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Pyrite Crystals in the Parenchyma Cells in Wood of Fossil Root

VERY small octahedral crystals (1 micron-20 micron) of iron pyrite have been found in the ray and wood parenchyma cells in parts of a fossil root of Upper Eocene age. The black humified wood is elsewhere partially replaced by veins of pyrite, as commonly seen in fossil wood of this sort. The wood, illustrated in Figs. 1 and 2, was taken from one of many roots observed in the Beacon Cliff section of the Lower Headon beds near Milford-on-Sea, Hampshire. Similar roots occur in exposures of these beds at Totland Bay, Isle of Wight, and in both places the roots are in the position of growth'. All the wood that we have examined anatomically is of a single type and, although some of the finer diagnostic features are not well preserved, it is closely similar in structure to the wood of *Taxodium distichum* (swamp cypress). We cannot, however, ignore the possibility that the roots belonged to the Tertiary *Sequoia couttsiae* which is prominent among the plants identified from other remains in the Lower Headon beds[2]. A full description and discussion of the identity of our material will be presented elsewhere.

Microscopic pyrite, in the form of crystals and framboidal spherules, is common in dark shales and muds, and where it occurs in Recent sediments it is a clear indication of early syngenetic formation of iron sulphide. A feature of especial interest is the constant association of the pyrite in these sediments with organic material, and pyrite is often found within the walls of diatoms, foraminifers, and plant spores and pollen grains[2,4]. Coleman has recently described[5] the replacement by pyrite of hollow rotted rootlets in freshwater clays of the Mississippi delta.

The precise role of organic matter in the early formation of pyrite is difficult to assess. There can be little doubt that the cells of animals and plants do not normally contain sufficient sulphur to account for the quantities of sulphides produced in sediments; and decomposing organic matter would not be capable of reducing sulphate to any appreciable extent in the absence of sulphur bacteria'. It has been suggested that pyrite spherules

Fig. 1. Radial section of wood showing horizontal tiers of ray cells containing crystals. A vertical row of wood parenchyma cells is arrowed at top right (x 60).

are the remains of sulphur bacteria or some other organism which deposited sulphides in their cells[7], but pseudomorphic bacterial cells have not been seen in the pyrite of spherules, nor was any organism found to be directly precipitating pyrite in Recent sediments which contained organic material in which pyrite had formed[4].

Preferential mineralization of organic material is clearly significant in fossilization[8], and has some relevance to the

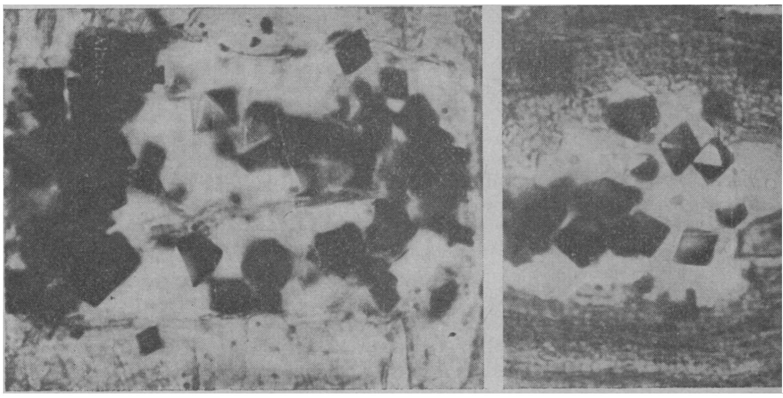

Fig. 2. Crystals at higher magnification (x 600).

genesis of certain ore deposits[9]. Emery has stressed[10] the importance of the creation of a microenvironment within shells of decomposing diatoms, foraminifers and the like, which become infilled with pyrite. The localization of masses of tiny pyrite crystals in the parenchyma cells of our fossil root certainly supports the view that the micro-environment within the dead or dying tissue is an important factor in the early formation of pyrite. The parenchyma cells are the only cells which contained protoplasm, and these cells have provided the essential conditions that promoted the crystallization or precipitation of iron sulphide from the solution infiltrating the rotting root. The actual presence of sulphur bacteria within these cells would not be necessary for this to have taken place.

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Author's (DWB) Note: I have made two changes to the text; Oligocene replaced by Upper Eocene and Hordle Cliff replaced by Beacon Cliff, both on p.1

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