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COMPLEX SILVER ORES FROM MOREY, NEVADA

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ABSTRACT

Silver ores at Morey, Nevada occur as kryptothermal fracture fillings cutting a nevadite intrusive. Gangue minerals are rhodochrosite, quartz, pyrite, and arsenopyrite. The major silver minerals are diaphorite, owyheeite, andorite, pyrargyrite, and stephanite. Jamesonite and sphalerite are also abundant.

Owyheeite is the most important silver mineral and has formed at the expense of andorite via a complex series of replacements with fizelyite, diaphorite, or rarely freieslebenite as intermediate products.

Single crystals of diaphorite, fizelyite, and owyheeite have been studied goniometrically. Diaphorite has been confirmed as monoclinic $2/m$ with $\beta = 90^\circ 5'$, $a:b:c = 2.6900:1:5.4024$ or, after transformation to new axes, $\beta = 116^\circ 27.5'$, $a:b:c = 2.6900:1:3.0172$. The transformation (Zepharovich to Hellner) is $100/001/\frac{1}{2}0$.

Ten forms are reported for owyheeite and the axial ratio is $a:b:c = 0.840:1:0.312$. One fizelyite crystal showed eight forms and gave $a:b:c = 0.703:1:0.458$.

INTRODUCTION

The Morey district is a small silver camp in the Hot Creek range in northeastern Nye County, Nevada. The district is about 28 miles by dirt road north of Warm Springs. The first recorded production was in 1867 (Couch & Carpenter 1943).

Ores occur as kryptothermal fracture fillings which vary from a fraction of an inch to several feet in width. High grade ores occur in vertical shoots separated by lean or utterly barren vein matter. Three vertical east-west veins account for most of the district's production. They may be distinguished on the basis of their mineralogy and abundance of certain gangue minerals. Each of the veins is irregular and branching; satellitic veins which deviate from the east-west trend are apt to be barren or narrow.

The host rock is a nevadite (Richthofen 1868; Cross 1884) composed of invariably cracked or broken phenocrysts of quartz, orthoclase (or rarely sanidine), biotite, and oligoclase in a microcrystalline paste of quartz and orthoclase. The nevadite comprises an intrusive mass several miles in diameter flanked on the east by cognate flows. These flows may be traced to the west where they grade imperceptibly into the intrusive mass. Farther to the east they become progressively more glassy and the sanidine/orthoclase ratio increases. Cognate xenoliths, almost invisible in the intrusive mass, become progressively more conspicuous in flows to the east.

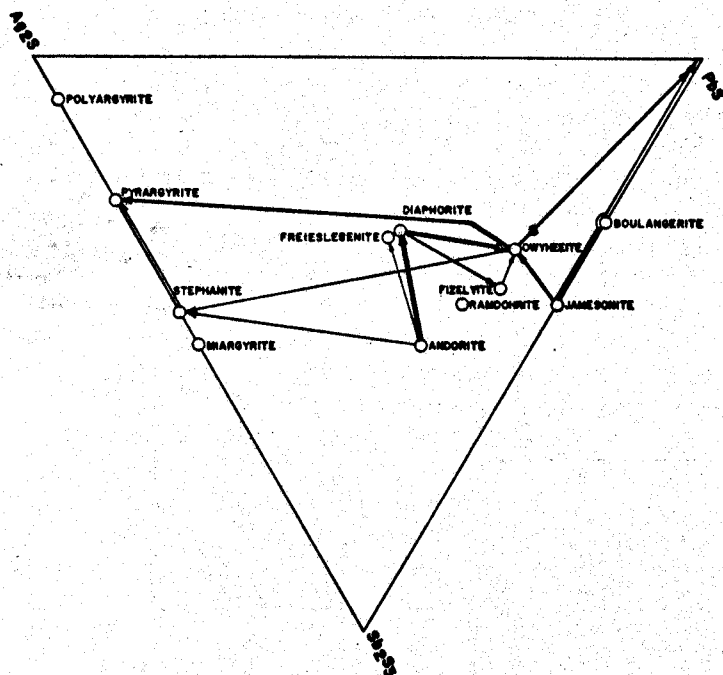


FIG. 1. Paragenesis in the system $\text{Ag}_2\text{S-PbS-Sb}_2\text{S}_3$. Arrows indicate the direction in which replacements occur and the width of the lines indicates the relative importance of the changes.

THE VEINS

The veins consist largely of rhodochrosite and quartz and show sharp contacts with their walls. Tiny pyrite, arsenopyrite, and very rare cassiterite euhedrons typically line the veins and indent the host rock. Pyrite and arsenopyrite are generally disseminated in the walls an inch or so from the vein. Commonly they are concentrated about previously sericitized xenoliths.

Mild sericitization of the walls and the introduction of pyrite and arsenopyrite was followed by copious amounts of rhodochrosite which fills the veins or lines them as coarse euhedrons. Tiny veinlets normal to the vein walls also are filled with rhodochrosite. Broken crystals of jamesonite and sphalerite are perched on the rhodochrosite or embedded in outer zones of the crystals. Sphalerite and jamesonite continued to crystallize after completion of rhodochrosite deposition and during the onset of quartz deposition. Broken and healed crystal fragments of these two sulfides occur in quartz which veins fractured rhodochrosite.

Andorite and owyheeite follow jamesonite and were essentially contemporaneous with the bulk of the quartz. Following crystallization of

andorite was a period of severe brecciation. All earlier minerals were fragmented and are enclosed by new quartz containing a contemporaneous generation of owyheeite. During the crystallization of this later owyheeite andorite was replaced by diaphorite and then either owyheeite directly or with fizelyite as an intermediate step.

Much of the newly-formed diaphorite was redistributed as tiny euhedrons in quartz vugs with pyrargyrite and very rare canfieldite.

A final stage of deposition was the replacement of owyheeite by galena; other sulfosalts are replaced variously by bournonite, pyrargyrite, and stephanite.

The paragenesis is shown in Fig. 1 where the width of the lines indicates the relative importance of the changes.

Oxidation of the veins is limited to about 50 feet owing to the relief in the area and the relative lack of pyrite. At the surface the veins are replaced by porous oxides of manganese and bindheimite. Below this is a thin zone of native silver and chlorargyrite which gives way at greater depth to pyrargyrite and gypsum. Rozenite is a post-mine mineral.

Other species noted are wurtzite, boulangerite, freieslebenite, and tetrahedrite.

DIAPHORITE

Diaphorite occurs in vugs in comby quartz with corroded sphalerite crystals. The crystals seldom exceed 2 mm in length but are highly complex and ideally suited for goniometric study. Most crystals are brilliant black but some are tarnished metallic blue or bronze.

Seventeen crystals were measured. Data from several had to be rejected since the crystals may be composed of lamellar intergrowths with andorite. These intergrowths are the result of *in situ* replacement of andorite.

The remaining 13 crystals were examined to see if their monoclinic symmetry reported by Hellner (1958) could be verified. The mineral has long been considered orthorhombic and has been subjected to morphological study by several workers (Palache 1938, 1941; Schaller 1937; Prior & Spencer 1897).

Orientation with the classical c as the axis of adjustment provided good angular measurements for {110}, {130}, {150}, {221}, {621}, and {531} (orthorhombic indexing). Faces of these forms were then grouped into odd and even quadrants on the basis of the largest ϕ obtained for any of the faces of {110}. Values were then "smoothed" (Terpstra & Codd 1961, chapter VII). The bias introduced by selecting the highest ϕ for the faces of {110} was justified by the appearance of quadrant groups for faces of the other forms. Using the ϕ values for {110} a value for μ was obtained from the following relation: