UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

GEOCHEMICAL EXPLORATION STUDIES IN THE DILLON, MONTANA-IDAHO 1° x 2° QUADRANGLE: GEOCHEMICAL RECONNAISSANCE OF MINING DISTRICTS IN THE SOUTHERN PIONEER MOUNTAINS AND VICINITY, BEAVERHEAD COUNTY, MONTANA

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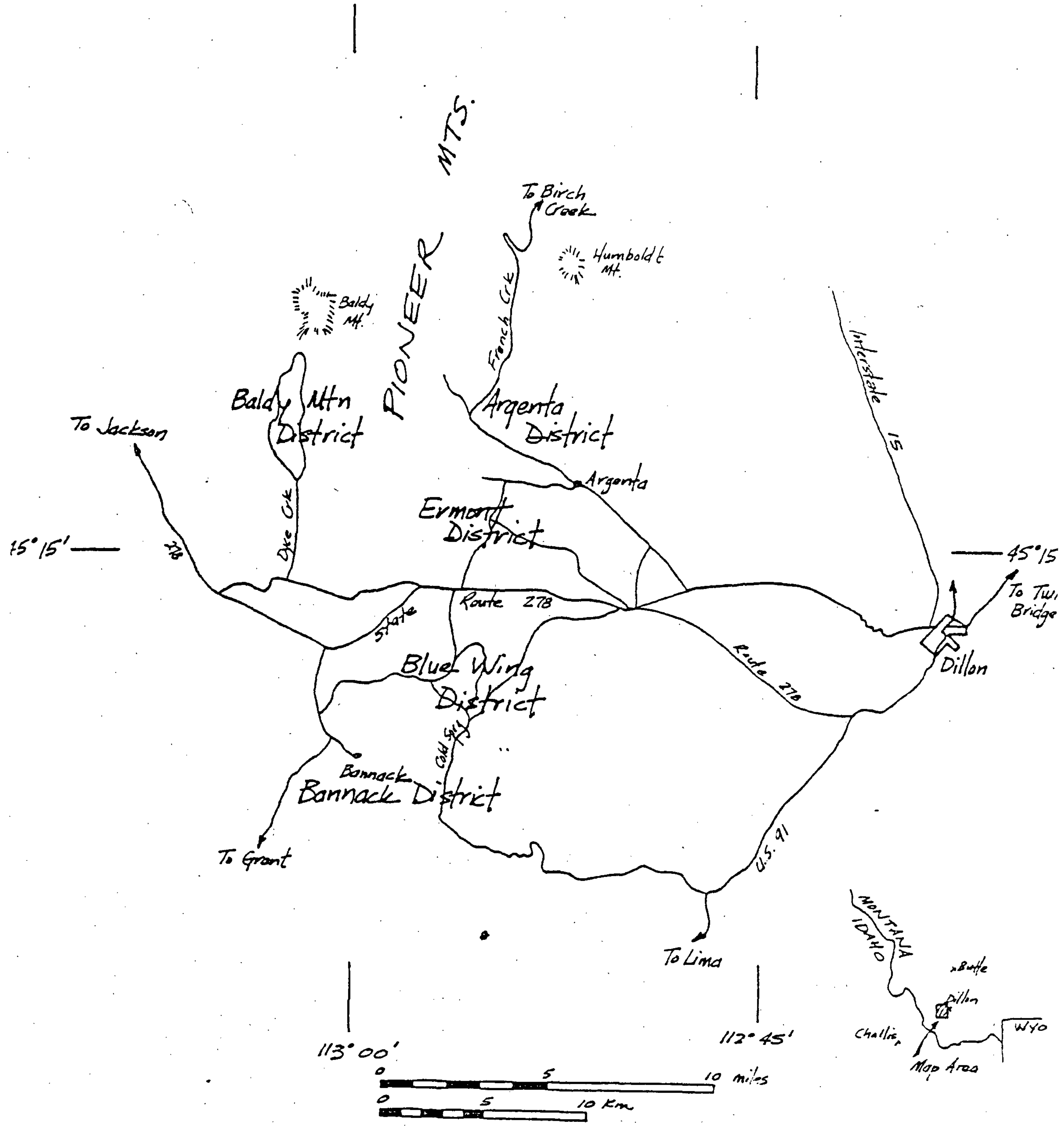
INTRODUCTION

Mineral resource studies are being undertaken in the Dillon, Montana-Idaho, 1° x 2° quadrangle as part of the Conterminous United States Mineral Assessment Program (CUSMAP) of the U.S. Geological Survey. A broad spectrum of coordinated geologic, geochemical, and geophysical data is being systematically collected for the purposes of disseminating and interpreting mineral-resource information for land-use planning and resource management. The synthesis of regional geological information is an integral part of the program in order to increase the understanding of crustal evolution and the controls on the distribution of mineral deposits.

The overall objectives of the geochemical exploration investigations in the Dillon project area are to (1) define the broad, regional geochemical patterns; (2) geochemically characterize the different types of known mineral deposits; (3) undertake research to develop and (or) evaluate regional geochemical exploration techniques; (4) research the genesis of geochemical dispersion patterns germane to gaining an understanding of regional metallogenesis and the geological controls of mineral occurrences; and (5) to provide supportive data to the consanguineous geologic and geophysical studies.

The purpose of this preliminary report is to present reconnaissance geochemical exploration data from mineral districts in the vicinity of the southern Pioneer Mountains, Beaverhead County, MT (fig. 1). A considerable number of historically productive mineral deposits occur in the southern Pioneer Mountains, including the Bannack, Blue Wing, and Argenta mining districts. The economically most important metals in the area discussed in this report include silver, gold, copper, lead, zinc, and tungsten.

FIGURE 1.--Major mining districts in the southern Pioneer Mountains and vicinity.



Previous studies in the area have catalogued the geology, mineralogy, and production of the various mineral deposits (Winchell, 1914; Shenon, 1931; Geach, 1972), but none of the studies have geochemically characterized the deposits in order to build a systematic picture of the interrelationships (or lack thereof) of the deposits for exploration and evaluation purposes. The geochemical survey described here has found distinct elemental suites that are of considerable value in gaining an understanding of the known deposits and, when utilized in conjunction with other geological factors, affords one the opportunity of defining and assessing minerals exploration targets.

SAMPLING AND ANALYTICAL PROCEDURES

Rock samples were collected during this study from selected mines and prospects in all of the major mining districts in the vicinity of the southern Pioneer Mountains. The samples were chosen whenever possible to represent ore, altered host rock, and unaltered host rock. All samples were analyzed for 31 elements using a six-step semiquantitative emission spectrographic technique (Grimes and Marranzino, 1968), and for five elements (zinc, arsenic, antimony, tin, and tungsten) using wet-chemical techniques. Colorimetric techniques were used to analyze for arsenic (Almond, 1953) and tungsten (Quin and Brooks, 1972). Atomic-absorption spectrophotometric techniques were used to analyze for zinc (Ward and others, 1969), antimony (Welsch and Chao, 1975), and tin (Welsch and Chao, 1976).

BANNACK MINING DISTRICT

The Banncak mining district is in T. 8 S., R. 11 W., approximately 20 miles southwest of Dillon, MT (fig. 1). From 1862 intermittently until World War II, Tertiary to Holocene placer deposits along Grasshopper Creek and adjacent lode deposits were mined for the contained gold values. Shenon (1931) estimated that approximately $10 million in placer gold and $2 million in combined metal values from lode deposits were recovered from the district. Lyden (1948) estimated that from

$2-3 million in placer gold were mined. The settlement of Bannack served as the first Montana territorial capital in 1863, and the town is now partially restored as a state park.

Geology

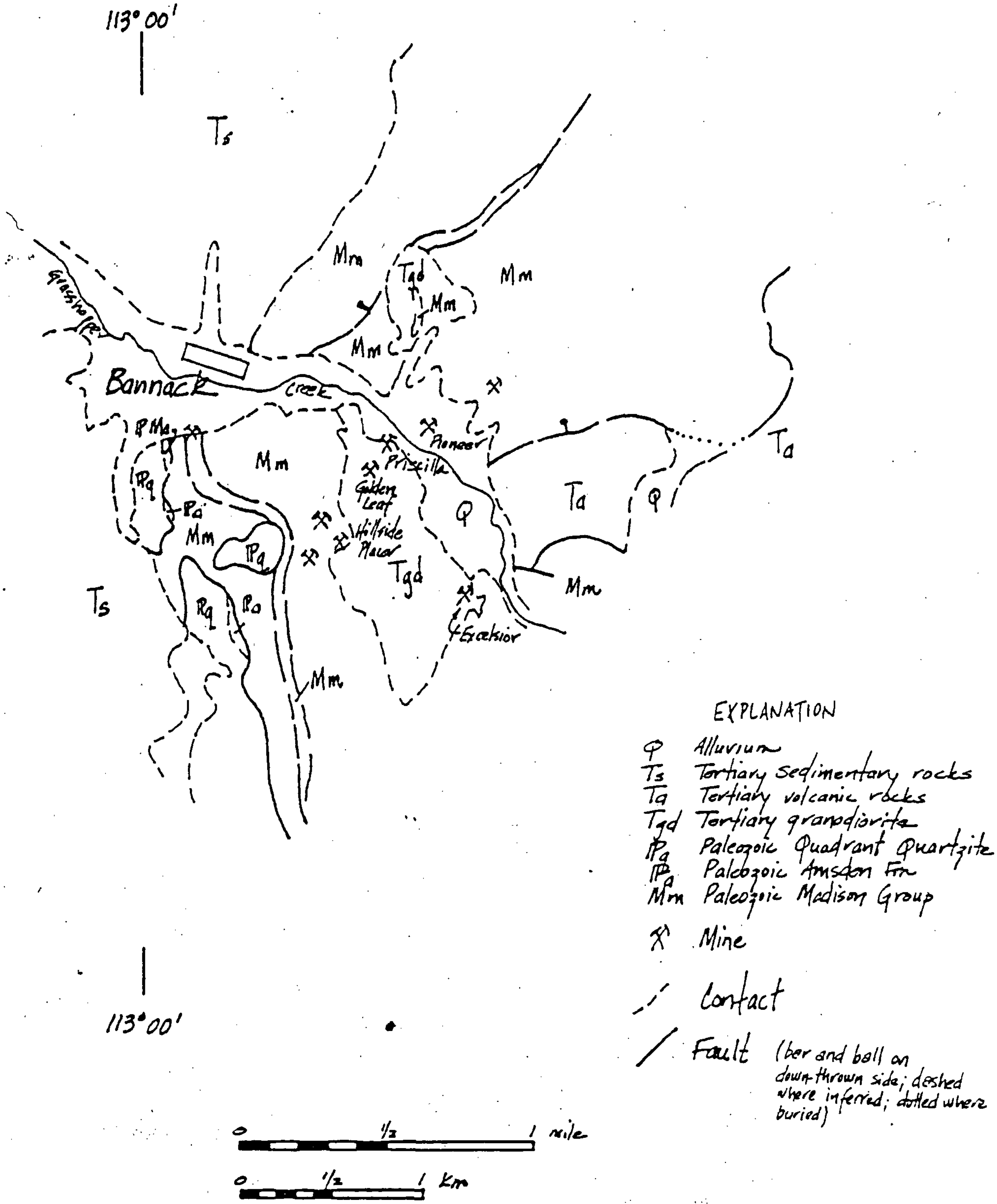
The general geology of the district (fig. 2) was mapped by Lowell (1965). Mississippian carbonates and Pennsylvanian quartzites are the oldest exposed rocks in the district, although Precambrian metamorphic rocks and older Paleozoic formations occur south of Bannack. Probable Laramide (L. W. Snee, Aug. 1979, unpublished data) extrusive and intrusive rocks occupy the eastern part of the district, and the mineral deposits in the area appear to be genetically related to these rocks. Nonmarine Tertiary sediments and volcanic rocks are prevalent in the area, particularly in the western part of the district.

Lowell (1965) assigned the Mississippian carbonate rocks to the Madison Group. He recognized both the Lodgepole and Mission Canyon Limestones, although the two formations are undivided wherever altered to marble by the intrusive rocks. Shenon (1931) described several hundred feet of carbonate rocks in the district consisting of blue-gray, blue-white, and pink crystalline limestone. Some parts of the section contain abundant fossil remains, and black chert lenses and nodules occur in the middle part of the section.

The Quadrant Quartzite crops out on the south side of the district and consists of white to pinkish-white vitreous quartzite (Shenon, 1931).

Extrusive volcanic rocks are prevalent in the district and consist of rhyodacite to andesite flows, tuffs, agglomerates, and tuff breccias. The volcanic rocks are intruded by a medium-grained granodiorite stock that is exposed at two localities in the main part of the Bannack district. The mineralogy of the intrusion and that of the majority of the extrusive rocks

FIGURE 2.--Generalized geologic map of the Bannack mining district.



consists of plagioclase (andesine), orthoclase, biotite, hornblende, quartz, and magnetite. Pyrite is common along fractures and joints (Shenon, 1931). The age of these igneous rocks is unknown, although we infer a Laramide age on the basis of regional geochemical and igneous patterns.

The structural framework of the area is dominated by north-trending folds and faults. North-trending, west-dipping thrust faults bring the Madison Group limestones over older Paleozoic carbonate rocks. The low-angle faults are displaced by northwest- and northeast-trending high-angle structures, and all of these faults are intruded by the granodiorite.

Mineralization

Two episodes of metallization were recognized during the present study: (1) an early contact metasomatic event producing skarn assemblages in the carbonate rocks, and (2) a later fracture-controlled mineralization episode.

There are two types of skarn assemblages that were recognized during the field study: magnetite-dominant calc-silicate assemblages and garnet-dominant assemblages. The magnetite rock occurs as pods and stringers in the Madison limestones immediately adjacent to the granodiorite contact. Epidote, tremolite, quartz, specular hematite, and pyrite are common accessory minerals, although most of the exposed rocks are oxidized, and the magnetite is mixed with serpentine, quartz, malachite, and various clay minerals. The garnet skarn consists primarily of red garnet, pyroxene, epidote, idocrase, quartz, calcite, and pyrite. Away from the limestone-granodiorite contact the limestones are bleached and recrystallized to coarse calcite.

The vein systems crosscut the calc-silicate rocks in many instances, and the main alteration phases associated with the veins are quartz, sericite, clay minerals, and chlorite. The width of alteration selvages on the veins varies from a few inches to several feet. The vein sulfides occur as open-space fillings in quartz. The immediate edges of the veins consist of quartz and sericite, grading outward in the larger veins into an argillic assemblage. Many of the mineral deposits occur near the contact of the granodiorite and the sedimentary rocks (Shenon, 1931), and some of the primary mineral phases in the granodiorite are altered. Cloudy feldspar grains are common due to white mica and clay, and biotite and hornblende are frequently altered to chlorite, magnetite, and, less commonly, epidote. Shenon (1931) described the alteration of hornblende to biotite, but this relationship was not confirmed during the present investigation.

Gold is the most important ore mineral in the Bannack district. Shenon (1931) noted the presence also of native silver, tetradymite, galena, sphalerite, argentite, and chalcopyrite.

Geochemistry

Geochemical sampling in the district suggests that the predominant elemental suite is gold, silver, copper, molybdenum, tungsten, and zinc (table 1). Arsenic, antimony, and tin are also present in some of the sampled occurrences, but the variability in these elements suggests that they do not serve as useful characterizers of precious-metal mineralization. Lead was not found to be abundant in any of the samples analyzed.

TABLE 1.--*Trace elements in ores in the Bannack mining district.*

Mine/prospect	Location	Trace-element suite
Pioneer mine	Sec. 8	Au-Ag-Cu-Mo-Sn-Zn
Golden Leaf mine	Sec. 8	Au-Ag-As-Cu-Mo-Pb-W
Hillside placer	Sec. 8	Au-Ag-Cu-Mo-W-Zn
Priscilla mine	Sec. 8	Ag-Cu-Mo-Sn-W-Zn

Iron and manganese oxides are the most consistent carriers of the ore-suite elements. The garnet skarn rocks do not appear to contain the same trace elements as the quartz veins. Magnetite skarn contains copper, silver, and tin; adjacent to the quartz veins these rocks are highly anomalous in silver, copper, tin, tungsten, and zinc, and are slightly anomalous in arsenic and antimony. The altered granodiorite does not consistently contain any of the ore-suite elements, although copper, molybdenum, and silver are common. The recrystallized and bleached limestone contains only trace amounts of antimony and silver. A pervasively altered volcanic rock contains anomalous beryllium, lanthanum, and molybdenum with minor amounts of arsenic and antimony.

BLUE WING MINING DISTRICT

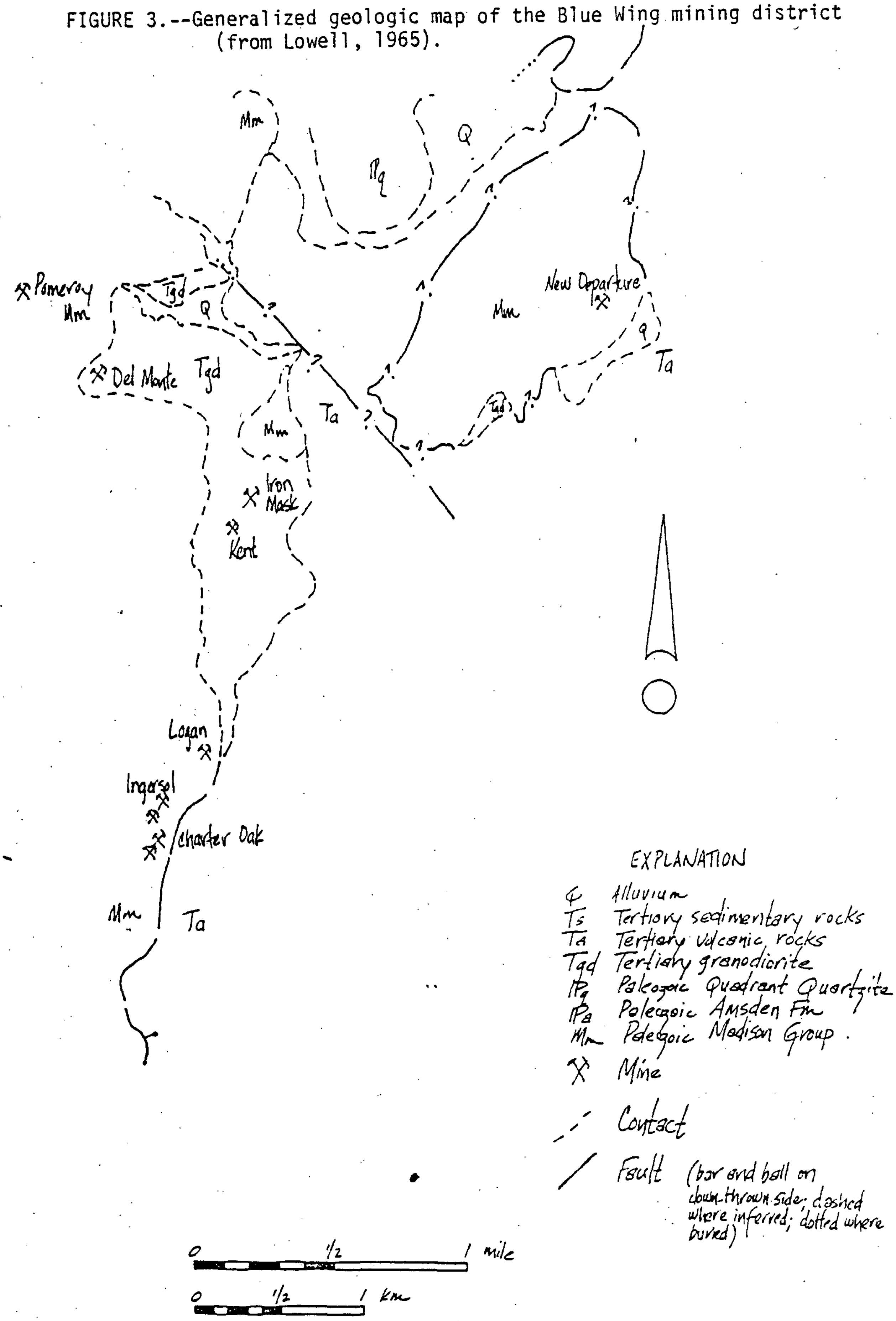
The Blue Wing mining district is immediately north of the Bannack district in T. 7 S., R. 11 W. The first locations in the district were apparently in 1864 and were the first silver deposits located in Montana (Shenon, 1931). Total mineral production from the district is not accurately known, although sporadic production to date of primarily silver areas has been approximately $2-3 million (Shenon, 1931; Geach, 1972).

Geology

As in the Bannack district, Lowell (1965) found Mississippian carbonate rocks to be the oldest rocks in the district (fig. 3). These rocks are in tectonic contact with Laramide(?) extrusive volcanic rocks, and both of these sequences are intruded by granodiorite.

The west-dipping Madison limestones are thrust over the Devonian Jefferson Dolomite(?) along a northerly trend. The granodiorite is primarily but not exclusively exposed along this thrust contact. Regional aeromagnetic data (U.S. Geological Survey, 1975) and data from mine workings in the district

FIGURE 3.--Generalized geologic map of the Blue Wing mining district (from Lowell, 1965).



(Shenon, 1931) suggest that erosion along the fault trend has served to expose the intrusion, but the emplacement of the intrusion was not controlled by the thrust faulting.

Mineralization

Three types of metallization were recognized in the district during the present study: (1) an early contact-metasomatic episode producing skarn assemblages in the carbonate rocks, and (2) a later fracture-controlled mineralization that produced open-space filling veins and pervasive replacement of the limestone adjacent to the fissures.

Only garnet skarn was found in the district during this study. In addition to garnet, pyroxene, idocrase, epidote, quartz, and calcite make up the skarn rock.

The open-space filling veins are made up of sulfide minerals in a matrix of quartz, calcite, and sericite. The replacement veins are made up chiefly of dense fine-grained quartz. Alteration haloes adjacent to the open-space fissure veins are narrow and end abruptly against ostensibly unaltered limestone. The replacement veins on the other hand have broad alteration haloes consisting of quartz and calcite in the carbonate rocks, and quartz, calcite, sericite, and clay in the volcanic rocks.

Shenon (1931) reported the ore minerals to consist of galena, tetrahedrite, jamesonite, sphalerite, pyrite, chalcopyrite, argentite, cerargyrite, pyrargyrite, polybasite, and stibnite.

The mineral deposits in the Blue Wing district are not as deeply weathered as those in the Bannack district. Relict sulfide minerals are commonly found in the gossans. Minerals common in the oxidized rock include quartz, goethite, hematite, jarosite, undifferentiated iron and manganese oxides, azurite, malachite, hemimorphite, and anglesite.

Geochemistry

Geochemical sampling in the district suggests that the predominant elemental suite is silver, arsenic, cadmium, copper, molybdenum, lead, antimony, and zinc (table 2). Tin is ubiquitous in the southern part of the district, vanadium seems to predominate in the central part of the district, and barium occurs in the ores of the northern part of the district.

Iron and manganese oxides give the best indications of fissure-vein mineralization. Where the replacement deposits occur, silver, lead, antimony, and zinc are dispersed into the alteration haloes away from the main zone of metallization. The recrystallized and bleached limestone contains silver. The slightly to strongly altered granodiorite contains small amounts of silver, zinc, and antimony.

ERMONT MINING DISTRICT

The Ermont mining district and adjacent Badger Pass region are about 14 miles west of Dillon, MT, in T. 6 S., R. 11 W. The Ermont gold deposits were discovered in 1926 (Shenon, 1931), and produced bullion until World War II (Geach, 1972). In excess of $1,400,000 in gold (Geach, 1972) was taken from the district. No documented production has occurred in the Badger Pass area.

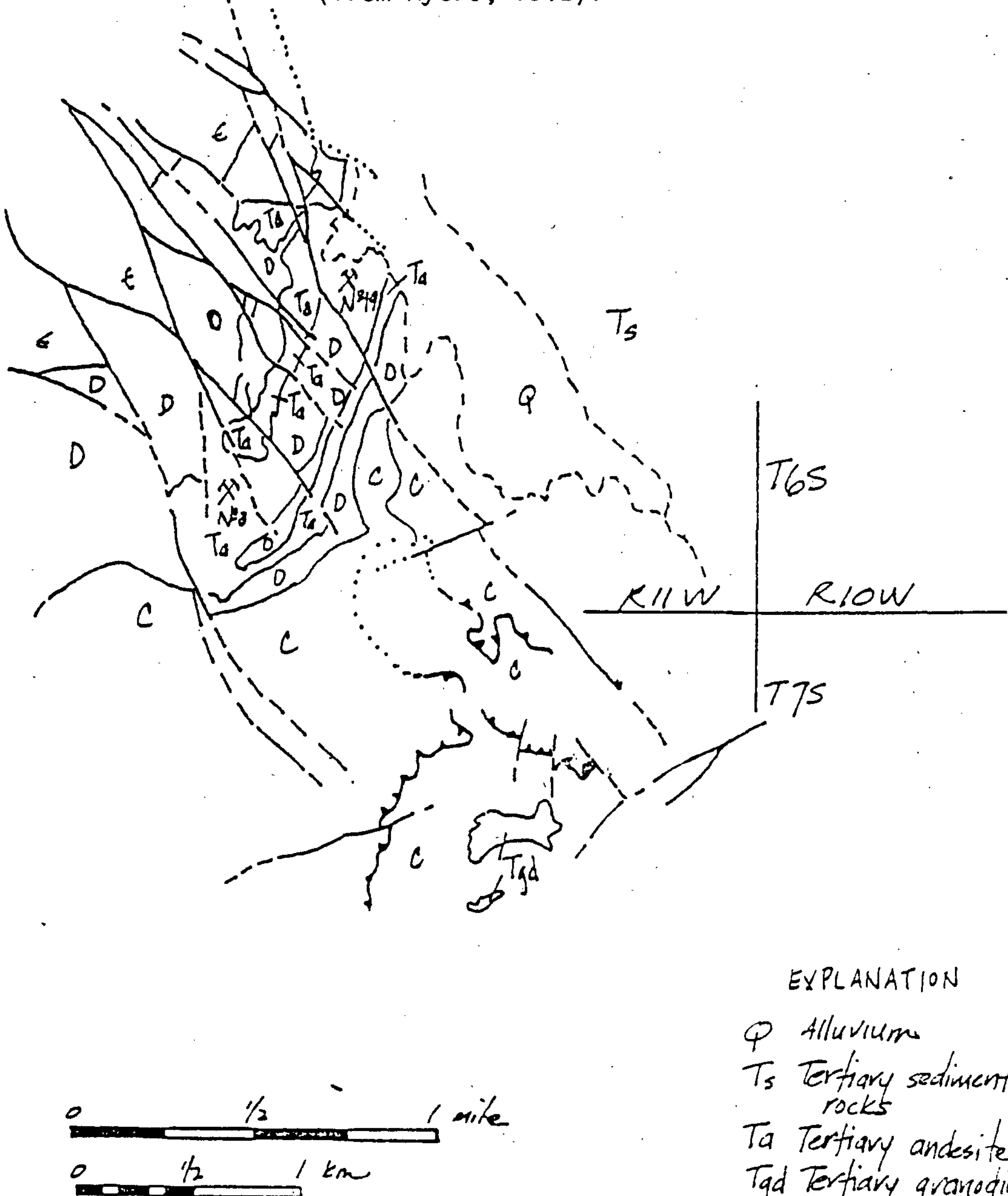
Geology

The general geology of the district was mapped by Kelly (1941) and Myers (1952)(fig. 4). Cambrian through Mississippian sedimentary rocks are exposed in the district, with the majority of the productive horizons occurring in Devonian dolomites. The rocks in general strike northeast and dip to the southeast. Andesite dikes intrude the sedimentary rocks throughout the area.

TABLE 2.--*Trace elements in ores in the Blue Wing mining district.*

Mine/prospect	Location	Trace-element suite
Charter Oak mine	Sec. 4	Ag-As-Cd-Cu-Mo-Pb-Sb-Sn-Zn
Bob Ingersoll mine	Sec. 4	Ag-As-Cd-Cu-Mo-Pb-Sb-Sn-Zn
Logan mine	Sec. 33	Ag-As-Cd-Cu-Mo-Pb-Sb-Sn-Zn
Iron Mask mine	Sec. 28	Ag-As-Cd-Cu-Mo-Pb-Sb-Sn-V-Zn
Pomeroy mine	Sec. 28	Au-Ag-As-Cu-Mo-Pb-Sb-V-Zn
Del Monte mine	Sec. 28	Ag-Ba-Cd-Cu-Pb-Sb-Zn
New Departure mine	Sec. 26	Ag-As-Ba-Cd-Cu-Mo-Pb-Sb-Zn

FIGURE 4.--Generalized geologic map of the Ermont mining district (from Myers, 1952).



EXPLANATION

Northeast of the main part of the district the Cambrian Flathead Quartzite, Wolsey Shale, and Pilgrim Dolomite crop out. Neither the Meagher Formation, Park Shale, nor Red Lion Formation were separately recognized by Myers (1952) in the area. The Pilgrim Dolomite crops out in the western part of the mineralized area and consists of thick-bedded, sugary dolomite containing some chert beds. The Devonian Jefferson Dolomite overlies the Cambrian units and consists of thin- to medium-bedded, black, fetid dolomite. The Three Forks Shale overlies the Jefferson and is mostly thinly laminated, fissile shale. The Mississippian Madison Group crops out in the south and southeastern parts of the district and hosts mineralization in the Badger Pass region.

Northerly trending andesite dikes and sills crop out in the main part of the district and are spatially associated with mineralization. The dikes contain andesine phenocrysts in a finer grained andesine, orthoclase, and augite-bearing groundmass (Kelly, 1941).

The predominant structural framework of the area consists of north- to northwest-trending high-angle faults. A major zone of thrust faulting is exposed about 1 mile southeast of the center of the Ermont district, and this zone transects the Badger Pass region.

Mineralization

Two distinct types of metallization can be recognized geochemically in the district: (1) replacement gold deposits similar to the Carlin-type, and (2) gold- and silver-bearing base-metal sulfide fissure veins. Only the former type of metallization has been productive.

The gold ore is disseminated and occurs as replacements of limy dolomite and also as replacements of andesite. Pyrite is the principal sulfide mineral present, although stibnite is not uncommon. The gold does not occur as visible particles (Kelly, 1941). Alteration in the dolomite consists chiefly of quartz and appears to be fault controlled. Alteration in the andesite dikes consists of quartz, sericite, kaolinite, chlorite, and calcite (Kelly, 1941).

The precious- and base-metal mineralization spatially overlaps the gold mineralization on the western side of the Ermont district, and possibly extends into the Badger Pass region. The mineralized samples observed were thoroughly oxidized, but the porous nature of the silica boxworks suggests that the deposits were formed by open-space filling. Quartz, sericite, and clay occur in the host rocks adjacent to the veins.

Geochemistry

Geochemical sampling in the district suggests two different trace-element suites (table 3). The main elements accompanying gold mineralization are arsenic, barium, molybdenum, antimony, and tungsten with minor amounts of silver, lead, and zinc. The main elements accompanying the silver mineralization are arsenic, cadmium, copper, molybdenum, lead, antimony, and zinc with minor amounts of gold.

The trace elements accompanying the gold mineralization display a broad dissemination into the bedrock around the structures controlling the mineralization. Silicified ledges of Jefferson Dolomite and altered andesite show the same trace-element suites. In contrast, the alteration haloes accompanying the silver mineralization do not display the trace-element suite except immediately adjacent to the vein. Ostensibly unaltered Jefferson Dolomite and andesite porphyry within the district but away from the exploited deposits do not contain elemental suites suggestive of either type of metallization, although the dolomite contains anomalous amounts of silver, lead, and antimony.

TABLE 3.--*Trace elements in ores in the Ermont mining district.*

[Parentheses () denote those elements not consistently found in all samples taken from a given deposit.]

Mine/prospect	Location	Trace-element suite
Gold deposits:		
Ermont No. 2	Sec. 35	Au-(Ag)-As-Ba-Mo-Sb
Ermont No. 19	Sec. 35	Au-(Ag)-As-Ba-(Pb)-Sb-(Zn)
Badger mine	Sec. 26	Au-(Ag)-Ba-Mo-(Pb)-Sb-W
Prospect	Sec. 26	Au-(Ag)-As-Ba-Mo-(Pb)-Sb-W-(Zn)
Prospect	Sec. 35	Au-(Ag)-As-Ba-Mo-Sb-(Zn)
Silver deposits:		
Big West mine	Sec. 35	Ag-As-Cd-Cu-Mo-Pb-Sb-Zn

ARGENTA MINING DISTRICT

The Argenta mining district is in T. 6 S., R. 11 W. about 1 mile north and northeast of the Ermont district. The district extends more than 4 miles northwest of the Argenta townsite, and as such is one of the largest precious- and base-metal camps in the region. Ore was discovered in 1865, and production has occurred sporadically until the present. Total production from the district has been on the order of $6 million (Shenon, 1931; Geach, 1972); the principal economic metals are gold, silver, copper, lead, and zinc.

Geology

Rocks of all ages occur in the district, but the principal mineral deposits occur in Precambrian and Paleozoic sedimentary rocks (fig. 5). The district is on the eastern flank of a large anticline, the core of which consists of Precambrian quartzite. Myers (1952) called this prominent structural feature the Humboldt Mountain anticline.

The northwestern part of the district consists primarily of complexly faulted Precambrian and Cambrian quartzite, shale, and dolomite. The core of the district near the settlement of Argenta is underlain by Madison Group limestones.

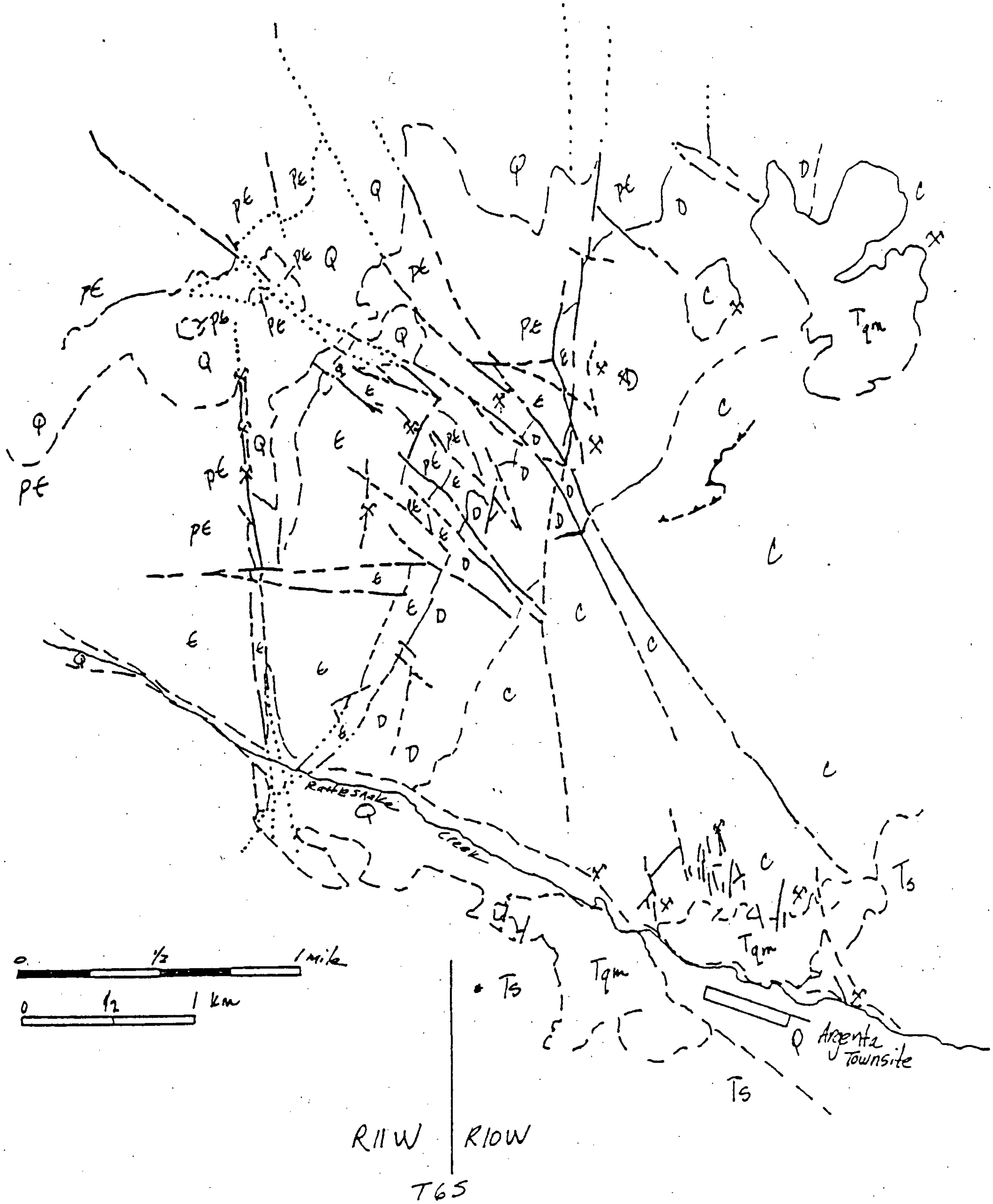
Both extrusive and intrusive igneous rocks occur in the district. The most important of these rocks in terms of the mineralization are quartz monzonite and granodiorite stocks and andesite porphyry and dacite porphyry dikes. Shenon (1931) described the petrography of the various igneous rocks: The mineralogy of the granitic stocks is andesine, orthoclase, quartz, biotite, hornblende, and magnetite. The andesite dikes contain andesine phenocrysts in a finer grained matrix of andesine and augite with accessory magnetite. The dacite dikes contain phenocrysts of feldspar, quartz, and augite in a very fine grained felted groundmass.

FIGURE 5.--Generalized geologic map of the Argenta mining district.

EXPLANATION

Q Alluvium
Ts Tertiary sedimentary rocks
Tqm Tertiary quartz monzonite
C Paleozoic Madison Group
D Paleozoic Jefferson Dolomite
Є Paleozoic Pilgrim Dolomite
pЄ Precambrian

⚒ Mine
contact
Thrust fault (dashed where inferred)
Fault (dashed where inferred; dotted where buried)



North- to northwest-trending high-angle faults are the predominant structural features in the district. Major thrust faults are both west and east of the main part of the district.

Mineralization

Two episodes of mineralization are evident in the district: (1) an early metasomatic alteration of carbonate rocks that produced a skarn assemblage, and (2) a later fracture-controlled complex base- and precious-metal metallization.

The skarn assemblage consists in the most productive areas of garnet, idocrase, pyroxene, tremolite, calcite, quartz, and epidote. Fine-grained pyrite and base-metal sulfides occur in the skarn. Large masses of skarn north of Argenta are composed wholly of fine-grained garnet and quartz. Bleached recrystallized limestone surrounds the skarn but contains no calc-silicate minerals.

The complex metal veins occur as tabular shoots along bedding planes and fissures and as pipelike bodies (Shenon, 1931). All of these types occur close to the contact with the granitic rocks. Alteration adjacent to the veins consists of quartz and sericite grading outward into a quartz and clay assemblage. Veins crosscutting the granitic stocks produced intense phyllic alteration consisting of calcite adjacent to the veins and a weak chloritization of mafic minerals away from the veins. The dike rocks are intensely altered. The feldspar is altered to sericite, and the groundmass appears to be mostly quartz and epidote. The andesite shows a thorough alteration of all feldspar to sericite, and the mafic minerals are pseudomorphed by chlorite, epidote, and magnetite.

Geochemistry

The geochemical sampling in the district suggests that the predominant elemental suite is silver, arsenic, cadmium, copper, molybdenum, lead, antimony, and zinc (table 4). Tin and tungsten are common in all but the western parts of the district, and bismuth occurs sporadically.

Iron and manganese oxides are the most useful indicators of mineralization. The calc-silicate hornfels and skarn rocks usually contain silver, lead, and zinc but do not consistently contain the other trace elements characteristic of the complex base- and precious-metal mineralization. Likewise, the altered dike rocks are anomalous in silver, lead, and zinc, but are not anomalous in the other elements. The altered stocks contain silver, copper, molybdenum, lead, and zinc; frequently contain tin and tungsten; and infrequently contain bismuth. Weakly propylitized quartz monzonite west of the Argenta townsite contains anomalous lead and zinc.

BALDY MOUNTAIN MINING DISTRICT

The Baldy Mountain mining district is in T. 6 S., R. 12 W., 3 miles west of the Argenta district on the south side of Baldy Mountain. Gold placers and lode silver deposits were discovered in the 1860's (Geach, 1972), but production has been sporadic and there has probably been little actual metal recovered. After World War II, tungsten was discovered in skarns, but there has been no economic production.

Geology

The general geology of the district has never been mapped in detail. Geologic studies are being conducted in conjunction with the current geochemical studies, and preliminary results indicate that Precambrian, Cambrian, Devonian, and Mississippian sedimentary rocks are complexly faulted and intruded by the

TABLE 4.--*Trace elements in ores in the Argenta mining district.*

[Parentheses () denote those elements not consistently found in all samples taken from a given deposit.]

Mine/prospect	Location	Trace-element suite
Unnamed	Sec. 30	Ag-As-Bi-Co-Cu-Mo-Pb-Sb-V-W-Zn
Unnamed	Sec. 30	Ag-As-Cu-Mo-Pb-Sb-Sn-W-Zn
Iron Mountain West	Sec. 30	Ag-As-Cd-Cu-Mo-(Sb)-Pb-Zn
Iron Mountain	Sec. 30	Ag-As-Cd-Cu-Pb-Sn-(W)-Zn
Iron Mountain East	Sec. 30	Ag-Ba-Cd-Cu-Mo-Pb-Zn
Mauldin	Sec. 29	Ag-Pb-Zn
Prospect	Sec. 13	Au-Ag-As-Cd-Cu-Mo-Pb-Sb-Sn-W-Zn
Tuscarora	Sec. 18	Ag-As-Bi-Cd-Cu-Mo-Pb-Sb-Sn-Zn
Dexter	Sec. 17	Ag-Bi-Cd-Cu-Mo-Pb-Sn-(W)-Zn
Mayday	Sec. 7	Au-Ag-As-Cd-Cu-Mo-Pb-Sb-V-Zn
Groundhog	Sec. 18	Ag-As-Cu-Mo-Pb-Sb-Zn
Midnight South	Sec. 24	Ag-As-Cd-Cu-Mo-Pb-Sb-Sn-V-Zn
Argenta	Sec. 13	Au-Ag-As-Cd-Cu-Mo-Pb-Sb-Sn-V-Zn
Rena	Sec. 18	Ag-As-Cu-Mo-Pb-Zn
Jack	Sec. 13	Ag-As-Cd-Cu-Pb-Sb-Zn
Goldfinch	Sec. 13	Au-Ag-As-Cu-Pb-Sb-Zn
Dexter East	Sec. 16	Ag-As-Cd-Cu-Pb-V-Zn
Yellow Band	Sec. 2	Au-Ag-As-B-Mo-Sb-(Zn)
Stinson	Sec. 14	Ag-As-Mo-Pb-Sb-Zn

Pioneer batholith (D. R. Zimbelman, Aug. 1979, unpublished data)(fig. 6). The Cambrian formations consist of dolomite, quartzite, and sandy shale. The Devonian Jefferson Dolomite occurs in the area as thin-bedded carbonaceous dolomite. Thin- to thick-bedded Madison Group limestones are also present in the area and are the principal host rocks from the tungsten mineralization. A gabbro and a granodiorite phase of the Cretaceous Pioneer batholith intrudes all of the Paleozoic formations and the Precambrian quartzite.

The complexities of the structural setting are not well understood, but both major thrust faults and high-angle faults are important in the district (D. R. Zimbelman, Aug. 1979, unpublished data).

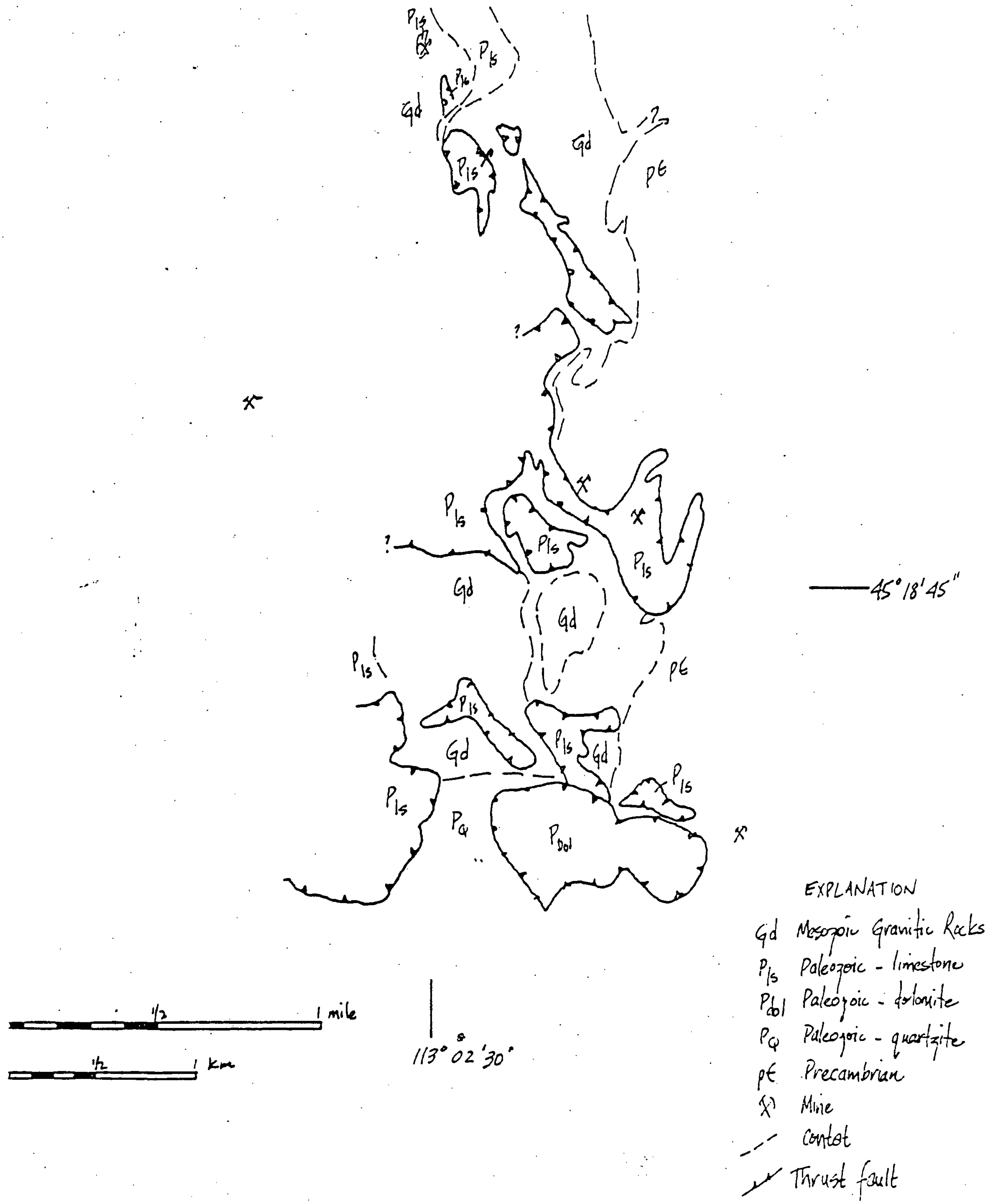
Mineralization

Two episodes of mineralization are evident in the district: (1) an early skarn alteration of Paleozoic carbonate rocks, and (2) a fault-controlled complex base- and precious-metal vein mineralization. Two distinctive types of skarn were noted during the present study: a dark-green pyroxene-dominant calc-silicate rock and a garnet-dominant rock.

The pyroxene skarn consists almost wholly of coarse-grained, dark-green pyroxene with lesser amounts of coarse-grained, zoned, dark-red-brown garnet. Pyrite is a common accessory mineral. The garnet skarn consists primarily of red-brown garnet, epidote, pyroxene, calcite, and quartz. Pyrite and chalcopyrite are common accessory minerals.

The vein mineralization consists primarily of quartz with variable amounts of base-metal sulfides and free milling gold. Most of the ore constituents observed during this study were oxidized. However, some specimens of pyrite, galena, chalcopyrite, sphalerite, and tetrahedrite(?) were noted.

FIGURE 6.--Preliminary geologic map of the Baldy Mountain mining district (D. R. Zimbelman, Aug. 1979, unpublished data).



Geochemistry

The geochemical sampling in the district suggests that the predominant element suite in veins is silver, gold, arsenic, bismuth, copper, lead, antimony, vanadium, and zinc (table 5). Cadmium appears to be present at some localities. The prefissure vein recrystallization and silication of the rocks makes most of the host rocks for the complex base-metal-precious-metal veins impermeable to the later mineralizing solutions. Therefore, away from the fracture systems the host rocks do not readily give indications of the location of buried veins. Analyses of iron and manganese oxide coatings on the fractures are the best indicators of hidden metallization.

The skarns are variable, the pyroxene calc-silicate rock containing manganese, molybdenum, tin, and tungsten, and the garnet skarn containing some silver, copper, and zinc in addition to the molybdenum, tin, and tungsten.

DISCUSSION

The similarity of trace-element suites in the several mining districts suggests the possibility of a common genetic process. The early contact metasomatism is generally deficient in the base metals and is enriched in tungsten and molybdenum. These skarns were probably formed at moderately high temperatures (400°-600°C(?)) and represent a rapid expulsion of the rest of the aqueous phase from the crystallized pluton now observed at the contact. The presence of high base-metal content and lower temperature vein deposits crosscutting the skarn deposits is therefore suggestive of a source somewhat removed from the observed plutons. Altered feldspar porphyry dikes are present in all of the mining districts discussed in this report, and these may represent phases of the later crystallizing magmas that gave rise to the vein occurrences.

TABLE 5.--*Trace elements in ores in the Baldy Mountain mining district.*

Mine/prospect	Trace-element suite
Nick Preen mines	Ag-Bi-Cd-Cu-Pb-Sb
Sec. 24 mine*	Ag-As-Cu-Pb-Sb-V-Zn
Old Faithful mine	Ag-Au-As-Bi-Cu-Pb-Sb-V-Zn
Sec. 14	Ag-Co-Cu-Zn
Sec. 11	Mn-Mo-Sn-W
Tungsten mill	Ag-Bi-Cu-Mo-Sn-V-W
Garret Hill	Mn-Mo-Sn-W
Sec. 23	Ag-As-Bi-Mo-Pb-Sb

*Cable mine (?), Geach (1972).

In the Bannack and Blue Wing mining districts the geochemical evidence indicates that the two mining districts may be related to a large hydrothermal system whose focus is northeast of the Argenta districts (Berger and others, unpublished data; Siems and others, 1979). If this model is valid, then the distribution of selected trace elements as well as the styles of mineralization may point to the center of hydrothermal activity. In the Bannack and Blue Wing areas this model is illustrated with respect to trace elements by the distribution of tin and barium in the various deposits (table 2), and the style of mineralization is one of predominantly replacement-type ores on the periphery of the district (e.g. New Departure mine).

The Argenta mining district is similar to the Bannack area in that mines in the core of the district contain trace amounts of tin and also tungsten, and the peripheral mines (e.g., along French Creek and in Ermont) have large masses of siliceous replacement ores. These features suggest a relationship to a zoning pattern around an unexposed hydrothermal source. Additional geochemical work is currently underway to further elucidate any zoning patterns and to investigate any possible genetic relationships of the Argenta and Ermont districts.

A ramification for the whole Dillon region of the geochemical patterns and the interrelationships of contact metasomatic deposits and later crosscutting fissure-vein deposits is that anomalous concentrations of metals may not be wholly explainable by the geometries of observable rock units. Not all mining districts are parts of larger systems; however, geochemical indicators similar to those in the Bannack area that may be found throughout the region should at least be investigated for the possibility of larger, complex mineralization systems.

RESULTS OF CHEMICAL ANALYSES

The results from the chemical analyses are given in Table 6. All values are in parts per million except where noted otherwise. The following abbreviations are used in the table:

G, greater than value shown;

N, below level of detection (value given);

L, detected below level of determination (value given);

S, emission spectrographic analysis;

AA, atomic-absorption analysis;

CM, colorimetric analysis;

P, partial extraction.

Sample locations are given in Table 7.

TABLE 6.--Analytical data from rock samples collected in mining districts in the southern Pioneer Mountains, Beaverhead County, Montana. Dillon DATE 5/ 3/79

ROWNO	SAMPLE	1 S-FE%	2 S-MG%	3 S-CA%	4 S-TI%	5 S-MN	6 S-AG	7 S-AS	8 S-AU	9 S-B	10 S-BA
1	8G12001	20.0000	0.1500	1.5000	0.0200	1300.0000	5.0000	200.0000N	10.0000	10.0000	200.0000
2	8G12002	5.0000	2.0000	2.0000	0.5000	1300.0000	0.5000N	200.0000N	10.0000N	10.0000L	700.0000
3	8G12003	7.0000	1.5000	15.0000	0.2000	3300.0000	0.5000N	200.0000N	10.0000N	10.0000L	50.0000
4	8G12004	0.7000	0.5000	7.0000	0.1500	500.0000	0.5000L	200.0000N	10.0000N	30.0000	150.0000
5	8G12005	1.5000	0.5000	1.5000	0.3000	1300.0000	0.5000N	200.0000N	10.0000N	50.0000	700.0000
6	8G12006	0.5000	0.2000	5.0000	0.1000	150.0000	0.5000	200.0000N	10.0000N	30.0000	150.0000
7	8G12007	1.5000	0.0300	0.2000	0.0300	2300.0000	150.0000	500.0000	10.0000N	20.0000	70.0000
8	8G12008	7.0000	0.0300	1.0000	0.0300	1500.0000	200.0000	700.0000	10.0000N	10.0000	100.0000
9	8G12009	7.0000	0.0200L	0.1500	0.0020	1500.0000	500.0000	700.0000	10.0000N	10.0000	150.0000
10	8G12010	5.0000	0.1000	5.0000	0.0150	5000.0000G	500.0000	700.0000	10.0000N	10.0000	200.0000
11	8G12011	5.0000	1.5000	1.5000	0.5000	1300.0000	5.0000	200.0000N	10.0000N	10.0000	1000.0000
12	8G12012	1.0000	0.0500	1.5000	0.0500	700.0000	100.0000	200.0000	10.0000L	20.0000	150.0000
13	8G12013	10.0000	0.7000	0.7000	0.3000	700.0000	70.0000	500.0000	10.0000N	200.0000	150.0000
14	8G12014	7.0000	1.5000	3.0000	0.5000	1500.0000	500.0000	200.0000N	10.0000N	20.0000	1000.0000
15	8G12015	7.0000	2.0000	2.0000	0.3000	2000.0000	2.0000	200.0000N	10.0000N	20.0000	1500.0000
16	8G12016	3.0000	1.0000	7.0000	0.0100	5000.0000G	1000.0000	200.0000N	10.0000N	10.0000L	20.0000
17	8G12017	0.2000	0.7000	1.5000	0.0200	5000.0000G	1000.0000	200.0000	10.0000N	15.0000	200.0000
18	8G12018	0.5000	5.0000	15.0000	0.0100	3300.0000	50.0000	200.0000N	10.0000N	10.0000	150.0000
19	8G12019	0.7000	3.0000	10.0000	0.1500	700.0000	30.0000	200.0000N	10.0000N	30.0000	200.0000
20	8G12020	1.5000	1.0000	10.0000	0.1500	5000.0000G	500.0000	200.0000	10.0000N	50.0000	500.0000
21	8G12021	3.0000	1.0000	10.0000	0.1500	5000.0000G	300.0000	200.0000N	10.0000N	20.0000	500.0000
22	8G12022	0.0500	1.5000	15.0000	0.0070	700.0000	2.0000	200.0000N	10.0000N	10.0000N	20.0000
23	8G12023	5.0000	0.7000	3.0000	0.5000	1500.0000	10.0000	200.0000N	10.0000N	15.0000	1000.0000
24	8G12024	2.0000	5.0000	7.0000	0.0300	5000.0000G	500.0000	200.0000N	10.0000N	10.0000	70.0000
25	8G12025	1.5000	0.0700	0.5000	0.1500	150.0000	1.5000	200.0000N	10.0000N	50.0000	150.0000
26	8F12026	15.0000	0.0700	0.3000	0.1000	150.0000	1.5000	200.0000	10.0000N	20.0000	300.0000
27	8F12027	5.0000	1.5000	1.0000	0.5000	700.0000	0.5000N	200.0000N	10.0000N	20.0000	700.0000
28	8F12028	0.2000	0.1000	1.0000	0.0200	100.0000	1.0000	200.0000L	10.0000L	20.0000	500.0000
29	8F12029	7.0000	0.1500	0.2000	0.3000	300.0000	0.5000	3000.0000	10.0000N	50.0000	200.0000
30	8F12030	5.0000	0.2000	0.1500	0.3000	20.0000	0.5000L	2000.0000	10.0000N	100.0000	1000.0000
31	8F12031	1.0000	7.0000	15.0000	0.0200	200.0000	0.5000	200.0000N	10.0000N	20.0000	50.0000
32	8F12032	1.5000	0.5000	0.3000	0.0300	1500.0000	500.0000	10000.0000G	10.0000N	10.0000	20.0000
33	8F12033	5.0000	0.7000	0.5000	0.2000	1300.0000	10.0000	1000.0000	15.0000	200.0000	500.0000
34	8F12034	0.1000	7.0000	10.0000	0.0030	150.0000	1.0000	200.0000N	10.0000N	10.0000	20.0000L
35	8F12035	20.0000G	0.7000	1.5000	0.0500	500.0000	20.0000	700.0000	10.0000N	10.0000L	200.0000
36	8F12036	2.0000	3.0000	7.0000	0.2000	500.0000	1.0000	200.0000N	10.0000N	20.0000	500.0000
37	8F12037	5.0000	1.0000	1.5000	0.2000	700.0000	0.5000N	200.0000N	10.0000N	10.0000	700.0000
38	8FJ2039	5.0000	0.5000	0.0500	0.2000	300.0000	15.0000	300.0000	10.0000N	50.0000	300.0000
39	8FJ2040	3.0000	0.7000	1.0000	0.2000	700.0000	0.5000N	200.0000N	10.0000N	15.0000	1000.0000
40	8FJ2041	20.0000	0.0300	0.1000	0.0700	3300.0000	20.0000	700.0000	10.0000N	10.0000	200.0000
41	8FJ2042	20.0000	0.0200	0.0500	0.0500	700.0000	10.0000	700.0000	10.0000N	10.0000	200.0000
42	8FJ2043	5.0000	1.0000	1.0000	0.2000	1300.0000	1.0000	200.0000N	10.0000N	15.0000	1000.0000
43	8FJ2044	10.0000	0.5000	0.1000	0.2000	150.0000	5.0000	200.0000N	10.0000N	10.0000	700.0000
44	8FJ2045	7.0000	1.5000	0.5000	0.0300	5000.0000G	300.0000	200.0000N	10.0000N	30.0000	5000.0000G
45	8FJ2046	15.0000	2.0000	0.2000	0.1500	5000.0000	20.0000	200.0000N	10.0000N	100.0000	50.0000
46	8FJ2047	1.5000	2.0000	10.0000	0.2000	700.0000	3.0000	200.0000N	10.0000N	20.0000	300.0000
47	8FJ2048	5.0000	2.0000	1.5000	0.5000	1500.0000	5.0000	200.0000N	10.0000N	15.0000	1000.0000
48	8FJ2049	0.5000	5.0000	20.0000	0.0020L	5000.0000G	10.0000	200.0000N	10.0000N	10.0000N	20.0000L
49	8FJ2050	10.0000	0.0500	0.0500	0.1500	150.0000	200.0000	5000.0000	10.0000L	10.0000	100.0000
50	8FJ2051	7.0000	1.5000	0.3000	0.5000	500.0000	20.0000	200.0000N	10.0000N	50.0000	1000.0000

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ROWNO	SAMPLE	11 S-BE	12 S-BE	13 S-CD	14 S-CO	15 S-CR	16 S-CU	17 S-LA	18 S-MO	19 S-NB	20 S-NI
1	8GI2001	1.5000	1.5000	20.0000N	10.0000	15.0000	2000.0000	20.0000L	50.0000	20.0000N	5.0000
2	8GI2002	1.5000	1.5000	20.0000N	20.0000	70.0000	70.0000	50.0000	5.0000	20.0000L	20.0000
3	8GI2003	1.0000L	1.0000L	20.0000N	10.0000	50.0000	5.0000	20.0000	5.0000N	20.0000N	10.0000
4	8GI2004	1.5000	1.5000	20.0000N	5.0000	10.0000	5.0000L	50.0000	5.0000N	20.0000L	10.0000
5	8GI2005	3.0000	3.0000	20.0000N	5.0000	10.0000L	5.0000L	100.0000	5.0000	20.0000L	5.0000
6	8GI2006	1.0000L	1.0000L	20.0000N	5.0000L	30.0000	5.0000L	20.0000	5.0000N	20.0000L	7.0000
7	8GI2007	2.0000	2.0000	200.0000	5.0000L	50.0000	2000.0000	20.0000	50.0000	20.0000N	15.0000
8	8GI2008	1.0000L	1.0000L	50.0000	5.0000L	20.0000	2000.0000	20.0000	7.0000	20.0000N	7.0000
9	8GI2009	1.0000L	1.0000L	20.0000	5.0000L	20.0000	700.0000	20.0000	10.0000	20.0000N	7.0000
10	8GI2010	1.5000	1.5000	200.0000	5.0000L	30.0000	5000.0000	20.0000	15.0000	20.0000N	10.0000
11	8GI2011	1.5000	1.5000	20.0000N	50.0000	70.0000	30.0000	70.0000	5.0000N	20.0000L	15.0000
12	8GI2012	1.5000	1.5000	20.0000N	5.0000L	20.0000	150.0000	20.0000	5.0000N	20.0000L	10.0000
13	8GI2013	3.0000	3.0000	20.0000N	150.0000	50.0000	500.0000	150.0000	10.0000	20.0000L	50.0000
14	8GI2014	1.0000	1.0000	20.0000N	30.0000	15.0000	50.0000	50.0000	5.0000N	20.0000L	5.0000
15	8GI2015	1.0000	1.0000	20.0000N	30.0000	10.0000	15.0000	30.0000	5.0000N	20.0000L	5.0000
16	8GI2016	1.0000L	1.0000L	300.0000	5.0000N	10.0000N	1500.0000	20.0000	5.0000N	20.0000N	5.0000L
17	8GI2017	1.0000L	1.0000L	200.0000	5.0000L	20.0000	2000.0000	30.0000	5.0000	20.0000N	7.0000
18	8GI2018	1.0000L	1.0000L	20.0000N	5.0000L	30.0000	70.0000	20.0000	5.0000N	20.0000N	5.0000
19	8GI2019	1.0000	1.0000	20.0000N	5.0000	70.0000	30.0000	20.0000	5.0000N	20.0000L	15.0000
20	8GI2020	1.0000	1.0000	20.0000	5.0000	50.0000	500.0000	20.0000	15.0000	20.0000L	20.0000
21	8GI2021	1.0000	1.0000	300.0000	5.0000L	70.0000	700.0000	30.0000	5.0000N	20.0000L	15.0000
22	8GI2022	1.0000	1.0000	20.0000N	5.0000N	20.0000	5.0000L	30.0000	5.0000N	20.0000L	5.0000
23	8GI2023	1.5000	1.5000	20.0000N	15.0000	20.0000	20.0000	70.0000	5.0000N	20.0000L	5.0000
24	8GI2024	1.0000L	1.0000L	150.0000	5.0000N	30.0000	700.0000	20.0000	10.0000	20.0000N	20.0000
25	8GI2025	2.0000	2.0000	20.0000N	7.0000	50.0000	10.0000	70.0000	15.0000	20.0000L	50.0000
26	8FI2026	1.0000	1.0000	20.0000N	5.0000N	200.0000	10.0000	50.0000	20.0000	20.0000N	15.0000
27	8FI2027	1.0000	1.0000	20.0000N	20.0000	50.0000	30.0000	70.0000	5.0000	20.0000L	20.0000
28	8FI2028	1.0000L	1.0000L	20.0000N	5.0000N	15.0000	5.0000L	20.0000	5.0000N	20.0000L	5.0000
29	8FI2029	1.0000	1.0000	20.0000N	20.0000	30.0000	50.0000	100.0000	7.0000	20.0000L	20.0000
30	8FI2030	1.0000	1.0000	20.0000N	10.0000	50.0000	50.0000	100.0000	10.0000	20.0000L	5.0000
31	8FI2031	1.0000L	1.0000L	20.0000N	5.0000	10.0000	5.0000L	20.0000	5.0000	20.0000N	20.0000
32	8FI2032	1.0000L	1.0000L	500.0000G	5.0000	10.0000	1000.0000	30.0000	30.0000	20.0000L	5.0000
33	8FI2033	1.5000	1.5000	20.0000N	20.0000	50.0000	50.0000	50.0000	5.0000N	20.0000L	10.0000
34	8FI2034	1.0000L	1.0000L	20.0000N	5.0000N	10.0000	5.0000	30.0000	5.0000N	20.0000N	5.0000L
35	8FI2035	1.5000	1.5000	20.0000N	200.0000	30.0000	200.0000	20.0000L	20.0000	20.0000L	10.0000
36	8FI2036	1.0000	1.0000	20.0000N	10.0000	100.0000	10.0000	30.0000	5.0000N	20.0000L	20.0000
37	8FI2037	1.0000	1.0000	20.0000N	20.0000	30.0000	5.0000	50.0000	5.0000N	20.0000L	10.0000
38	8FJ2039	2.0000	2.0000	20.0000N	5.0000N	30.0000	150.0000	100.0000	20.0000	20.0000L	5.0000
39	8FJ2040	1.5000	1.5000	20.0000N	10.0000	20.0000	50.0000	70.0000	5.0000N	20.0000L	5.0000
40	8FJ2041	1.0000	1.0000	150.0000	5.0000N	50.0000	1500.0000	20.0000	10.0000	20.0000L	15.0000
41	8FJ2042	5.0000	5.0000	50.0000	10.0000	30.0000	10000.0000	20.0000	5.0000N	20.0000N	50.0000
42	8FJ2043	1.5000	1.5000	20.0000N	15.0000	10.0000	150.0000	50.0000	5.0000N	20.0000L	5.0000
43	8FJ2044	1.0000	1.0000	20.0000N	10.0000	10.0000	200.0000	70.0000	15.0000	20.0000L	5.0000
44	8FJ2045	3.0000	3.0000	500.0000G	500.0000	20.0000	10000.0000	70.0000	20.0000	20.0000N	100.0000
45	8FJ2046	5.0000	5.0000	150.0000	50.0000	50.0000	15000.0000	30.0000	5.0000N	20.0000N	50.0000
46	8FJ2047	1.0000	1.0000	20.0000N	10.0000	100.0000	70.0000	20.0000	5.0000N	20.0000L	30.0000
47	8FJ2048	1.0000	1.0000	20.0000N	15.0000	500.0000	50.0000	20.0000	5.0000N	20.0000N	70.0000
48	8FJ2049	1.0000L	1.0000L	20.0000N	5.0000N	10.0000N	70.0000	20.0000L	5.0000N	20.0000N	5.0000L
49	8FJ2050	1.0000L	1.0000L	20.0000	5.0000N	30.0000	700.0000	20.0000L	300.0000	20.0000N	15.0000
50	8FJ2051	1.5000	1.5000	20.0000N	15.0000	50.0000	70.0000	70.0000	5.0000N	20.0000L	50.0000

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ROWNO	SAMPLE	21 S-PB	22 S-SB	23 S-SC	24 S-SN	25 S-SR	26 S-V	27 S-W	28 S-Y	29 S-ZN	30 S-ZR
1	8GI2001	10.0000L	100.0000N	5.0000N	50.0000	100.0000L	100.0000	50.0000N	10.0000	700.0000	10.0000L
2	8GI2002	15.0000	100.0000N	20.0000	10.0000N	700.0000	200.0000	50.0000N	30.0000	200.0000N	150.0000
3	8GI2003	10.0000	100.0000N	15.0000	10.0000N	100.0000L	150.0000	50.0000N	30.0000	200.0000N	100.0000
4	8GI2004	15.0000	100.0000N	5.0000	10.0000N	100.0000	30.0000	50.0000N	20.0000	200.0000N	200.0000
5	8GI2005	20.0000	100.0000N	10.0000	10.0000N	200.0000	30.0000	50.0000N	30.0000	200.0000N	300.0000
6	8GI2006	10.0000	100.0000N	5.0000	10.0000N	100.0000	30.0000	50.0000N	15.0000	200.0000N	150.0000
7	8GI2007	20000.0000	3000.0000	5.0000L	15.0000	100.0000	50.0000	50.0000N	10.0000N	10000.0000G	15.0000
8	8GI2008	10000.0000	1500.0000	5.0000	15.0000	200.0000	200.0000	50.0000N	10.0000	7000.0000	15.0000
9	8GI2009	15000.0000	1000.0000	5.0000N	50.0000	100.0000L	500.0000	50.0000N	10.0000	5000.0000	10.0000N
10	8GI2010	15000.0000	500.0000	5.0000N	10.0000	100.0000	1000.0000	50.0000N	10.0000	10000.0000G	10.0000
11	8GI2011	150.0000	100.0000N	15.0000	10.0000N	300.0000	150.0000	50.0000N	20.0000	200.0000	200.0000
12	8GI2012	500.0000	150.0000	5.0000N	10.0000N	100.0000L	500.0000	50.0000N	10.0000N	500.0000	30.0000
13	8GI2013	1000.0000	500.0000	10.0000	10.0000N	100.0000L	200.0000	50.0000N	100.0000	1000.0000	300.0000
14	8GI2014	70.0000	100.0000N	20.0000	10.0000N	500.0000	200.0000	50.0000N	30.0000	200.0000N	150.0000
15	8GI2015	70.0000	100.0000N	20.0000	10.0000N	500.0000	200.0000	50.0000N	30.0000	200.0000N	150.0000
16	8GI2016	10000.0000	1500.0000	5.0000N	10.0000N	100.0000	100.0000	50.0000N	20.0000	10000.0000	10.0000N
17	8GI2017	5000.0000	2000.0000	5.0000N	10.0000N	100.0000	100.0000	50.0000N	10.0000L	10000.0000	10.0000N
18	8GI2018	300.0000	200.0000	5.0000N	10.0000N	150.0000	70.0000	50.0000N	10.0000	200.0000	10.0000N
19	8GI2019	150.0000	100.0000N	7.0000	10.0000N	200.0000	70.0000	50.0000N	20.0000	700.0000	70.0000
20	8GI2020	1500.0000	500.0000	5.0000	10.0000N	100.0000	150.0000	50.0000N	15.0000	1000.0000	70.0000
21	8GI2021	5000.0000	700.0000	7.0000	10.0000N	150.0000	70.0000	50.0000N	20.0000	10000.0000G	200.0000
22	8GI2022	20.0000	100.0000N	5.0000	10.0000N	150.0000	15.0000	50.0000N	10.0000	200.0000N	10.0000L
23	8GI2023	150.0000	100.0000N	10.0000	10.0000N	500.0000	150.0000	50.0000N	30.0000	200.0000N	100.0000
24	8GI2024	5000.0000	1500.0000	5.0000	10.0000N	100.0000	30.0000	50.0000N	10.0000L	7000.0000	20.0000
25	8GI2025	15.0000	100.0000N	7.0000	10.0000N	300.0000	70.0000	50.0000N	50.0000	200.0000N	300.0000
26	8FI2026	20.0000	100.0000N	5.0000	10.0000N	500.0000	100.0000	50.0000N	70.0000	200.0000N	50.0000
27	8FI2027	30.0000	100.0000N	20.0000	10.0000N	200.0000	200.0000	50.0000N	30.0000	200.0000N	200.0000
28	8FI2028	10.0000N	300.0000	5.0000L	10.0000N	100.0000L	10.0000	50.0000N	10.0000N	200.0000N	15.0000
29	8FI2029	30.0000	300.0000	20.0000	10.0000N	150.0000	200.0000	50.0000L	30.0000	200.0000	200.0000
30	8FI2030	100.0000	300.0000	20.0000	10.0000N	100.0000	200.0000	50.0000L	30.0000	200.0000N	300.0000
31	8FI2031	20.0000	100.0000	5.0000	10.0000N	100.0000	20.0000	50.0000N	10.0000	200.0000N	10.0000
32	8FI2032	20000.0000G	10000.0000	5.0000L	10.0000N	100.0000	300.0000	50.0000N	10.0000	10000.0000G	50.0000
33	8FI2033	300.0000	150.0000	15.0000	10.0000N	100.0000L	200.0000	50.0000N	30.0000	2000.0000	200.0000
34	8FI2034	200.0000	100.0000N	5.0000L	10.0000N	100.0000L	20.0000	50.0000N	10.0000N	200.0000N	15.0000
35	8FI2035	300.0000	100.0000L	5.0000N	10.0000N	100.0000	500.0000	50.0000	20.0000	300.0000	20.0000
36	8FI2036	30.0000	100.0000N	10.0000	10.0000N	300.0000	100.0000	50.0000N	30.0000	200.0000N	200.0000
37	8FI2037	70.0000	100.0000N	15.0000	10.0000N	500.0000	150.0000	50.0000N	30.0000	200.0000N	70.0000
38	8FJ2039	3000.0000	100.0000L	10.0000	10.0000	100.0000L	150.0000	50.0000L	30.0000	700.0000	200.0000
39	8FJ2040	100.0000	100.0000N	10.0000	10.0000N	300.0000	100.0000	50.0000N	20.0000	200.0000	100.0000
40	8FJ2041	3000.0000	100.0000N	7.0000	10.0000N	100.0000L	200.0000	50.0000N	20.0000	10000.0000G	50.0000
41	8FJ2042	15000.0000	100.0000N	15.0000	10.0000N	100.0000	100.0000	50.0000N	30.0000	7000.0000	20.0000
42	8FJ2043	700.0000	100.0000N	10.0000	10.0000N	300.0000	150.0000	50.0000N	20.0000	500.0000	100.0000
43	8FJ2044	100.0000	100.0000N	10.0000	10.0000	100.0000L	100.0000	50.0000L	20.0000	200.0000	100.0000
44	8FJ2045	20000.0000	100.0000N	5.0000L	10.0000N	200.0000	100.0000	50.0000N	300.0000	10000.0000G	10.0000
45	8FJ2046	10000.0000	100.0000N	7.0000	10.0000N	100.0000L	150.0000	50.0000N	150.0000	10000.0000G	50.0000
46	8FJ2047	150.0000	100.0000N	10.0000	10.0000N	150.0000	100.0000	50.0000N	20.0000	200.0000	200.0000
47	8FJ2048	70.0000	100.0000N	15.0000	10.0000N	200.0000	200.0000	50.0000N	20.0000	500.0000	150.0000
48	8FJ2049	2000.0000	100.0000N	5.0000N	10.0000N	150.0000	10.0000	50.0000N	10.0000N	300.0000	10.0000N
49	8FJ2050	15000.0000	2000.0000	5.0000N	10.0000	100.0000	150.0000	50.0000L	10.0000N	2000.0000	50.0000
50	8FJ2051	500.0000	100.0000N	15.0000	10.0000N	100.0000	200.0000	50.0000N	50.0000	5000.0000	200.0000

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ROWNO	SAMPLE	31 S-TH	32 AA-ZN-P	33 AA-SB-P	34 CM-AS	35 CM-W	36 CM-W-P
1	8GI2001	100.0000N	780.0000	3.0000	80.0000	10.0000	0.0000B
2	8GI2002	100.0000N	35.0000	2.0000	10.0000L	1.0000L	0.0000B
3	8GI2003	100.0000N	35.0000	1.0000	20.0000	3.0000	0.0000B
4	8GI2004	100.0000N	45.0000	2.0000	10.0000	1.0000	0.0000B
5	8GI2005	100.0000N	40.0000	2.0000	10.0000	1.0000	0.0000B
6	8GI2006	100.0000N	20.0000	1.0000	10.0000L	1.0000L	0.0000B
7	8GI2007	100.0000N	32000.0000	200.0000G	200.0000	1.0000L	0.0000B
8	8GI2008	100.0000N	15000.0000	200.0000G	400.0000	1.0000L	0.0000B
9	8GI2009	100.0000N	3400.0000	200.0000G	200.0000	1.0000L	0.0000B
10	8GI2010	100.0000N	44000.0000	200.0000G	400.0000	1.0000	0.0000B
11	8GI2011	100.0000N	140.0000	10.0000	20.0000	2.0000	0.0000B
12	8GI2012	100.0000N	480.0000	120.0000	160.0000	3.0000	0.0000B
13	8GI2013	100.0000N	1500.0000	200.0000G	800.0000	3.0000	0.0000B
14	8GI2014	100.0000N	60.0000	5.0000	20.0000	1.0000L	0.0000B
15	8GI2015	100.0000N	85.0000	3.0000	10.0000	2.0000	0.0000B
16	8GI2016	100.0000N	30000.0000	200.0000G	40.0000	1.0000N	0.0000B
17	8GI2017	100.0000N	12000.0000	200.0000G	160.0000	1.0000N	0.0000B
18	8GI2018	100.0000N	180.0000	100.0000	40.0000	1.0000	0.0000B
19	8GI2019	100.0000N	900.0000	15.0000	20.0000	1.0000	0.0000B
20	8GI2020	100.0000N	760.0000	200.0000G	120.0000	1.0000	0.0000B
21	8GI2021	100.0000N	52000.0000	200.0000G	120.0000	1.0000	0.0000B
22	8GI2022	100.0000N	70.0000	2.0000	20.0000	1.0000	0.0000B
23	8GI2023	100.0000N	130.0000	10.0000	10.0000	1.0000	0.0000B
24	8GI2024	100.0000N	8000.0000	200.0000G	160.0000	1.0000L	0.0000B
25	8GI2025	100.0000N	170.0000	5.0000	40.0000	2.0000	0.0000B
26	8FI2026	100.0000N	45.0000	5.0000	200.0000	5.0000	0.0000B
27	8FI2027	100.0000N	80.0000	4.0000	120.0000	1.0000L	0.0000B
28	8FI2028	100.0000N	30.0000	40.0000	80.0000	1.0000N	0.0000B
29	8FI2029	100.0000N	180.0000	200.0000	2000.0000	5.0000	0.0000B
30	8FI2030	100.0000N	65.0000	140.0000	1200.0000	2.0000	0.0000B
31	8FI2031	100.0000N	150.0000	40.0000	80.0000	1.0000N	0.0000B
32	8FI2032	100.0000N	280000.0000	200.0000G	12000.0000	1.0000N	0.0000B
33	8FI2033	100.0000N	1900.0000	120.0000	1600.0000	3.0000	0.0000B
34	8FI2034	100.0000N	95.0000	4.0000	10.0000	1.0000L	0.0000B
35	8FI2035	100.0000N	110.0000	40.0000	1600.0000	10.0000	0.0000B
36	8FI2036	100.0000N	35.0000	4.0000	40.0000	1.0000N	0.0000B
37	8FI2037	100.0000N	35.0000	3.0000	10.0000L	1.0000	0.0000B
38	8FJ2039	100.0000N	580.0000	40.0000	400.0000	2.0000	0.0000B
39	8FJ2040	100.0000N	170.0000	2.0000	10.0000	1.0000	0.0000B
40	8FJ2041	100.0000N	9600.0000	20.0000	800.0000	1.0000N	0.0000B
41	8FJ2042	100.0000N	9400.0000	10.0000	400.0000	1.0000	0.0000B
42	8FJ2043	100.0000N	520.0000	2.0000	40.0000	1.0000	0.0000B
43	8FJ2044	100.0000N	200.0000	2.0000	20.0000	5.0000	0.0000B
44	8FJ2045	100.0000N	110000.0000	15.0000	80.0000	1.0000N	0.0000B
45	8FJ2046	100.0000N	38000.0000	5.0000	400.0000	1.0000N	0.0000B
46	8FJ2047	100.0000N	400.0000	2.0000	10.0000	1.0000L	0.0000B
47	8FJ2048	100.0000N	540.0000	2.0000	20.0000	1.0000	0.0000B
48	8FJ2049	100.0000N	500.0000	1.0000L	20.0000	1.0000L	0.0000B
49	8FJ2050	100.0000N	3000.0000	200.0000G	4000.0000	3.0000	0.0000B
50	8FJ2051	100.0000N	3000.0000	4.0000	20.0000	1.0000L	0.0000B