Object Number	K452	Description	Pommel in gold, of cocked-hat form, with garnet cloisonné decoration. Catalogue no. 51.

Sample Description and location.

Small sample K452-2 collected from darker coloured lining material inside pommel cap.

Figure 1. Sample K452-2 collected from darker coloured lining material inside pommel near RH side in image.

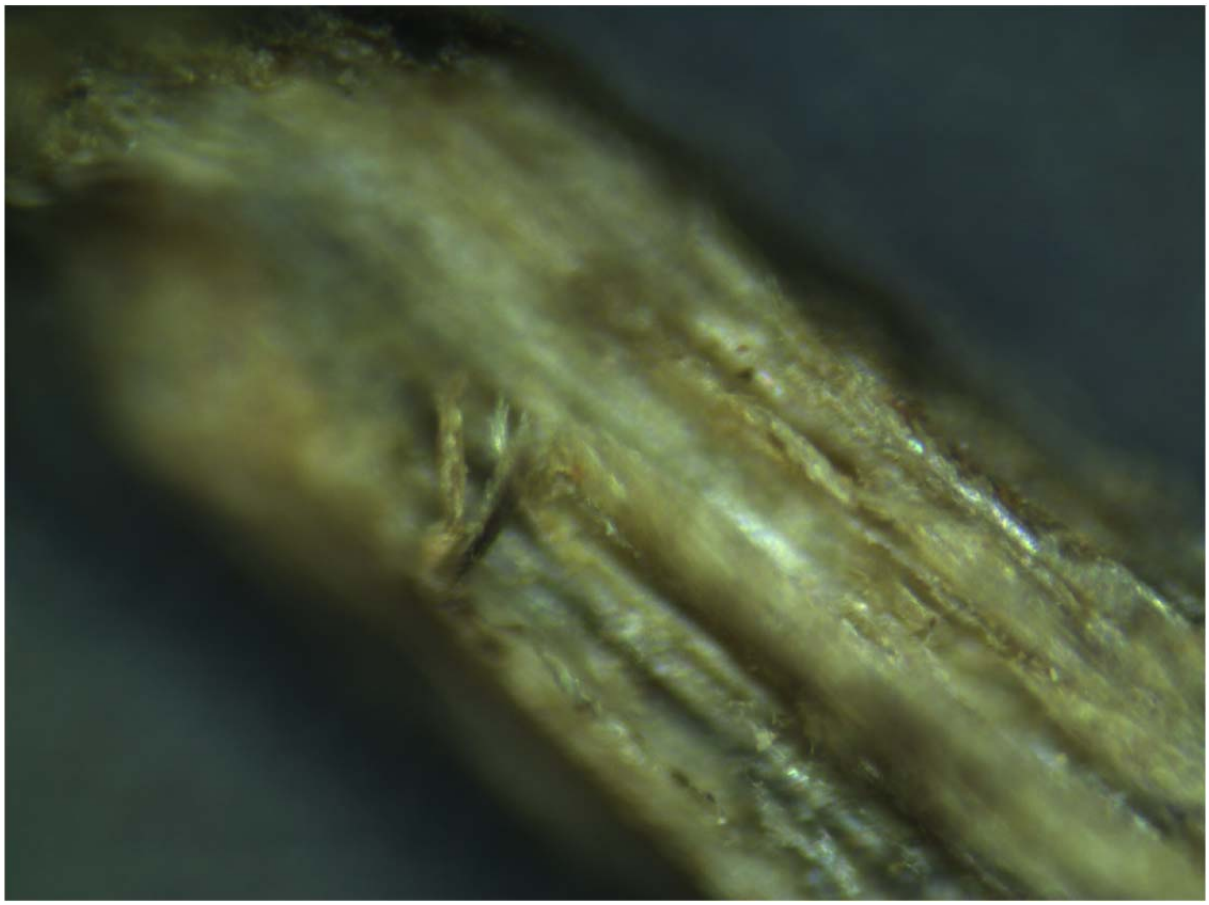


Figure 2. Image showing sample K452-2-1. Note woody structure of material.

FTIR Analysis

Comments: Spectrum K452-2-1 (top, red) is a close spectral match for cellulosic material (bottom, blue). Papyrus shown here as a generic sample of cellulosic carbohydrate for comparison only. FTIR spectra of different cellulosic plant materials are superficially similar and cannot be readily distinguished by eye (Garside & Wyeth 2003). In addition, degradation of one or more components of the plant material e.g. through oxidation of the cellulose molecule, will influence the position and intensity of spectral peaks relative to non-deteriorated reference spectra (Stuart 2007, Ciolacu *et al.* 2011).

There are, however, a number of fairly consistent spectral peaks indicative of cellulosic carbohydrate within a sample. The majority of cellulosic carbohydrates will exhibit a broad band from 3600–3100cm^{-1} arising from O-H stretching in bound or absorbed water (Tipson 1968, Stuart 2007, Naumann *et al*. 2007, Bodirlau & Teaca 2009). A broad band relating to C-H stretching from aromatic hydrocarbons at 3100-3300 cm-1 can be obscured or partially obscured by the broad O-H stretching band described previously (Tipson 1967). Additional peaks relating to the cellulose component of plant material include peaks for C-H stretching of methylene groups between 3000 and 2800cm^{-1}, C-H deformation in cellulose and hemicellulose at 1371cm^{-1}, C-H vibrations at 1319 cm^{-1}, an intense peak at about 1030cm^{-1} relating to C-O bonding (this is typically a combined peak for cellulose and hemi-cellulose), and a shoulder at 897cm^{-1} relating to C-H bending. Additional shoulders at 1155cm^{-1} and 1105cm^{-1} on the C-O band at about 1030cm^{-1} relate to stretching and contraction (so called 'breathing') vibrations within the benzene rings, and glycosidic linkages between carbohydrate molecules respectively (Tipson 1968, Naumann *et al*. 2007, Bodirlau & Teaca 2009).

Representative Spectrum

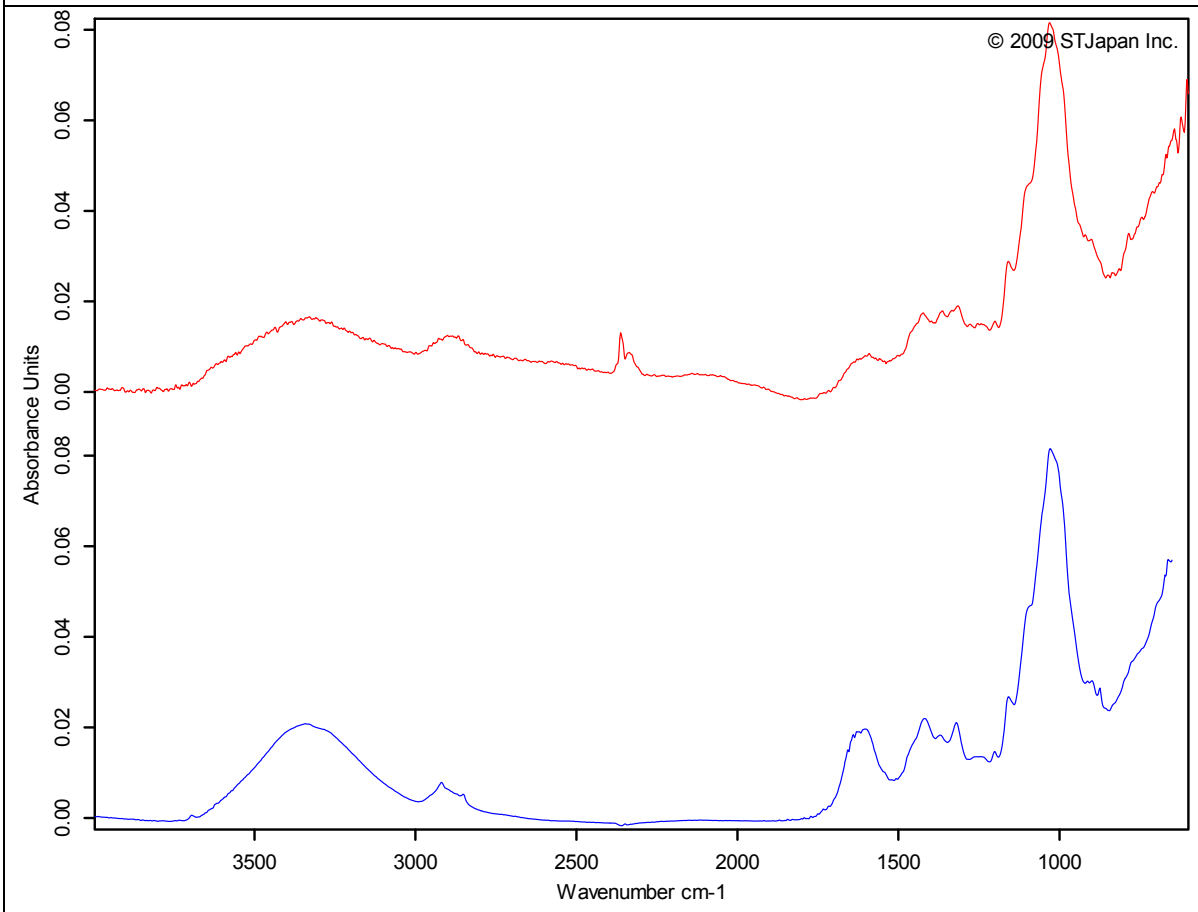


Figure 3: Top (red) K452-2-1. Bottom (blue) Papyrus Egypt reference spectrum, ST Japan 2009.

SEM analysis

Object K452 yielded up two separate samples- one of suspected carbohydrate (K452-2), the other of suspected calcium carbonate material (K452-1). SEM analysis was supposed to have been carried out on the calcium carbonate sample but was erroneously carried out on the carbohydrate sample. A small area of K455-2- was analysed using SEM EDS. Aluminium, potassium, magnesium, oxygen, and silicon were all detected within site of interest 3 as shown below. Some of these elements may relate to earth minerals from the burial environment.

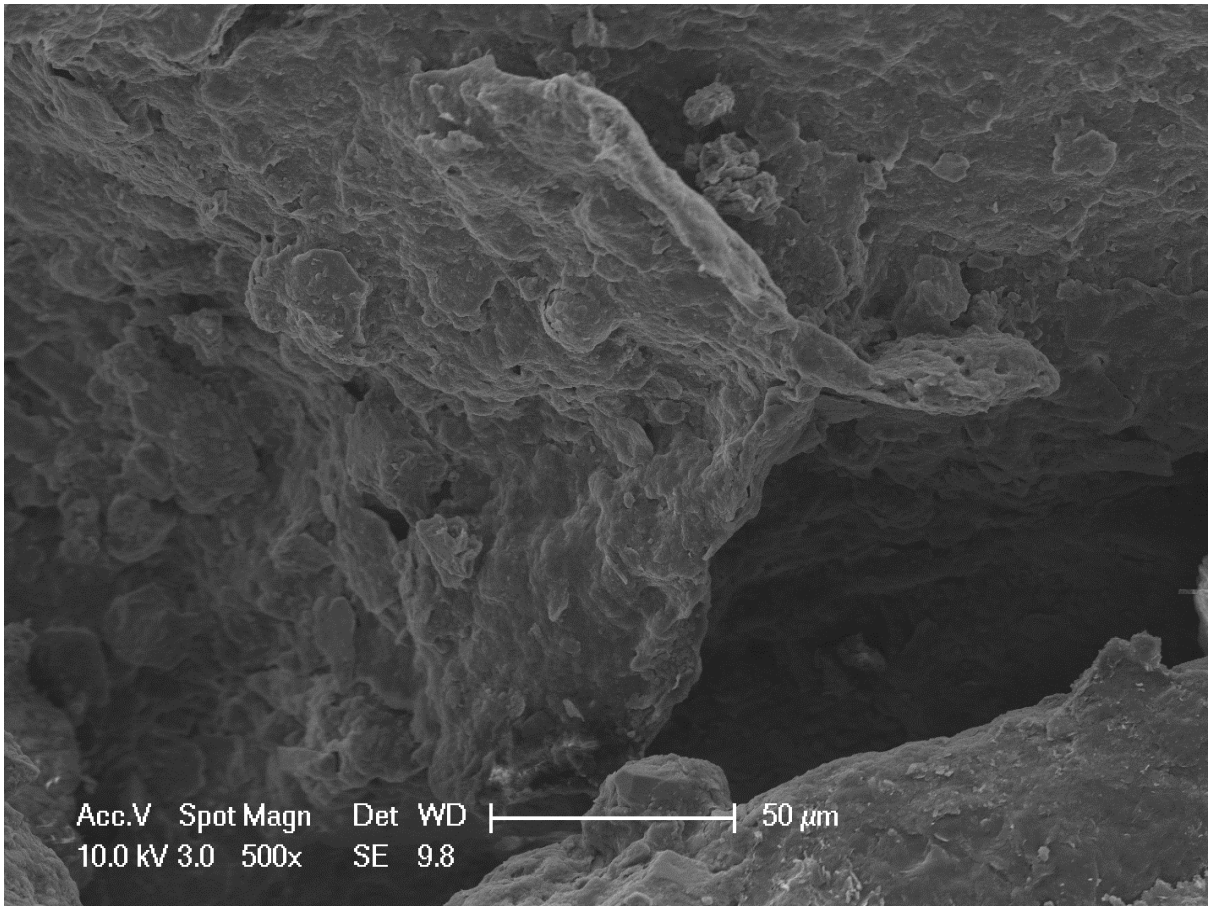


Figure 4. Secondary electron detail of K455-2 showing somewhat globular surface texture.

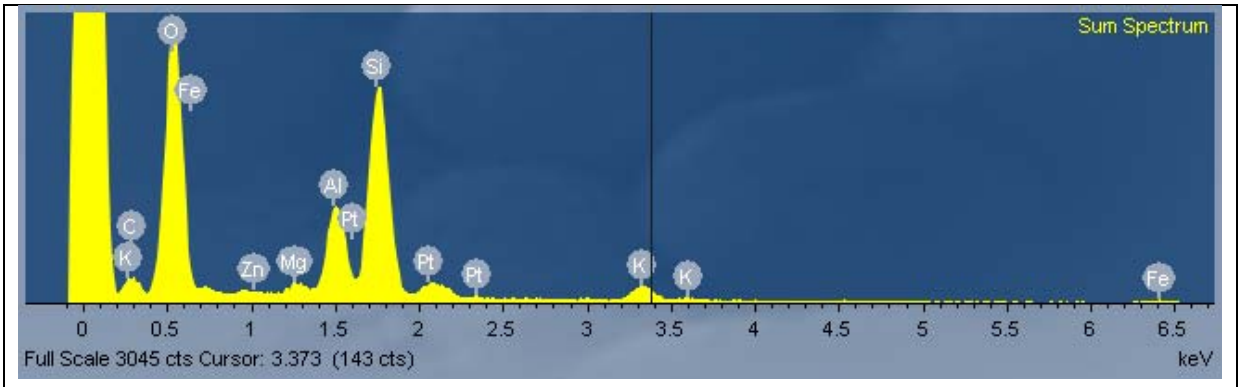
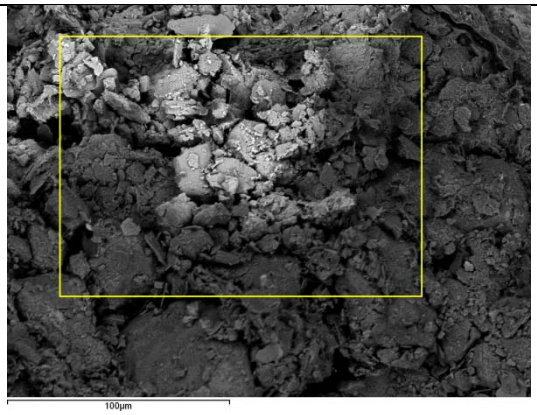
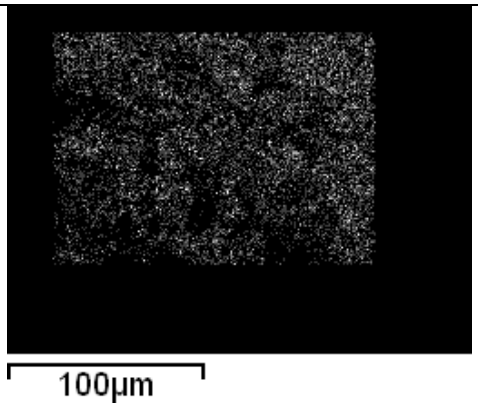


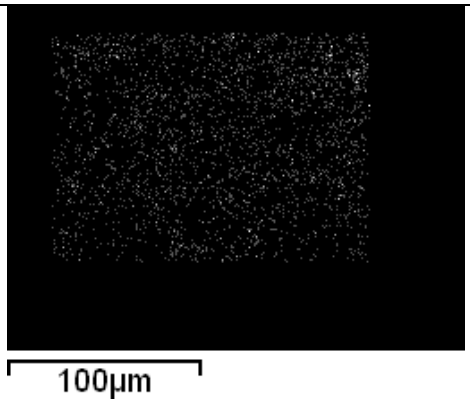
Figure 6. Sum spectrum for K455-2



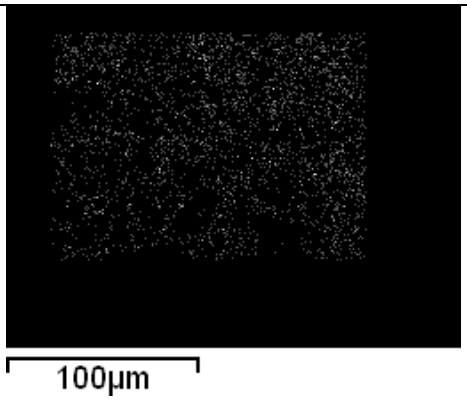
K455-2 SOI 3 Electron Image



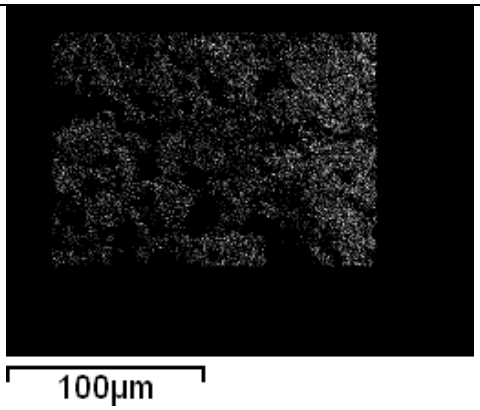
Al Ka1



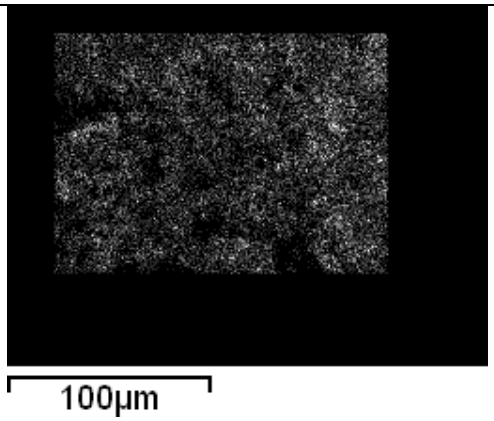
K Ka1



Mg Ka1



O Ka1



Si Ka 1