GREEN MONSTER MINE

CLARK COUNTY, NEVADA

by

Arnold L. Brokaw

U. S. Geological Survey

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LIST OF ILLUSTRATIONS

Green Monster mine, Clark County, Nevada

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Introduction

The Green Monster mine, approximately 13 miles west of Goodsprings, is near the end of a long spur extending westward from the Spring range into Mesquite Valley. _/ Access is by a gravelled road

_/ See Ivanpah topographic sheet, U. S. Geol. Survey.

branching from the Wilson Pass road near the Keystone mill. Plate 1 shows the topography and geology of the mine area and Plate 2 the plan and geology of the underground workings.

The claims were first located in 1894 and were soon afterward acquired by the Hearst Estate. These people have retained the title until the present. In 1919 John Darington leased the ground and sank a winze in ore from near the southern end of the 200 level. The development was unprofitable, and there is no record that any shipments were made. The property then stood idle until Roy Jacobson leased it in 1942. In that year two cars of zinc ore was shipped to Coffeyville, Kansas. Shipments to the Metals Reserve stockpile at Jean during the following two years amounted to 2,496.4 tons averaging about 19 percent zinc and 1 percent lead.

Rocks

The local stratigraphic section includes several hundred feet of dolomite, limestone, and quartzite of Carboniferous age, locally covered by Quaternary terrace gravel and slope wash. Characteristics of the Paleozoic beds are summarized in the following table.

	Thickness (Feet)
Bird Spring formation (Pennsylvanian)	
5. Dark gray, coarsely crystalline dolomitic limestone in beds 2 to 5 feet thick; locally with small masses of fossiliferous chert. Top not exposed in mapped area; exposed thickness.................	120-140
4. Cream-colored fine-grained quartzite in beds 6 to 15 inches thick; weathers light gray..............	25-30
———————— Unconformity ————————	
Monte Cristo limestone (Mississippian)	
3. Yellowpine limestone member.—Predominantly coarse-grained limestone obscurely bedded in massive beds 5 to 10 feet thick; contains abundant large horn corals. Locally altered to light gray or buff coarsely crystalline dolomite.....................	75 ±
2. Arrowhead limestone member.—Predominantly fine-grained dark gray limestone in beds 2 to 5 inches thick with half-inch partings of clayey shale; abundantly fossiliferous. Locally altered to light gray coarsely crystalline dolomite...............	8-12
1. Bullion dolomite member.—Dark gray limestone in beds 5 to 10 feet thick and containing scattered nodules of ferruginous chert; mostly altered in mine area to light gray or buff dolomite with grain size averaging 1.5 mm. Base not exposed....	150 ±

Structure

The beds strike generally northwest and dip southwest at moderate to high angles. In the Monte Cristo limestone the dip averages around 55 degrees. The homoclinal structure thus indicated belongs to the normal limb of a sharp syncline plunging southeast. The opposite limb of this fold has been thrust northeastward along the fault mapped south of Number 1 shaft (pl. 1). This thrust is the principal fault in the area, and the faults in and around the ore bodies, which are in the footwall of this thrust, all appear to be related to it.

The contact between the Bird Spring formation and the Yellowpine limestone member of the Monte Cristo limestone is locally sheared, but the most conspicuous bedding shears are in the Arrowhead limestone member, especially along its contact with the Bullion dolomite member. Surfaces of movement in the thin beds are commonly marked by conspicuous seams of gouge, but the bedding in the Arrowhead seldom is obliterated by brecciation.

Several minor thrusts in the upper Bullion link with the bedding shears along the base of the Arrowhead limestone. These faults strike approximately parallel to the bedding and dip in the same direction, but at slightly smaller angles. One of the thrusts shows at the surface northeast of the inclined shaft. Several others were mapped underground but were not recognized on the surface. Movement along individual faults does not exceed a few feet, and brecciation along isolated thrusts is generally negligible. However, the ground at or near the junction of bedding shears and thrusts is brecciated and favorable for the development of ore bodies.

Several tear faults were mapped that strike nearly at right angles to the strike of the bedding and dip toward the southeast or northwest at angles of 60 degrees or more. The offset along these tears amounts to only a few feet, and the direction of relative movement is variable. The striations along the faults are inclined with the dip of the associated thrusts. As indicated on plate 1, some of the tears are within imbricate blocks bounded by thrusts or by bedding shears at the top and bottom of the Yellowpine limestone member. Some of the tear faults, however, displace both thrusts and bedding shears, but as none appears to offset the principal thrust in the Bird Spring, most if not all are limited to the footwall block of this fault.

Ore Deposits

General statement

The ore replaces dolomite breccia in the upper few feet of the Bullion dolomite member and the lower part of the Arrowhead limestone. Most of it has been mined from tabular bodies elongated in the plane of the bedding. The ore, which originally was composed of sphalerite with accessory galena, is now oxidized to depths below the deepest level of exploration, or more than 400 feet below the surface. However, the persistence of residual sulfides in small quantities throughout most of the mineralized ground indicates that the forms of primary ore bodies have not been appreciably altered by migration of oxidized substances.

Recent shipments of crude ore mostly contained between 15 percent and 25 percent of combined metals, with lead averaging around 1 percent. That the proportion of lead may increase with depth is suggested by the fact that the deepest development has been in ground containing 10 percent or more of this metal.

Mineralogy

Most of the ore is a mixture of hydrozincite ($ZnCO_3.2Zn(OH)_2$) and calamine ($ZnOH_3.SiO_3$) in a gangue of white dolomite and ocherous limonite. Earthy hydrozincite stained brown by iron oxides is widespread in the sheets, and a purer white variety, which forms veinlets along fractures below the ore bodies, represents zinc that has migrated beyond the original boundaries of the mineralized ground. The calamine mostly forms friable aggregates of iron-stained crystals associated with the brown hydrozincite. In some stope areas it is the most abundant ore mineral.

Smithsonite ($ZnCO_3$), in pale gray botryoidal masses, locally forms veinlets in fractures crossing the ore zones, but it has not been an appreciable source of zinc. Aurichalcite, the basic carbonate of zinc and copper, is a minor constituent that accounts for the traces of copper commonly reported in assays. Small residual pods and lenses of dark brown to black sphalerite locally occur in the dolomite gangue or they are surrounded by masses of brown hydrozincite.

The lead minerals include cerussite ($PbCO_3$), anglesite ($PbSO_4$), and galena (PbS); cerussite is the most abundant and appears as brown or grey granular masses. The largest concentration was found near the bottom of the Darington winze (pl. 7). Lenses and kernels of galena, rarely more than 3 inches across, are commonly surrounded by thin rinds of anglesite.

Shoots

Shoot "A".—The largest body of ore mined to 1944 extended from the surface to the 200 level. (See pl. 5.) The shoot was a tabular body that had a strike and dip essentially parallel to the bedding and a plunge of 30° to 40° to the southeast. On the average the thickness of the ore was 5 to 8 feet, though locally it was as much as 15 feet. Masses of cerussite were mined from along the "A" fault; elsewhere the ore was mostly brown hydrozincite and calamine.

Shoot "B".—A body, which was shaped like a cylindrical pipe for the greater part of its length, was mined from a short distance above the 200 level to 77 feet below the 300 level. The bottom of the ore was not reached in the winze from the 300 level. At its upper limit the pipe expands into a tabular body merging with Shoot "A". The principal ore mineral was brown and white hydrozincite, but lead minerals become more abundant with increasing depth.

Shoot "C".—A tabular body of brown hydrozincite ore, 50 feet wide and 10 feet thick, has been mined through a raise near the southeast end of the 200 level. The shoot has been mined to a depth of 73 feet below the level by the Darington winze, but the downward limit has not been determined. Below the level the ore contained 10 percent or more lead as galena. This is the largest concentration of galena yet found in the mine. Sphalerite also is more common here than elsewhere.

Geologic controls of the ore deposits

The locations of ore bodies are governed by the interrelationships of (1) the sheared contact between the Arrowhead and Bullion, (2) the minor thrusts that branch from this sheared contact and cut across the upper beds of the Bullion, and (3) local conduits along tear faults.

Unsheared sulfides occur along several of the tears and thrusts, and as all the faults in the mine are believed to be contemporaneous, they are thought to predate the introduction of the sulfides. Tear faults that cross the stopes are marked by concentrations of galena or cerussite, and thus they are regarded as having been the local conduits along which the mineralizing solutions rose. There is nothing to indicate why some of the high-angle faults should have been local feeders, whereas others evidently were not, nor is it known whether the supposed feeding fissures connected directly or indirectly with the sources of the mineralizing fluids.

It is fairly clear, however, that the beds in the Arrowhead were not only generally unfavorable for replacement by sulfides, but that they acted as a barrier to upward movements of hydrothermal solutions in general. Over most of the area the base of the Arrowhead is also the contact between dolomitized ground below and unaltered limestone above; and all the ore bodies mined to date have hanging walls along this same contact, which is sheared and layered with clay gouge.

Branching from the shears along the Arrowhead-Bullion contact are the minor thrusts in the upper part of the Bullion. Near the junction of the bedding shears and the thrusts the ground is brecciated, and the ore occurs mainly in this breccia. Indeed, the southeastern plunge of the main shoots appears to follow generally the lines of intersection between the thrusts and the bedding shears, although in some places the ore occurs in broken ground paralleling the mineralized tear faults.