UNITED STATES DEPARTMENT OF THE INTERIOR
Harold L. Ickes, Secretary

GEOLOGICAL SURVEY
W. C. Mendenhall, Director

Bulletin 931

STRATEGIC MINERALS INVESTIGATIONS 1941

Part 2, K–S

Short papers and preliminary reports by
C. H. DANE, R. G. YATES, C. F. PARK, Jr.
and others

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1943

CONTENTS

[The letters in parentheses preceding the titles are those used to designate the papers for separate publication]

ILLUSTRATIONS

TABLES

INDEX

UNITED STATES DEPARTMENT OF THE INTERIOR
Harold L. Ickes, Secretary

GEOLOGICAL SURVEY
W. C. Mendenhall, Director

Bulletin 931-K

THE WILD HORSE QUICKSILVER DISTRICT
LANDER COUNTY, NEVADA

BY

CARLE H. DANE AND CLYDE P. ROSS

Strategic Minerals Investigations, 1941
(Pages 259-278)

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1942

For sale by the Superintendent of Documents, Washington, D. C. - - - - - - - - Price 25 cents

CONTENTS

ILLUSTRATIONS

THE WILD HORSE QUICKSILVER DISTRICT, LANDER COUNTY, NEVADA

By Carle H. Dane and Clyde P. Ross

ABSTRACT

The presence of cinnabar in the Wild Horse district, in western Lander County, Nev., has been known since about 1916, but little ore was produced until 1940. In that year and early in 1941, deposits discovered in 1939 were mined to apparent exhaustion by the Wild Horse Quicksilver Mining Co., which had produced 827 flasks at the end of April 1941.

The district is underlain by moderately deformed sandstone, shale, and limestone of Lower and Middle Triassic age, locally covered by remnants of a mantle of Tertiary fanglomerate, tuff, and lava. The Triassic rocks are partly silicified, and cinnabar has been found in and near silicified rock, particularly the silicified limestone at the base of the Middle Triassic. The ore bodies so far discovered were individually small and ill-defined, and had an average tenor of less than 0.5 percent of quicksilver. Other similar ore bodies are to be expected at moderate depths, but the cost of exploration for them may, perhaps, prove excessive.

INTRODUCTION

The Wild Horse district, in Lander County, Nev., is one of several quicksilver mining districts in Nevada that have attracted renewed interest recently. The district does not appear to have any generally accepted name and, for convenience, is here designated by the name of its principal mine. The area is sometimes called the McCoy district, after one of its discoverers, but this name is more commonly applied to a gold district, also in Lander County, that lies about 30 miles to the northeast, in the northern part of the Fish Creek Mountains. The Wild

Horse quicksilver district should not be confused with the Wild Horse antimony district in Pershing County.[1]

During July and August 1940, C. H. Dane, with temporary assistants, did about 3 weeks' field work in the district and mapped the topography and geology of an area of about 1¼ square miles on a scale of 500 feet to the inch. C. P. Ross, who had made brief visits to the district in November 1939 and June 1940, spent about a week there during July and August 1940, giving special attention to the mine workings. The writers are indebted to Mr. Robert Crerar, manager of the Wild Horse Quicksilver Mining Co., and to Messrs. Henry W. Gould and Bruce Gould for hospitality, information, and assistance, and they have profited by discussions with Mr. Crerar about the origin of the deposits. They are also indebted to Messrs. H. G. Ferguson and Siemon Muller of the Geological Survey for making available their knowledge of the Triassic stratigraphy and general geology of the region, and to Mr. F. C. Calkins, also of the Geological Survey, for many helpful suggestions during the preparation of this report.

No general geological studies of the region including the district have been made since the exploratory work of the Fortieth Parallel Survey, but a small sketch map and brief description of the northern part of the district were published in 1931 by Schuette.[2]

Location and topography

The Wild Horse quicksilver district is in the western part of Lander County, a few miles southeast of the common corner of that county with Pershing and Churchill Counties (fig. 24). It lies in the rolling hills, with a relief of only a few hundred

---

1/ Lincoln, F. C., Mining districts and mineral resources of Nevada, p. 221, Reno, Nev., 1923.

2/ Schuette, C. N., Occurrence of quicksilver ore bodies: Am. Inst. Min. Met. Eng. Trans. 1931, pp. 440-441, 1931.

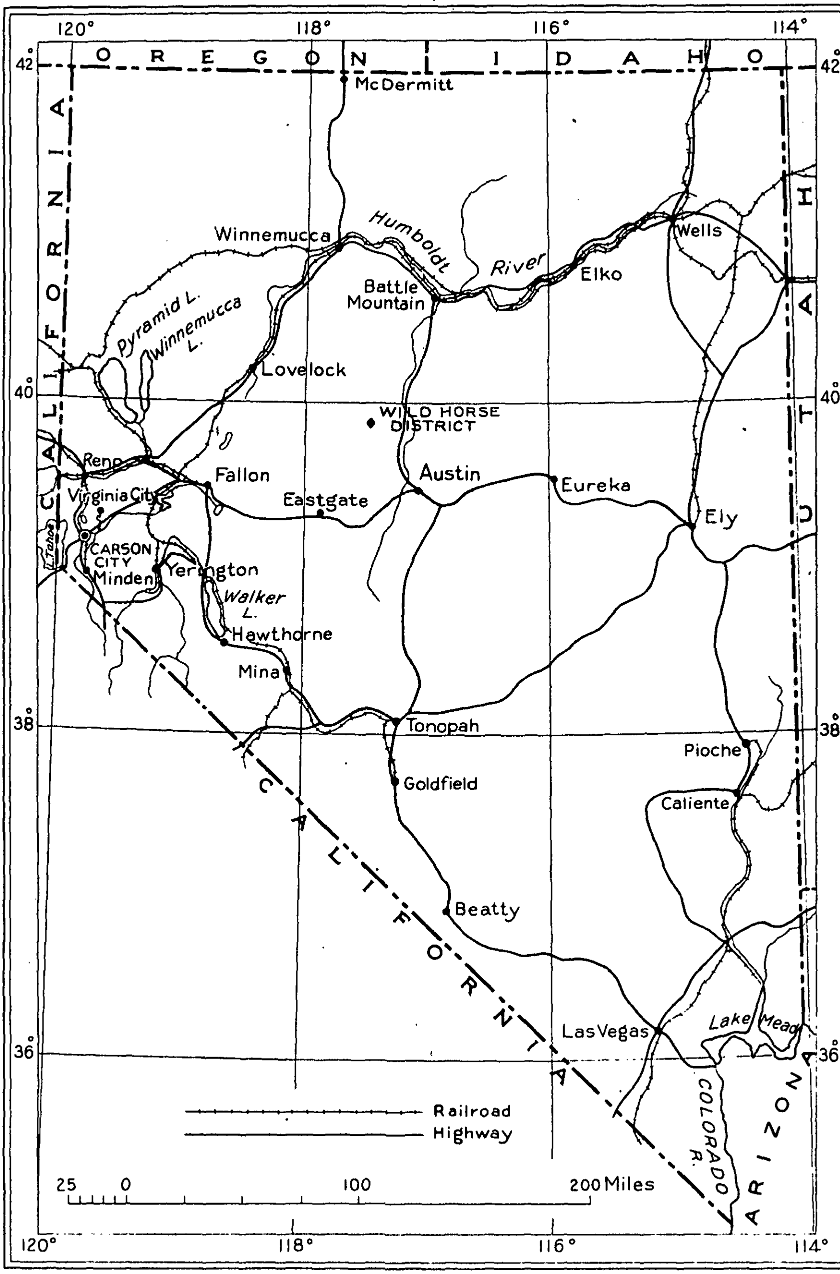


Figure 24.—Index map of Nevada showing the location of the Wild Horse quick-silver district.

feet, northeast of the northern end of the New Pass Range and east of south of the Augusta Mountains. Its average altitude, according to several barometric observations, is close to 5,000 feet above sea level. It drains northwestward, through the low country between the two ranges, into Dixie Valley. A few miles to the north and also to the east of the Wild Horse district there are low divides, beyond which there is a slight but abrupt descent northward and eastward to the open sweep of Antelope Valley.

The district is accessible only by unimproved roads, which enter it from the south, northwest, and north. The one used almost exclusively by the Wild Horse Quicksilver Mining Co. extends from their mine southwest across the northern end of the New Pass Range into the Edwards Creek Valley and down that valley to Eastgate, which is on U. S. Highway No. 50 and about 50 miles from the mine. Close to Eastgate the road is graded and in places thinly surfaced with gravel. Fallon, Churchill County, about 52 miles by highway west of Eastgate, is the supply point for the Wild Horse mine and the terminus of a branch of the Southern Pacific Railroad. Another unimproved road extends for a little over 10 miles from the mine to a point close to Cane Spring, the sole source of water for the mining district, thence northeast to Nevada State Highway 8A close to Watts station on the abandoned Nevada Central Railroad. The highway is reached at a point about 30 miles from the district and 40 miles south of Battle Mountain, which is on U. S. Highway No. 40 and the Southern Pacific Railroad. A third, rarely used road leads northwestward from the district along the dry winding bed of Shoshone Creek, passing through the short gorge called the Hole-in-the-Wall into Dixie Valley, where it joins a network of roads that lead north, west, and south. The unimproved parts of all the roads in the region are poor, but they can be traveled by car without difficulty except at times during the winter.

History

Mining in the district started about 1916 with the discovery of cinnabar by Bert McCoy and associates at the site of the mine still commonly called the McCoy. These deposits were worked intermittently, and some quicksilver is reported to have been produced with retorts in 1919 and from time to time in later years. The Quicksilver Corporation of América did considerable development there in 1936 and reports that it obtained title to the McCoy property in 1937. Since 1937 it has done assessment work only.[3]

Quicksilver production of the Wild Horse mine, Lander County, Nevada

	Ore		Flasks	Value
	Tons treated	Average grade (pounds per ton)		
1940				
January	604	6.91	55	$8,952
February	527	6.2	43	7,274
March	522	11.31	78	13,468
April	493	8.93	58	9,888
May	534	18.56	130	21,320
June	539	24.25	172	28,988
July	412	12.55	68	11,378
August	532	9.43	66	11,470
September	550	4.55	33	5,830
October	539	5.64	39	7,220
November	554	3.49	24	3,830
December	119	5.39	10	1,500
1941				
January	.....	.....	...	....
February	115.2	7.4	11	1,640
March	229.6	6.29	18	2,700
	6,269.8	.....	805	135,458

The only other property in the district was discovered April 27, 1939, by Clyde A. Garrett and his son. A number of shallow prospect pits were dug in 1939. In September of that year the Wild Horse Quicksilver Mining Co. acquired control of the property and began work. By the end of 1939 a 20-ton Gould rotatory

3/ Sternberg, Samuel, secretary Quicksilver Corporation of America, letter of May 26, 1941.

furnace was installed. Quicksilver was produced throughout 1940. Since early in December 1940 there has been comparatively little ore in sight, but production at a reduced rate continued through April 1941. In May of that year a small force was still exploring the property.4/ The table on page 263, furnished through the courtesy of H. W. Gould, records the production of the mine to the end of March 1941. In April, 22 flasks more were produced.

GEOLOGY

The rocks of the Wild Horse district (see pl. 45) include a succession of gently folded and somewhat faulted sedimentary rocks of Lower and Middle Triassic age. The beds dip westward except at the southern edge of the district where they dip southwest and south. Above an irregular surface cut by erosion on the Triassic rocks lies a Tertiary deposit of talus or fanglomerate, succeeded by white rhyolitic tuff and pinkish-gray rhyolite. The tuff and rhyolite were also deposited on an irregular surface and in places rest directly on the Triassic rocks. The surfaces on which the fanglomerate and rhyolite were deposited correspond in a general way with the present topographic surface, the highest parts of which probably were not covered by the fanglomerate. The tuffs and rhyolite flows locally have steep dips, but these are all believed to be original. In the absence of suitable key beds no reliable evidence of post-tuff folding or faulting was observed within the limits of the district, although the tuff is known to have been faulted in the general region.

Exposures are in general poor: the resistant beds crop out as conspicuous ledges, but they are lenticular, and the softer beds are covered in large part with a mantle of surface debris.

4/ Gould, H. W., letter of May 13, 1941.

Lower Triassic rocks

The oldest rocks exposed in the Wild Horse district are sandstones, green and gray conglomerates, and red sandy dolomitic shales, of Lower Triassic age as classified by Muller and Ferguson.[5] About 500 feet of these Lower Triassic beds are exposed within the limits of the area mapped. This is not their full thickness.

The Lower Triassic beds are divided on the map (see pl. 45) into three units. The lowest unit, of which only the uppermost 150 feet is exposed, includes chiefly beds of red and tan sandstone and sandy shale, but there are numerous beds a foot or less in thickness of siliceous pebble conglomerate. The middle unit is a ledge-forming bed of hard resistant conglomerate of siliceous pebbles distinguished from the conglomerate beds below only by its greater thickness and continuity. This unit ranges in thickness from 10 to 25 feet. The upper unit, about 325 feet thick, consists chiefly of fine-grained, tan-colored sandstone and tan and drab, hard, thin-bedded shales, and typically weathers to a soft, yellow-gray slope. Its topmost part is in most places fine-grained, thin-bedded sandstone, but it is locally conglomeratic, and at one locality there is a conglomerate bed 30 feet thick at the top of the unit. The lower half of the unit contains more conglomerate than the upper half; the conglomerate beds are in most places not more than a foot thick, but a lens 20 feet thick is exposed a few hundred feet east of the McCoy mine. Farther east this unit consists mainly of ripple-marked, tan-colored sandy shales and hard, red dolomitic clays with only a few thin conglomerate beds.

Throughout the Lower Triassic rocks as exposed in the Wild Horse district, the conglomerates consist of closely packed pebbles, whose maximum size is everywhere about 1 inch in diameter,

---

5/ Muller, Siemon, and Ferguson, H. G., personal communication.

with a matrix, very subordinate in amount, of much smaller pebbles or sand. The pebbles are almost without exception of dense siliceous rock, ranging from light gray or greenish gray to bright, light green. The color of the conglomerate as a whole is normally light tan ranging to dark brown on joint surfaces or where the rock is silicified.

Middle Triassic rocks

The Middle Triassic rocks of the Wild Horse quicksilver district were subdivided for mapping into three units: a basal unit of limestone beds, probably nowhere more than 50 feet thick, a middle unit of gray limy shales and thin gray limestones with some sandstone beds, in greatest thickness about 1,250 feet, and an upper, cliff-forming unit, in which thick beds of dolomite predominate. The top of this highest unit is not exposed within the limits of the district.

The basal unit of the Middle Triassic consists, where unaltered, of light-gray limestone closely crowded with crystalline calcite pseudomorphs or hollow casts of fossil shells, presumably pelecypods. There may be a single bed of such limestone as much as 25 feet thick, or there may be two beds of gray limestone each 5 feet thick or more, separated by gray limy shale as much as 10 feet thick. Immediately overlying this gray limestone zone is a limestone that is nearly black on fresh fracture and commonly gives off a fetid odor when broken. This black limestone and the overlying calcareous shale and thin-bedded limestone contain abundant ammonites of the genus *Acrocordiceras*.

The middle unit of the Middle Triassic rocks consists chiefly of calcareous shale and thin-bedded limestone, but, particularly in the northern part of the district, there are some fine-grained sandstones and sandy shales in the basal part of the unit. About 300 feet above the base of the Middle Triassic there is a zone of thin-bedded, brown, platy and slabby calcareous sandstones or sandy limestones containing compressed specimens of Acrocordiceras and shells of the pelecypod genus Daonella. The higher beds where exposed consist mostly of soft, gray calcareous shales but include also a few ledges of light-gray, thick-bedded limestone. Within the limits of the area mapped the uppermost part of this thick unit of gray limy shale is concealed, but a little farther northwest some ledges of porous, white, conspicuously cross-bedded limestone crop out.

The upper unit of the Middle Triassic rocks crops out within the area covered by plate 45, only along the western border. Here a small part of a continuous high ridge composed of massive ledges of limestone and dolomite belonging to this unit has been mapped. The lowest exposures include beds of gray limestone containing abundant crystalline calcite shells. Above these are massive ledges of gray limestone, some of which contain abundant irregular stringers and grains of pinkish chert. About 50 to 75 feet above the base of this unit the beds are largely dense dolomite of a light, uniform gray. The total thickness of this dolomite was not measured, but it must greatly exceed the 250 feet exposed within the limits of the mapped area.

Tertiary rocks

Fanglomerate.--Unconsolidated talus or fanglomerate of Tertiary age lies in places on an irregular eroded surface of Triassic rocks. In the area north and east of the road fork leading to the Wild Horse quicksilver mine the individual boulders and transported blocks are very large, and some of them can be recognized as derived from the ridge of dolomite and cherty limestone that lies only a thousand feet to the west. A block of limestone in the small exposure of fanglomerate 500 feet north of the Wild Horse road fork is 25 feet long and 5 feet wide. For a distance of 1,500 feet east of the road fork, blocks 6 to 8 feet long are numerous. East and north of this place the fanglomerate includes chiefly smaller-sized material, most of which is apparently derived from the older rocks exposed in the eastern part of the mapped area, especially the shattered silicified limestone and black limestone from the basal unit of the Middle Triassic rocks. The fanglomerate was deposited on an erosion surface having greater relief than the present topography. Its maximum exposed thickness is about 50 feet, but its original maximum thickness must have exceeded 250 feet, judging from the relief of the surface upon which it rests and the minimum grade over which the large boulders of Triassic dolomite and limestone could have moved to their present position.

Tuff and rhyolite.--The youngest rocks exposed in the district are soft brilliant white tuffs and subordinate pinkish-gray rhyolites, which rest on an irregular erosion surface of Triassic rocks and Tertiary fanglomerate. At one locality, about 500 feet west of the Wild Horse mine, soft thin-bedded gray shales are exposed in a prospect pit. These were mapped as part of the tuff, which may locally include other soft nontuffaceous beds that were not recognized in the weathered exposures.

Silicified rock

The rocks are locally much silicified. The distribution of the more obviously silicified material, much of which is stained by iron oxides, is shown approximately by the stippled pattern on plate 45, but partly silicified rock extends beyond the boundaries of the areas thus mapped. The principal silicified masses are on the hill to the north and west of the Wild Horse workings and at intervals along a belt that extends northward to and beyond the McCoy mine. They are mainly in the gray fossiliferous limestone beds at the base of the Middle Triassic sequence, but they extend into the sandstone of the upper unit of the Lower Triassic beds, and, to an even greater extent, upward into and above the black limestone high in the basal Middle Triassic unit. The crest and southwest slopes of the hill north of the Wild Horse mine have a cap over 50 feet thick so thoroughly silicified that the character of the original rock was not ascertained. This cap is thought to underlie the erosion surface on which the fanglomerate was laid down. Throughout the area mapped silicified material tends to extend along the bedding.

In places the rock mass as a whole is permeated and partly replaced by silica; elsewhere stringers and blebs of dense siliceous material invade the calcareous rocks irregularly. In some of the rock these stringers are so closely spaced that none of the original material remains. Some bands of silicified rock follow straight lines possibly determined by earlier fractures of northerly trend, but the outlines of both the permeated masses and those made up of stringers and beds are generally most irregular, being apparently independent of the intensity of local shattering and of the trend of the fractures in the rocks.

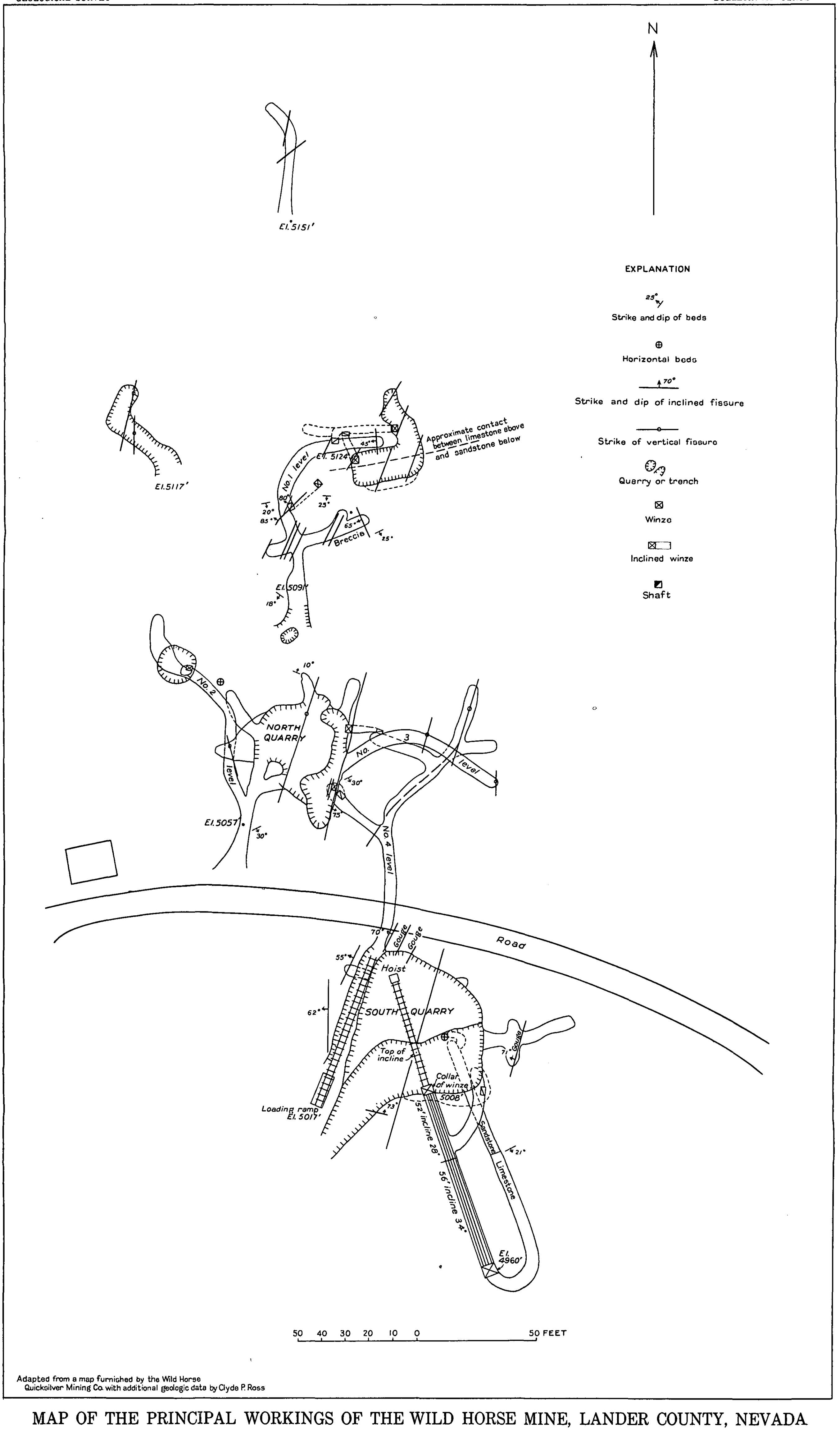
Part of the silicification must have occurred before the Tertiary fanglomerate was deposited, for this unit includes boulders of silicified rock, and the silicified ledges, particularly in the northern part of the district, appear to be sharply cut off by the erosion surface on which the fanglomerate rests. Some silicification, on the other hand, occurred later, for at a locality 1,500 feet south and east of the main Wild Horse workings the fanglomerate includes a small mass of rubble or talus composed of small fragments of conglomerate, chunks of sandstone, individual pebbles and sand grains, and some boulders of silicified limestone. This whole aggregate is silicified and is stained brilliant pink and red. There is also a little banded siliceous sinter above the rubble and immediately beneath the tuff. West of the workings there is a mass of silicified fragments, but this may be, at least in part, fault breccia rather than surface debris.

Silicification appears to have resulted from the circulation of siliceous water chiefly in the general zone of limestone and permeable sandstone at the base of the Middle Triassic and top of the Lower Triassic. The precipitation of the silica from these circulating waters, presumably heated, took place close to the surface in Tertiary time. The sinter mentioned above may have been deposited by some of this water that issued at the surface as a hot spring.

Structure

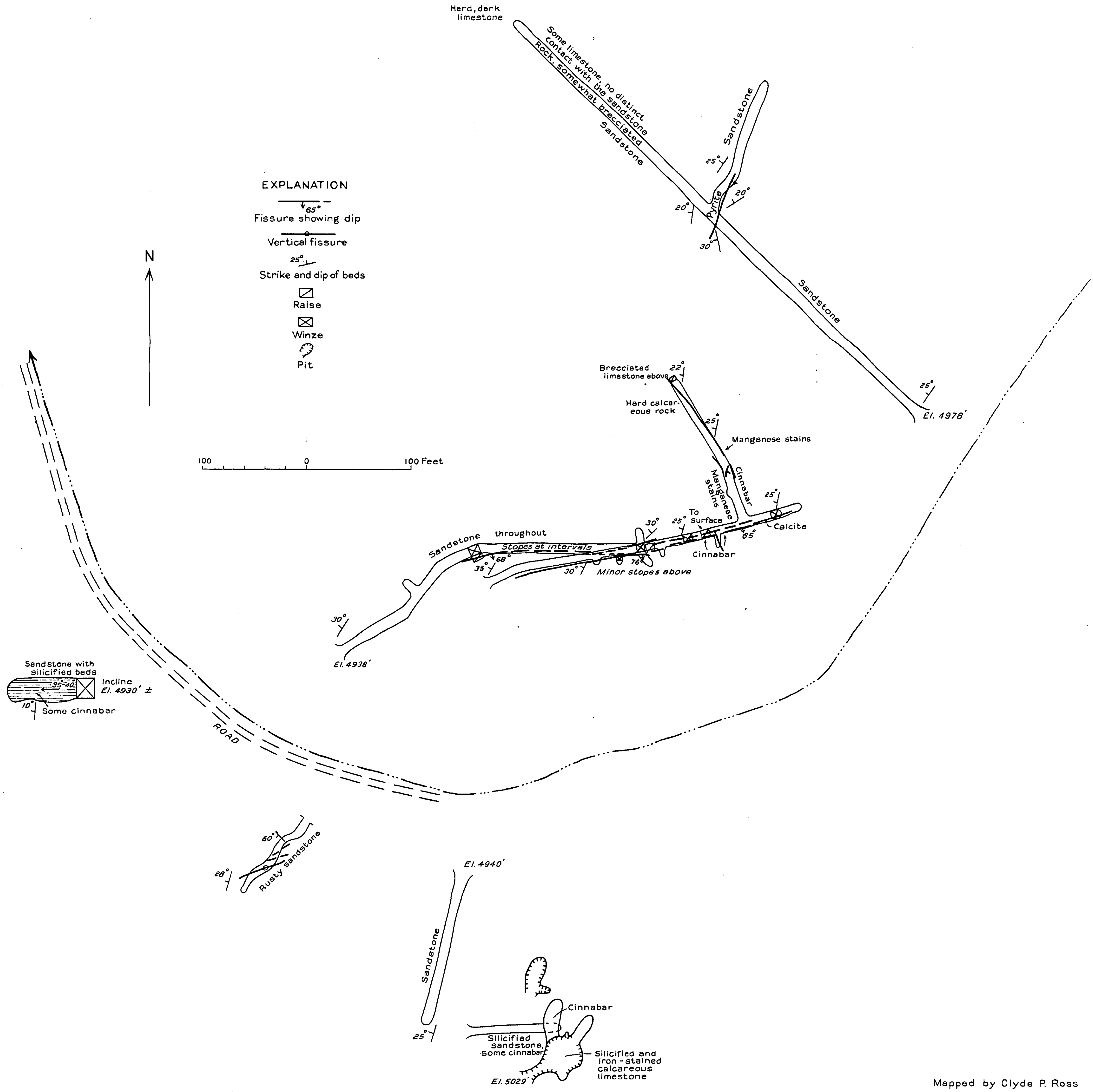
In general the pre-Tertiary rocks of the district dip southwestward at angles ranging from 5° to 60°, most steeply along a line corresponding nearly with the base of the Middle Triassic, where the dips are generally about 30°, and in the westernmost part of the area mapped. Along the southern edge of the exposure of Triassic rocks there is a rather abrupt bend in the strike of these rocks, which dip nearly south at angles as high as 60° there. The structure here seems to be essentially that of an anticlinal nose plunging southwestward, but it is concealed in great part by overlying Tertiary beds.

The maps show 14 faults, all confined to areas of pre-Tertiary rocks. All but four of the faults mapped range in strike from N. 40° W. to N. 10° E., with an average trend close to north. The downthrow is toward the west, with a few probable exceptions such as the fault of small throw near the northwest corner of the area. There are undoubtedly other small faults that were not recognized on the surface because of lenticularity of beds and poor exposures. Minor faults of this kind are revealed in the mine workings, where some of them are marked by vein minerals or by narrow bands of gouge, and a few are stained by oxides of iron and manganese. A few such faults--one, for example, at the portal of the tunnel above the principal Wild Horse quarry--displace the beds only a few inches, and most of



MAP OF THE PRINCIPAL WORKINGS OF THE WILD HORSE MINE, LANDER COUNTY, NEVADA

U. S. GOVERNMENT PRINTING OFFICE: 1942 O-430316 (Faces p. 270)



SKETCH MAP OF THE PRINCIPAL WORKINGS OF THE McCOY MINE

U. S. GOVERNMENT PRINTING OFFICE: 1942 O-430316 (Faces p. 270)

the faults plotted on plates 46 and 47 may be of almost equally small displacement. The minor faults in the Wild Horse workings cut silicified rock, and the siliceous material between them is in part brecciated. On the other hand, the two larger faults mapped on plate 45 in the area of the workings border silicified masses in such a way as to suggest that they guided the silicifying solutions.

Near the southeastern corner of the area, there are two faults, striking a little south of west, with a shattered zone between them, whose total displacement is more than 350 feet, with the downthrow on the south. The northern fault, which is sharp, clean-cut, and straight, drops the upper sandstone unit of Lower Triassic age below the level of the underlying conglomerate ledge. The southern fault of the pair, which is less clean-cut, can be shown in general to drop the shale unit of the Middle Triassic to the level of the upper sandstone unit of the Lower Triassic. A breccia of silicified limestone and sandstone exposed near the Tertiary contact about 200 feet west of the calcine dump of the Wild Horse furnace suggests that there may be another fault, concealed beneath the Tertiary rocks, that has about the same trend as the two faults just described. A small fault with this trend cuts the upper beds of the Lower Triassic about 1,500 feet north of the Wild Horse mine, and a larger fault of the same trend cuts the dolomite ridge on the western edge of the area mapped.

The other faults mapped strike from N. 40° W. to N. 10° E.; many strike nearly north. They cause a downthrow on the west with the exception of one fault of small throw in the northwestern part of the area mapped. The maximum throw on any of these faults is about 100 feet. There are probably other small faults that were not recognized because of lenticularity of beds and locally poor exposures. The harder beds are much jointed, with from two to five sets of joint planes, on some of which there may be compensating offsets of an inch or more.

ORE DEPOSITS

The district contains the quarries and associated workings of the Wild Horse mine, the tunnels, shafts, and small open cuts of the McCoy mine, and prospect pits and short tunnels scattered over most of the area covered by the mining claims, whose approximate extent is shown in the incomplete sketch map forming figure 25. The ore deposits are in fractures and indefinitely bounded bodies in and near silicified portions of the basal limestone of the Middle Triassic and nearby parts of the underlying sandstone, which, where completely silicified, is difficult to distinguish from the limestone. The district has yielded over 6,000 tons of selected ore having an average grade of roughly 0.5 percent of quicksilver. In May 1941 little ore remained in sight.

Mineralogy

The deposits contain cinnabar, together with small amounts of mercuric chloride minerals and of pyrite and stibnite, in a quartz gangue with some calcite, barite, kaolin, and collophanite. The few tiny grains of tourmaline and zircon locally recognized in the ore are presumably detrital grains that have survived the silicification of the sedimentary rocks.

The amount and character of the cinnabar vary widely. In places, especially in sandstone at a distance from known ore bodies, it forms thin films in cracks and is scattered between the quartz grains. Such material is of very low grade, but it is widely distributed, as shown by prospect holes between the Wild Horse quarries and the McCoy mine and by the cuts and tunnels of the latter property. In the ore of the Wild Horse mine much of the cinnabar forms rather coarsely crystalline

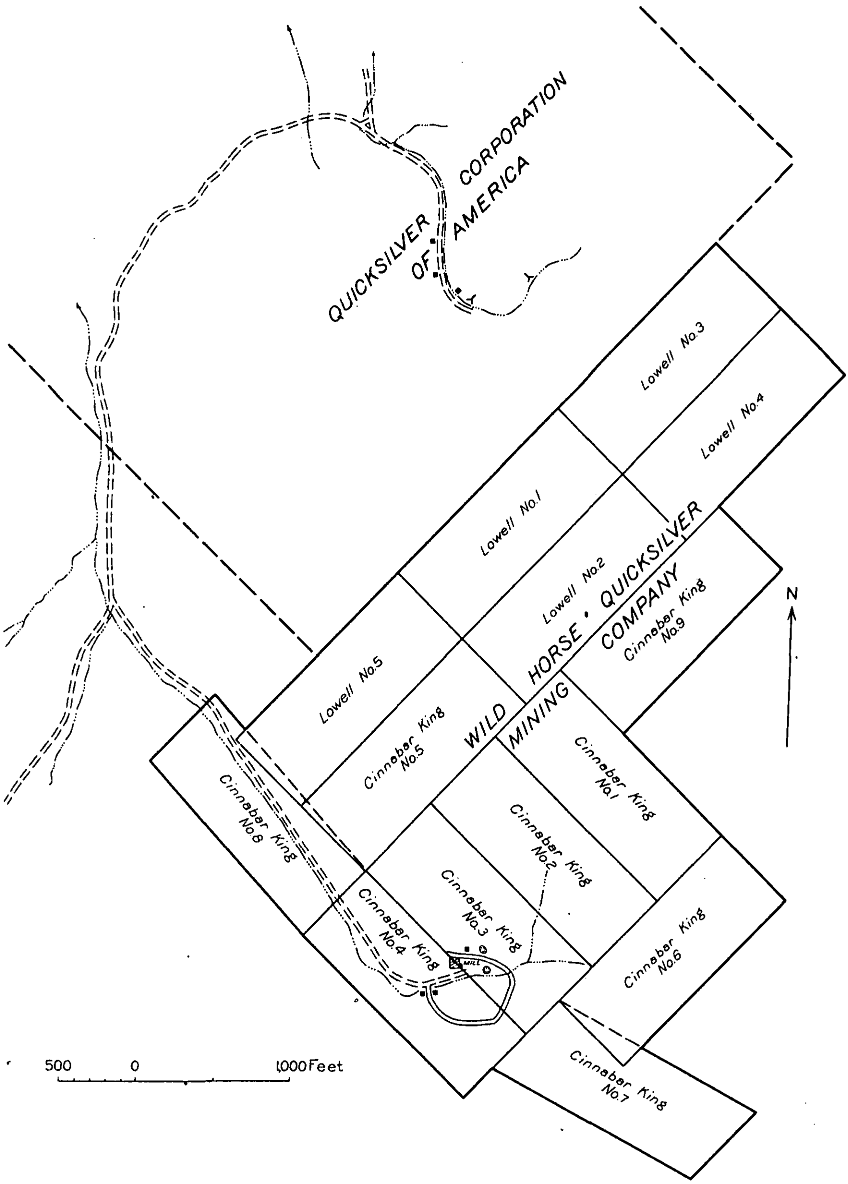


Figure 25.—Property map of the Wild Horse district, adapted from a map furnished by the Wild Horse Quicksilver Mining Co.

aggregates and crusts in fractures and between original clastic grains in the silicified rock. Some unfilled cavities, in part lined with cinnabar, remain in the partly silicified limestone. The cinnabar aggregates have been enlarged by replacement of the rock that borders the openings. In places, especially in the richer spots, part of the cinnabar is in the fine pulverulent form commonly called paint. In this as in many other districts, exposed grains of cinnabar are covered with a black film that hides their identity from the casual observer. The production records on page 263 show that the average sorted ore sent to the furnace contained slightly less than 0.5 percent of quicksilver, but many small ore shoots were much richer. One sample taken from the right-angled trench near the northern border of the area shown in plate 46 was found by J. J. Fahey of the Geological Survey to contain 18.78 percent of quicksilver. This sample yielded 0.28 percent of mercuric chloride, which suggests that small quantities of chloride minerals are associated with the cinnabar, although they are nowhere abundant enough to be recognizable.

Pyrite was recognized only in small quantities in one of the McCoy tunnels, but iron stains in the rocks suggest that it is also present elsewhere. Stibnite was not seen by the writers, but Robert Crerar found small, bladed aggregates of it in a few places.

Nearly all the cinnabar exposed in the southern half of the area mapped on plate 45 is in silicified rock, although in places the characteristic dark outcrops are not conspicuous. Most of the quartz is earlier than the cinnabar but some fills cracks in aggregates of cinnabar. Clay minerals, barite ($BaSO_4$), and collophanite ($CaO.P_2O_5.CO_2.H_2O$), are present but visible only under the microscope. The last named, an amorphous, hydrous phosphate rare in deposits of this sort, was identified by Charles Milton of the Geological Survey in material from the main Wild Horse quarry. His tests indicate that the specimen he studied contained about 10 percent of collophanite, but probably most of the ore contains less. The collophanite forms granules which tend to be grouped close to cinnabar. A sample of unsilicified gray limestone from the basal beds of the Middle Triassic was found by J. J. Fahey to contain some phosphate. Calcite in moderately coarse crystals lined open fractures exposed in the tunnels on the McCoy ground.

Origin

The cinnabar appears to have been deposited at a late stage in the silicification of the rocks, in the zone close to the base of the Middle Triassic rocks, by solutions which came near the surface and may even at times have emerged upon it. Much of the water of these solutions was doubtless of meteoric origin, but the mercuric sulphide, much of the silica, and some of the minor constituents must be of magmatic origin, being perhaps related to the igneous activity that gave rise to the Tertiary lava and tuff in the vicinity.

Schuette [6/] has suggested that the silicified limestone at the McCoy mine is so dense that it may have acted as an impervious cap beneath which cinnabar collected to form ore shoots. Much of the silicification preceded the deposition of cinnabar, so that the denser and less fractured parts of the silicified limestone may have tended thus to act as dams. However, most of the quicksilver ore in the Wild Horse mine is believed to have been deposited within the limestone rather than below it.

Distribution

Most of the cinnabar-bearing material is distributed in rocks close to the base of the Middle Triassic strata. Nearly

6/ Schuette, C. N., op. cit.

all the ore so far mined has come from silicified Middle Triassic limestone, but much cinnabar is sparsely scattered through the Lower Triassic sandstone immediately below, and the incline close to the McCoy camp (see pl. 47) discloses some cinnabar in sandstone above the limestone.

Most of the cinnabar is in distinctly fractured rock, and the ore at the Wild Horse mine came from an area in which minor faults trending somewhat east of north are plentiful. These faults, however, have little influence on the shapes of the several ore bodies. Much of the ore so far mined came from an irregular quarry about 60 feet in diameter, but this contained much waste rock. The ore bodies were individually small and, in detail, appear to have been unsystematic in arrangement.

The mode of origin advocated above implies that these ore shoots are confined to much shallower depths than is true of many other kinds of lodes. The ore shoots may, nevertheless, have a greater vertical range than that of the narrow zone explored by existing workings. Limestone similar in original character and in degree of silicification to that containing the known ore bodies persists down the dip to depths not yet explored and may well contain other ore shoots. The upper sandstone unit of the Lower Triassic, moreover, has not been sufficiently explored to prove that it contains no undiscovered ore bodies. However, exploration for deeper ore shoots, when it is not guided by definite clues as to their location, involves the risk of expenditures that might exceed the reward.

Mines

The Wild Horse mine.--The Wild Horse property is in the southern part of the district, and comprises 14 unsurveyed claims. It is owned by the Wild Horse Quicksilver Mining Co., a subsidiary of H. W. Gould & Co. In 1940 and the early part of 1941 this company produced 827 flasks of quicksilver from somewhat more than 6,000 tons of ore. It received an average of about $168 a flask for the product. Detailed cost figures are not available, but it is safe to assume that this relatively brief operation was profitable even if it should turn out that the difficulty in discovering new ore bodies is such that the mine shuts down without adding materially to its production record. The ore was easy to treat and in part high grade but factors such as the isolation of the district, the fact that all water had to be hauled over 10 miles in metal drums, and the small size of the individual ore bodies added much to the cost of operation here.

The mine has been explored by a series of small quarries, glory holes, trenches, and tunnels which extend through a vertical range of a little more than 250 feet. Plate 46 is drawn mainly from a map furnished by the company, which shows the principal workings as they were on February 18, 1941 and indicates the principal fractures. Geologic observations made by C. P. Ross in July 1940 have been added. The principal workings extend over an area that has a length from north to south of somewhat more than 520 feet and a maximum width of about 130 feet. In addition, scattered pits and short trenches are scattered over a distance of about 3,500 feet north of the principal quarry (pl. 45).

Most of the workings within the area of plate 46 are in limestone of the basal unit of the Middle Triassic sequence, but the workings on the hillslopes above the north quarry are in the Lower Triassic sandstone. These workings disclose cinnabar in several places, and the exceptionally rich sample mentioned on page 274 came from one of them. The tunnel from the bottom of the incline from the south quarry, driven after the writers left the district, penetrated this sandstone for a distance of 50 feet, and probably some of the tunnels higher on the slope also penetrated sandstone. All the rocks are so silicified that it is not everywhere possible to distinguish between rock that was originally sandstone and rock that was originally limestone. Nearly all the ore mined has come from small bodies scattered through the tilted slab of altered limestone which forms the surface of this part of the hill and which appears to have a maximum thickness of 20 or 30 feet. The rest of the unit has been removed by erosion, in part, at least, before the Tertiary strata mantled the region. The prospect openings north of the area covered by plate 46 are mainly in sandstone. Several show cinnabar but not enough to encourage further exploration.

McCoy mine.--The McCoy mine includes 16 unsurveyed claims. This mine has had several brief periods of activity but its production has been small. The only activity in the summer of 1940 was assessment work.

The several branching tunnels, which, as shown on plate 47, are distributed along both sides of the gulch, have an aggregate length of close to 1,000 feet. These tunnels are mostly in the upper sandstone unit of the Lower Triassic strata. There also are several small excavations, shown on plate 47. These are also close to the top of the Lower Triassic sandstone. Sandy beds in the shale unit of the Middle Triassic are explored by a vertical shaft (see pl. 45) near the top of the ridge southwest of the camp and by an incline about 65 feet long close to the gulch near the upper camp buildings.

The incline, which is in partly silicified sandstone, the two long tunnels that extend into the ridge on the north side of the stream a short distance north of east of the incline, and several of the smaller workings near the top of the Lower Triassic sandstone show some cinnabar. This mineral lines minor fractures and, in the two tunnels just mentioned, is in and near calcite veins. Moderately rich ore is said to have been taken from some of the workings, but the material that remains in sight is of low grade.

The use of the subjoined mailing label to return this report will be official business, and no postage stamps will be required

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

OFFICIAL BUSINESS

This label can be used only for returning official publications. The address must not be changed.

PENALTY FOR PRIVATE USE TO AVOID PAYMENT OF POSTAGE, $300

GEOLOGICAL SURVEY,

WASHINGTON, D. C.