MELONITE IN BOULDER COUNTY, COLORADO

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Introduction

Melonite, a rare ditelluride of nickel ($NiTe_2$), was first described by Genth (1868), who found minute amounts in a mixture of quartz, hessite, altaite, and, possibly, native tellurium from the Stanislaus mine in the Mother Lode region of California. Later, Hillebrand (1883–1884) identified melonite in telluride ore from the Forlorn Hope mine in Boulder County, Colorado.

Additional occurrences have been noted for the Cripple Creek District of Colorado; Illinawortina, South Australia; and, recently, in Quebec and Ontario, Canada. The Quebec occurrence has been described in detail by Peacock and Thompson (1946), who found that melonite in the Robb-Montbray Mine appears in patches up to 20 mm. wide associated with altaite, tellurbismuth, montbrayite, pyrite, chalcopyrite, and gold, or is disseminated through wall rock. Thompson (1949) reports that small amounts of melonite have been found in the Wright-Hargreaves, Toburn, and Macassa mines at Kirkland Lake in Ontario.

Analyses of concentrates from the telluride ores of certain mines in the Magnolia District in Boulder County consistently yield small amounts of nickel, and, although it has been suspected that the nickel comes from melonite, specimens containing megascopically visible melonite are found only with great difficulty and are virtually nonexistent. In 1946 the writer began a systematic investigation of the telluride ores of the Magnolia District in an effort to isolate the nickel mineral. It soon became apparent that the study should be extended to include all of the telluride ores of Boulder County—a task nearing completion. This paper is intended to describe only one result of this interesting and complex study.

Boulder County Telluride Ores

The Boulder County telluride deposits are at the extreme northeastern end of the mineral belt of Colorado. Much of the ore has been mined from small pockets and lenses in complex, erratically mineralized fissures, many of which trend east or northeast and are related both in space and time to a series of strong northwesterly trending faults, locally called "breccia reefs."

Boulder County has yielded a variety of ores including gold-bearing base metal ores, lead-zinc-silver ores, ferberite (tungsten) ores, and gold-silver telluride ores. The deposits appear to be related genetically to Tertiary igneous activity which began in late Cretaceous or early Tertiary and continued into middle or late Tertiary. In certain mines the telluride ores are associated with either leptothermal lead-zinc-silver or epithermal tungsten mineralization, or both, and field and laboratory studies indicate that all three types of ores have a common origin. In many mines the telluride ores grade downward or laterally into lead-zinc-silver ores and show a crude zonal relationship.

Mineralogically, the telluride ores consist of complex aggregates of chalcedonic quartz, sparse carbonates and sulfates, sulfides, tellurides, and native gold or native tellurium. The mineralogy and structure suggest shallow deposition at a relatively low temperature, and the deposits probably should be classified as epithermal.

Most of the productive veins are found in pre-Cambrian granite, but some ore has been recovered from schist and gneiss, which, locally, has been extensively granitized. The Boulder County telluride ores differ from those in certain other localities, such as Cripple Creek, in that they are not visibly related to extensive extrusive and near surface intrusive igneous activity.

Occurrence of Melonite

Figure 1 shows the salient geologic features of the area of telluride mineralization in Boulder County and the locations of mines yielding ore in which melonite has been identified in the present study. The major late Cretaceous or Tertiary igneous intrusions and the strong northwest trending faults (breccia reefs) are shown in order that the space relationships between these features and the telluride deposits may be grasped. Although specimens from many mines did not yield melonite, it is probable that if a sufficient number and variety of specimens from each mine were available and could be studied, melonite would be found as a constant accompaniment of all or most of the telluride deposits of the area.

Identification of Melonite

A combination of tests was used to establish the presence of melonite in samples of telluride ore. The presence of nickel in gross samples was verified by crushing the ore, dissolving in acid, and applying the dimethylglyoxime test. About a fourth of more than two hundred samples tested in this manner gave a positive test for nickel. However, tests showed that the distribution of melonite in an individual deposit is very erratic. Next, the nickeliferous samples were examined in polished sections, and the melonite was identified by etch reactions and microchemical tests for nickel and tellurium. A final check was made by means of *x*-ray powder techniques.

In polished section the melonite is an early mineral deposited on the walls of small vugs or druses and stands out in relief against gangue minerals and later ore minerals. The mineral generally appears in thin coat-

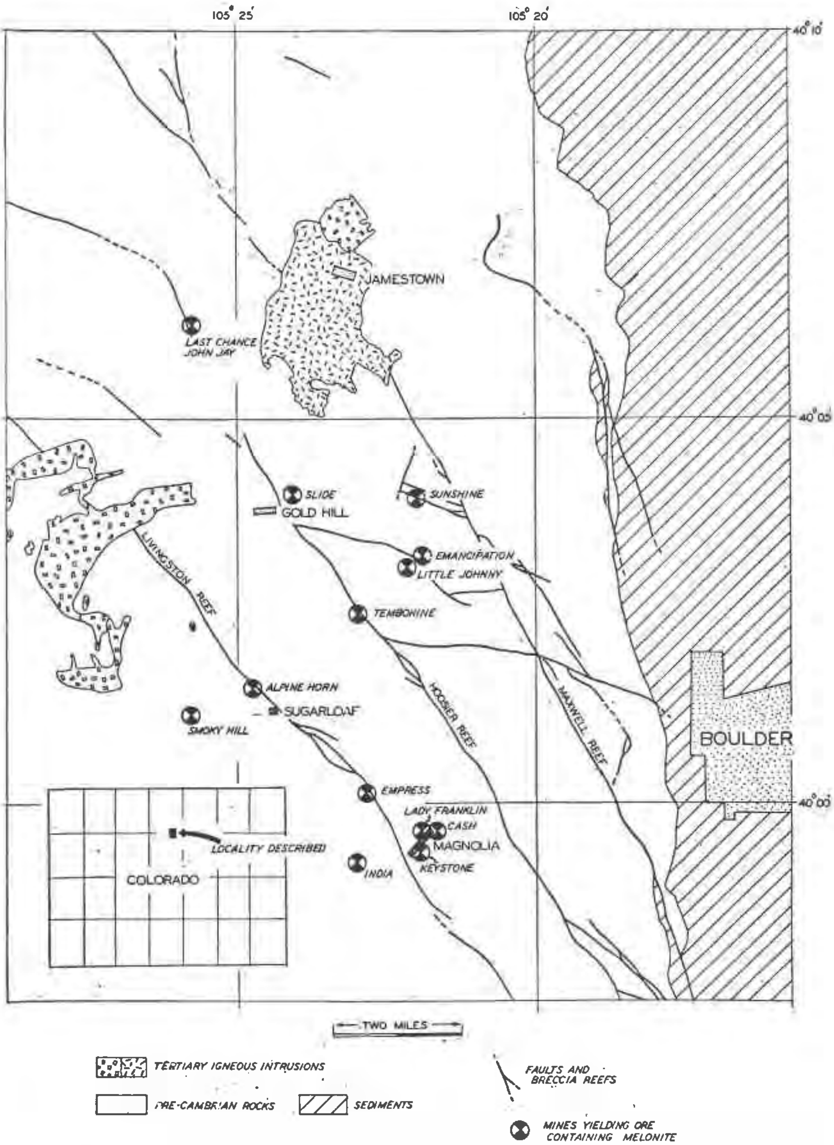

FIG. 1. Outline map of a part of Boulder County, Colorado showing locations of mines yielding melonite.

ings with a colloform structure, the sinuosities of which reflect in detail the irregularities of the walls of the cavities. The general appearance suggests repeated deposition of thin colloidal layers, but under polarized light the melonite is seen to comprise equigranular or radiating aggregates of tiny, moderately to strongly anisotropic grains.

In reflected light the melonite has a pale coppery color, the exact hue of which depends on the color of adjacent, contrasting, gray, white, or yellowish minerals. The etch reactions are consistent with those described by Short (1940) and Thompson (1949). HNO_3 quickly effervesces and stains black; HCl and KCN, negative; $FeCl_3$ slowly stains light to dark brown; KOH and $HgCl_2$, negative.

The *x*-Ray powder patterns gave results that agree in detail with data given by Peacock and Thompson (1946) for melonite from Quebec.

Mineral Association and Paragenesis

Melonite is the earliest telluride mineral in a complex sequence of gangue and ore mineral depositions. It is commonly associated with other later ore minerals and is coated or covered by them. Systematic examination of polished sections of samples from widely scattered deposits in the telluride district reveals a fairly consistent sequence of deposition of gangue and ore minerals. The position of melonite in relation to other minerals in the paragenetic series is shown in Fig. 2. In the

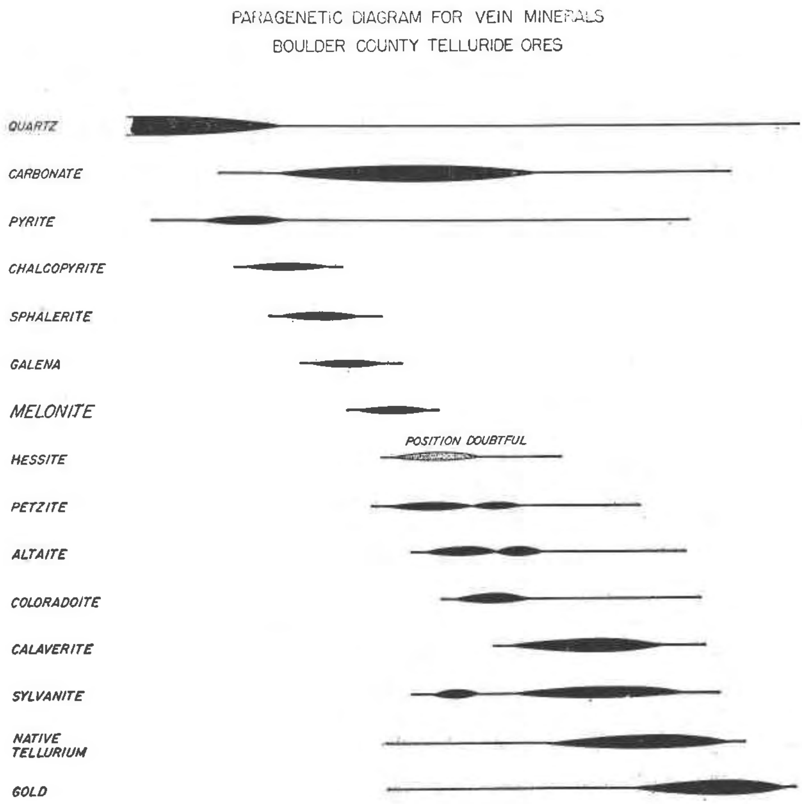

Fig. 2. Paragenetic diagram for Boulder County telluride ores.

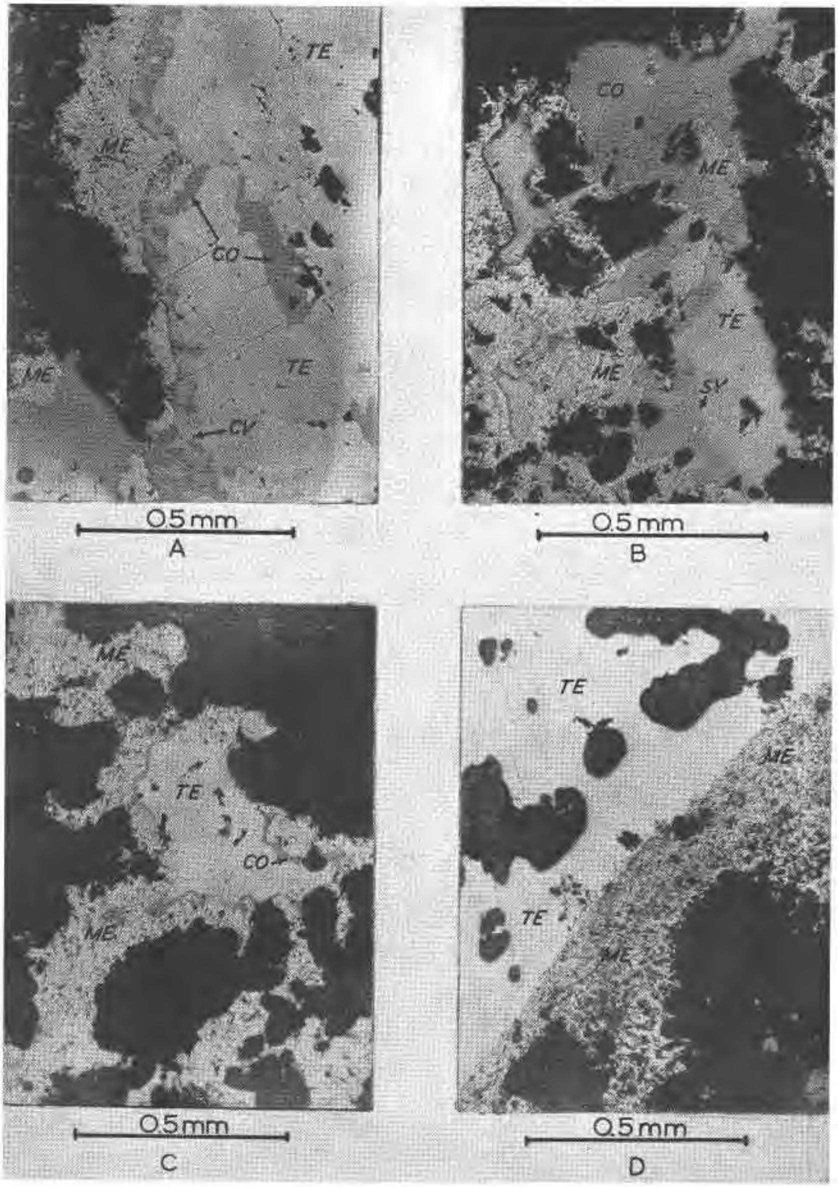

FIG. 3. Photomicrographs of melonite-bearing telluride ores from Boulder County.

A. Melonite (ME), coloradoite (CO), calaverite (CV), and native tellurium (TE). Alpine Horn Mine, Sugarloaf District.

B. Melonite (ME), coloradoite (CO), sylvanite (SY), and native tellurium (TE). Empress Mine, Sugarloaf District.

C. Melonite, coloradoite, and native tellurium. Cash Mine, Magnolia District.

D. Melonite and native tellurium. Sunshine District.

ore mineral sequence melonite follows the sulfides and marks the beginnings of telluride deposition (Fig. 3). Later than the melonite are several tellurides including hessite (Ag_2Te), petzite (Ag_3AuTe_2), altaite (PbTe), coloradoite (HgTe), calaverite ($AuTe_2$), and sylvanite ($AuAgTe_4$). Native tellurium and native gold are the last minerals deposited in the ores, but are not found in proximity to each other in a single ore body.

Although melonite is found with a variety of tellurides, many specimens show a constant association of melonite, coloradoite, calaverite or sylvanite, and native tellurium.

Acknowledgments

Much difficulty was experienced in obtaining a representative suite of telluride ores because most of the mines in Boulder County have been inactive for many years. Many of the specimens were obtained from collections at the University of Colorado, but the study did not assume any real significance until owners of private collections became aware of the investigation and generously donated or loaned specimens in their possession. The writer wishes to acknowledge a particular debt of gratitude to Dr. C. N. Eddy, J. E. Byron, and Russell R. McLellan for their contributions of specimens and their continued interest in the progress of the study.

References

Genth, F. A. (1868), Contributions to mineralogy: *Am. Jour. Sci.*, **45**, 305–321.

Hillebrand, W. F. (1883-1884), Mineralogical notes, II: *Colo. Sci. Soc., Proc.*, **1**, 123.

Peacock, M. A., and R. M. Thompson (1946), Melonite from Quebec and the crystal structure of $NiTe_2$: *Univ. Toronto Studies, Geol. Ser.*, **50**, 63–73.

Short, M. N. (1940) *Microscopic determination of the ore minerals: U. S. Geol. Survey, Bull.* **914.**

Thompson, R. M. (1949), The telluride minerals and their occurrence in Canada: *Am. Mineral*, **34**, 359.