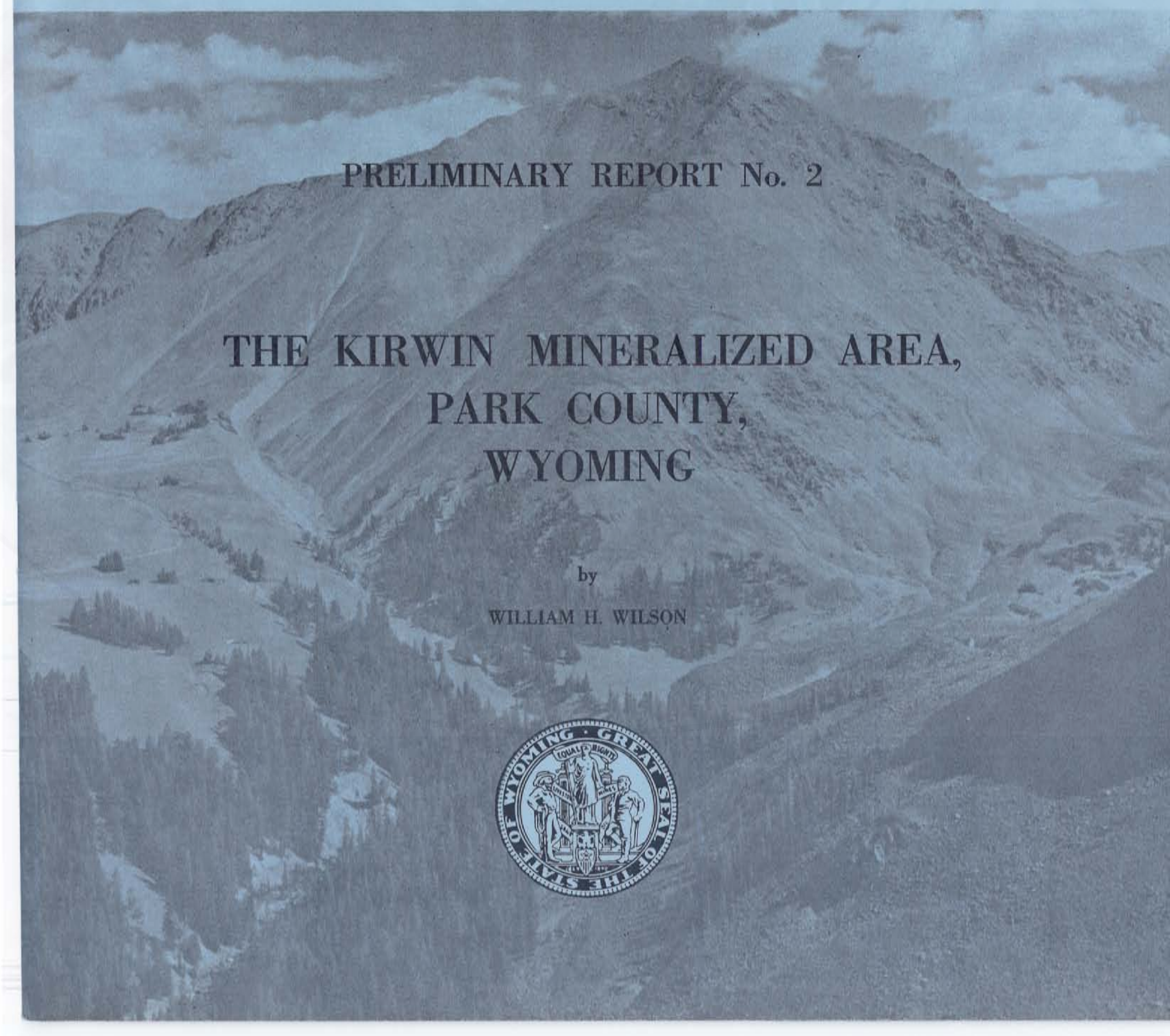
THE GEOLOGICAL SURVEY OF WYOMING

Daniel N. Miller, Jr., State Geologist



PRELIMINARY REPORT No. 2

THE KIRWIN MINERALIZED AREA, PARK COUNTY, WYOMING

by

WILLIAM H. WILSON

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With a 1980 Addendum by the author

LARAMIE, WYOMING

1964 (1980)

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INTRODUCTION

The Kirwin mineralized area (Fig. 1) is located in portions of Ts. 45 and 46 N., and Rs. 103 and 104 W. (unsurveyed), in the Absaroka Mountains of northwest Wyoming (Pl. 1). It is situated near the head of Wood River and adjacent to the head of the Greybull River, which lies to the northwest of the area.

The area is accessible approximately eight months of the year by only one road which is best traveled by a four wheel drive vehicle or pickup truck. Meeteetse, the nearest town, is 33 miles to the northeast, and Cody, railpoint for the Chicago, Burlington and Quincy, is 32 miles north of Meeteetse on State highway 120.

Mapping was done on enlarged high-altitude aerial photographs having a scale of approximately 1,650 feet to the inch. These data were then transferred to a planimetric base which was enlarged from the U.S. Geological Survey Kirwin quadrangle that had an original scale of one-half inch equals one mile. In spite of the lack of modern topographic maps, a fairly good transfer of geologic data was accomplished.

This report represents a portion of the writer's study of the geology and mineral deposits of a hitherto unmapped area of 850 square miles in the southern Absaroka Mountains of Hot Springs and Park Counties, Wyoming.

Fig. 1. Kirwin mineralized area. View looking south toward Bald Mountain (tree-covered slope in the center of the photo). Glaciated valley of Cascade Creek is to the right of Bald Mountain. Galena Ridge is located in the right foreground.

TOPOGRAPHY AND CLIMATE

The topography of the mapped area is exceedingly rugged and varies in elevation from 8,300 to more than 12,000 feet. The narrow "U"-shaped canyon of the Wood River contrasts with the high rolling "flats" which lie at elevations between 11,500 to 12,000 feet.

Except for certain north-facing slopes below timberline (approximately 10,000 feet), which are covered by a dense growth of conifers, and the high rolling "flats" (covered by a thin veneer of decomposed rock and grass), rock exposures are generally good in the area.

The climate is typical of the high mountain areas in Wyoming. Although the area can usually be reached by vehicle sometime in May, many of the higher prospects are still covered by snow until July. Snow slides are common in the winter, and spring runoff during June may hamper accessibility by vehicle. Except for the months of July and August, exploration work at the higher elevations would be hampered, at times by strong cold winds.

HISTORY AND DEVELOPMENT

Mineralization was discovered in the Kirwin area in the 1890's. Since this period, more than 200 claims (Pl. 1) were patented and approximately 7,500 feet of development work, such as shafts, adits, and pits, has been undertaken. Most of these workings are now caved or flooded, the major exception to this being the Galena Ridge tunnel (adit) which is 2,327 feet long. Most of the adits were driven to intersect veins cropping out at the surface without thoroughly prospecting the outcrops.

The district as a whole is still in the prospect stage, since little real development has been accomplished. No reliable record of any production from this district is available except for a few bulk sample shipments.

GENERAL GEOLOGY

Rocks underlying the mapped area (Pl. 1) are assigned to the Wiggins formation of Oligocene (and possibly late Eocene) age. The Wiggins formation was defined by Love (1939, p. 79) as the sequence of light-colored volcanic rocks that comprises the high divides and ridges of an area located about six miles southwest of the Kirwin area. In an earlier study of the Kirwin area, Hewett (1912, p. 124) believed the rocks here to be the stratigraphic equivalent of the Late Basic Breccia (Hague, 1899). His reasoning is correct, since the rocks exposed at Kirwin are known by the writer to overlie the Early Basalt Flows of Hague which crop out on the Grey bull River to the north. Where these flows are absent, the Wiggins formation rests unconformably upon the middle Eocene Pitchfork formation, which is considered to be the sedimentary equivalent of the Early Basic Breccia (Hay, 1956, p. 1866).

In the vicinity of the map area, the Wiggins formation is about 3,800 to 4,200 feet thick. Here, and in the vicinity of the granodiorite intrusives, the layered rocks are dominantly andesite flows and flow breccias. These, however, intertongue with, and grade laterally in almost all directions, into volcanic sedimentary rocks (located outside the mapped area).

Layered Rocks

For descriptive purposes, the Wiggins formation is here divided into three units: 1) lower member, 2) Crosby breccia member, and 3) upper member. In mapping (Pl. 1), the Wiggins has been separated into two units, and these are separated by a major unconformity. The Crosby breccia is included here as the basal unit of the upper member. Because of the relief on this unconformable surface, which varies from 500 to approximately 1,000 feet, the writer has tentatively included the Crosby breccia and upper member of the Wiggins in the Oligocene. The lower member includes beds that are probably equivalent to the upper part of Love's (1939) upper Eocene Tepee Trail formation.

Lower member

The lower member is composed of about 1,700 feet of greenish-gray to grayish-purple to dark-gray andesite flows and flow breccias and a few interbedded tuffs. These rocks, which show fair bedding in most places, are particularly well exposed on the rugged slopes of Wood River, from Meadow Creek to Kirwin.

A significant propylitized greenish-gray andesite breccia containing a varying amount of angular grayish-purple andesite porphyry fragments crops out in the Kirwin area. The fragments average about two inches in diameter but some are as large as one foot. In most places the fragments occupy about one-fourth of the volume of the rock, but locally they include as much as 50 to 75 per cent of the volume. These fragments are sometimes observed within curving flow lines. In thin section the greenish gray matrix consists of subhedral altered plagioclase phenocrysts (calcic andesine is the approximate composition) together with minor amounts of altered hornblende enclosed in a felted to pilotaxitic matrix of plagioclase microlites, quartz, and sanidine (?). Alteration products are epidote, chlorite, calcite, kaolinite, and sericite. The grayish-purple fragments include seriate phenocrysts of calcic oligoclase and highly corroded and altered hornblende in a somewhat microgranular groundmass containing plagioclase microlites, quartz, chalcedony, and sanidine (?). Alteration is similar to that in the greenish-gray matrix but is not as intense. Except for a thin selvage of albite (?), the borders show no fusing or alteration.

Most of the intercalated flows are hornblende- or hornblende-biotite andesite porphyries. A few are pyroxene andesite porphyries. These are essentially similar to the matrix of the previously described breccias and are only subdivided as such because of the predominance of pyroxene or amphibole. The plagioclase phenocrysts in both types are andesine, and these seriate subhedral crystals are usually altered to calcite, kaolinite, or sericite. Quartz is present in the matrix as well as in individual anhedral to resorbed phenocrysts. As a rule, more quartz is present in the amphibole types, to the extent that these might be more correctly classified as dacites or dacitic andesites. Biotite occurs in both types in varying amounts but is more prevalent where amphibole is dominant. An occasional phenocryst of sanidine also occurs in the amphibole types. The ground-mass of these flows is dominantly felted to pilotaxitic, but microgranular and cryptofelsitic textures have also been observed. In hand specimen some of these show flow layering.

A few individual crystal tuff beds and a few beds of lithic tuff, ranging in composition from rhyolitic to andesitic in composition, have been observed interbedded or intercalated in the andesite breccia-flow sequence. The rhyolitic types are composed of small crystals, or phenocrysts, of oligoclase, sanidine (?), quartz, and biotite, which are enclosed in a cryptofelsitic to turbid, weakly birefringent groundmass. The andesite (some may be trachyandesitic types) contains much more plagioclase (calcic oligoclase to sodic andesine) and only subordinate amounts of quartz and sanidine (?) as individual crystals. Highly altered crystals of hornblende and pyroxene also appear in minor amounts in the andesitic tuffs. The matrix, however, is similar to the rhyolitic types.

All of the rock types listed above are lenticular and most of them cannot be traced along the strike, or laterally, for any appreciable distance.

Crosby Breccia Member

The term Crosby breccia member of the Wiggins formation has been proposed (Wilson, 1963, p. 17-18) for a distinctive unit that crops out near the base of the southeast slope of Mount Crosby. This unit is characterized by an abundance of light greenish-gray angular rhyolite fragments in addition to andesite porphyry fragments. At the type section, one-fourth mile west of Dollar's cabin, the member is exposed as a buff-weathering massive poorly bedded (to no bedding at all) vertically jointed "rim-rock-like" outcrop. The Crosby breccia, which is 525 feet thick there, actually contains three individual units which have rhyolite fragments included. The lowermost two of these units are the most persistent along the strike. Another unit contains large discrete fragments of rock that contain both rhyolite and andesite porphyry fragments.

The areal distribution of the Crosby breccia extends beyond the limits of the mapped area. On the northwest side of Wood River a thickness of 500 feet is usually maintained from the type locality to Canyon Creek. From there, however, it thins northward to less than 100 feet. On the southwest side of Wood River the member is less than 100 feet thick and is discontinuously exposed along the strike.

The member as a whole varies in its contact relations with the underlying flows and flow breccias of the lower member of the Wiggins formation. On the south flank of Mount Crosby the contact with the underlying rocks appears to be conformable; however, between there and Chief Mountain it grades from one of erosional unconformity to that of angular discordance. In general the base of the member is exposed between the 10,000 and 11,000 foot contour intervals.

In outcrop the matrix is a light greenish-gray fragmental dacitic andesite which encloses blocks and lapilli of rhyolite and subangular to subrounded andesite porphyries of various shades of green and purple. Often these andesite fragments enclose smaller fragments which vary in texture and composition from felsitic to andesitic. The rock mass as a whole is estimated to contain from 75 to 95 per cent fragments.

Upper member

The upper member of the Wiggins formation is similar to the lower member in that is is also variable in gross lithology and mode of deposition. Like the lower part of the formation, these beds (flows, breccias, etc.) are also lenticular with minor intercalated erosional unconformities. In general, the member rests on a minor erosional unconformity at the top of the Crosby breccia. Where the Crosby breccia is absent the base of the upper member has been placed at a pronounced angular unconformity that separates it from the lower member.

In the vicinity of Kirwin the upper member is, with one exception, dominantly igneous. These rocks are interbedded hornblende-biotite andesite and pyroxene andesite flows and flow breccias. Some of the breccias, because of the subrounded character of the larger fragments, may be classified as agglomerates but do not occur as vent fillings in the mapped area. A well-exposed section on the south slopes of Mount Crosby consists of pinkish to pale lavender to greenish-gray interbedded andesite flows and breccias. Bedding in the flows and breccias varies from poor to fair. The breccias are essentially monolithologic and consist of subangular to subrounded andesite fragments in shades of green and purple. The majority of these fragments, which are subangular, range in size from one-half inch to several feet, although the average size is about two inches. Many of these beds are probably the result of autobrecciation in that they contain fragments of underlying flows that have consolidated.

Although not exposed on Mount Crosby, the basal part of the upper member as exposed on Mount Sniffel consists of a 50-foot zone of interbedded freshwater (?) limestone breccia (actually two distinct beds) and andesite breccia. The lower limestone breccia bed is yellowish gray and the upper bed is medium dark gray in color. The overlying rocks on Mount Sniffel and Spar Mountain, to the east, are similar to those on Mount Crosby; however, abundant irregular cavities up to several inches in size and filled with calcite rhombohedrons and scalenohedrons are characteristic of the breccias on Spar Mountain.

Intrusive Rocks

The intrusive rocks of the Kirwin area consist of three plutonic bodies of varying size, and many dikes. Evidence for two periods of intrusion have been observed as follows: on the southeast slope of Spar Mountain, where a narrow hornblende andesite porphyry dike intersects a larger dacite porphyry dike, and on the south-southeast-trending ridge of Mount Sniffel, where the Cascade Creek andesite is intersected by a narrower hornblende-biotite andesite porphyry dike. Several other occurrences of dike intersection and dike-pluton intersection have also been noted, particularly on the east side of Brown Mountain, where a dacite dike intrudes the granodiorite, and on the north side of Meadow Creek Basin, where an andesite porphyry dike intrudes the granodiorite.

Granodiorite

There are two bodies of granodiorite in the area; one in Meadow Creek Basin and the other on the eastern shoulder of Brown Mountian. Megascopically, both are light to medium light gray, fine- to medium-grained equigranular rocks containing visible plagioclase feldspar, hornblende, biotite, quartz, and some pyroxene and pyrite. Some specimens are porphyritic. Narrow aplite dikes and glomeroporphyritic clusters of hornblende crystals of random occurrence have also been observed in both intrusives.

The larger of the two granodiorites is a rudely ovoid pluton which underlies most of Meadow Creek Basin. It is exposed over an area approximately two miles long (northeast-southwest direction) and one mile wide (northwest-southeast direction) with an exposed thickness of approximately 1,500 feet. The contact of the stock (?) with the surrounding flows and breccias is largely concealed with the exception of that at the eastern end. There a well-developed sheeting occurs with dips ranging from 35° northwest to vertical. In the south-central area the pluton displays three prominent directions of rudely vertical joints. Another joint set, near the southeast contact, strikes east-northeast (essentially parallel to the southern margin) and dips inward, to 77° north-northwest. These observations seem to indicate that the body has the shape of an asymmetric funnel.

In addition to the joint sets, there are highly fractured zones within the pluton, and a number of these are stained with iron oxide. Much of this oxidation is due to the weathering of disseminated pyrite, but some is due to the oxidation of biotite and hornblende. Disseminated pyrite, chalcopyrite (?), and malachite-coated fractures occur in a limited area in the southeastern part of the intrusive.

With the exception of a slight doming at the northwest side and the previously noted jointing, the andesite flows and breccias are relatively undisturbed. No xenoliths of andesite or breccia have been noted within the pluton.

The smaller of the two granodiorites is a somewhat crescent-shaped intrusive body which crops out on the eastern shoulder of Brown Mountain. It occupies an area roughly two-thirds of a mile long (north-south direction) by one-third mile wide (east-west direction). The contact is concealed on all sides; however, well-developed joints parallel the western and northern margins, and these dip from 40° inward (toward the stock) to vertical. In the central portion three prominent directions of jointing were observed; east-west, northeast-southwest, and northwest-southeast, with steep dips varying from 25° to 80° south, southeast, and northeast, respectively. No correlation between jointing and mineral lineation was observed, but the surrounding flows and breccias are relatively undisturbed, and it may be that this intrusive body is also funnel-shaped like the Meadow Creek Basin granodiorite.

Local concentrations of hornblende and/or specular hematite are visible on joint planes, particularly on the southeast side. Iron oxide-stained joint zones also occur locally.

Andesite

The Cascade Creek andesite dike-like plug crops out on the east side of Mount Sniffel. This intrusive strikes east-west, dips 55° south, is more than 250 feet wide (near the east end), and is exposed along the strike for more than three-fourths of a mile with a difference in elevation of approximately 1,000 feet. In outcrop the rock is somewhat similar to the other andesite dikes except that it is of darker color and the margins are less porphyritic than the center or core. There is no field evidence to indicate that this might be a composite or multiple dike.

Although this is probably not a differentiated dike in the accepted sense, thin sections show differences in texture and mineral composition across the width of the outcrop. The northern and southern portions of the dike are hornblende-pyroxene andesite and hornblende-biotite andesite, respectively. The core, or central portion, is dacitic or dacitic andesite.

Dikes

Many vertically-dipping dikes are exposed in the upper Wood River area.

These show a general north-northwest trend, but just north of Kirwin they crop out in radial pattern around the granodiorites. All of the dikes intrude the Wiggins formation and are almost entirely confined to the thickest part of the section which is dominantly igneous. None of the dikes has been observed as a feeder to, or connected to, the individual flows.

Some of the dikes range in width from several feet to over several hundred feet (one occurrence noted) and from several tens of feet to more than two miles in length. Most of the dikes, however, are about ten to fifteen feet wide and approximately one mile in length.

At least 95 per cent of the dikes are andesite porphyries which can usually be subdivided as to whether biotite or hornblende predominates. These range in color from light gray with a greenish cast to a dark greenish-gray. With the exception of one, all are mineralogically similar in that they contain megaphenocrysts of plagioclase, biotite, and hornblende embedded in a very fine-grained groundmass. Many are propylitized, particularly in the mineralized area.

Dacite porphyry comprises approximately four per cent of the exposed dikes in the area. These vary in color from grayish-orange to very light to medium light gray with megaphenocrysts of plagioclase, sanidine (?), quartz, biotite, and hornblende which are enclosed within a fine-grained groundmass.

Only one rhyolite dike was noted, and this occurs as a very limited exposure just north of (and possibly intruding) the Brown Mountain granodiorite. The rock is a light gray aphanite with a few megaphenocrysts of quartz.

Structure

The structure of the volcanic rocks in the Kirwin area is relatively simple. Doming in the area seems to be indicated, since the Wiggins formation is apparently folded into an anticline whose axial trace is parallel to, and along the source of, Wood River. Here, the Wiggins formation dips 8° to 10° northwest on the northwest side of the river, while on the southeast side of the river, the formation dips about 5° southeast. The fold could be related to a concealed intrusive or a volcanic vent which may be associated with the Bald Mountain altered zone.

Faulting, with one exception, is relatively unimportant in the Kirwin area. The limestone breccia zone has been offset about 150 feet by a vertical fault on the east slope of Mount Sniffel. Elsewhere, several small normal faults have been noted offsetting dikes a few feet, but these bear no relationship to mineralization.

The most significant structural features of this district are the joint or fissure zones. There are at least four zones: one of north-northwest strike and steep easterly dip, the second of approximately northwest strike and steep northeast dip, the third of west-southwest strike and steep north-northwest dip, and the fourth of northeast strike with an approximate vertical dip. It can be seen (Pl. 1) that most of the veins and many of the dikes trend in a north-northwest direction. There is the distinct possibility that some displacement has occured along some of the joints, or joint zones, but direct evidence such as offset beds or slickensides was not observed by the writer.

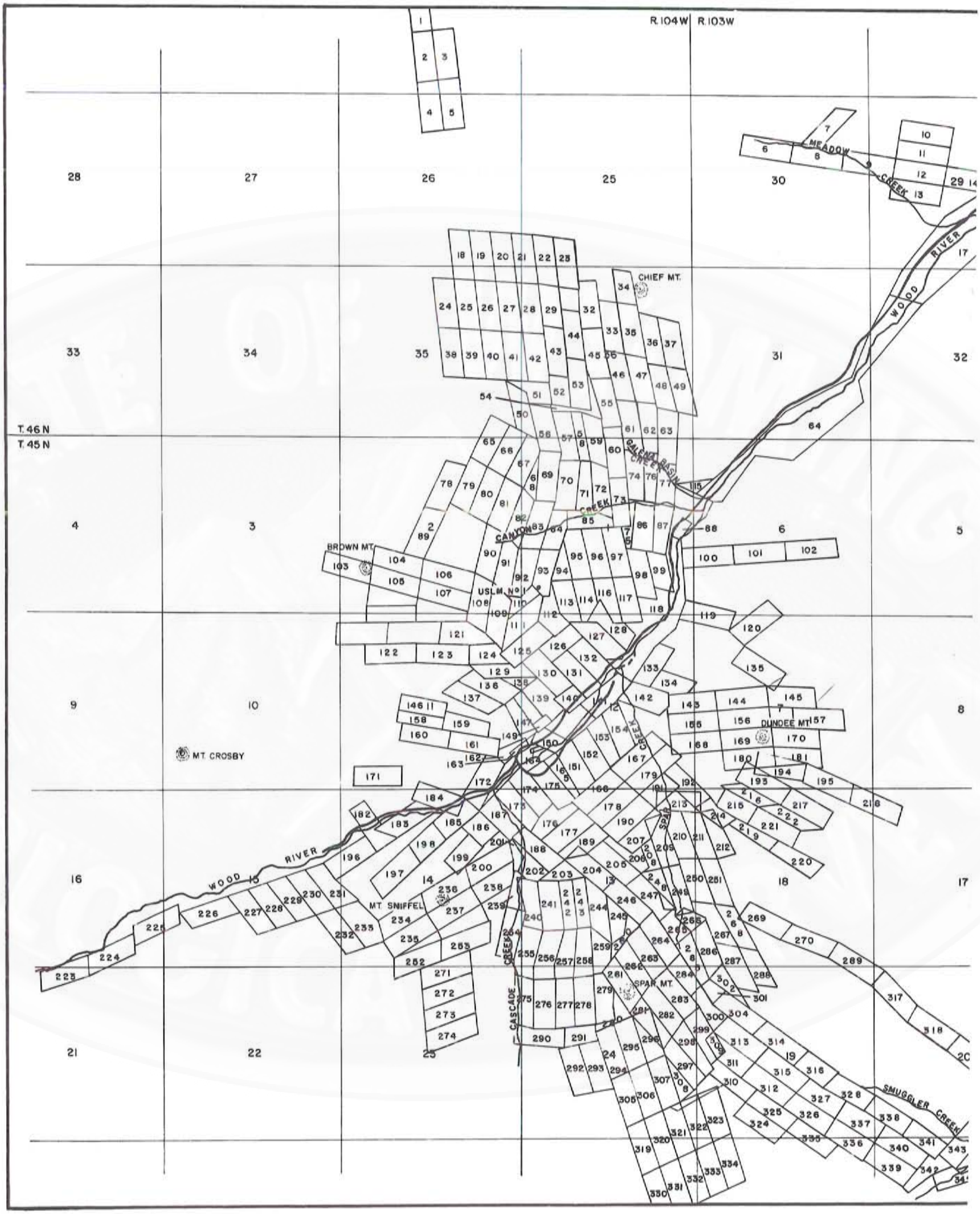
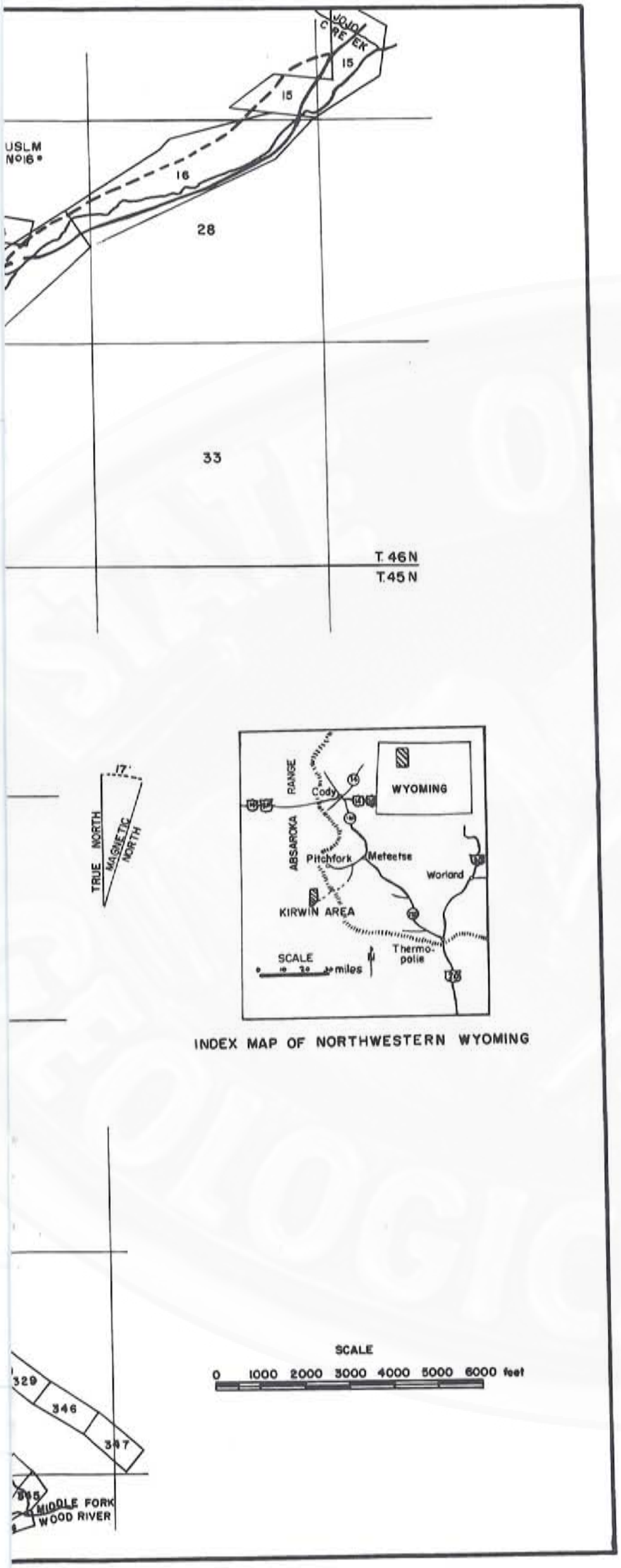


Plate 1. Claim map of Kirwin Mining District, Park County, Wyoming.



KEY TO PLATE 1

1. Midnight Sun No. 5
2. Midnight Sun No. 4
3. Midnight Sun No. 3
4. Midnight Sun No. 1
5. Midnight Sun No. 2
6. Meadow No. 2
7. Meadow No. 3
8. Meadow No. 1
9. Free Trade
10. Meadow View
11. Meadow View No. 2
12. Meadow View No. 3 (351)
13. Bryton
14. Bob Bob (351)
15. Wood River No. 2 Placer (230)
16. Wood River Placer (230)
17. Kirwin No. 3 Placer (244)
18. Morning Glory No. 12
19. Morning Glory No. 13
20. Morning Glory No. 14
21. Morning Glory No. 15
22. Big Bonanza
23. Little Bonanza
24. Morning Glory No. 6
25. Morning Glory No. 10
26. Morning Glory No. 9
27. Morning Glory No. 8
28. Morning Glory No. 7
29. Krachy No. 2 (250 A)
32. Montana No. 1 (413)
33. Big Mike No. 3 (413)
34. Big Mike No. 4 (413)
35. Big Mike (413)
36. King of the Camp (413)
37. Dixie Queen No. 2 (413)
38. Morning Glory No. 6
39. Morning Glory No. 5
40. Morning Glory No. 4
41. Morning Glory No. 3

42. Morning Glory No. 2
43. Krachy (250 A)
44. Krachy No. 4 (250 A)
45. Montana (413)
46. Iowa No. 3 (181)
47. Big Mike No. 2 (413)
48. Duke of Argyle (413)
49. Dixie Queen (413)
50. Antelope (181)
51. Morning Glory No. 1
52. Krachy Fr. (250 A)
53. Krachy No. 3 (250 A)
54. Basin (248), Coon (248)
55. Atlas (181)
56. Deer (181)
57. Hoodoo (181)
58. Mascot (181)
59. Cariboo (181)
60. Iowa (181)
61. Iowa No. 2 (181)
62. Queen Mary No. 1 (413)
63. Queen Mary (413)
64. Kirwin No. 2 Placer (244)
65. Meeteetse No. 4
66. Meeteetse No. 2
67. Poe (181)
68. Elk (181)
69. Helena (142)
70. Oregon (242)
71. Marie (181)
72. Manilla (181)
73. Mendota (181)
74. Little Johnnie (143 A)
75. Canyon Creek (181)
76. Wizzard No. 2 (181)
77. Wizzard (181)
78. Crazy Horse No. 1
79. Meeteetse No. 3
80. Meeteetse No. 1
81. Anaconda (141)
82. Horse Shoe (181)
83. Ground Hog (181)
84. Maverick (181)
85. Cold Day (181)
86. Big Johnnie (143 A)
87. 102 Lode (181)
88. Little Johnnie Mill Site (143 B)
89. Crazy Horse No. 2
90. Black Hills (181)
91. Golden Wedge (181)
92. Central (181)
93. Brooklyn (181)
94. Brunell (181)
95. Frederick (181)
96. Irene Group (181)
97. 98 Lode (181)
98. 100 Lode (181)
99. 101 Lode (181)
100. Success No. 1
101. Success No. 2
102. Success No. 3
103. Uncle Sam (258)
104. Verticle No. 1
105. Black Prince (258)
106. Vertical
107. Republic (258)
108. Golden Star (181)
109. Golden Belt (181)
110. Monument (256)
111. Buckskins Last Chance (256)
112. Great Unknown (256)
113. Madona (181)
114. Lady Bird (181)
115. Krachy Mill Site (250 B)
116. Peoria (181)
117. 99 Lode (181)
118. Kirwin Placer (181)
119. Boyer

KEY TO PLATE 1 (Cont.)

120. Nixie
121. Reserve No. 3
122. Sible
123. Bighorn
124. Reserve No. 2
125. Last Chance (149)
126. Humbold (149)
127. New Tom Thumb (375)
128. Kickapoo (181)
129. Reserve No. 1
130. Mountain Queen (149)
131. Ross Hannibal (149)
132. Silver Cliff (149)
133. Longhorn (414 A & B)
134. Longhorn No. 2 (414 A & B)
135. Dewey
136. Elina May
137. Pense
138. Shut Out
139. Little Jack (393)
140. Mountain Queen Fr. (149)
141. Lessing (149)
142. Freemont (249)
143. Roosevelt No. 2 (414 A & B)
144. Dundee No. 5 (414 A & B)
145. Dundee No. 6 (414 A & B)
146. Verna May (373)
147. Mayflower (378)
149. Elmira Mill Site (259 B)
150. Soo (409)
151. North Side (411)
152. Comstock (491)
153. Shilo (243)
154. Goethe (149)
155. Alabama (414 A & B)
156. Dundee No. 3 (414 A&B)
157. Wyoming (414 A&B)
158. Mattie B. (373)
159. Aggie B. (373)
160. Flora E. (373)
161. Molly Logan (373)
162. New Auburn No. 2 (378)
163. Cheming Mill Site (307 B)
164. Ada Mill Site (414 B)
165. Granite (411)
166. Park (322)
167. Elinor (319)
168. Dundee No. 4 (414 A & B)
169. Roosevelt No. 1 (414 A & B)
170. Dundee No. 7 (414 A & B)
171. Valentine
172. Auburn (378)
173. Rex (251)
174. Park (251)
175. Illonies (251)
176. Yellow Jacket (251)
177. Dakota Fr. (251)
178. Argentine (322)
179. Bessie (319)
180. K. of P. (414 A & B)
181. Dundee No. 8 (414 A&B)
182. Minnie
183. Glenwood
184. Tumlum (307 A & B)
185. Evening Star (307 A & B)
186. Union (307 A & B)
187. Victor No. 1
188. Rester (251)
189. Dakota (251)
190. Afton (322)
191. Tunnel (319)
192. Panhandle (410)
193. Dundee No. 1 (259 A&B)
194. Elkton (259 A)
195. Oneida (414 A & B)
196. Groundhog
197. Rainbow (307 A & B)
198. North Side No. 2 (307 A & B)

199. Comet (307 A & B)
200. Zarille
201. Victor No. 2
202. Sammie (251)
203. Triangle (251)
204. Main (251)
205. Omaha (251)
206. Tunnel No. 2 (328)
207. Tunnel No. 1 (328)
208. Tunnel No. 3 (328)
209. Bay Horse (328)
210. Washakie (410)
211. Moro Castle (410)
212. Cuba Fr. (410)
213. Moro Castle Fr. (410)
214. Cuba (410)
215. Portland (259 A & B)
216. Silver Cliff (259 A & B)
217. Dundee No. 2 (259 A & B)
218. No. 10 (AM) (414 A & B)
219. Alabama (415)
220. Concord (415)
221. Connecticut (259 A & B)
222. Olymphia (259 A & B)
223. Upper (434)
224. Black Pine (434)
225. Red Spruce (434)
226. A. B.
227. Bee No. 1
228. Bee No. 2
229. Bee No. 3
230. Bee No. 4
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233. Bee No. 5
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235. Victor No. 5
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245. Butte (251)
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249. Gray Horse (328)
250. Pilot No. 1 (410)
251. Santiago (410)
252. Good Hope No. 2
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255. Pickwick (148)
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258. Fannie (251)
259. Spar View (251)
260. Hourglass (251)
261. Christian (251)
262. Climax (251)
263. Iron Clad (251)
264. January (251)
265. Best Friend (328)
266. New (328 B)
267. Pilot No. 2 (410)
268. Merrimac (410)
269. Keister (410)
270. Eldora No. 4 (410)
271. Quartzite No. 1
272. Quartzite No. 2
273. Quartzite No. 3
274. Quartzite No. 4
275. Silver Plate (251)
276. Black Fox (251)

KEY TO PLATE 1 (Cont.)

277. Hoosier (251)
278. Prairie (251)
279. Silver Waive (251)
280. Kay See (251)
281. File Closer (251)
282. Belmont (321)
283. High Tide (321)
284. Dauntless (328)
285. Fearless (328)
286. Oskaloosa (328)
287. Pilot No. 3 (410)
288. Porto Rico (410)
289. Eldora No. 3 (410)
290. Silver Plate No. 2 (251)
291. Louise (251)
292. Red Cloud (251)
293. Pete (251)
294. Atlantic (251)
295. Bentley (251)
296. Philip (251)
297. Washakie No. 1 (251)
298. Washakie (251)
299. Titon (321)
300. Burro (328)
301. Chrysolite (328)
302. Pearcy Chester (328)
304. Smuggler (328)
305. Albert (251)
306. Burdett (251)
307. Henry (251)
308. Washakie No. 2 (251)
310. Tamarack (408)
311. Golden Wedge (328)
312. Doctor (408)
313. Mystic (328)
314. Maid of the Mist (328)
315. Camp Bird (328)
316. Rubye (328)
317. Eldora No. 2 (410)
318. Eldora (410)
319. Ellen No. 1
320. Garfield No. 4
321. Garfield No. 3
322. Garfield No. 2
323. Garfield No. 1
324. Mercur (408)
325. Anelbert No. 2 (408)
326. Middle Fork (408)
327. Anelbert No. 1 (408)
328. Singue (408)
329. Yreka (410)
330. Ellen No. 2
331. Garfield No. 5
332. Garfield No. 6
333. Garfield No. 7
334. Garfield No. 8
335. Esmeralda (408)
336. Granite (408)
337. Crawford No. 1 (408)
338. Bushwacher No. 2 (408)
339. Stone (408)
340. Crawford No. 2 (408)
341. Rubber Neck (408)
342. Parrot (408)
343. Cyanide No. 4 (408)
344. Bartlett (408)
345. Cyanide No. 5 (408)
346. Yreka No. 2 (410)
347. Yreka No. 3 (410)

MINERALIZATION

Two types of mineralization occur in the Kirwin area. The first consists of pyrite-chalcopyrite-molybdenite-quartz veins which occur in a highly altered and partly silicified zone on Bald Mountain. The second vein-type consists of galena, sphalerite, tetrahedrite, and minor pyrite-chalcopyrite in a carbonate-quartz gangue. The latter type commonly contains silver. Although gold has been reported in assays (Table 1) from the district, it was not observed in any of the 25 polished surfaces examined by the writer. The veins, which cut the flows and breccias of the Wiggins formation, are considered to be simple fracture-filled epithermal types of mineralization.

*Table 1. Assays of the Kirwin mineralized area.**

No.	Claim	Au oz.	Ag oz.	Cu %	Pb %	Zn %	Mo %	Where & How Taken
1	Bryan	0.04	4.2	-	-	-	-	dump-grab
	Bryan	0.25	30.5	2.33	Tr.	-	Tr.	dump-grab
8	Wolf shaft	Tr.	Tr.	-	Tr.	-	0.55	dump-grab
9	Oregon	0.03	10.8	-	0.1	-	-	vein-channel
	Oregon	0.11	28.9	0.2	2.5	-	-	dump-grab
10	Smuggler	0.06	8.1	0.8	-	-	-	opencut-grab
	Smuggler	0.07	4.8	0.2	-	-	-	dump-grab
11	Pickwick	0.09	1.5	-	-	-	-	dump-grab
	Pickwick	0.04	4.3	-	-	-	-	vein-channel
	Pickwick	0.03	2.2	-	-	-	-	vein-channel
12	Tumlum	0.02	17.6	-	3.2	-	-	dump-grab
	Tumlum	0.07	41.1	-	31.9	-	-	dump-grab
14	Illonies	0.02	0.2	-	-	-	0.51	dump-grab
	Illonies	Tr.	Tr.	0.5	Tr.	-	0.14	dump-grab
15	Anaconda	0.03	1.4	-	20.6	-	-	dump-grab
	Anaconda	0.04	11.9	-	61.8	-	-	shaft-grab
	Anaconda	0.02	7.3	Tr.	39.9	-	-	dump-grab
16	Bl. Prince	0.06	6.0	0.2	3.1	-	-	outcrop
18	L. Johnnie	0.01	1.5	-	1.1	-	-	vein-grab
	L. Johnnie	0.19	111.8	0.03	-	1.2	-	dump-bulk
19	Mendota	0.04	14.7	-	0.55	-	-	dump-grab

* Private communication.

Note - Numbers refer to locations on Plate 2.

Structure and Spatial Distribution of Veins

The mineral deposits in the Kirwin district lie, with only a few exceptions, in a system of narrow, steeply dipping, sub-parallel fissure veins. The system, for the most part, strikes rudely north to north-northwest, and the individual veins vary in dip from N. 80° E. to N. 85° W. Several other veins strike between west-southwest and west-northwest, but with the exception of the Tumlum, are unimportant economically.

The second type of vein, of which only two occurrences were observed, may be considered a bedding plane, or contact, vein, lying along the contact of the Crosby breccia with the lower member of the Wiggins formation. This is best observed at the Anaconda prospect northwest of the Brown Mountian granodiorite (Pl. 1). Some displacement is shown parallel to the contact and this is believed to have been instrumental in localizing minerlization. In other areas along this contact there is a little specular hematite but no base metal mineralization. The writer does not believe that the contact was particularly susceptible to mineralization unless there had been some prior bedding plane movement, such as that near the Brown Mountain granodiorite stock.

For the most part the more mineralized veins are clustered around the Brown Mountain granodiorite. Further, practically all of the veins are paralleled by a dike, although in a few cases there are cross-cutting relationships which show that the vein was later than the dike. Although several veins are adjacent to, and in, the Meadow Creek granodiorite, it is difficult to evaluate them since only a limited amount of prospecting has been done. Unfortunately, too, all of these prospects are now caved, thus rendering only a limited amount of geological information.

The veins of the Kirwin district are narrow, as a rule, with widths varying from several inches to a maximum of eight feet. The average width is between one to two feet, with the mineralization occurring in narrow shoots up to 14 inches in width. The veins generally crop out in shallow depressions, but some are conspicuously marked by yellowish and brownish iron oxide and greenish malachite stain. The walls are well defined and show little mineralization and alteration. The vein material is frequently banded, crustified, and occasionally vuggy, with the ore minerals occupying either narrow veinlets or disseminated in a silicified, partially brecciated matrix.

Sufficient development work has not been done to establish the horizontal or vertical extent of a mineralized shoot within the veins. Unfortunately the three adits to the Bryan mine (pl. 1), which is the only mine to have been developed on three levels, are caved. Hewett (1912, p. 130) reports, however, that the shoots in the Bryan vary from 50 to 250 feet in length and coincide with the dip of the vein. Limited observations on Galena Ridge (north of Canyon Creek) seem to indicate that the shoots vary from 50 to 300 feet in length and are apparently of shallow, but unknown depth.

Mineralogy and Zoning

The ore minerals as identified, and arranged in the order of their observed abundance, include pyrite, galena, sphalerite, chalcopyrite, chalcocite, tetrahedrite, molybdenite, stephanite, and specular hematite. The minerals found in the oxidized zone are limonite, malachite, anglesite, molybdite, native copper, azurite, cuprite, and native gold. Quartz is the most abundant gangue mineral, but calcite, siderite, dolomite (?), and barite are generally present in most of the veins.

Galena is the principal ore mineral and is always silver-bearing.

Secondary enrichment is unimportant in the district, since erosion is taking place faster than enrichment. Somewhat northwest of Bald Mountain, however, is a zone of soil and decomposed rock of unknown thickness. This area then should be explored more thoroughly to determine if a zone of secondary enrichment is present.

A rude vertical zoning occurs throughout the district. Galena, which is found in the highest veins, passes downward into galena-sphalerite-chalcopyrite-tetrahedrite. The ideal relationship occurs on Bald Mountain where the upper levels of the Bryan mine show galena which passes with depth into increasing amounts of galena, sphalerite (?), chalcopyrite, and traces of molybdenite. Only pyrite and molybdenite, with traces of chalcopyrite are present in the Illonies vein which lies about 1,300 feet vertically below the upper levels of the Bryan.

A reversed order of zoning occurs radially around the Brown Mountain granodiorite stock with galena-sphalerite veins lying close to the periphery and the pyrite-chalcopyrite-molybdenite veins occupying the outer zone.

Alteration

Rock alteration in the Kirwin district is of four types: 1) district-wide propylitization and the development of secondary quartz in the andesite flows, breccias, and dikes adjacent to the mineralized area; 2) areas of oxidation or iron oxide staining which may be due to hydrothermal solutions, but more likely due to the weathering of pyrite, biotite, and hornblende in fracture zones; 3) narrow zones, up to several inches in width, of sericitization and silicification immediately adjacent to the vein walls; and 4) the Bald Mountain altered and silicified zone.

Bald Mountain Altered Zone

An ill-defined zone composed of altered, silicified, tuffaceous-looking rock crops out sporadically on Bald Mountain and on the southeast slope of Brown Mountain (Pl. 1). Insofar as can be determined, the zone is somewhat elliptical in plan; approximately one and one-third miles long (north-northwest direction) and about seven-eights of a mile wide (west-southwest direction). The exposed thickness is approximately 900 feet. No exposures of the contact with the surrounding rocks (lower member of the Wiggins formation) have been observed.

Hand specimens of this zone vary in color from light gray to pinkish-gray tuff (?) to a "bleached-looking" silicified rock. In places megaphenocrysts (?) of rounded quartz are present, while in others porphyritic textures and breccia and/or agglomerate fragments appear.

Studies of thin sections show that the zone, at the base of Dundee and Bald Mountains, can be traced, in a northeast-southwest direction, from moderately fresh-appearing andesite (or andesite breccia) into progressively more intensely altered zones. The comparatively unaltered andesite apparently grades into a rock with a highly silicified microgranular groundmass. Plagioclase is almost completely altered to sericite, and phenocrysts of quartz are highly resorbed and embayed by the groundmass. Relic outlines of hornblende and biotite are present, but these minerals have been completely oxidized to limonite. Occasionally a little chlorite remains in the cores of these minerals. The few sanidine (?)

phenocrysts present have been altered to kaolinite. Abundant calcite, opal and illite also have been observed in the thin sections. Varying amounts of eipdote, magnetite, and pyrite are also present. Near the base of Bald Mountain, at Kirwin, molybdenite and copper sulfides partially coat fractures and fill veinlets in this highly altered rock. Molybdenite and pyrite also occur disseminated in quartz veins (?), and molybdite partially coats fracture surfaces within this zone.

The zone is of interest because of the occurrence of copper and molybdenum on Bald Mountain. Poor exposures limit field observations, but both metals occur sporadically, or in trace amounts, in an area approximately 4,000 feet long (northeast-southwest direction) by 3,600 feet wide (northwest-southeast direction) over a difference of elevation of 1,300 feet. In places, the zone appears to have a steep westerly dip. The character of this zone is unknown, but, since dacitic and andesitic float is fairly abundant on Bald Mountain, it may represent the alteration border or halo of a concealed dacite or andesite plug, a breccia-filled volcanic vent, or a complex structural relationship of both features.

SUGGESTIONS FOR PROSPECTING

Although silver-bearing galena is the principal economic mineral that has been observed, the area is probably of more significance in the exploration for copper and molybdenum. In view of this, a geochemical survey of Bald Mountain is recommended. This method could be supplemented by self-potential or induced polarization surveys in areas of favorable anomalies. The low percentage of observed sulfides, however, may indicate the unfavorable aspect of the self potential method. The above methods also may be of assistance in locating additional lead-silver veins, or extensions, in the high "flat" between Canyon and Meadow Creeks.

From a regional standpoint, much of the southern part of the Absaroka Range is known by the writer to be underlain by volcanic sedimentary rocks which are considered to be poor hosts for metallic mineralization. The fact that a number of intrusive bodies, ranging in composition from rhyolite to basaltic andesite, occur in the area does not significantly alter the above statement. The Kirwin area is unique in that it is a local area composed primarily of igneous flows and breccias which are intruded by plutonic rocks of intermediate composition. These facts can be applied as geological guides to additional mineral exploration in the southern Absaroka Mountain area.

The molybdenum deposits at the confluence of Needle Creek with the South Fork of the Shoshone River (located about 20 miles northwest of Kirwin) are located in a geological environment that is somewhat similar to the Kirwin area. A study of these is being included as part of the Geological Survey of Wyoming's Southern Absaroka project.

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REFERENCES CITED

Hague, Arnold, 1899, Absaroka Folio: U.S. Geol. Surv. Geol. Atlas of the U.S., Folio No. 52, 7 p.

Hay, Richard L., 1956, Pitchfork formation, detrital facies of Early Basic Breccia, Absaroka Range, Wyoming: Am. Assoc. Petroleum Geologists Bull., vol. 40, p. 1863-1898.

Hewett, D.F., 1912, The ore deposits of Kirwin, Wyoming: U.S. Geol. Surv. Bull. 540, p. 121-132.

Love, John David, 1939, Geology along the southern margin of the Absaroka Range, Wyoming: Geol. Soc. Am. Special Paper No. 20, 134 p.

Wilson, William H., 1963, Correlation of volcanic rock units in the Southern Absaroka Mountains, northwest Wyoming: Univ. Wyo. Contributions to Geology, vol. 2, no. 1, p. 13-20.

1980 ADDENDUM

Meadow Creek Area

Recent field mapping by the writer (1975) indicates that the Meadow Creek stock is a multiple pluton composed of a westernmost, earlier, dark gray, fine-grained granodiorite in contact with an easternmost, younger, light to medium gray, coarse-grained to porphyritic granodiorite. An ill-defined zone trending north-northwest across the western half of the stock area is more granitic in composition and is believed to represent the chilled contact facies of the younger granodiorite. The location of the intrusion, as a whole, is believed to have been partially controlled by the intersection of the main east-west Wood River fault and a north-trending fault which offsets the volcanics to the north of the plug (omitted on Pl. 2).

An intense area of quartz-sericite-pyrite alteration and disseminated copper mineralization occurs in an irregular north-striking zone within the younger granodiorite along the north fork of Meadow Creek. The zone, which is about 3000 feet long and of an average width of 300 feet, contains disseminated chalcopyrite and azurite- and malachite-coated fracture surfaces. Traces of an unidentified silver-colored mineral (galena or molybdenite ?) associated with quartz veining also occur here. Copper concentrations in this zone range from 200 to 700 ppm. Two diamond drill holes were drilled to depths of approximately 1000 feet in this zone, but data are unknown.

Bald Mountain Area

Diamond drill hole data, from AMAX Exploration, Inc. (1972, 1973), indicate that the rocks on Bald Mountain are composed of an outer doughnut-shaped mineralized stockworks, a central volcanic vent zone of intrusive breccia of older rocks and mineralized rock fragments - partially intruded into the stockworks, and a fine-grained quartz porphyry which occupies a major area of the central vent zone. A zone of welded(?) tuff, which occurs to the north-northwest, is of obscure relationship, but may be intrusive to the others above.

The stockworks shows a crude hypogene zoning in which low pyrite and chalcopyrite and molybdenite occur in the center, and high pyrite and chalcopyrite and low molybdenite occur in the inner zone with high molybdenum around the vent rocks contact described above. A secondary enriched zone, containing chalcocite, digenite, and covellite overlies part of the stockworks, which, in turn, is overlain by a barren leached cap.

Canyon Creek - Wood River Area

In 1970, Mobil Oil Co. drilled a dry hole to a depth of 4860 feet below the surface adjacent to the confluence of Canyon Creek with Wood River. The hole penetrated approximately 2200 feet of andesitic flows and breccias and bottomed in Paleozoic sediments that were intruded by igneous rocks. Therefore the total thickness of the volcanic rocks, in the Kirwin area, is revised to 6500 feet.

ADDITIONAL REFERENCES

Cooper, J.J., Geology of the Kirwin copper deposit, Park Co., Wyo: abstr., Wyo. Geol. Assoc. meeting, Casper, Wyo., May 18, 1973.

Miller, C.P., and Cooper, J.J., Geology of the Kirwin porphyry copper deposit: AIME meeting, Tucson, Ariz., Feb. 21, 1972.

Wilson, W.H., 1975, The copper-bearing Meadow Creek granodiorite, upper Wood River area, Park Co., Wyo: Wyo. Geol. Assoc., 27th Ann. Field Conf. Guidebook, p. 235-241.


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