United States
Department of the Interior
U.S. Geological Survey

[Reports. Open file] no. 38

Geology of the Lippincott lead area, Inyo County, California

A preliminary report

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49-17

In cooperation with the
State of California
Division of Mines

1949

CONTENTS

ILLUSTRATIONS

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Introduction

In recent years the only continuous mining activity in the Ubehebe Mining district of Inyo County, California, has been at the Lippincott lead mine, which formerly was known as the Southern lead mine. The property is owned and operated by George Lippincott. It is 19 miles N. 59° E. from Keeler and 4 miles south of Ubehebe Peak (fig. 1; see map of Ballarat quadrangle, U. S. Geological Survey).

The mine is somewhat inaccessible. It is 32 miles by an unsurfaced road through Racetrack Valley to the paved road that starts at Ubehebe Craters in Death Valley. On the paved road it is 85 miles farther to Death Valley Junction, or 125 miles to Lone Pine, which is on U. S. Highways 6 and 395. A more direct route to Lone Pine is by a rough, narrow, and steep road from Racetrack Valley, through the south end of Saline Valley and up to the paved road between Darwin and Keeler. Over the shorter route it is advisable to use vehicles that have been well tested on rough mountain roads. At times torrential rains have made the more direct road impassable, whereas they have merely roughened the road to Death Valley. During 1948 and 1949 Mr. Lippincott has kept the roads open and scraped. The Racetrack playa, about 2½ miles north of the mine, has been used as a landing field.

Lack of water is a serious difficulty and has delayed construction of a mill. The nearest spring, although only 2½ miles south of the mine, is inaccessible and probably several hundred feet lower than the mine. Water has been hauled nearly 30 miles from Goldbelt spring and about 40 miles from Scotty's Castle.

The geologic and topographic map of the mining area (pl. 1) and geologic maps of the mine workings (pls. 2 and 3) were made as part of the investigation of the geology and mineral deposits of the Ubehebe Peak quadrangle, undertaken by the U. S. Geological Survey in cooperation with the California State Division of Mines. These maps, in preliminary form, are made available to the public before the larger project has been completed.

The mining area was surveyed during parts of 1947 and 1948 with telescopic alidade and plane table, starting from a chained baseline from which a plane table triangulation network was extended. The scale of the map is one inch to 200 feet and the contour interval is 10 feet. Edward M. MacKevett, geologist of the U. S. Geological Survey, assisted with the mapping. Mr. George Lippincott and his miners generously cooperated.

Rock units, designated merely by letters on the map of the Lippincott area, are equivalent to formations distinguished in mapping the Ubehebe Peak quadrangle. The formation names have not yet been settled and the geologic ages of the rocks, although moderately well determined from fossils and the sequence of beds, are still under consideration; hence, formation names and ages have been omitted from this preliminary report.

The rocks of the mining area comprise Paleozoic dolomite and a little limestone, shale, and quartzite, which were intruded and somewhat metamorphosed by quartz monzonite. The principal mineral deposits are in the dolomite in a zone bordering the intrusive contact.

Sedimentary and metamorphic rocks

The principal masses of sedimentary rocks are dolomites that range in color from nearly white or yellowish gray to dark gray. As a result of metamorphism of the dolomites near the contact with a stock of quartz monzonite, the colors are for the most part considerably lighter than the colors of the same unaltered formations. Metamorphism also has changed chert nodules and sandy and muddy impurities in the dolomites to such minerals as tremolite, diopside, antigorite, chrysotile, and—nearer the contact—garnet, epidote, idocrase, and scapolite. The dolomite grains have been recrystallized to a variety of sizes ranging from rather fine to moderately coarse. The largest carbonate grains, however, appearing in broad bands at the top and on the southwestern side of the highest ridge, are calcite, either white or colored brown by enclosed iron oxide. The metamorphic silicate minerals tend to be darker or weather darker than the dolomite, making conspicuous bands, which locally appear folded and twisted.

Certain smaller but nevertheless prominent masses of rocks consist of (1) quartzite grading into interstratified quartzite and dolomite; (2) small patches of shale and siltstone somewhat metamorphosed to schistose and hornfelsic rocks; and (3) some limestone.

The oldest unit of rock shown on the map (pl. 1) is a dark-gray dolomite marked da. It forms the eastern and southern flanks of the hill in the northeastern part of the area, and also the upper part of the southern slope of the hill in the northwestern corner. The dolomite contains some nodules of dark chert. In places this has been metamorphosed to tremolite radiating in white clots. The dolomite marked db, lying stratigraphically above the first dolomite, is very light gray and contrasts sharply with the first. The next layer of dolomite, dc, is also light gray but tends to weather in part yellowish or brownish, particularly near the base and near the top, where impurities have been metamorphosed to calc-silicate minerals. This rock unit forms an irregular band in the lower hills diagonally across the area. Stratigraphically above it, the next unit is dd, the very light gray dolomite that forms the prominent ridge above mine workings. A subdivision, ddq, in the bottom of unit dd, comprises white quartzite, quartzitic dolomite, and some interstratified dolomite. The lower boundary of the subdivision is sharp against medium-gray dolomite at the top of unit dc, but the upper boundary is gradational in that thinner and more widely spaced quartzite beds continue in the main part of dolomite dd. The lead deposits are in dd, especially in the lower part where thin beds of quartzite persist in the dolomite.

The rock units from da to dd are in continuous stratigraphic sequence. The remaining units are separated from dd either by faults or intrusive masses of quartz monzonite. Although these units are fragmentary in the mining area, it is known through comparison with the sedimentary sequence in nearby areas that the normal stratigraphic succession above dd is ls, qls, and sh, (pl. 1). Limestone ls, as exposed in patches in the southwestern part of the Lippincott area, is a medium-gray rock that has been bleached from its usual dark gray by metamorphism. Some parts are thinly bedded and controted. A quartzite and impure limestone unit, qls, has been separated from unit ls by quart monzonite, but still is associated with the metamorphosed silty shale sh. This association with dark shale on one side and limestone on the other serves to distinguish the quartzite of qls from the quartzitic member ddq at the base of dolomite dd.

The Paleozoic rocks in a few places are covered by patches of old gravel containing fragments as large as boulders, and consisting of a wide variety of rocks found in adjoining areas. Patches lower than the 3900- to 3950-foot contours have slumped down the hillsides or are remnants of re-worked material. The alluvium, al, is finer gravel left by recent inter-mittent torrents in canyon bottoms and on alluvial fans.

Igneous rocks

The major intrusive rock is quartz monzonite, which forms a large stock south and west of the Lippincott area. Only the border was mapped to show the zone of contact with the sedimentary rocks. The border zone, especially in the southeastern part of the area, contains considerable aplite and pegmatite. The quartz monzonite consists of nearly equal quantities of orthoclase and plagioclase, less quartz, and a little hornblende. The volume percentage of minerals in a typical specimen of the quartz monzonite from just south of the area was determined by a micrometric analysis to be 41 percent orthoclase, 38 percent plagioclase, 16 percent quartz, 3 percent hornblende, and 2 percent accessory sphene and magnetite. The texture is coarse-grained, and somewhat porphyritic from larger crystals of orthoclase, which locally are parallel. A few small dikes of fine-grained gray mafic rock cut both quartz monzonite and dolomite dd. This mafic rock has been greatly altered and impregnated with fine-grained pyrite, which readily weathers staining the rock a characteristic brown.

Structure

The major structure of the sedimentary rocks is an overturn of the openly folded upright sequence that occurs in the northern part of the area to the overturned sequence that occurs in the central and southern parts. The zone of overturning is marked by a fold that to the east becomes a fault. The short but conspicuous fold superficially resembles an overturned anticline plunging east, but as the younger beds are in the core, it is actually an inverted overturned syncline. Along the fault, which dips about 70° S., the south block has moved west relative to the north block. The horizontal component of movement, indicated by the relative locations of the vertical contact of dolomites da and db, is about 500 feet. Minor folds in the overturned sequence now are inverted anticlines and synclines.

A long fault is nearly parallel to the western margin of the area, and cuts across sedimentary rocks and quartz monzonite. The nature of the displacement is not shown in the map area, but northward beyond the area the west block has moved north relative to the east block. The fault intersects a broad zone of sheared rock which trends southeastward from the northwest corner of the area, and which is well exposed at the main junction of drainage. Displacement along the shear zone is not measurable, and may have been obscured by slippage along bedding planes. Minor faults, which in general trend north or northwest, and which perhaps are related to the shear zone, were the principal control of lead deposits.

Mineral deposits

Mineralization, presumably from the quartz monzonite, produced the following types of deposits; lead-bearing veins in the dolomite; irregular masses of copper- and iron-bearing minerals at the intrusive contact; brown-weathering siliceous replacement along fractures in dolomite; broad limonite-stained zones of coarse calcite in dolomite dd; black tourmaline veins in the more pegmatitic and aplitic facies of the quartz monzonite; a few quartz veins (some contain coarse barite) in the quartz monzonite; traces of scheelite in light-colored silicate rock well beyond the garnetiferous contact zones; and small poorly defined zones of talc replacing dolomite da. At present (1949) only the lead deposits are of economic interest.

The lead deposits are in siliceous veins and replacements along minor faults and breccia zones. All the deposits are in dolomite dd, and most are in the stratigraphically lower part that contains a little interbedded quartzite and sandy dolomite. The lead ore shoots are like pods and pipes along veins which pinch to mere stringers. Galena and cerussite are the lead ore minerals, in a little gangue of quartz and chalcedony; other associated minerals have not yet been studied. Both galena and cerussite occur from the surface to the deepest workings about 200 feet below the surface. Within this short vertical range the oxidation of the sulfide ore depended more on the local permeability of the enclosing material than on the nearness to the surface. Samples of the ore await analysis by the Geological Survey but the galena, according to Mr. Lippincott, carries considerable silver.

The largest ore body that has been mined was in the Main workings of the Lippincott mine (1, pl. 1). The pipelike ore shoot from its outcrop near the shaft plunged about 70° NW. for at least 200 feet (pl. 3). The diameter may have been as much as 10 feet. In the Addison workings of the Lippincott mine (4, pl. 1), ore was mined from a shoot about 125 feet long, inclined 40°. Ore was found also in the Confidence No. 1 and the Confidence No. 2 workings (3 and 2, pl. 1), and in 1949 a good pocket was being mined from the Taylor shaft of the Confidence No. 1.

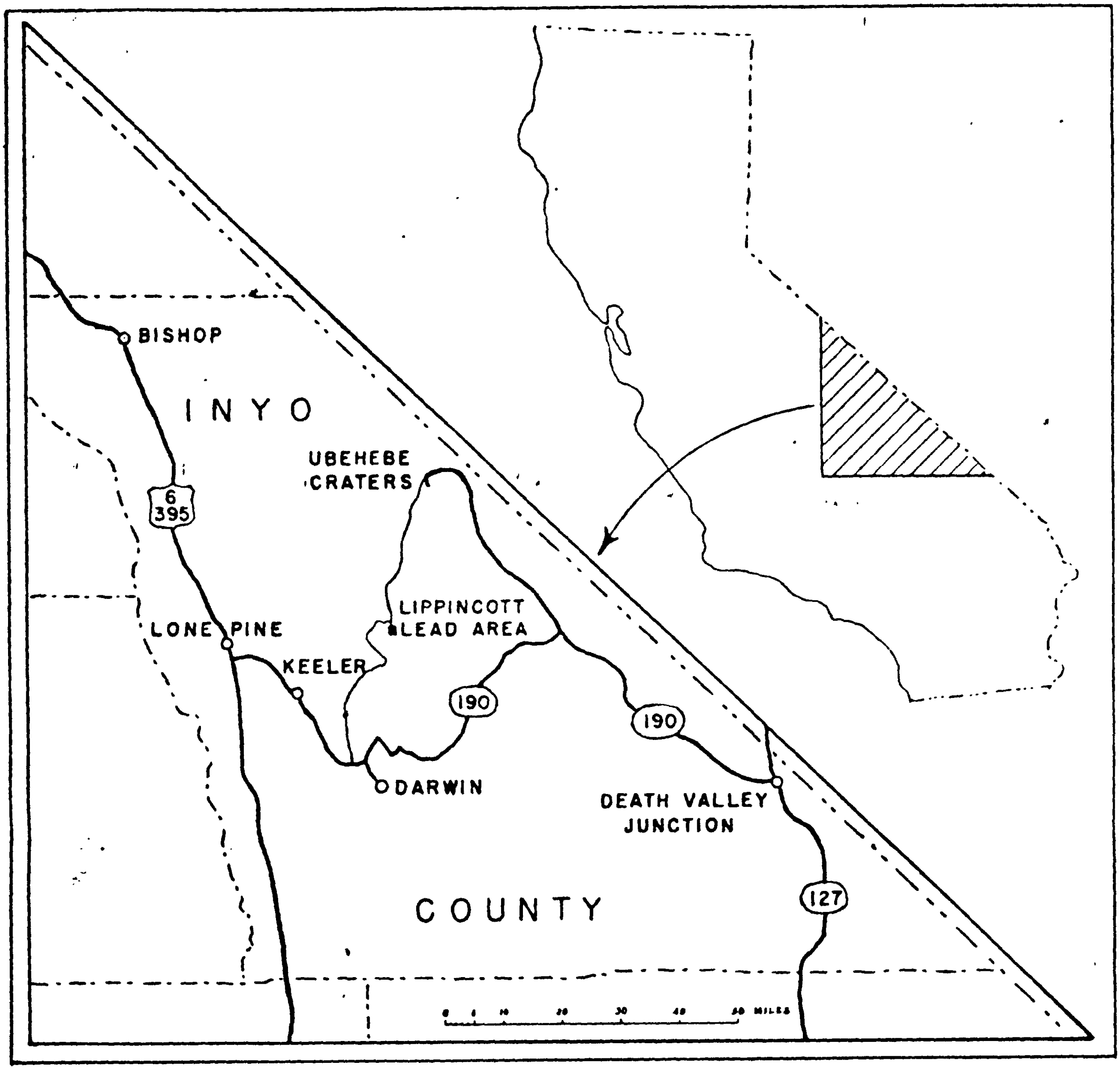

FIGURE 1.— Index map showing location of the Lippincott lead area.