


Object Number	K972	Description	Mount in gold from the tip of a hilt-guard, with serpent ornament in niello. Catalogue no. 412.
		Sample Description and location.	
		K972-1 Conservation sample 'Organic material from inside' tested. Small green coloured fragments removed from sample bag K972-1.	



Figure 1. Structured green/white material inside K972.



Figure 2. Sample K972-1

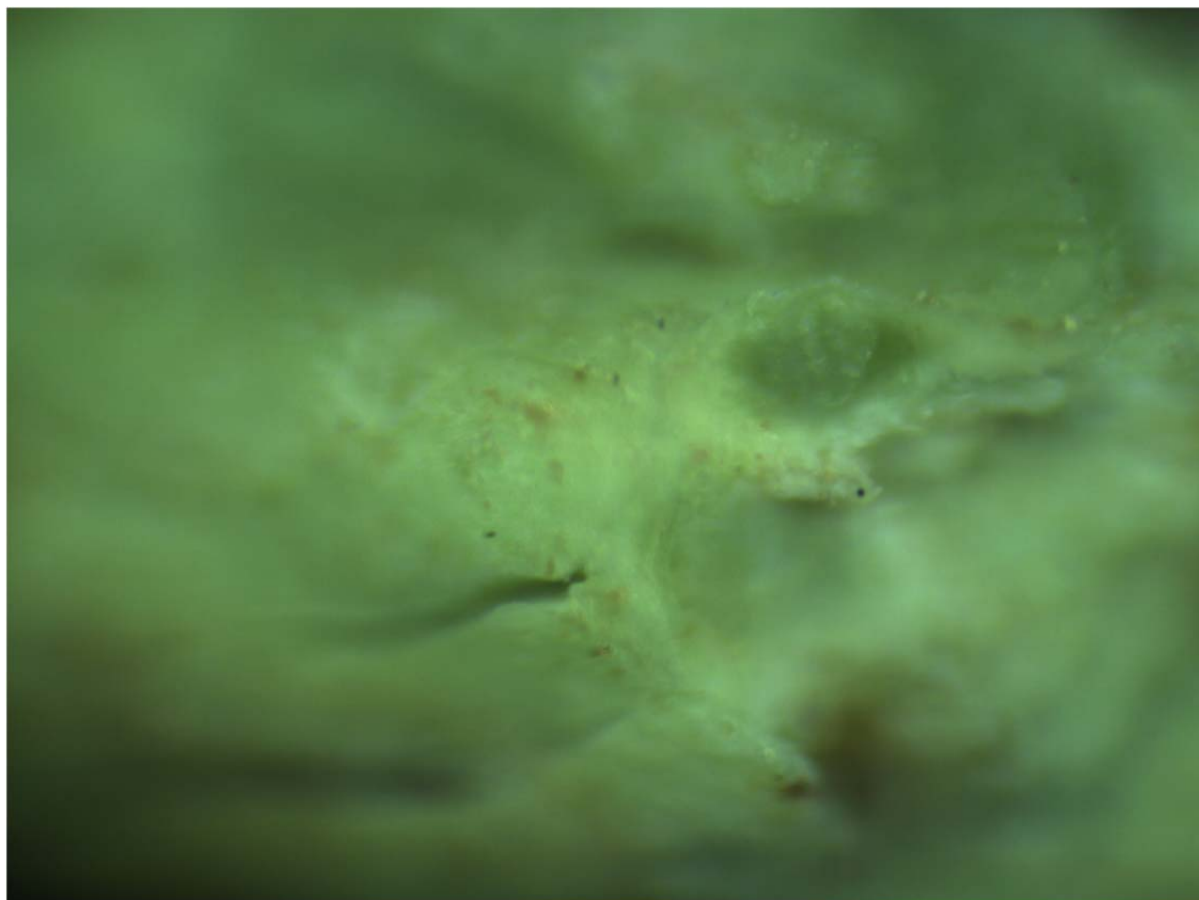


Figure 3. Detail showing FTIR analysis point for sub-sample K972-1-5

FTIR Analysis

Comments: Spectrum K972-1-5 (top, red) is likely bone. The most intense bands in FTIR spectra for bone arise from the mineral component of the bone, in accordance to its larger proportion in the composite. Bands at 557 and 600 cm^{-1} correspond mainly to PO_4^{3-} bending vibrations, despite some minor contribution from collagen (amide bands) in that region. Absorptions at 961 and 1012 cm^{-1} correspond to the symmetric and asymmetric stretching of phosphate, respectively. It should also be also mentioned that acidic phosphate (HPO_4^{2-}), a frequent anionic substitution in the crystal lattice of hydroxyapatite, usually originates a band at ca. 1110 cm^{-1} , which is normally overlapped with that from the PO_4^{3-} asymmetric stretching vibration (Figueiredo *et al.* 2012, Querido *et al.* 2013, Fleet *et al.*, 2004).

Biological apatites present in bone, dentin and enamel contain different amounts of carbonate, principally from CO_3 replacement of PO_4 ions (S'lo'sarczyka *et al.* 2005). Bands at around 870 cm^{-1} (bending) and 1400-1450 cm^{-1} (stretching) arise from carbonate substitutions in the crystal lattice of hydroxyapatite (Ibrahim *et al.* 2011, Figueiredo *et al.* 2012). The predominantly collagen protein component of the bone, where it is present at all in archeological material, is indicated by carbonyl stretching at about 1650 cm^{-1} (amide I), C-N and N-H vibrations at around 1550 cm^{-1} (amide II) that are subtly visible in the spectrum for K972-1-5, and to a broad N-H stretching band centred around 3350 cm^{-1} , with the latter often partially obscured by a broad H_2O band between 3700-2500 cm^{-1} (Figueiredo *et al.* 2012, Querido *et al.* 2013). The higher ratio of mineral to protein in bone means that the protein peaks described above are often quite subtle in relation to the intense mineral related bands.

Representative Spectrum

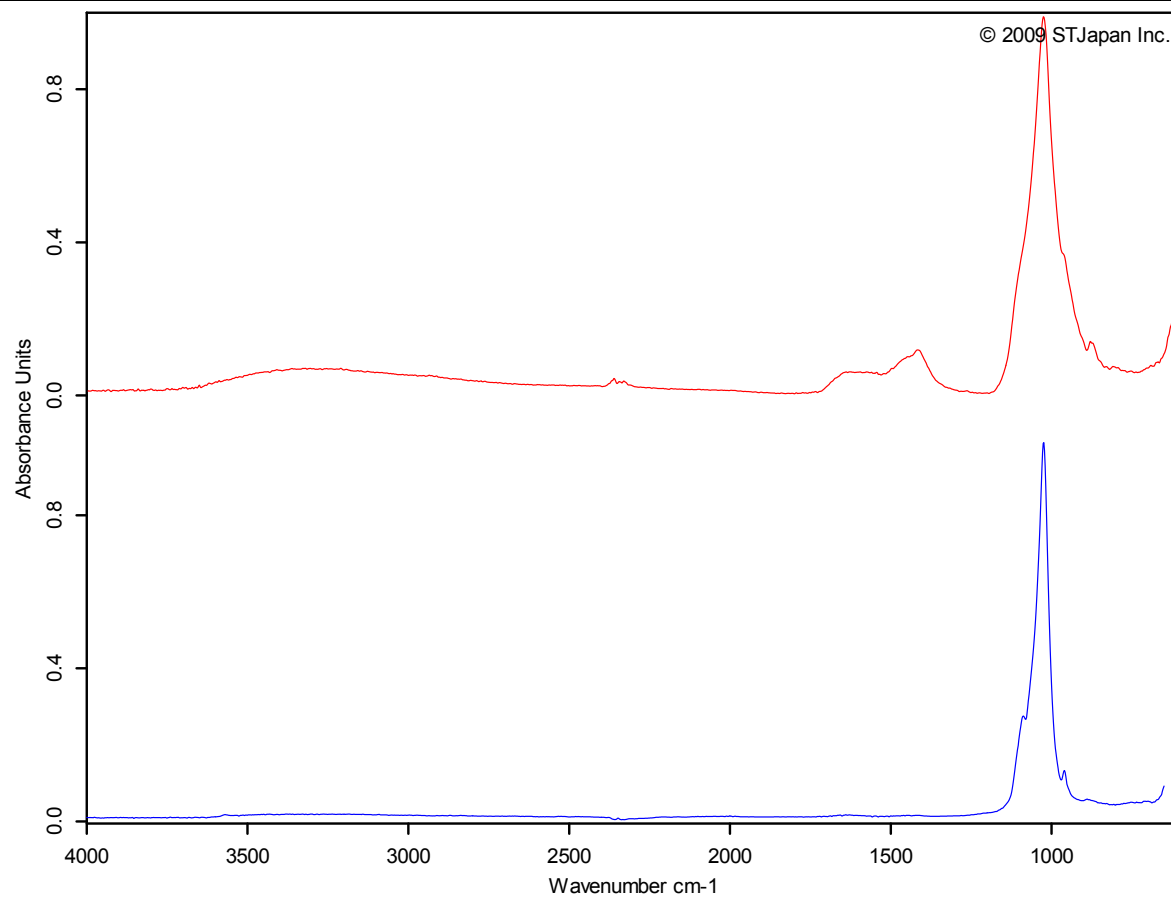


Figure 4. Top (red) spectrum for K972-1-5. Bottom (blue) Bone phosphate reference spectrum, ST Japan 2009.

SEM Analysis

SEM analysis was carried out to examine the microstructure of sample K972-1. The sample appears to have a structure consistent with that of trabecular or cancellous bone tissue, as indicated in figures 6 and 7.

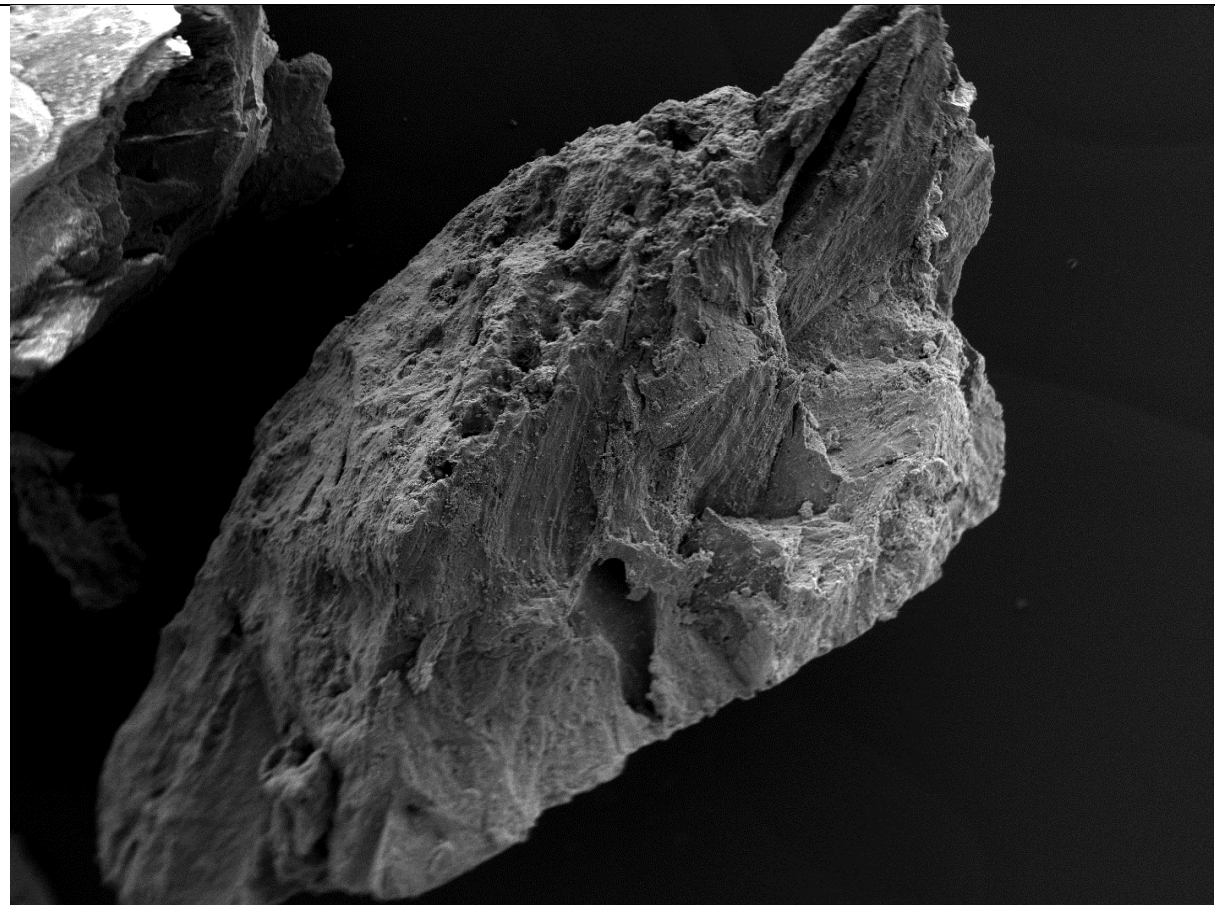


Figure 5. Secondary electron image of sample K972-1

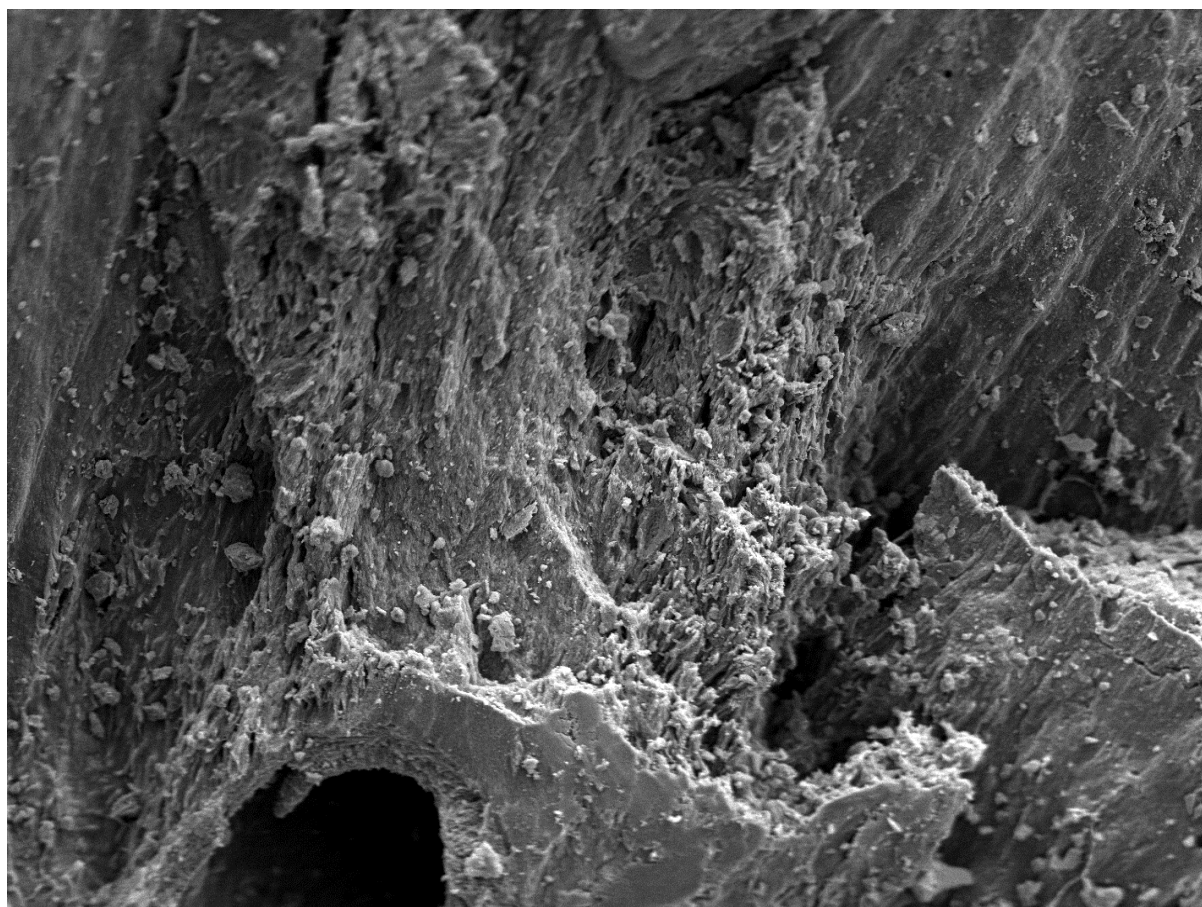


Figure 6. Secondary electron image detail showing cancellous bone tissue structure .

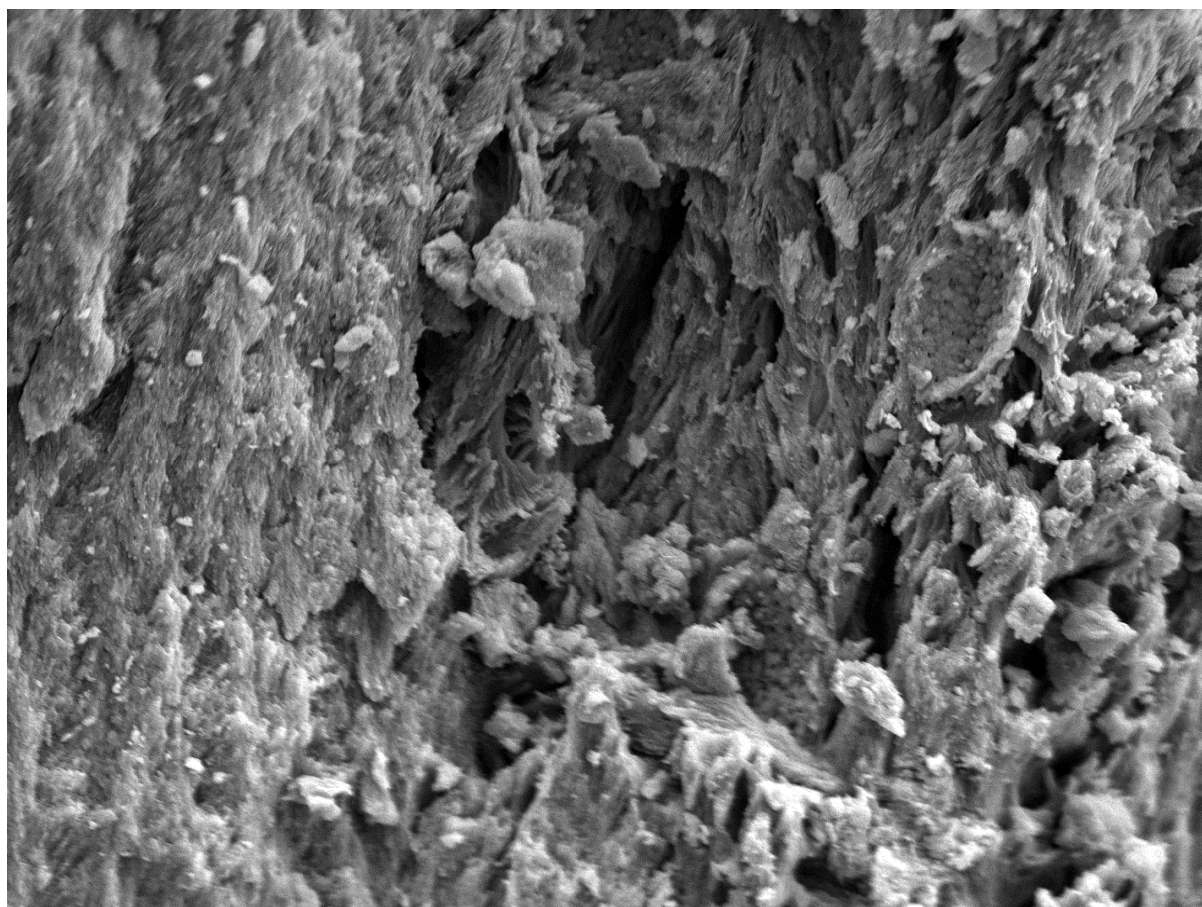


Figure 7. Secondary electron image detail showing cancellous bone tissue structure.



Figure 7. Photomicrograph detail showing cancellous bone tissue structure for K972.