Luccombe Chine

[SZ 583 793]

Introduction

Luccombe Chine is the best available site for the study of plant fossils from the Lower Greensand Group (Early Cretaceous Epoch), which has yielded an important Aptian flora. The specimens are permineralized, showing well-preserved anatomical details. The assemblage is dominated by coniferalean remains, including a variety of woods of the type known as *Protocupressinoxylon,* and of cones of the *Pityostrobus*-type*.* There are also finely preserved cones of the now-extinct cycadeoids, including the famous *Bennettites gibsonianus,* which for a long time was taken as the 'standard' cone type for this group. In addition, there is the enigmatic wood type known as *Aptiana,* which some authors have suggested may belong to an early angiosperm. Many of the species reported from here are unknown elsewhere. Together with the quality of the preservation, this makes Luccombe Chine a site of considerable palaeobotanical significance.

The first record of coniferous wood from the Lower Greensand of the Isle of Wight was by Mantell (1847), although he did not specifically mention this site. Barber (1898) provided a more detailed description of some small conifer stems and pieces of larger ones from the succession, although again the locality information is vague. The earliest reference specifically to Luccombe Chine appears to have been made by Stopes (1912, 1915).

Description

Stratigraphy

On the Isle of Wight, the Lower Greensand Group is about 260 m thick. It is clayey in the lower part (Atherfield Clay Formation, lower Aptian) and sandy above (Ferruginous Sands, Sandrock and Carstone Formations, upper Aptian and lower Albion). The plant fossils found at Luccombe Chine are from the Sandrock Formation and are late Aptian in age. They occur in a layer of pyrito-phosphatic nodules in the upper of two clay bands that form ledges in Knock Cliff. Above the Sandrock here are bright yellow and white sands with laminae of clay and bands of green sand of the Carstone Member.

Palaeobotany

The plant fossils found at Luccombe Chine are all preserved as carbonate petrifactions and show good internal anatomy. The conifer stems that Barber (1898) described were named *Cupressinoxylon vectense.* His pieces came from Shanklin but Stopes found more at Luccombe Chine in 1912. She used all of them in her description of the species (Stopes, 1915), which is extremely common in the neighbourhood of Luccombe Chine and Shanklin. The wood is clearly coniferous, having secondary wood of small, regular tracheids up to just over 25 mm in diameter, with bordered pits. The medullary rays are mostly uniseriate but a few are partly biseriate. Annual rings are well marked although they are composite, with some having three or four irregular amalagamated zones in each. Similar wood, called *Cupressinoxylon luccombense* Stopes, was based on a woody branch that was probably not less than 5 cm in diameter when alive.

Stopes (1915) also described two species of *Podocarpoxylon* from Luccombe Chine: *P. gothanii* and *P. solmsii.* The material on which these are based was found by Solms-Laubach in 1889, Jones in 1898, as well as by Stopes herself in 1912. Capellini and Solms-Laubach (1892) mentioned finding the wood in their account of *Cycadeoidea gibsoniana.* Both species are clearly coniferalean with tracheid and uniseriate rays in their secondary wood. The radial walls of the medullary ray cells have single, very large, simple pits (occasionally with borders) or sometimes two or even more pits.

Stopes found another type of conifer wood in 1912 and gave it the new name *Vectia luccombensis* because she could not include it in any known genus. This was founded on massive, uniform secondary tissue that is entirely composed of

regular, alternating, thick-walled elements (fibres) and thin-walled elements (probably sieve tubes) in tangential bands. It appears to be phloem from a large trunk.

Sequoia giganteoides Stopes was described from a single minute leafy twig that had drifted into a large decaying piece of *V. luccombensis.* The adpressed leaves are very similar to those of the extant *Sequoia gigantea* but smaller (0.5 mm in diameter) and with an axis that is 0.3 mm across.

Stopes (1912) first described three species of stem from the Lower Greensand as being of angiosperm origin. She later (1913, 1915) redescribed them, together with two more species, although only one, *Aptiana radiata* Stopes, came from Luccombe Chine. It was a single portion of stem, partly embedded in the characteristic glauconitic sandstone of the Lower Greensand. The exposed portion was only wood, but the embedded portion still had its phloem and part of the cortex preserved. Overall it is an exceptionally well-preserved specimen. The primary wood, surrounding the central pith, appears to be without bundles. The secondary wood, with its obvious growth rings, consists of bordered-pitted fibre-tracheids and single vessels with associated wood parenchyma. The medullary rays are numerous and either uniseriate or multiseriate. The phloem is composed of thickened elements and thin-walled cells in irregular alternating patches.

There is, however, a problem relating to the provenance of Stopes' woods. Harris (1956b) first expressed doubts about where they came from and Hughes (1961) suggested that confirmatory observations should be made before their provenance can be accepted. Hughes (1976) reiterated this problem and stated that, although gymnosperm wood is abundant at Luccombe Chine, no other specimen of *Aptiana* has yet been found. He stressed the urgent need to find at least one reliably located specimen, noting that Luccombe Chine appears to be the best locality for further searches.

The cycadeoid stems that have been collected from the Isle of Wight are of extreme taxonomic, nomenclatural and historical importance even though they are of doubtful provenance (Watson and Sincock, 1992). The problem is that some specimens have a water-worn appearance suggesting that they were found as beach pebbles rather than extracted from the cliff. Carruthers' original specimen of *Cycadeoidea gibsoniana* was one of these. It has exquisitely preserved flowers with a small domed receptacle (Watson and Sincock, 1992). From this specimen Carruthers (1870a) was able to recognize and illustrate the female flower structure of cycadeoids for the first time. Watson and Sincock (1992) have redescribed the specimen. They showed that, like many other cycadeoid stems, it has diamond-shaped indentations that mark the original positions of leaf petiole bases. The ridges between them consist of petrified scales from the basal portions of the petioles. Flowers, preserved in cavities, are sparse and difficult to detect except in cut surfaces. Carruthers completely overlooked them.

Reconstructions of cycadeoids, as illustrated in (Figure 6.4), are based on petrified trunks belonging to either *Cycadeoidea* Buckland or *Monanthesia* Wieland ex Delevoryas. Both are known as short and tall trunks and are separated on the basis of the distribution of their flowers. *Monanthesia* shows a flower in the axil of almost every leaf while in *Cycadeoidea* they are scattered.

Interpretation

The Lower Greensand flora as a whole is rich in species, with Stopes (1915) listing one alga, two ferns, nine cycadophytes, 27 conifers and five angiosperms. Of these, a significant seven came from Luccombe Chine. Their excellent preservation as petrifactions permits detailed anatomical studies to be undertaken and accurate comparisons made with living taxa.

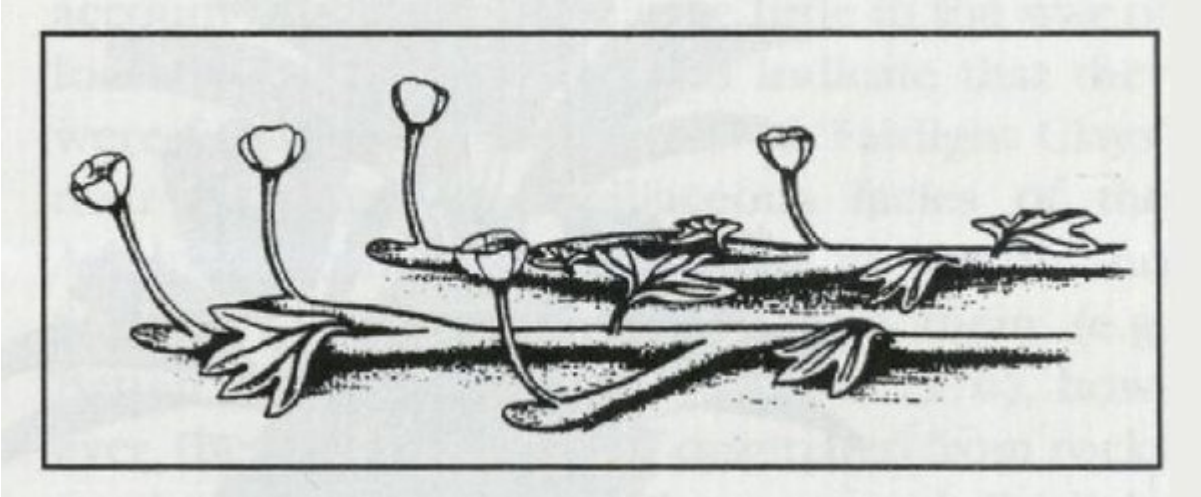
The Lower Greensand flora differs from that of the underlying Wealden in a number of respects, other than in mode of preservation. There are fewer pteridophytes and cycadophytes and more conifers. There are also angiosperms, which have yet to be unequivocally identified in macrofossil material from the Wealden. The Lower Greensand flora is of course largely composed of woods and the specimens were all transported some distance before being covered by marine sediments. There is, therefore, a distinct probability of sorting as wood, seeds and fruits can float a long way before sinking. In contrast, leaves become waterlogged much more quickly and sink or decay far from the more buoyant organs. The Tertiary locality of Sheppey (Chapter 7) is another marine deposit that contains only buoyant seeds, fern petioles

and wood.

Conclusions

Luccombe Chine is an important site for beautifully preserved petrified gymnosperm and angiosperm stems and especially for bennettitalean trunks. At about 110 Ma old, they are the oldest macrofossil remains known in Britain that are unquestionably derived from flowering plants. All deserve further study, and collecting should yield additional specimens that would increase knowledge of this significant flora.

References



(Figure 6.4) Reconstruction of the early possible angiosperm Bevhalstia, described by Hill (1996) from the English Wealden. (Redrawn from an original by Annette Townsend.)