PYRITE CONSERVATION
(from Fossil Plants of the London Clay - Margaret E. Collinson)

A considerable amount of material in early collections from the London Clay has been lost, due to 'pyrite decay'. Pyrite, of which the plant fossils are largely or partially composed, is liable to destruction if stored in conditions of high relative humidity. The early method of storing in glycerine was inappropriate, as glycerine continues to absorb water from the air. Howie *(1977a, b, 1979)* has shown that decay progresses in several stages with the formation of sulphuric acid and crystalline decay products of different colours (white, pink, yellow, and green) representing the hydrated iron salts. Attempts to varnish or coat material to prevent deterioration are never totally successful as all the compounds used seem to have some permeability to water vapour in air at relative humidity above 60% (Howie *1979).* In addition, the various coatings used may prevent future detailed study of surface structure.

All materials collected from foreshore exposures must be washed thoroughly with water to remove the chlorides present in the sea water which catalyse the decay reactions. If there are any acidic decay products present, these may be neutralised by exposure to gaseous ammonia or using ethanolamine thioglycollate (Cornish and Doyle). This, coupled with subsequent drying, effectively arrests any decay. Neutralisation requires laboratory equipment and treatment for already deteriorating material is therefore restricted in availability.

Recognition of material which is liable to decay is not a straightforward matter. Some specimens are apparently composed of more stable pyrite than others. This may be related to the crystalline structure and the amount of crystal surface available for water contact. The only secure method is to treat all pyrite as degradable. Some Sheppey plant specimens will be destroyed by a few days of exposure to high relative humidity.

After washing and neutralisation (if necessary), the specimens must be dried thoroughly. This may be accomplished by desiccation over silica gel or in a vacuum oven. It is then recommended that the material is stored in silicon oil (Howie *1979).* To avoid loss of carbonaceous layers, which often occurs when plant material is dried, desiccation may be accomplished by transfer through an alcohol series. The specimens may then be transferred via an alcohol-toluene, toluene-silicon oil series into silicon oil. Non-carbonaceous plant material may be stored dry providing the relative humidity is constantly below 55%. In practice this means that material stored in an inhabited room in a centrally heated house will probably not decay. Material stored in the garage or cellar may not survive.

Perhaps one of the most suitable alternatives to silicon oil (which is expensive) is household paraffin. Although not recommended by Howie *(1979),* this is favoured by Cooper *(1977).* It is unsuitable for long-term storage of carbonaceous plant material (as are other organic solvents) as solution of the carbonaceous layers will occur. Any important carbonaceous specimens should be stored in silicon oil. A final alternative is to store material in sealed containers with a quantity of self-indicating silica gel (blue to pink when wet). This can facilitate the display of material which may be more difficult in fluid storage. Blue silica gel, however, represents a very low relative humidity and would probably result in the exfoliation of carbonaceous layers. Conditioned silica gel (conditioned to an intermediate relative humidity) is recommended by Howie (pers. comm. *1980)* for carbonaceous material and for other pyritic material, e.g. material in shales, which cannot be dried to very low relative humidity (Howie *1979).*

Because of the inherent risk of decay of the material a permanent record as a photograph or drawing is a very necessary part of any London Clay flora collection. Subsequently specimens may be dried and studied using the scanning electron microscope. Fractured surfaces of pyritic parts often reveal detailed cellular structure, as has been shown by the excellent work of Wilkinson *(1981, 1983).* Alternatively specimens may be cut and the polished faces studied using reflected-light microscopy, as with the ferns (Collinson and Ribbins *1977).*