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Iron Resources of California
Bulletin No. 129

PART J

Hirz Mountain Iron-Ore Deposits
Shasta County, California

By CARL A. LAMEY
GEOLOGICAL SURVEY, U. S. DEPARTMENT OF THE INTERIOR

Issued by the
STATE DIVISION OF MINES

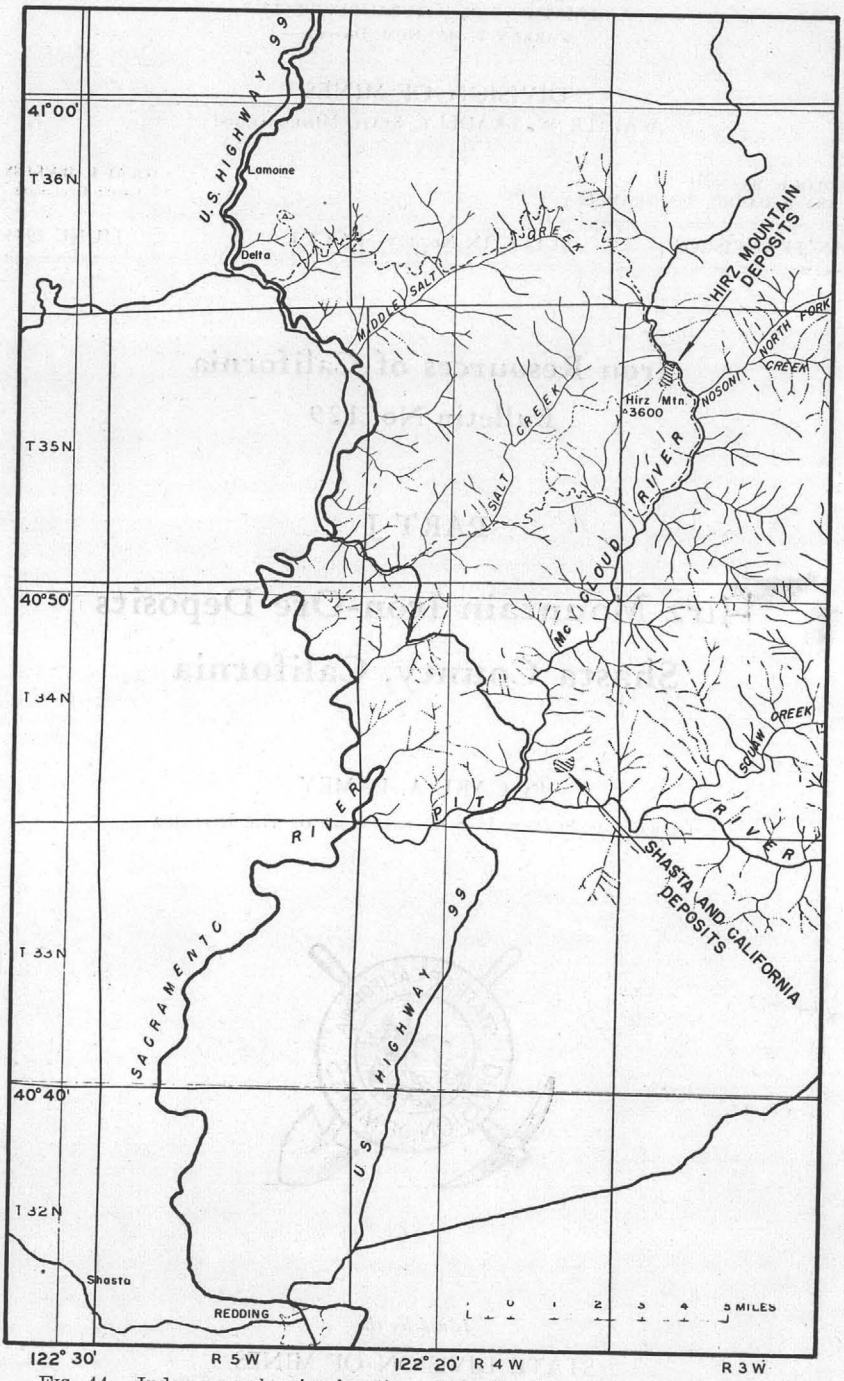

FIG. 44. Index map showing location of the Hirz Mountain and the Shasta and California iron-ore deposits, Shasta County. *Prepared from Forest Service topographic map of Shasta National Forest (west half), California, Mt. Diablo meridian, 1936.*

HIRZ MOUNTAIN IRON-ORE DEPOSITS, SHASTA COUNTY, CALIFORNIA *

By Carl A. Lamey **

United States Department of the Interior, Geological Survey

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ABSTRACT

The Hirz Mountain iron-ore deposits are about 24 miles approximately N. 20° E. of Redding, California. They are near the McCloud River and lie along the brushy lower slopes that form the northeastern approach to Hirz Mountain, at altitudes ranging from 1300 to 1700 feet. They are difficultly accessible over a rough mountain road.

Much of the bedrock of the area is covered. The rocks exposed are (1) the Permian (?) McCloud limestone, (2) the Permian Nosoni formation composed of pebbly and tuffaceous sediments interbedded with basaltic and andesitic flows, and (3) a late Jurassic or early Cretaceous quartz diorite. The distribution of outcrops indicates that the Nosoni formation and the McCloud limestone probably occupy much of an area previously mapped as underlain by quartz diorite, and that locally along the strike the Nosoni formation is separated from the McCloud limestone by a fault.

Relatively few and poor exposures, and generally weak magnetic attraction, indicate that two small zones of iron ore are present, separated from each other by about 1200 feet of quartz diorite and limestone. The iron ore is chiefly magnetite, which occurs as partial replacements of the McCloud limestone and the Nosoni formation, and as disseminations and small stringers in both of these formations and in the quartz diorite. Locally the ore is accompanied by garnet and epidote, and near some deposits the limestone has been partly silicified. Apparently the quartz diorite rose along the contact between the McCloud limestone and the Nosoni formation and produced the few small iron-ore deposits.

The orebodies are probably very discontinuous and shallow. Exposures and magnetic attraction indicate that the reserves probably do not exceed a few hundred thousand tons.

INTRODUCTION

The Hirz Mountain iron-ore deposits are in secs. 5, 7, and 8, T. 35 N., R. 3 W., M.D., Shasta County, California, about 24 miles in a north-

* Published by permission of the Director, Geological Survey, United States Department of the Interior. Manuscript submitted for publication February 24, 1945.

** Field geologist of the Geological Survey, United States Department of the Interior.

easterly direction from Redding (see fig. 44). They are at altitudes ranging from 1300 to 1700 feet and lie along the lower slopes that form the northeastern approach to Hirz Mountain, the crest of which attains an altitude of 3600 feet. The slopes along which the deposits lie are exceedingly brushy and are rather steep and irregular, being cut by a number of intermittent streams (see Pl. XIV).

The deposits are difficultly accessible. In the late summer of 1944 they could be reached by driving north from Redding about 18 miles over U. S. Highway 99, and thence from the vicinity of Salt Creek about 13 miles over the McCloud River road (see fig. 44). The McCloud River road is narrow, rough, and poorly graded. Earlier in the summer, part of it was covered by water ponded by the Shasta dam on the Sacramento River. Complete filling of the Shasta reservoir will cause flooding to an altitude of 1070 feet, and it is understood that the deposits cannot again be reached from the McCloud River road. The only other means of access is by driving considerably farther over a Forest Service mountain road that leaves U. S. Highway 99 near Delta, or by barge on the McCloud River from the vicinity of the Shasta and California deposits (see fig. 44) if such service can be obtained.

Between August 29 and September 20, 1944, a plane-table topographic and geologic map and a dip-needle survey were made of the most promising parts of the deposits and enough of the surrounding area to show the general geologic relations. In this work the writer was ably assisted by P. Dean Proctor. Inasmuch as the extent of the iron-ore deposits did not appear to be sufficient to warrant mining, even on a small scale, and as other work that required the writer's attention was already in progress, the project was discontinued before completing what might otherwise have been considered a desirable geologic unit. This lack of completeness of the mapping, and the very poor exposures in much of the area, make the position of formation boundaries very uncertain.

PREVIOUS PUBLICATIONS

Practically nothing has been published about the Hirz Mountain deposits. The general geology of the region in which they are located was discussed by J. S. Diller, and the deposits mentioned briefly [1].

GENERAL GEOLOGY

Rock Succession, Distribution, and General Relations

The succession of rocks exposed in the area mapped follows:

Succession of rocks exposed near the Hirz Mountain iron-ore deposits

Igneous rocks
- Late Jurassic or early Cretaceous
  - Quartz diorite

Sedimentary and metamorphic rocks
- Quaternary
  - Alluvium and colluvium
- Permian
  - Nosoni formation and metamorphic rocks derived from it
- Permian (?)
  - McCloud limestone and metamorphic rocks derived from it

[1] Diller, J. S., U. S. Geol. Survey Geol. Atlas, Redding folio (no. 138), 14 pp. 1906.
Logan, C. A., Shasta County, iron, Jennings group: California Min. Bur. Rept. 22, p. 190, 1926.

Colluvium [2] mantles the greater part of the lower slopes leading up to Hirz Mountain, and alluvium fills much of the bottom of the McCloud River valley and the lower parts of its tributary valleys. Little of the colluvium, except some small patches that appear to be remnants of high terrace deposits, is shown on the map in order that the probable distribution of the underlying formations can be depicted. Inasmuch as the areas of actual rock exposures are shown separately, the distribution of the colluvium is readily inferred.

One small exposure of alluvium was mapped separately because it differs materially from the rest. Apparently it is older than the main mass of alluvium, but the age relations are obscure.

Exposures of Nosoni formation are found chiefly in the McCloud River and along its banks, but a few higher exposures indicate that this formation is present along the lower slopes in a considerable part of the area (see Pl. XIV).

The McCloud limestone rises high above the east side of the McCloud River in a prominent exposure, and a few small outcrops project above the alluvium in the valley of a tributary stream, but the chief exposures of this formation are on the higher slopes to the westward, where they continue beyond the area mapped.

The principal exposures of quartz diorite are along the intermediate slopes, between the Nosoni formation and the McCloud limestone, but dikes of diorite cut both of these formations (see Pl. XIV), and such dikes are much more numerous in unmapped exposures of McCloud limestone farther west.

A comparison of the present map with the one in the Redding folio reveals one important difference. The folio map does not show Nosoni formation west of the McCloud River but indicates quartz diorite in the area shown by the present map to be occupied in part by Nosoni formation and in part by McCloud limestone cut by quartz diorite. Some of the outcrops along the McCloud River clearly are sedimentary rocks, and others are flows interbedded with the sediments. One of the few small exposures in the covered area shows bedding, and the others appear to be very fine-grained flows. Hence the tentative boundary of the Nosoni formation was placed considerably west of the McCloud River. To the north of the Nosoni formation there are a few outcrops of McCloud limestone and of diorite. Since the limestone is practically unmetamorphosed and conforms approximately in strike and dip to the large limestone mass east of the river, it seems more likely that the rocks are chiefly McCloud limestone cut by quartz diorite intrusions rather than chiefly quartz diorite that surrounds a few limestone remnants.

Description of Formations

Alluvium and Colluvium. Most of the mappable alluvium consists of the usual collection of sand and coarser fragments that would be expected along stream courses. One very small patch mapped separately contains fragments that are considerably more weathered than those in the other alluvium, and that are moderately well cemented. The colluvium consists chiefly of fragments of the rocks exposed in the immediate

[2] *Ed. Note.* Colluvium: heterogeneous aggregates of rock detritus, such as talus and avalanches, resulting from the transporting action of gravity. A general term applicable to several grades or types. Definition from *Dictionary of Geological Terms* by C. M. Rice, p. 82, 1940.

vicinity, but locally it is composed of more or less rounded fragments of iron ore, and well-rounded fragments of jasper and some dark-colored igneous rocks. Some of the jasper fragments are several feet in diameter.

Nosoni Formation. The exposures of Nosoni formation consist chiefly of sediments interbedded with lava flows. The sedimentary parts of the formation range from nearly olive-drab or greenish-brown, thinly bedded muddy and silty material, to a gray and greenish rock composed of fine sand and small pebbles embedded in a fine-grained matrix that appears to be tuffaceous. In some of the flows, small but sharply defined plagioclase, and perhaps also olivine, are discernible under a lens. Most of the flows are traversed by small streaks of epidote or show some degree of epidotization. The flows appear to be basalts or andesites.

Near the quartz diorite, trenches expose small amounts of dark-gray to greenish rock, some of which contains epidote, garnet, and magnetite, the latter as small disseminated crystals and as veinlets. Much of this rock has been sheared, so that there is difficulty in determining whether it belongs to the Nosoni formation or to the quartz diorite. However, as it generally is finer grained than the definite exposures of contact quartz diorite, and as some of it is slightly pseudo-porphyritic, the likelihood is that it is somewhat metamorphosed rock of the Nosoni formation.

McCloud Limestone. In general the McCloud limestone is light gray to nearly white, and finely crystalline. Some of it contains a considerable amount of chert, which is present as lenses and nodules. Near the larger masses of diorite the limestone is more coarsely crystalline and some of it is essentially a marble. Locally garnet, epidote, and a pyroxene, probably hedenbergite, are present, or the limestone is partly silicified.

Several small cavern openings were noted in the McCloud limestone just west of the exposures mapped. It is of some interest to note that a short distance south of the Hirz Mountain area, deposits in caverns in the McCloud limestone were found to inclose numerous bones of Pleistocene animals.[3]

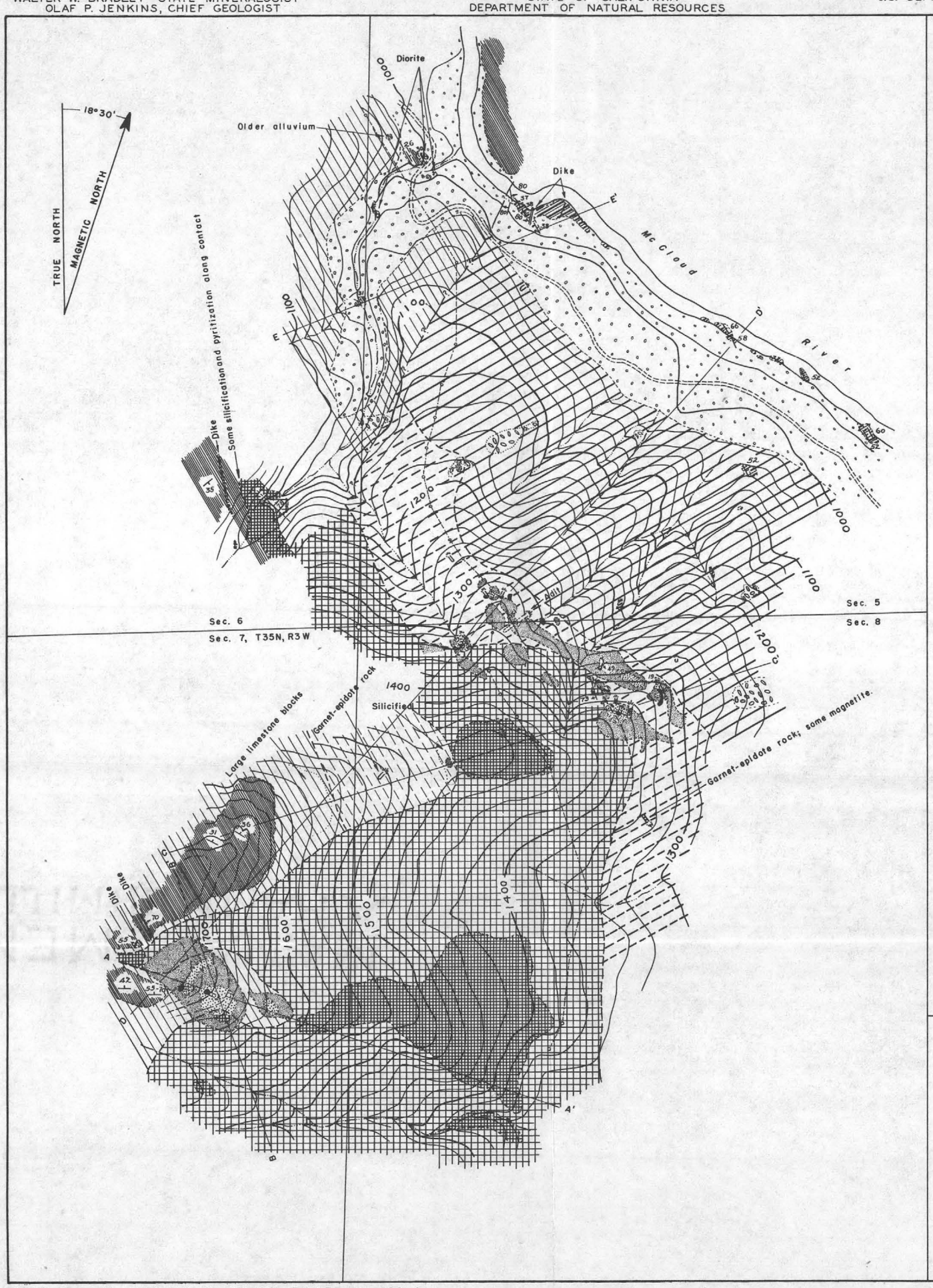
Quartz Diorite. Most of the exposed quartz diorite is gray and relatively coarse grained. Some of it is light colored and has a spotted appearance produced by the contrast between nearly white plagioclase and dark hornblende or augite. Some of it contains a considerable amount of pyrite, the decomposition of which facilitates its weathering to brownish rubble and sand.

Structure

Scarcity of exposures and the small area mapped make the interpretation of structure uncertain. In general the dip of the sedimentary rocks is between 30° and 60° to the northeast, but one limestone exposure in sec. 6 shows a dip to the southeast (see Pl. XIV). A number of small faults and shear zones trend either northwest or northeast, and dip steeply. In general the dikes follow the same structural trends as the faults.

Apparently a fault of some magnitude separates the Nosoni formation from the McCloud limestone in sec. 5. The large exposure of lime-

[3] Diller, J. S., op. cit., p. 3.



EXPLANATION

IGNEOUS ROCKS

LATE JURASSIC OR EARLY CRETACEOUS

Partly exposed quartz diorite

Covered area probably underlain by quartz diorite

Quartz diorite dike

SEDIMENTARY AND METAMORPHIC ROCKS

QUATERNARY

Alluvium

Older alluvium (cemented)

Colluvium. Float composed of rounded fragments of iron ore and other material; probably high terrace deposits.

PERMIAN

Exposed Nosoni formation. Pebbly and tuffaceous sediments interbedded with andesitic and basaltic flows.

Covered area probably underlain by Nosoni formation.

Partly metamorphosed Nosoni formation, chiefly covered. Contains some garnet and epidote, and some iron ore.

PERMIAN(?)

Exposed McCloud limestone; contains some chert.

Covered area probably underlain by McCloud limestone

Partly metamorphosed McCloud limestone, chiefly covered. Contains some garnet and epidote, and some iron ore; some of it is silicified.

ECONOMIC FEATURES

Exposed iron ore (magnetite and some hematite).

Covered area probably underlain by small bodies of iron ore near the surface, as indicated by magnetic attraction and a few trenches.

Covered area probably underlain by rocks containing small magnetite veins and some disseminated magnetite, as indicated by magnetic attraction.

MISCELLANEOUS SYMBOLS

Probable fault, position and direction doubtful.

Known fault or shear, and inclination.

Vertical shear

Strike and dip of bedding

Formation boundary, position doubtful.

Trench

Forest Service telephone line

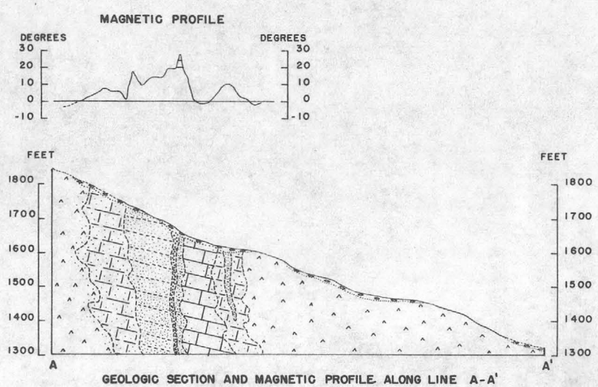
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

GEOLOGIC AND TOPOGRAPHIC MAP OF THE HIRZ MOUNTAIN IRON-ORE DEPOSITS, SHASTA COUNTY, CALIFORNIA

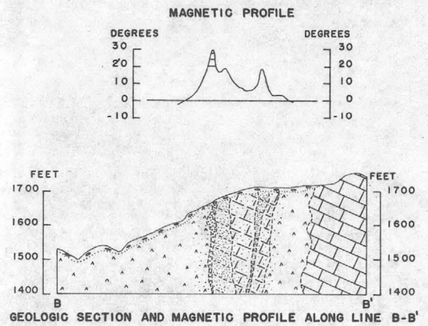
Scale
0 200 400 600 800 Feet

Contour interval 20 feet

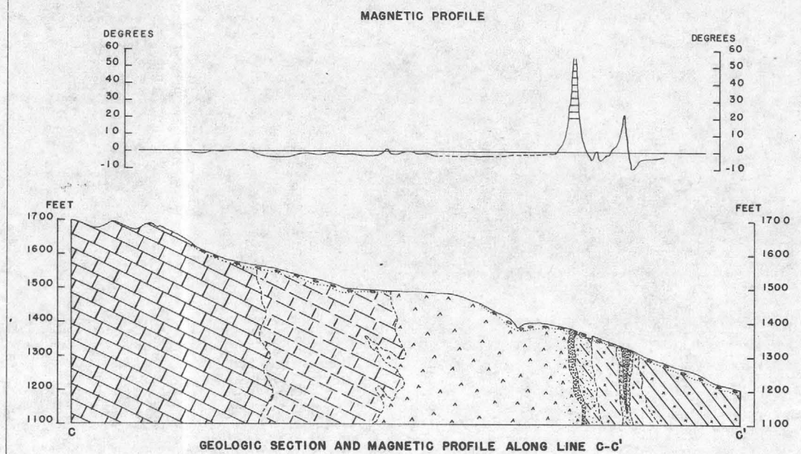
C. A. Lamey and P. D. Proctor, August-September, 1944



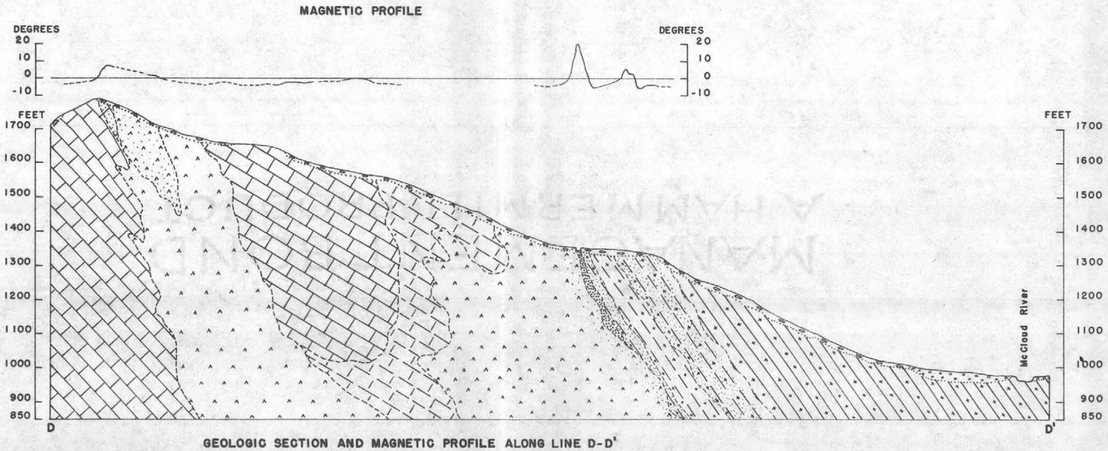
GEOLOGIC SECTION AND MAGNETIC PROFILE ALONG LINE A-A'



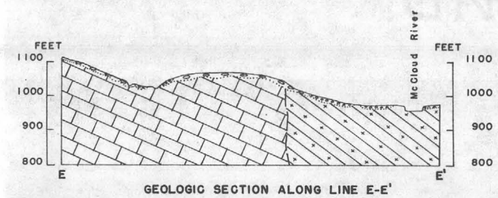
GEOLOGIC SECTION AND MAGNETIC PROFILE ALONG LINE B-B'



GEOLOGIC SECTION AND MAGNETIC PROFILE ALONG LINE C-C'



GEOLOGIC SECTION AND MAGNETIC PROFILE ALONG LINE D-D'

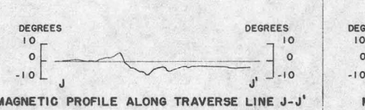


GEOLOGIC SECTION ALONG LINE E-E'

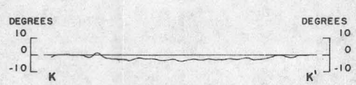
MAGNETIC PROFILE ALONG TRAVERSE LINE F-F'

MAGNETIC PROFILE ALONG TRAVERSE LINE G-G'

MAGNETIC PROFILE ALONG TRAVERSE LINE H-H'



MAGNETIC PROFILE ALONG TRAVERSE LINE J-J'



MAGNETIC PROFILE ALONG TRAVERSE LINE K-K'

MAGNETIC PROFILE ALONG TRAVERSE LINE H-L

EXPLANATION

IGNEOUS ROCKS

Quartz diorite (Late Jurassic or early Cretaceous)

SEDIMENTARY AND METAMORPHIC ROCKS

Alluvium

Colluvium

Nosoni formation (Permian). Pebbly and tuffaceous sediments interbedded with andesitic and basaltic flows.

Partly metamorphosed Nosoni formation. Contains some garnet and epidote.

McCloud limestone (Permian?). Contains some chert.

Partly metamorphosed McCloud limestone. Contains some garnet and epidote; some of it is partly silicified.

ECONOMIC FEATURES

Iron ore (magnetite and some hematite).

Iron ore and metamorphosed McCloud limestone, probably carbonate-silicate rock.

Partly metamorphosed McCloud limestone probably containing small amounts of iron ore.

McCloud limestone probably containing small magnetite veins and perhaps some disseminated magnetite.

Iron ore and partly metamorphosed Nosoni formation.

Quartz diorite probably containing small magnetite veins and some disseminated magnetite.

MISCELLANEOUS SYMBOLS

Probable fault, position and inclination doubtful.

Part of magnetic profile that probably indicates iron ore relatively near the surface; magnetic values higher than 20°.

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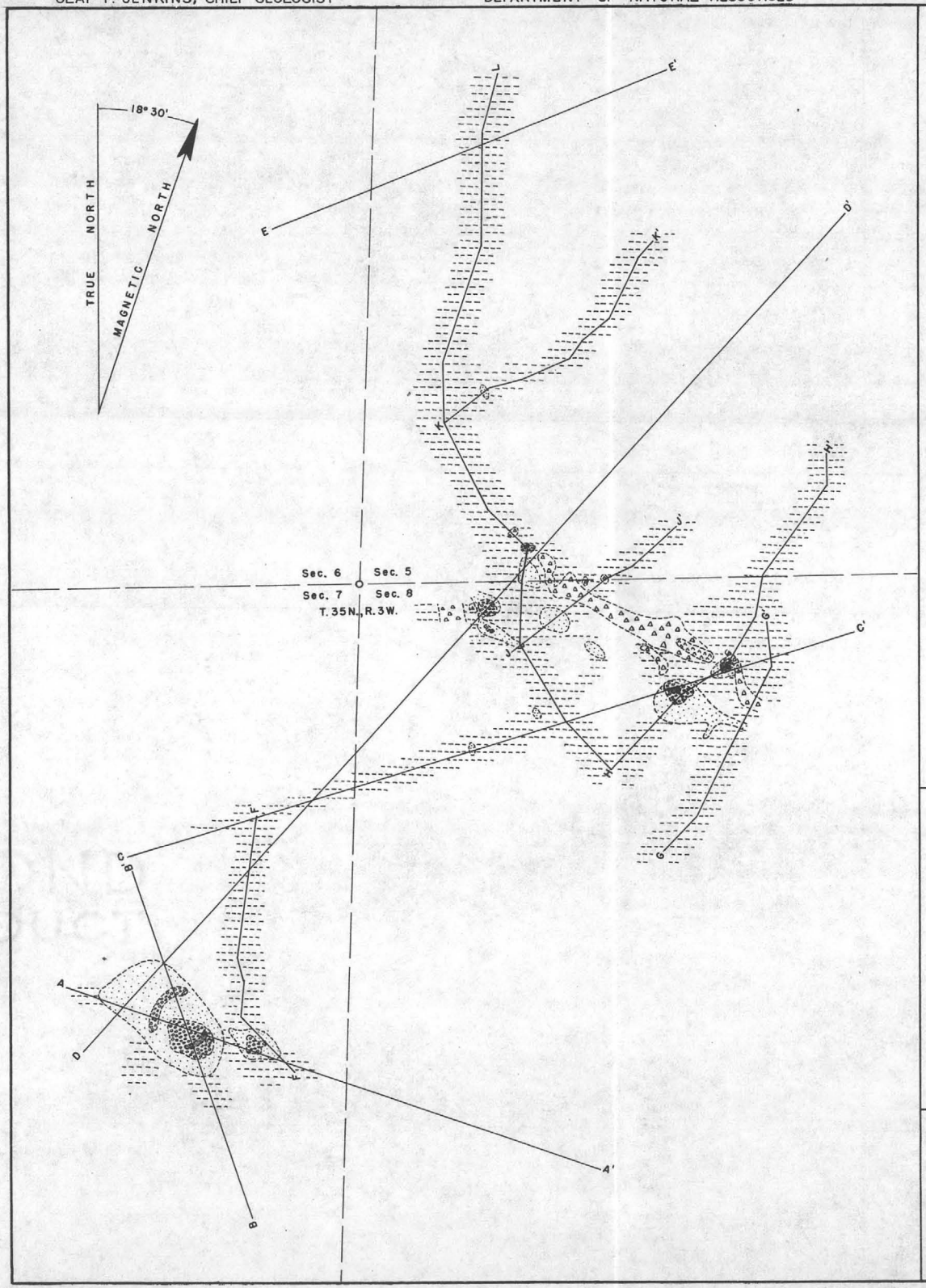
GEOLOGIC SECTIONS AND MAGNETIC PROFILES, HIRZ MOUNTAIN IRON-ORE DEPOSITS, SHASTA COUNTY, CALIFORNIA

Scale
0 200 400 600 800 feet

Field work by C. A. Lomey and P. D. Proctor, August-September, 1944



EXPLANATION

DIP NEEDLE VALUES

POSITIVE VALUES	NEGATIVE VALUES
Above 20°	-10° to -15°
10° to 20°	-5° to -10°
0° to 10°	0° to -5°

MAGNETIC PROFILE AND GEOLOGIC SECTION

A — A'

MAGNETIC PROFILE ONLY

K — K'

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MAGNETIC MAP
HIRZ MOUNTAIN IRON-ORE DEPOSITS
SHASTA COUNTY, CALIFORNIA

Scale
0 200 400 600 800 Feet

Field work by C. A. Lamey and P. D. Proctor, September, 1944

surface, no ore is exposed in the adit. A second small adit driven beyond a fault that cuts across a trench east of an intermittent stream in the northern part of sec. 8 exposes only fine-grained quartz diorite that contains some veinlets or iron ore along fractures.

The very spotty character of the magnetic attraction, and the lack of persistence of high magnetic values throughout an area of any appreciable size, also indicate that many of the bodies are shallow and that only a few small lenses of good ore are present. The geologic sections, magnetic profiles, and magnetic map (Pls. XV and XVI), show that there are only 3 very small areas yielding dip-needle values higher than 20°, and that there are but 7 areas yielding values higher than 10°, and 3 areas yielding values lower than –10°. Drilling at the Shasta and California deposits (see fig. 44), where geologic conditions are nearly the same as at Hirz Mountain, has shown that there is little likelihood of much ore being present near the surface unless dip-needle values exceed 20° or are less than –20° over an area of considerable size.

If it be assumed that the areas yielding dip-needle values of 10° or higher or of –10° or lower are underlain by ore, which is a very generous assumption, the reserves of inferred ore are as follows, using a tonnage factor of 10:

Upper zones	170,000 tons per 100 feet of depth
Lower zone	90,000 tons per 100 feet of depth
Total	260,000 tons per 100 feet of depth

It seems doubtful that many of the small iron-bearing bodies extend beyond a depth of a few hundred feet, and it is likely that a number of them do not attain a depth of 100 feet. Therefore, the reserves probably do not exceed a few hundred thousand tons, and apparently the ore could not be mined and transported profitably.

stone on the east side of the river rises several hundred feet above the neighboring outcrops of the Nosoni formation, which strike in the same general direction as the limestone.[4] Because the critical area is covered, a fault was not actually observed. Several small faults and dikes cut the Nosoni formation nearby.

ECONOMIC GEOLOGY

Ore Deposits

Exposures and magnetic attraction indicate that only two small zones of ore deposits are present, one in the NE¼ sec. 7, the other chiefly in the NW¼ sec. 8, at altitudes of approximately 1700 and 1300 feet respectively. They are separated from each other by about 1200 feet of quartz diorite and limestone (see Pl. XIV and section D-D′, pl. XV). These zones lie partly within and partly adjacent to the quartz diorite, near its contacts with the McCloud limestone and the Nosoni formation.

Fragments of iron ore scattered over the area may create an erroneous impression of the extent of the deposits. The relatively steep slopes cause migration of iron-ore fragments to considerable distances. Also, some of the fragments are associated with remnants of high terrace deposits. Magnetic traverses indicate that iron ore is present in only a small part of the area over which the fragments are distributed.

The ore consists chiefly of magnetite, but some hematite is present also. All of the exposed ore is considerably weathered. Much of it contains numerous cavities and openings partially filled with limonitic and clay-like products of decomposition. Very little pyrite was noted in the ore, but it is probable that at least part of the limonitic material was derived from pyrite. No character samples were collected because they probably would give erroneous value owing to the weathered character of the ore.

The few and poor exposures of ore and the spotted and generally weak magnetic attraction (see Pls. XV and XVI), indicate that the ore zones are characterized by local partial replacements of the McCloud limestone and the Nosoni formation, and by disseminated magnetite and small magnetite stringers in both of these formations and in the quartz diorite. Apparently the quartz diorite rose along the contact between the McCloud limestone and the Nosoni formation and produced the few small deposits that are present. Most exposures indicate that the mineralization was feeble. At the best exposure of the contact between the quartz diorite and the limestone, in the SE¼ sec. 6 (see Pl. XIV), the contact is marked merely by some silicification and pyritization.

Reserves

Exposures indicate that the orebodies are exceedingly discontinuous and are likely to be shallow, and that the reserves are very small indeed. An adit about 100 feet long near the boundary between secs. 5 and 8 cuts completely through the lower ore zone. Although a few pieces of ore were noted on the dump, and there is weak magnetic attraction at the

[4] Because of the lack of time and the difficulty of crossing the McCloud River, the topography and geology on the east side of the McCloud River were not mapped. The limestone forms a bold cliff, and the bedding is clearly seen from the west side of the river to be striking and dipping approximately the same as that in the exposures of Nosoni formation in and along the banks of the river, but the dip of the limestone steepens somewhat abruptly toward the northeast side of the exposure.