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Research Articles

The first known use of vermillion

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Abstract. Vermillion has been shown to be useful in preserving human bones from 5000 years ago. Remarkably well-preserved human bones have been found in the dolmenic burial 'La Velilla' in Osorno (Palencia, Spain), carefully covered by pulverized cinnabar (vermillion) which ensured their preservation even in non-favorable climatic conditions. We believe the red powder was deliberately deposited for preservative use because no cinnabar mine is to be found within 160 km, because of the large amount (hundreds of kilograms) used, and because its composition, red mercuric sulphide, is similar to that of preparations used in technical embalming. This finding pushes back the data of the use of mercury ore for preservation by four millennia in South America, and by at least one millennium in the Old World. Chemical and thermal analyses of vermillion in La Velilla have demonstrated its great purity and shown that the cinnabar was pulverized and washed (but not heated), producing a bright red-orange tone.
Key words. Preservation; vermillion; cinnabar; archaeology; neolithic; dolmenic; XRF-EDS; DTA.

The use of minerals as sources of pigment for decorative or protective purposes is as old as cave and body painting. Analyses of the painted walls of tombs and temples, of cosmetics, and of decorated surfaces in pottery, have provided valuable knowledge of the materials used by the ancients for paints, cosmetics and glazes[1,2]. In this paper we report analyses of a red powder from a neolithic burial site (3000 years B.C.) where remarkably well-preserved bones from up to 100 individuals were found. Especially remarkable is the fact that in the 'La Velilla' dolmen[3] in Osorno (Palencia, Spain), the cinnabar mineral was deliberately deposited in the burial, no mine existing within 160 km. In addition, the amount of ore found in the tomb is quite impressive (estimated at hundreds of kilograms), which implies a significant and intentional work process.

Material and methods

Samples of mineral from La Velilla were analyzed by energy dispersive X-ray fluorescence (XRF-EDX) and differential thermal analysis (DTA). Samples of other red mineral (such as ore coming from Riaño, Leon, Spain) were also analyzed for comparative purposes.
The apparatus used for XRF-EDX was a Philips PV9550 instrument, working at 40 kV, 100 μA for 200 seconds. The thermal analysis was carried out with a 1700 DTA system 7/4 instrument coupled to a System 4 Microprocessor Controller and a 3600 Thermal Analysis Data Station.
The DTA experiments were conducted in atmospheric air at a flow rate of 20 cm^3/min and a scan rate of 10 °C/min, using samples of about 40 mg.

Results

XRF-EDS scans of powder samples from Riaño and La Velilla (fig. 1) led to their identification as red mercuric sulphide. In the mineral from La Velilla silica and limestone, which usually accompany cinnabar, appear only as impurities.
DTA curves of the same samples analyzed by XRF-EDS (fig. 2) showed that neither was heated above 250 °C because they still maintain the higher temperature thermal effects of non-heated cinnabar[4]. This point is important because the red powder in La Velilla has been found covering the fire ashpans made during the ceremonies celebrating the dolmen construction.

Discussion

The preservation of human remains in most archaeological sites is determined by the environment in which those remains are buried, i.e., the climate (both local and regional) and the composition of the surrounding earth. Since in La Velilla the climatic conditions are not favorable, the preservative properties depend on the chemical nature of the earth containing the human bones. Certainly, the mercury-based composition of the 'red dust' makes the preservation of osseous remains

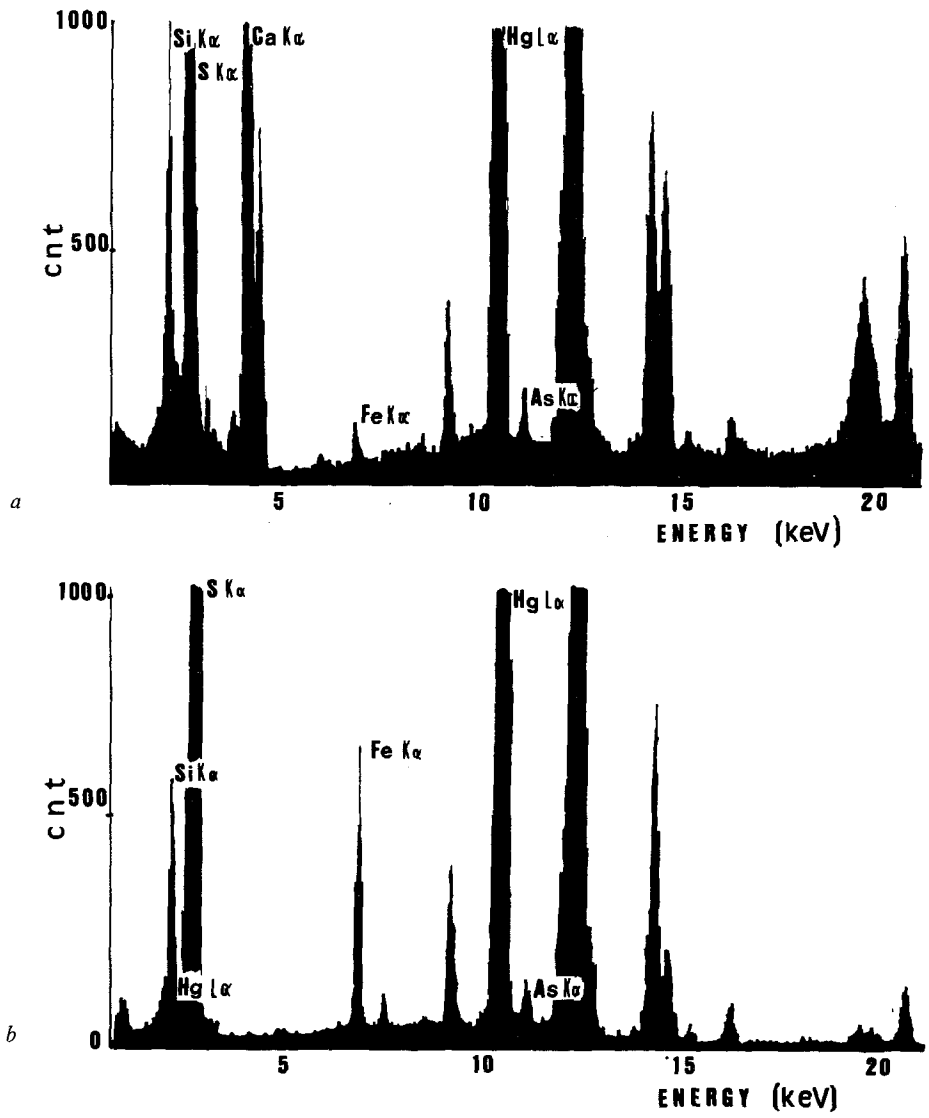

Figure 1. XRF-EDS spectra of cinnabar ores from Riaño (*a*) and La Velilla (*b*) (Spain).

possible by preventing the activity of destructive microorganisms[5].

Archaelogically, our findings push back the date of the use of mercury ore for preservation by four millennia in South America and by at least one millennium in the Old World. Recently, human bones coated with a paint containing cinnabar were discovered in a 900–1000 A.D. tomb in a 'Middle Sican' burial in Perú[6]. This type of preservation has never been reported previously, either in Europe or in the Middle East, although cinnabar was found in 'El Algar Culture' tombs in southeast Spain[7], and mercury was found in an amulet in an Egyptian tomb dated around the 16th century B.C.[8].

Before the finding in La Velilla, it was believed that Europeans did not resort to the bacteriostatic properties of the mercury-based antiseptics until Paracelsus' time, when people used it to treat the epidemic new diseases such as syphilis or 'morbus gallicus', exanthematic typhus, and 'Anglian exudation'[9]. Moreover, the scientific use of cinnabar in embalming arose as late as the 19th century. William Hunter was the first to inject vermillion (dispersed in a mixture of ordinary turpentine essence, Venice turpentine essence, lavender oil and camomile oil) into the femoral arteries of corpses, thus revolutionizing the art of embalming[10].

With respect to the surprising purity of vermillion in La Velilla, we think that it was attained by lixiviation. This operation, together with prior cinnabar grinding and the lengthy transport necessary, indicate the great value given to their use. As with jade in Chinese and Mesoamerican burials, we consider that there are suggestions that the La Velilla community had a conception of their own mortality, an important element in any cognitive map[11]; the cinnabar manipulation and the human bone preservation makes the La Velilla ritual unique. Evidence leads us to think that the dead, up to 100, were buried when only their bare bones remained. These were then immersed in vermillion and placed into

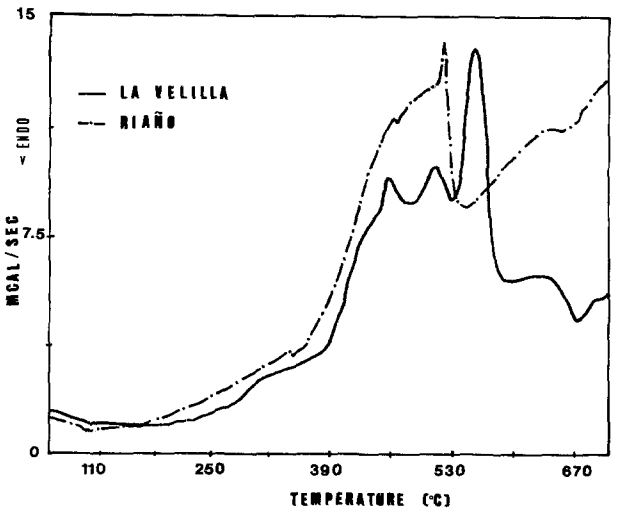

Figure 2. DTA curves of cinnabar ores from La Velilla and Riaño (Spain).

the dolmen. However, there are some indications that the removal of the flesh from the bones was not always complete. Other features that strengthen the hypothesis of a unique ritual are: that the ten great stone blocks which form the dolmen foundations lay horizontally (instead of vertically, as is usual); that foundation fire ashpans were made before the construction of the dolmen floor; and that special spatula-shaped bone idols, made from ovicaprid tibia and decorated with geometric themes or with female traits, and also stained with vermillion, were placed with the deceased[12].

Three factors stand out with respect to the color of the La Velilla powder: its high purity, the lack of heat treatment, and its high degree of pulverization by grinding. Natural bright scarlet-red cinnabar blackens on exposure to light or when it is heated above 260 °C, especially if the usual impurities in the ore are present. On the other hand, cinnabar clears (giving vermillion or red-orange tones) with grinding. Fine grinding and washing avoid the appearance of undesirable brownish tones, as is the case in La Velilla. Nevertheless, as the above technical operations are clearly intentional and they are not necessary for preservative purposes, additional reasons for such processing must be argued: the most sensible ones are magical, i.e., giving back the warm colour of blood and life to the bones.

In addition, it can be argued that some of these features are also found in other sites, but we affirm that they are all very similar to La Velilla characteristics. Another point is that cinnabar might have been used by error instead of ruddle, not to preserve the bones but only for magical purposes. However, we think this is not the case because cinnabar appears here unmixed with ruddle in the same site, and because both have very distinctive red tones. We also agree with Caley[13] and Levy[14] that the brightness, mobility and nonwetting properties of the mercury contained in cinnabar in its mines were highly noticeable to primitive societies. Likewise, the toxic (or sometimes curative) properties of the mercurial vapors that might appear after the preparation of vermillion by cinnabar grinding would also attract their attention. Thus, it seems more likely that the abundant and inert ochre was a substitute for the scarce and won- derful cinnabar in La Velilla, rather than the contrary.

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