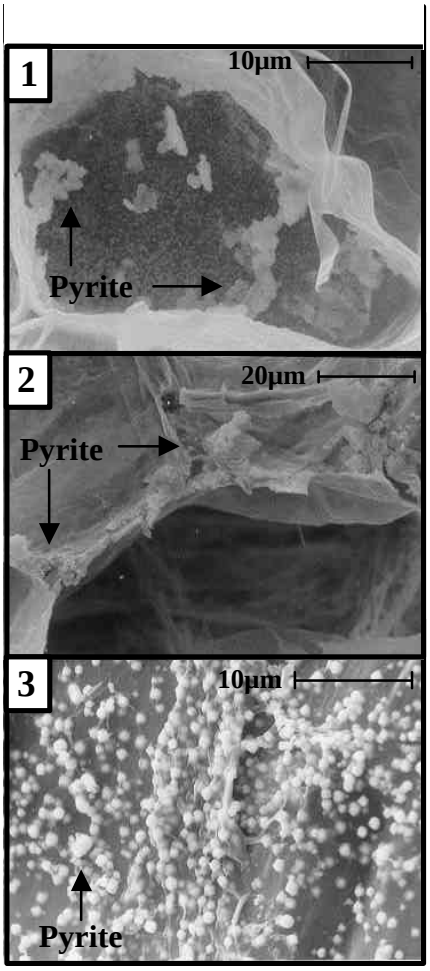
EXPERIMENTAL PYRITISATION OF PLANT CELLS. S. T. Grimes, D. Rickard, D. Edwards, A. Oldroyd, L. Axe, and K. Davies**,** Department of Earth Sciences, Cardiff University, CF1 3YE. Wales, UK (grimesst@cardiff.ac.uk).

Introduction: Our knowledge of plant evolution depends largely on the interpretation of fossilized plant remains. Fossilization through pyritisation is an important process which is not well understood. Two possible pathways are conventionally mooted: (i) *replacement*, in which the original plant microstructure is preserved to molecular dimensions and (ii) *infilling*, where internal casts of the structure are preserved. In order to test the relative importance of these processes in pyritisation, we carried out an experimental simulation of the process [1], based on the oxidation of iron (II) monosulfide (FeS) by H_2S [2].

Methodology: The celery petiole (leaf stalk) was chosen as the reactant plant material because it contains a range of tissues with cell walls of varying composition (cellulose and lignin). The celery was sectioned into ~1cm long chunks, and blanched in boiling de-ionised water for ~30s. Iron (II) monosulfide was first precipitated by saturating the celery for 1 week each in 100ml of 0.1M, $(NH_4)_2Fe(SO_4)_2.6H_2O$ and, 0.2M, $Na_2S.9H_2O$. Oxidation of the iron (II) monosulfide was achieved with 0.01M H_2S at 40•C in a reaction vessel also containing a pH buffer solution and a Eh poise (pH = 6, Eh = -250mv, 0.01M H_2S generated from $Na_2S.9H_2O$ by the addition of ~2ml 50% H_2SO_4).

Results: The initial iron (II) monosulfide precipitates mainly within the water conducting vessels of the vascular bundles. There is little evidence for migration of FeS into the surrounding parenchyma cells. In contrast, octohedral pyrite crystals, up to 2µm in diameter, are associated with parenchyma cells adjacent to near empty tracheids. The octohedral pyrite crystals are located within the parenchyma cells (Fig. 1), within the intercellular space (Fig. 2), and within the cell wall cellulose (Fig. 3). There is no evidence for the direct replacement of any organic material.

Discussion / Conclusions: *Replacement* of organic matter by iron sulfides is difficult process to envisage, because of the lack of a common ion. Our original hypothesis was that pyrite fossilization was a two stage process: pyrite initially precipitated within the cells (*infilling*) and subsequently replaced organic components as they decayed [3] through microbial activity (*replacement*). The results from this study indicate that this may not be the case and that the whole process may be a simple single stage process of *infilling* at both macroscopic and microscopic scales. In this process, apparent *replacement* is represented by infilling of interstial spaces in the plant microarchitecture at microscopic dimensions. The process suggests that pyrite formation in this system results from a reaction with aqueous, rather than solid FeS (cf. [4]) and that plant material may catalyse pyrite nucleation (cf. [5]).



References: [1] Rickard, D., Grimes, S.T., Edwards, D., Oldroyd, A., Axe, L., and Davies, K. (in prep) [2] Rickard, D., (1997) GCA, 63, 115-134. [3] Kenrick, P. and Edwards, D., (1988) Bot. J. Linn. Soc., 98, 97-115. [4] Rickard, D. and Luther, G. III (1997) GCA, 63, 135-147. [5] Schoonen, M.A.A. and Barnes, H.L (1991) GCA, 55, 1505-1514.