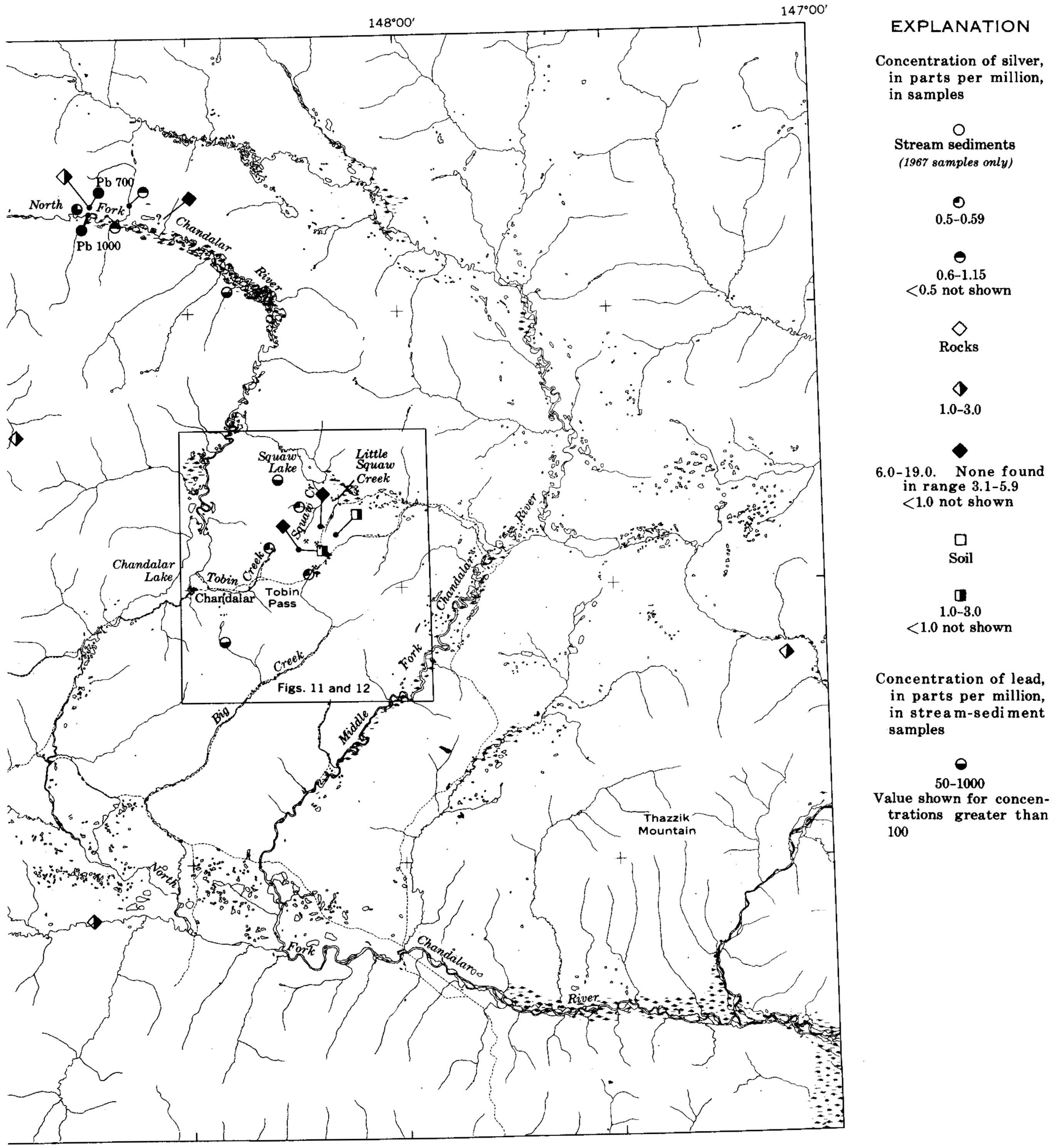
Figure 13.—Silver and lead in stream-sediment samples and

firmed by a duplicate analysis and probably reflects the effect of a single gold particle.

The concentrations of lead and molybdenum are high in stream sediments of Big Joe Creek and its tributaries, and gold occurs in quartz veins at the prospect near the headwaters of Big Joe Creek and on the mountain southwest of Big Joe Creek.

OTHER ANOMALOUS AREAS

A third association of anomalies is found in the carbonate terrane at the north margin of granitic



silver in rock and soil samples from Wiseman-Chandalar region.

rocks on the North Fork of the Chandalar. Here, gold in stream-sediment and rock samples is associated with anomalous concentrations of lead, zinc, and copper and relatively high concentrations of silver. Relatively high concentrations of silver also occur in rocks and stream sediments in a poorly defined zone that follows the trend of the carbonate rocks southwestward from the North Fork of the Chandalar to the North Fork of the Koyukuk (fig. 13). Although the maximum silver concentrations in the stream-sediment samples are only four or five times higher than the median value, higher concentrations are known at three localities in this zone. Schrader (1900) collected a vein sample that assayed 6 ppm silver and 18 ppm gold from a locality on the North Fork of the Chandalar whose approximate position is shown by a question mark on figure 13. A sample of galena submitted from a prospect in the nearby limestone (not shown on fig. 13) assays 360 ppm silver and 6.5 ppm gold. Farther west, silver and copper nuggets were found in the gold placer on Mule Creek according to Maddren (1913).[1]

The relatively high silver concentrations are principally in the area where the carbonate and calcareous rocks have been intruded by granitic and mafic rocks and are in part metamorphosed. Schrader ascribed his sample to the mafic rock unit, but the closeness of his locality to a granite sill makes an association with the mafic rocks uncertain.

Gold was detected in some samples outside the three main anomalous areas. A high concentration of gold occurs with silver in samples from one thin arsenic-rich vein in the system of east-trending quartz veins north of Thazzik Mountain. Gold was detected in sediment samples from many of the streams south of Wiseman that contain placer gold and from one stream that flows almost entirely in the glacial drift south of the mountains, but none of these samples contain high concentrations of other metals. Although many of the placers south of Wiseman probably have local sources, gold and silver in a quartz vein southwest of Emma Dome is the only direct evidence of mineralization in that area. A large gossan on Redstar Mountain in the northwestern part of the region contains high concentrations of arsenic, antimony, and molybdenum but no detectable gold.

SUMMARY

Gold-bearing quartz and quartz-stibnite veins are common in the Nolan-Hammond River area adjacent to the placer deposits and are probably part of the vein system that was the source of the placers. Although gold is generally present in trace amounts only, concentrations of as much as 9.2 ppm in stibnite and 5.8 ppm in quartz are present. Gold was not detected in the pyritic bedrock except near veins or where the bedrock may have been contaminated by placer gold. Antimony anomalies in stream sediments on and west of Acme Creek suggest the presence of veins west of the Nolan Creek placer deposits.

Near Chandalar most mineralization coincides with an area of northwest-trending shear zones that contains the known gold lodes. Within this area gold and arsenic were detected about 1 mile northwest of the Mikado mine along the strike of the Mikado shear zone. Gold and base-metal anomalies in stream-sediment samples 2-4 miles northwest of the Little Squaw mine indicate that an inferred shear zone near these anomalies may also be mineralized. Both shear zones merit further investigation. Gold was also detected in several streams outside the lode-bearing area. In most of these streams, gold is not accompanied by other metal anomalies.

North of the Wiseman-Chandalar mining area, reconnaissance sampling shows relatively high concentrations of silver accompanied by gold and lead in a zone that is poorly defined but follows the regional strike of the carbonate rocks along the north edge of the schist and granitic rocks. One lead-silver prospect is known, but much more sampling is required to determine the significance of this zone.

REFERENCES CITED

Alaska Division of Mines and Geology, 1969, Mining activities: Alaska Div. Mines Bull., v. 17, no. 10, p. 2.

Brosgé, W. P., and Reiser, H. N., 1960, Progress map of the geology of the Wiseman quadrangle, Alaska: U.S. Geol. Survey open-file map, scale 1:250,000.

——— 1964, Geologic map and sections of the Chandalar quadrangle, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-375, scale 1:250,000.

——— 1970a, Chemical analyses of stream-sediment samples from the Chandalar and eastern Wiseman quadrangles, Alaska: U.S. Geol. Survey open-file report, 56 p., tables, map.

——— 1970b, Chemical analyses of rock and soil samples from the Chandalar and eastern Wiseman quadrangles, Alaska: U.S. Geol. Survey open-file report, 8 p., 3 maps.

Chipp, E. R., 1970, Geology and geochemistry of the Chandalar area, Brooks Range, Alaska: Alaska Div. Mines and Geology, Geologic Rept. no. 42, 39 p.

Cobb, E. H., 1962, Lode gold and silver occurrences in Alaska: U.S. Geol. Survey Mineral Inv. Map MR-32, scale 1:2,500,000.

[1] Since this report was submitted, about 240 claims in seven groups have been staked north and northeast of Mule Creek, near two of the silver localities shown in figure 13.

——— 1964, Placer gold occurrences in Alaska: U.S. Geol. Survey Mineral Inv. Map MR-38, scale 1:2,500,000.

Maddren, A. G., 1913, The Koyukuk-Chandalar region, Alaska: U.S. Geol. Survey Bull. 532, 119 p.

Marshall, Robert, 1933, Arctic Village: New York Literary Guild, 397 p.

Mertie, J. B., Jr., 1925, Geology and gold placers of the Chandalar district, Alaska: U.S. Geol. Survey Bull. 773-E, p. E215-E263.

Reed, I. M., 1938, Upper Koyukuk region, Alaska: Alaska Dept. Mines [rept. unpub.], 169 p.

Schrader, F. S., 1900, Preliminary report on a reconnaissance along the Chandalar and Koyukuk Rivers, Alaska, in 1899: U.S. Geol. Survey 21st Ann. Rept., p. 443-486.

——— 1904, A reconnaissance in northern Alaska: U.S. Geol. Survey Prof. Paper 20, 139 p.

White, M. G., 1952, Radioactivity of selected rocks and placer concentrates from northeastern Alaska: U.S. Geol. Survey Circ. 195, 12 p.

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