


Object Number	K458	Description	Pommel in gold, of cocked-hat form, with filigree decoration. Catalogue no. 32.
		Sample Description and location.	
		Small sample collected from black material inside pommel cap labelled K458-1	



Figure 1. Sample K458-1 collected from dark coloured material (circle in red) inside pommel.

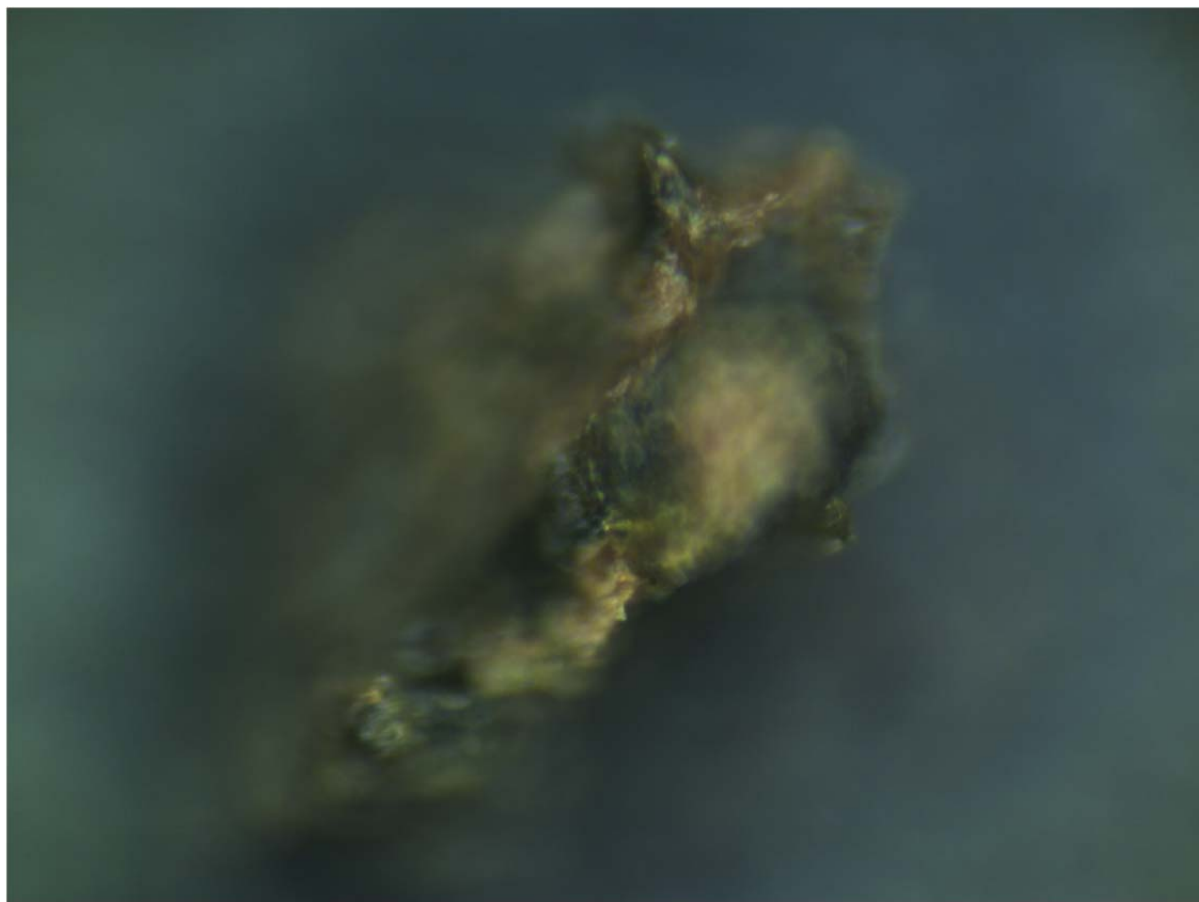


Figure 2. Detail of sub- sample K458-1-2.

FTIR Analysis

Comments: Spectrum K458-1-2 (red) appears to be a mixture of a keratin based animal glue such as hoof glue and beeswax. The FTIR spectra for keratinous materials exhibit characteristic bands for amide I (C=O stretching) between 1700 and 1600 cm^{-1} , and amide II (CN stretching and NH bending) between 1560 and 1500 cm^{-1} , and a broad band centred at around 3300 cm^{-1} related to N-H stretching. A doublet between 3000 and 2800 cm^{-1} relating to C-H stretching of methylene groups are characteristic of keratinous proteinaceous materials. (Welsch et al. 2012, Kennedy et al. 2013, Mansilla et al. 2011, Derrick et al. 1999). In oxidised keratinous materials such as the oxidised horse hair spectrum shown in Fig.3, an intense peak at about 1030 cm^{-1} is attributable to S=O bonding in cysteic acid. (Welsch et al. 2012, Kennedy et al 2013, Mansilla et al. 2011). This peak should be interpreted with some caution in this sample however as silicate based material such as is found in earth minerals also exhibit a sharp band at approximately 1000 cm^{-1} which relates to Si-O bonding. The peak at 1030 cm^{-1} may derive from cysteic acid in oxidised keratinous tissue, silicate based earth minerals deliberately added to the paste or from the burial environment, or a combination of both.

The FTIR spectrum for beeswax is characterized by dominant absorption bands around 2950 cm^{-1} and 2850 cm^{-1} that relate to C-H stretching of the methylene (CH_2) groups, a band at 1740 cm^{-1} that relates to C=O bonding characteristic of the ester groups, a band around 1460 cm^{-1} relates to C-H bending, and a doublet between 720 and 730 cm^{-1} relating to non planar skeletal deformation vibrations of long chain hydrocarbons (Derrick *et al* 1999, Birshtein and Tul'chinskii 1977). The bands in the region 1350 - 1180 cm^{-1} may be assigned to a phenomenon known as a 'band progression' present in fatty acids and fatty acid esters which result in a series of evenly spaced bands in this region. These are due to wagging and twisting vibrations of successive carboxyl coupled methylene groups (Baeten et al. 2010) shown in more detail in Fig. 4.

Representative Spectrum

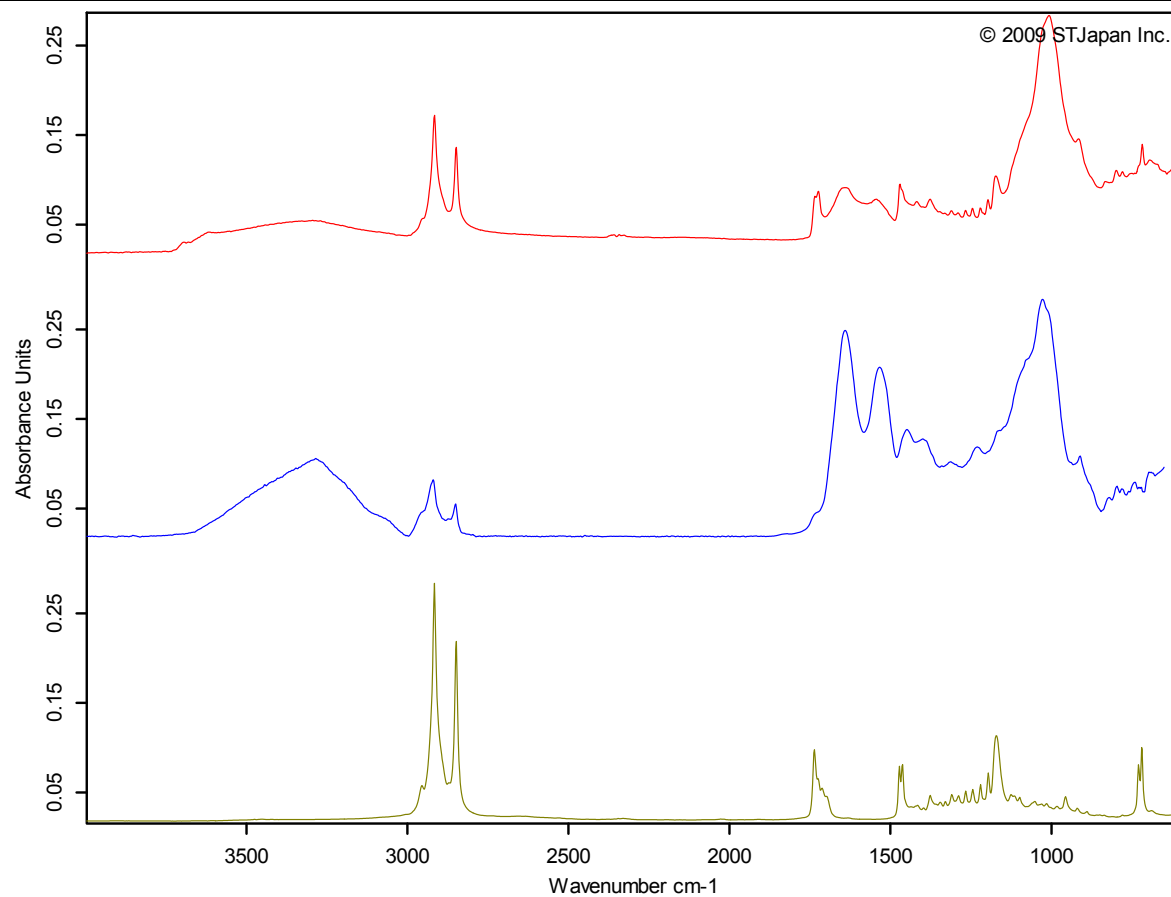


Figure 3: Top (red) K458-1-2. Middle (blue) Oxidised Horse Hair reference spectrum, ST Japan 2009. Bottom (green) Beeswax reference spectrum, ST Japan 2009.

Representative Spectrum

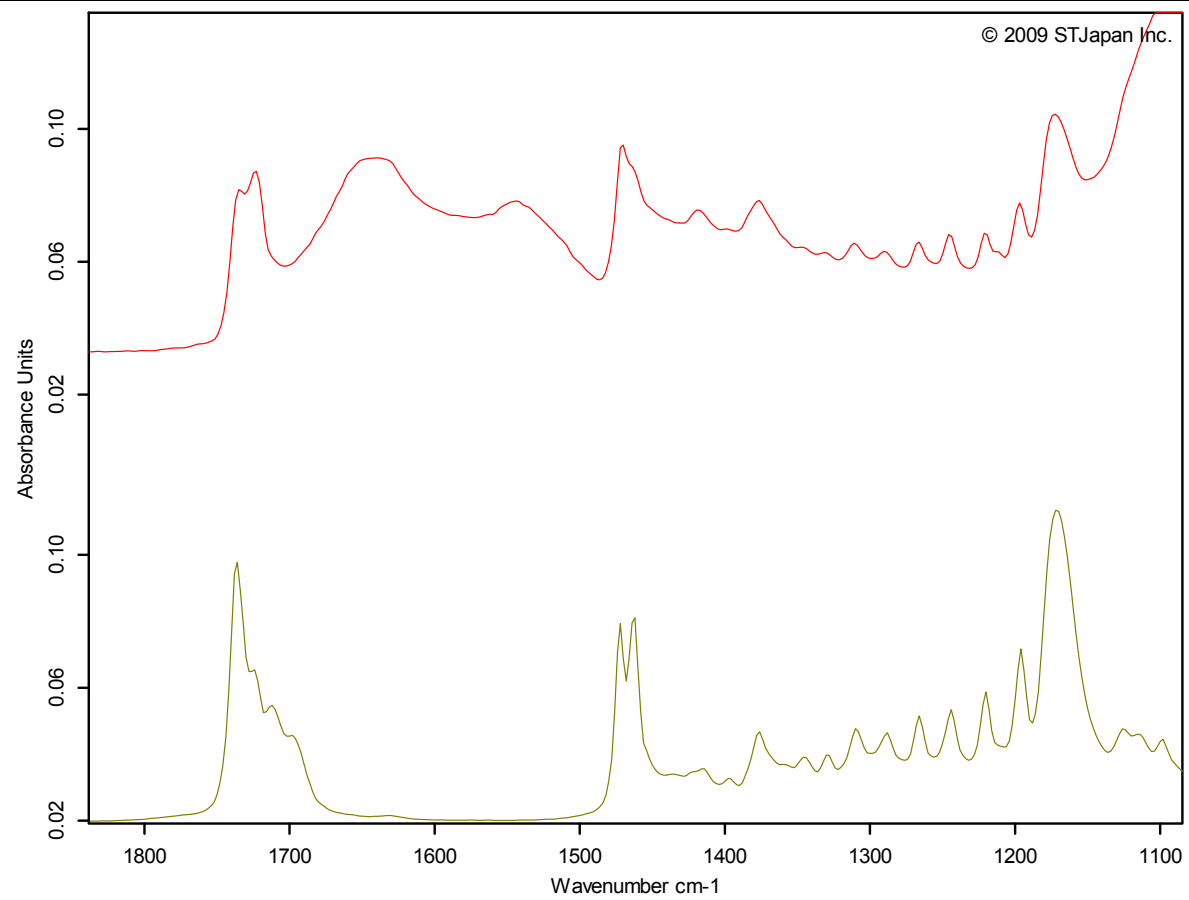


Figure 4: Detail showing spectral match in region between 1100 and 1800 cm-1 between top (red) K458-1-2, and bottom (green) Beeswax reference spectrum, ST Japan 2009.

SEM Analysis

Sample K458-1-2 was analysed to determine the nature of proteinaceous material identified using FTIR. There are no microstructures comparable with those of horn which suggests that the protein component in the sample is an animal glue or other amorphous material added to the beeswax. The texture of the wax is quite strange in so much as it appears textured or even porous in some images or parts of the sample, and smooth in others. Does this relate to an unevenly distributed protein glue through the beeswax?

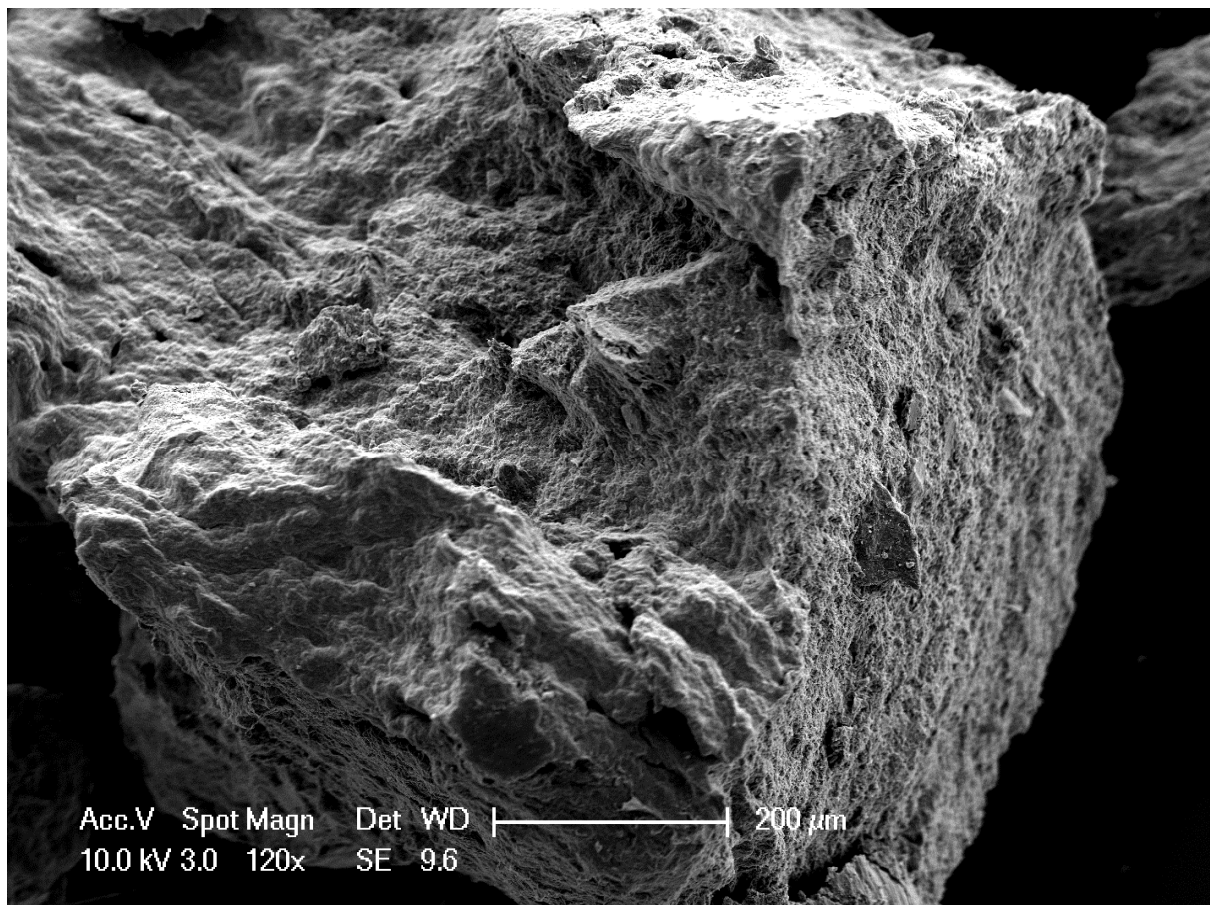


Figure 5. Secondary electron image showing sample K458-1-2. It is unclear if the texture is due to granular particulate. Note the inclusion jutting out from the right hand side of the sample.

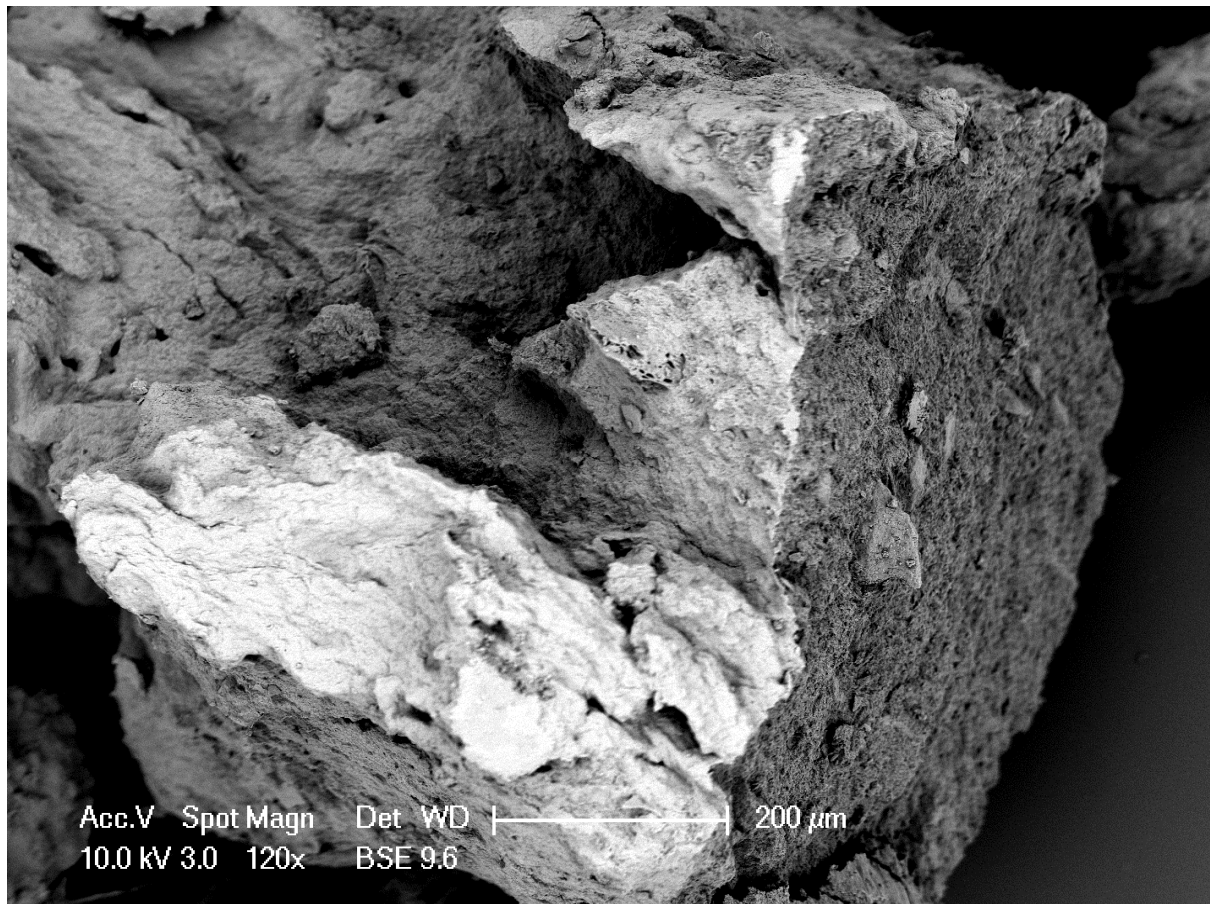


Figure 5. Backscatter electron image showing sample K458-1-2. The white area across the surface may be from a surface dusting of clay minerals, or could be related to an uneven platinum sputter coat on this part of the sample.

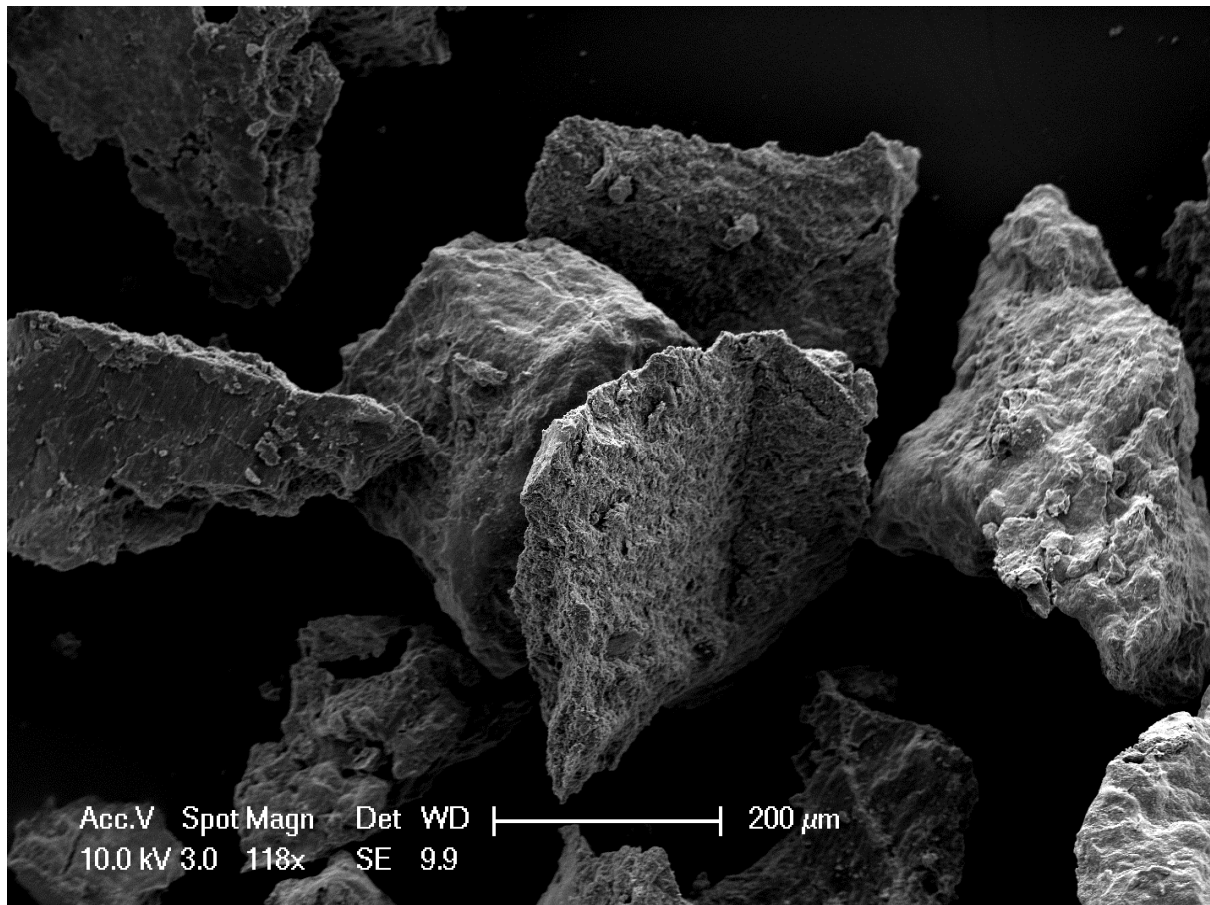


Figure 6. Secondary electron image showing fragments of sample K458-1-2. Some fragments appear to have a smooth texture with occasional surface particulate, while others appear to have a rougher almost porous texture.

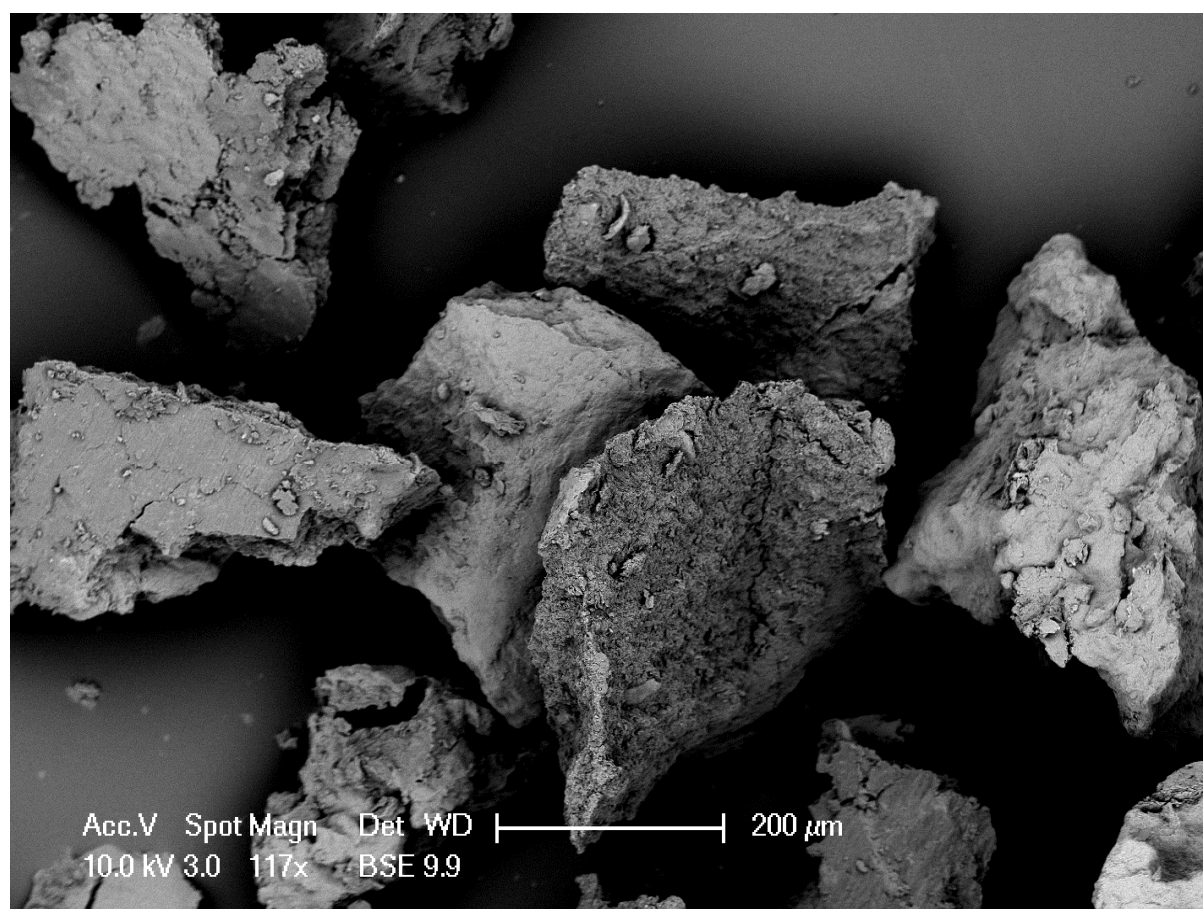


Figure 7. Back scatter electron image showing sample K458-1-2.