

On Crystals of Cuprite and Cerussite resulting from the slow alteration of buried coins.¹

By L. FLETCHER, M.A., F.C.S., President.

THE coins referred to in this paper were received through Professor J. W. Judd, F.R.S., to whom they had been sent by Mr. George W. Shrubsole, F.G.S., Honorary Curator of the Museum belonging to the Chester Society of Natural Science.

According to Mr. Shrubsole the Roman coins of Chester are generally found in soil consisting more or less of disintegrated red sandstone and clay: the coins of the find now under consideration must have been buried for fifteen centuries, for such as have been deciphered belong to what is called the Roman Third Brass, and range from Philipus, A.D. 244, to Constantine, A.D. 337. Mr. Shrubsole further remarks that crystals are not found to result from the alteration of isolated coins; when met with they line cavities between adjacent coins of a pile. And this ought, perhaps, to be expected. The water which trickles through the soil and contains dissolved carbonic acid and alkaline carbonates will convert into carbonate all metallic copper to which it has free access: a single coin or a pile of coins will thus, in the course of time, be covered with a more or less protective crust of carbonate of copper: within the crust, however, the action will be that of water rather than carbonic acid, and the material will be changed to oxide. But, while in the case of an isolated coin there is no internal cavity in which crystals have space for their development, in a pile such cavities will be produced through the thrusting asunder of adjacent coins by the formation of intervening carbonate near the rim.

The products of alteration noticed in these coins are blue and green carbonates of copper (chessylite and malachite), red oxide of copper (cuprite), and yellow carbonate of lead (cerussite).

The blue and green carbonates are uncrystallised.

The red oxide of copper is often distinctly crystallised; one cavity contains some transparent cubo-octahedra and cubes of great splendancy; they are nearly a millimeter in thickness.

¹ These products of alteration were exhibited at the meeting on October 20th, 1885.

The carbonate of lead, though rarely seen, is in one cavity present as a little tuft of yellow acicular crystals.

This mode of occurrence of carbonate of lead has been remarked by Lacroix :¹ the Roman coins examined by him were found in Algeria, and were those of the time of Severus, A.D. 205-234 : one of the coins was analysed by him with the following result :—

Copper	...	79.76
Lead	...	16.26
Tin	...	3.97
		99.99

On the same coins from Algeria were cubes of cuprite ; they showed no replacement either of their edges or quoins.

Cuprite is often found as a result of alteration of long buried objects of bronze. Small transparent octahedra were found on breaking fragments which had formed part of the leg of a gilded bronze horse found in the Saône, near Sainte Claire, in 1766 : red crystals were also observed in a similar object found in 1771 (or 1777) in the city of Lyon, and were proved by Sage to be chemically identical with the Cornish mineral cuprite discovered just before.² Buffon, however, thought that the red crystals were really an arsenic compound.³ Nöggerath describes dodecahedra and cubo-octahedra of cuprite as results of alteration of a Roman vessel dug up at Wichelshof near Bonn in 1818-9 :⁴ in this case the vessel might have been subjected to the action of fire.

Copper coins dug up from Torre del Greco after the Vesuvius eruption of 1794 had been converted into red oxide : and crystals were found on a brass candlestick.⁵ The red oxide has been met with as a furnace-product ; and, after the great fire of Hamburg, copper objects were found to have been changed to the same oxide.⁶

¹ *Société Minéralogique de France*, 1883, Vol. VI. p. 175.

² *Observations sur la Physique, sur l'Histoire naturelle et sur les Arts*, par Rozier et Mongez, 1779, Vol. XIV. p. 155.

³ *Histoire naturelle des Minéraux*, 1785, Vol. III. p. 56.

⁴ *Das Gebirge in Rheinland Westphalen*, 1824, Vol. III. p. 231.

⁵ *Schweigger's Journal für Chemie und Physik*, 1825, Vol. XLIII. p. 132. *Breislak's physische und lithologische Reisen durch Campanien*, 1802, p. 204.

⁶ *Erdmann's Journal der Chemie*, 1840, Vol. XIX. p. 118. *Hausmann's Beiträge zur metallurgischen Krystallkunde*, 1850, p. 17. *Leonhard, Hütten-Erzeugnisse*, 1858, p. 366.