MINERALOGICAL NOTES

MINERALOGICAL MAGAZINE, MARCH 1992, VOL 56, PP. 123–126

Gold from Botallack mine, St. Just, Cornwall

DURING a recent examination of oxidized samples from cliff exposures near Botallack mine (SX 362340) gold was observed in hand specimen and in thin section. Identification was confirmed by microprobe analysis. Although gold has been found in mineralised lodes elsewhere in southwest England (Russell, 1944; Clark and Criddle, 1982; Clayton *et al.*, 1990; Stanley *et al.*, 1990*a,b*) this is the first reported occurrence in the St. Just mining district, although both native silver and bismuth have been found in the district (C. J. Stanley, pers. comm.).

The Botallack mine is well known for the occurrence of an extensive supergene zone of copper enrichment, which was extensively mined in the last century (Dewey, 1923; Dines, 1956). Within the oxidised material an extensive range of secondary copper chlorides, oxy-chlorides, sulphates, oxides and arsenates occur along with native copper, silver and bismuth, chlorargyrite, scorodite, jarosite and gypsum (Bowell, in press). The mineral assemblages occur within fractures and cavities within the hematite–goethite–limonite cherty gossan along with occasional quartz nodules.

Gold was observed in two such vuggy cavities, one in a quartz nodule and the other in a finer grained heavily iron-strained chert matrix. In section the grains are anhedral, bright yellow, showing no colour zoning, and are up to 5 mm in the quartz and 1.4 mm in the chert (Fig. 1). The results of microprobe analysis of the grains in both quartz and chert, is presented in Table 1.

The gold in the quartz and chert show approximately the same composition of $Au_{96-97}Ag_{2-3}$ with minor amounts of iron and copper. The high iron values may be due to interference from the iron-strained gangue. Palladium was measured, but was below the detection limit of the instrument.

The occurrence of gold in the gossan, the presence of chlorargyrite, goethite, jarosite and scorodite inclusions, and the spatial association with secondary copper minerals suggest that the gold may also have been formed by supergene processes during oxidation of the primary copper deposit.

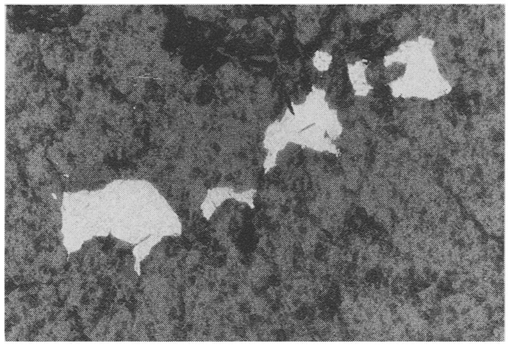

FIG. 1. Native gold in ferruginous cherty matrix. Wheal Hazard, Botallack, Cornwall. Field of view, 4 mm.

Table 1. Gold microprobe analysis

Grain Host	Au	Ag	Cu	Fe	Total
quartz[a]	96.62	2.29	0.15	0.23	99.29
chert[b]	97.54	2.06	0.10	0.41	100.11

a. Mean of five grains
b. Mean of three grains

Microprobe analysis carried out on Cambrige microscan 5. Accelerating voltage of 20kV. Radiations measured Au–Lα, Cu–Lα, Fe–Kα, Pd–Lα. Beam current of 2.50×10^{-8} on the Faraday cage. Standards: pure elements and FeS.

The atacamite-type minerals, which also occur within the oxidised portion of the ore body at Botallack, are thought to be an oxidation product of copper under arid saline conditions (Andrew, 1980). In such an environment it has been shown from field and experimental observations (Cloke and Kelly, 1964; Mann, 1984; Stoffregan, 1986) that gold is mobile as a chloride complex. The gold at Botallack may well represent an enrichment by such a process.

Acknowledgements. To C. J. Stanley and R. S. Scrivener for information on the distribution of gold in south-west England, and to J. F. W. Bowles for reviewing the note.

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KEYWORDS: gold, Botallack mine, Cornwall.

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[*Manuscript received 4 February 1991; revised 4 March 1991*]

Andersonite and schröckingerite from Geevor mine, Cornwall: two species new to Britain

SCHRÖCKINGERITE, $NaCa_3(UO_2)(CO_3)_3(SO_4)F.10H_2O$, is the most abundant of the uranyl carbonates and is of relatively widespread occurrence. It was first found at Joachimsthal, Czechoslovakia, as an alteration product of uraninite (Schraûf, 1873). It is found at numerous locations in the U.S.A., notably Wamsutter, Wyoming, Yavapai County, Arizona and several localities in Utah (Hurlbut, 1954; Frondel, 1958); it has even been mined as the primary ore in a few small deposits (Smith, 1984). Schröckingerite has also been reported from eastern Germany, Austria and Argentina (Frondel, 1958). In most of the deposits the habit is similar, described as globular aggregates of minute scales; distinct crystals to around one millimetre have also been reported (Hurlbut, 1954).

Andersonite, $Na_2Ca(UO_2)(CO_3)_3.6H_2O$, was first described by Axelrod *et al.* (1951) from specimens collected at the Hillside Mine, Yavapai County, Arizona, where it occurred as clusters of minute pseudo-cubic crystals, associated with gypsum, schröckingerite, bayleite and schwartzite. The mineral has subsequently been reported from other localities in the U.S.A., notably Grand County, New Mexico and San Juan County, Utah where it occurs as rhombohedral crystals to around 12 mm (Frondel, 1958; Roberts *et al.*, 1990).

Both andersonite and schröckingerite have now been found at the Geevor mine, Pendeen, Cornwall, where they occur on the walls of a drive along the Peeth Lode on 17 Level (1700 feet below surface). This is the first recorded occurrence of these species in Britain.

Most of the schröckingerite and andersonite is restricted to one part of the drive with a linear extent of approximately 4 metres. In this area the schröckingerite occurs as small greenish-yellow spheroidal globules, up to 4 mm in diameter, widely scattered over the tunnel wall. Specimens of this material were first brought to the authors' attention by Mr E. Gale of Geevor Tin Mines plc. Superficially, the (unbroken) globules appear featureless, but closer examination reveals them to be composed of aggregates of tiny, euhedral, pseudo-hexagonal plates (typically around 50 μm across, occasionally to 0.2 mm). Some appear to be cemented together by gypsum over the outer surface. This habit is similar to that recorded in other deposits (Hurlbut, 1954). The samples exhibit a strong yellowish-green fluorescence, which produces a remarkable display *in situ* on the tunnel walls.