ANALYSIS OF CRYSTALLINE MATERIALS PRESERVED IN A PALESTINE KOHL VESSEL FROM THE 4TH CENTURY A.D.

UNTERSUCHUNGEN AM KRISTALLINEN INHALT EINES KAJALGLASES AUS PALÄSTINA, 4. JH. A.D.

ANALYSE DU CONTENU CRISTALLIN D'UN RECIPIENT A KHOL DE PALESTINE DATANT DU 4ÈME SIÈCLE A.D.

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SUMMARY

The crystalline content of a Late Roman glass vessel used to hold cosmetic eye shadow (kohl) was analysed. The analytical techniques used were X-ray powder diffraction and scanning electron microscopy. The materials detected are described, indicating that they may have been used as kohl.

ZUSAMMENFASSUNG

Es wurde der kristalline Inhalt eines spätrömischen Doppelglasgefäßes aus Palästina mit Röntgenpulverdiffraktometrie und am Rastelektronenmikroskop untersucht. Der Gefäßinhalt wurde wahrscheinlich als Augenschminke (Kajal) benutzt.

RESUME

Le contenu cristallin d'un récipient romain provenant de Palestine a été analysé au diffractomètre poudre aux rayons X et au microscope électronique à balayage. Le contenu du récipient était probablement utilisé comme maquillage pour les yeux (khôl).

KEYWORDS: kohl, glass vessel, galena, anglesite, cerussite, x – ray diffraction

1. INTRODUCTION

The following is a report on a study of the materials contained in a double – tube flask from the collection of the “Württembergisches Landesmuseum” in Stuttgart. A typical glass vessel for holding cosmetic eye – paints might have one, two or four individual tubes.

Studies of kohl previously reported in the literature have dealt with Egyptian material /1/ and Late Roman to Byzantine material /2/. Galena (lead sulfide) and the basic copper carbonate, malachite were widely used in Egypt for this purpose. Both types were used in the Predynastic period, but the use of malachite had stopped by the end of the New Kingdom. The use of galena continued into the Coptic period. In Palestine glass vessels from the mid 4th to early 7th century only galena was found in previous studies /2/.

The double – tube flask of the collection of the Württembergische Landesmuseum was made out of one long glass bleb, which had been divided into two sections. Than both sections had been blown separately. The glass is light green in colour and shows many bubbles. Both tubes contained a chunk of altered, dark grey kohl (Fig. 1). One tube with a broken fragment shows part of a bronze or copper rod, sticking in the altered kohl. The total height of the vessel is 9.9 cm, the diameter of each tube is approximately 1.7 cm.

Fig. 1: Double tube flask made of light green glass with 4 bails. One tube is broken and shows the preserved residue of the kohl and the corroded bronze rod.

Fig 2: Detailed photograph of the rod sticking in the kohl.

In Fig 2 some details of the chunk and the sticking rod are shown. The rod is partly covered with green, blue – green and red coloured corrosion products. The surface of the kohl is dark grey in colour and shows sometimes metallic brightness.

2. EXPERIMENTAL PROCEDURES

For the detailed analyses at least one sample of the altered kohl was removed from each tube. The samples were prepared for X – ray diffraction (XRD), using a Siemens D 500 diffractometer. Scanning electron microscopy with energy dispersive spectrometry (SEM/EDS) were used to identify the chemical elements present. A Camscan scanning electron microscope including a Noran Voyager energy dispersive x-ray analyzer was used for microscopic investigation.

3. ANALYTICAL RESULTS

The results of the analyses of the kohl vessels are presented below. Two samples were removed from the surface of the solid chunk in both tubes. In both samples the most common alteration products of galena, anglesite ($PbSO_4$) and cerussite ($PbCO_3$) were present in major amounts. But galena (PbS) was also observed in minor amounts (see Fig. 2). Both samples are nearly identical in composition and could not be distinguished with x – ray diffraction.

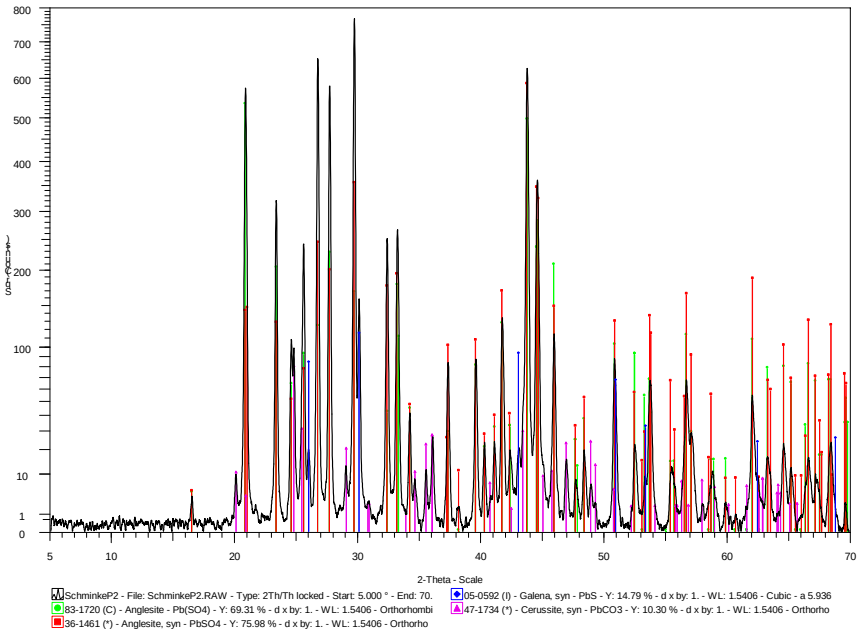

Fig. 2: XRD plot of the powdered kohl sample. Anglesite and cerussite occurred as common alteration products, but galena is also present.

It is reasonable that finely ground galena for use as kohl would have enough time to alterate into anglesite and cerrusite during ca. 1500 years of storage under unknown archaeological conditions. The analyses of a small piece of the rod, sticking inside the kohl showed cuprite and brochantite (see Fig. 3).

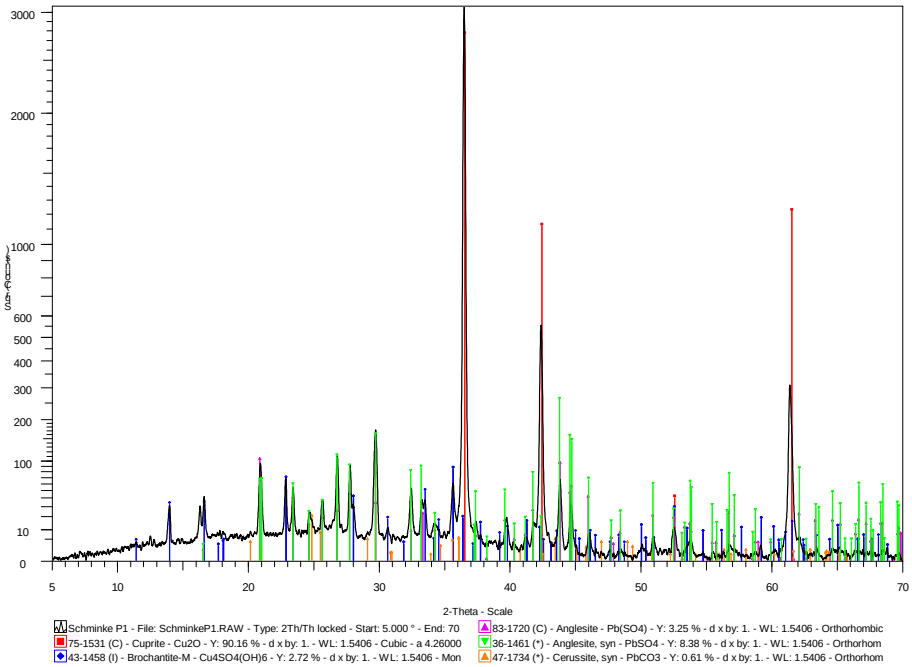

Fig. 3: XRD plot of a mixed sample with kohl (anglesite, cerussite) and alteration products of the bronze rod (cuprite, brochantite).

The complete vessel was placed under the scanning electron microscope for further investigations. The original surface of the kohl was studied in the broken tube. Elemental analysis showed high concentrations of lead and sulphur and some copper in the surrounding material of the rod, indicating a bronze alloy or copper metal. Other elements like Sb were absent, eliminating the use of stibnite as possible component in the kohl material.

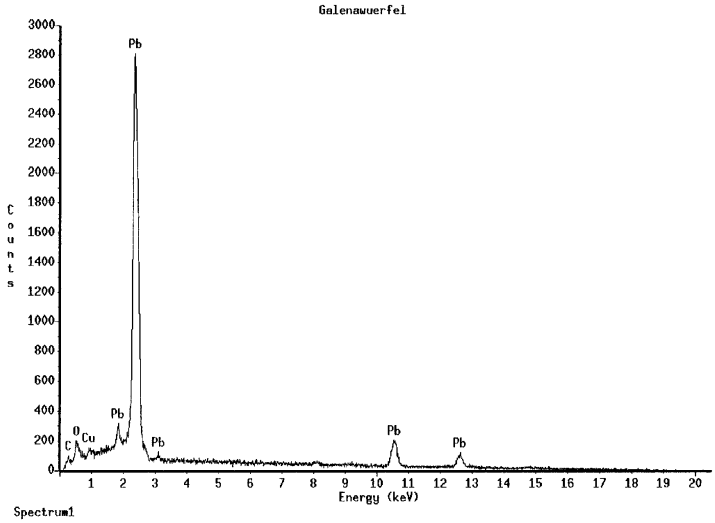

Fig. 4: Elemental analysis of a galena cube at the surface showing mainly Pb, S is buried by the Pb peak.

Photomicrographs of the surface are shown in Fig. 5 and 6. The kohl consists of a very fine grained groundmass with hypidiomorphic intergrown cubes of galena.

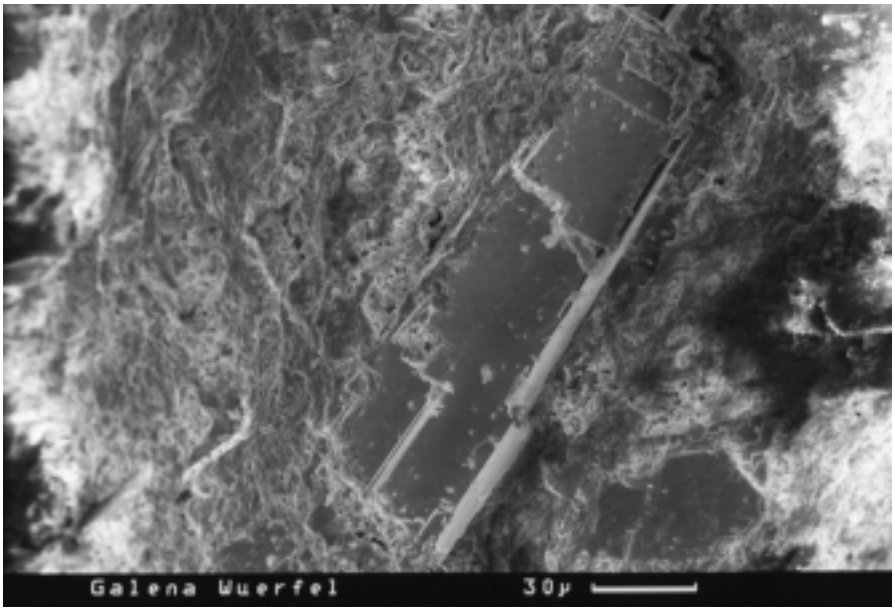

Fig. 5: Photomicrograph of the fine grained groundmass with intergrown galena cubes.

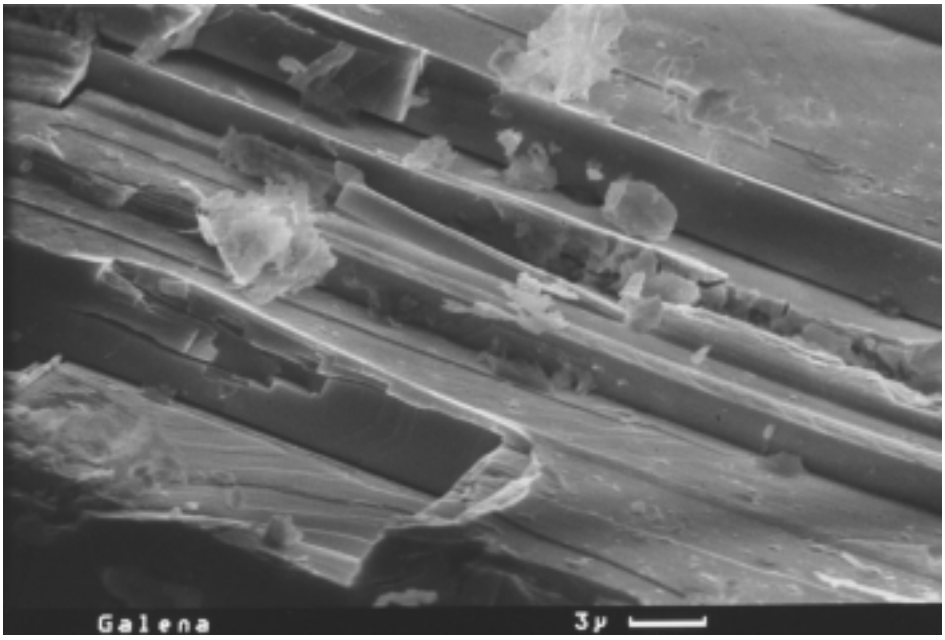

Fig. 6: Detailed photomicrograph of a galena cube.

4. CONCLUSIONS

In this study evidence was found only for galena as material used for the production of kohl. Both flasks contained identical materials. For its use as ancient make up (eye shadow) it should be ground very fine. It is reasonable to assume that most of the galena is altered to anglesite and cerussite during the long period of storage under unknown archaeological conditions.

5. ACKNOWLEDGEMENT

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