Stonesfield, Oxfordshire

[SJ 392 172], [SJ 387 168], [SJ 379 172], [SJ 387 171]

Introduction

Although the productive strata are not easily accessible, Stonesfield in Oxfordshire is historically one of the most important palaeontological sites in Europe, if not the world, especially for its diverse vertebrate fauna. A series of small quarries and mines have been excavated over the centuries to win the so-called Stonesfield 'Slate' or 'Tilestone' for building purposes and in particular as roofing 'slates'. The 'Slate' occurs within the Taynton Limestone Formation of mid Jurassic age (Mid Bathonian, *c.* 166 Ma). The process of splitting the slabs revealed an extraordinary diversity of fossils that were set aside by the quarry workers for sale to collectors. Fortunately, over the years many of the most interesting fossils found their way into museum collections and these include a diverse fauna of fossil insects. The overall fossil biota comprises an unusual mixture of marine, freshwater and terrestrial organisms. Many of the Stonesfield specimens of fossil fishes, reptiles, mammals, plants and insects and the taxa based upon them are of international importance. In addition to the fossil arthropod importance of this site, the area is also independently selected for the GCR for the Bathonian stratigraphy, Jurassic–Cretaceous Reptilia, Mesozoic Palaeobotany and Mesozoic Mammalia selection categories (Cox and Sumbler, 2002, Benton and Spencer, 1995, Cleal *et al.,* 2001, and Benton *et al.,* 2005).

Description

The tilestone outcrop is restricted to 'an approximately oval area within 1.5 km of Stonesfield village', according to Wyatt (2002, p.218; (Figure 4.37)) and has been mapped out from the distribution of old mine shafts, waste tips and borehole data. Lithologically, the tilestone facies comprises grey and buff coloured, calcareous, fine-grained sandstone and siltstone. With subordinate sandy limestones and shelly partings, it is generally well laminated and thus fissile, which is why it was exploited as a roofing material since Roman times. There are both laminae and scattered oolitic grains and sometimes small-scale, current cross-bedding. The maximum thickness of the most productive 'slate' horizon was stated to be 1.8 m (Fitton, 1828) but, more commonly, was less than half a metre. Details of individual shafts and adits are given by Wyatt (2002, p.219–220) and a measured section from Home Close Shaft, Stonesfield by Sumbler (in Bonham and Wyatt, 1993, see (Figure 4.38)) is as follows:

	Thickness (m)
Hampen Marly Formation	7.75
Taynton Limestone formation	
Limestone — oolitic, bioclastic, sparry, cross-bedded	1.13
Marl — oolitic, bioclastic; pebbles of limestone and sandstone in lower part	0.31
Limestone — oolitic, bioclastic, sparry	0.27
Stonesfield slate	
Sandstone — fine-grained, hard, calcareous, scattered ooliths; soft, cross-laminated and fissile at adit depth of 12.78–13.13 m; continuing below in hard, laminated, fissile sandstone with strings of ooliths; variably oolitic from 13.30 m with oyster shells	1.06
Limestone — coarse-grained oolitic, bioclastic, sparry	0.28

The Taynton Limestone Formation that includes the Stonesfield Slate occurs low down within the Great Oolite sequence and its overall lithology is typical of the succession as a whole, being composed mostly of shallow marine carbonates.

The fauna consists predominantly of marine Shelly invertebrates, especially molluscs with altogether some 80 species, mostly gastropods and bivalves (e.g. *Chlamys, Camptonectes, Gervillella, Placunopsis*), as well as belemnites and rare ammonites (e.g. *Clydoniceras, Micromphalites, Oppelia*) accompanied by a variety of brachiopods (commonly the rhynchonellid *Kallirhynchia*), crustaceans, annelids and corals. In addition, some 23 species of terrestrial plants (such as ferns, cycads, ginkgos and conifers, Cleal *et al.,* 2001), at least 14 species of insects, and three species of mammals (including the first pre-Tertiary mammals to be recognized such as *Amphilestes broderipi* (Owen) have been described along with 40 species of fish (including numerous sharks, rays and bony fishes, see Dineley and Metcalf, 1999) and 14 reptile species (e.g. turtles, crocodilians, ichthyosaurs and the first dinosaur to be recog nized and accepted as such — *Megalosaurus bucklandi* Meyer — see Benton and Spencer, 1995).

The faunal element of greatest significance in the present context is the entomofauna, which includes large beetles and dragonflies some of which are found in the slightly older Charlbury Formation of Gloucestershire (Figure 4.38). Even early palaeoentomologists like Brodie (1845b) noted that the Stonesfield insects are uncommonly large (>15 mm or more in length), that is on a centimetric, rather than millimetric, scale. This large scale of the remains is presumably the result of a taphonomic filter generated by the high-energy, shallow-marine environment.

Most of the remains are beetle (Coleoptera) elytra — but not all — see below. Most of the finds were made in the Victorian heyday of the historic tilestone quarrying. The following beetles have been recorded from Stonesfield:

Adikia punctulata Handlirsch, 1906 [p1.45, fig.52]

Bucklandia striata Handlirsch, 1906 [p1.45, fig.45]

Doggeria bucklandi (Mantell,1844) [p1.45, fig.421

Doggeriopsis stonesfieldiana Handlirsch, 1906 [p1.45, fig.43]

Katapiptus striolatus Handlirsch, 1906 [p1.45, fig.53]

Pallax prevosti Handlirsch, 1906 [p1.45, fig.621

Paradoggeria acuminata Handlirsch, 1906 [p1.45, fig.44]

Non-beetle insects from Stonesfield includes a dragonfly (Odonata) *Isophlebia gigantea* (Buckland, 1838) [Brodie 1845, p1.6, fig.22 (Figure 4.39)]

Furthermore there is the cicada-like (Hemiptera: Homoptera) *Palaeontina oolitica* Butler, 1873 [p1.49, figs 1–7]

P. oolitica was famously misidentified originally as a Jurassic butterfly (Lepidoptera): the error persisted well into the 20th Century. For instance, Handlirsch (1906–8, pl. 49) reconstructed these insects as hirsute Lepidoptera despite the lack of scales or hairs in the fossils. In reality, fossil butterflies are not found until Cenozoic times and *P. oolitica* is the type species of the type genus *Palaeontina* of the extinct family Palaeontinidae (now known as 'butterfly bugs') which consists of cicada-like plant bugs of the Mesozoic Era. The error originated earlier with misidentification of the open venation (through convergence) and the large size of the palaeontinid forewings.

One of the species found at this classic site by Brodie (1845b) was the large beetle *Kibdelia oolitica* (Brodie, 1845b) which has also been found at Eyeford and Sevenhampton in Gloucestershire (Brodie p1.6, fig.15; Handlirsch 1906–8, p1.45, fig.61). From the plants found in the Stonesfield tilestones, Brodie (1845b) concluded that the insects inhabited a well-vegetated coastal or island environment not far away, in a 'gulf' (Cleal and Rees, 2003).

Identification of rare ammonites (Torrens, 1974) such as *Procerites mirabilis* Arkell and the biozonal index *P. progracilis* allows the Stonesfield Slate to be assigned to the early Mid-Bathonian Progracilis Biozone.

Interpretation

The predominance of horizontal lamination in the Stonesfield Slate facies associated with subordinate cross-lamination has been interpreted as indicating deposition under shallow-water, high-energy, 'upper flow regime' conditions (Sellwood and McKerrow, 1974). The quartzose tilestones represent influxes of sand and silt into the otherwise carbonate-dominated sedimentary environment in which the oolitic and bioclastic deposits of the Taynton Limestone Formation accumulated. The provenance of the clastic debris is uncertain, but may have been from the erosion of sandstones on the London Landmass, which lay to the east.

The Stonesfield fossil flora gives some indication of the topography and vegetation of that landmass. Some interpretations suggested that the most-common plant fossils were derived from mangrove-like vegetation (Cleal *et al.,* Thomas, 2001, p. 107), but Cleal and Rees (2003) suggest a seasonal conifer-bennettitalean forest like that of the Purbeckian coastal vegetation, the flora growing along coastal fringes, behind which were low-lying coastal plains covered with cheirolepidiacean forests that were periodically inundated. However, another common element of the flora (*Pelourdea*) might have grown in slightly drier marginal habitats, suggesting that there were some areas of slight elevation.

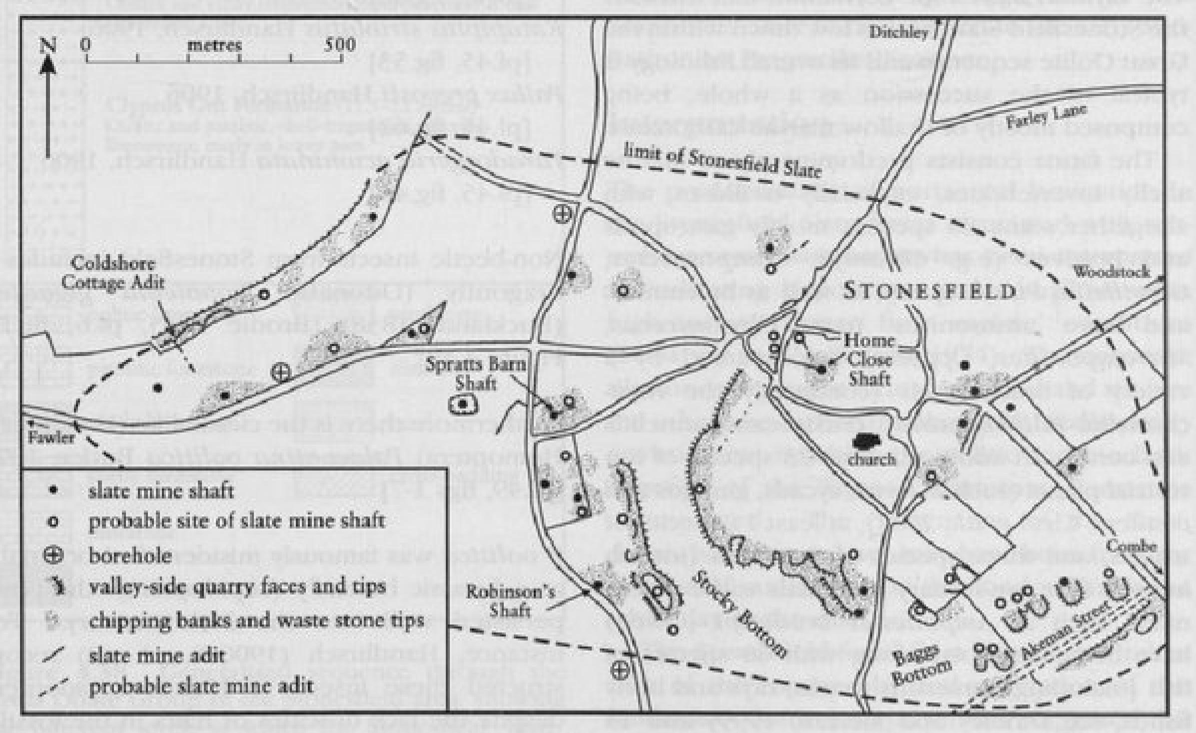
The presence and proximity of this subaerial landmass is supported by the occurrence of terrestrial remains such as dinosaurs, small mammals, land plants and insects. Sellwood and McKerrow (1974) suggested that the diversity of the Stonesfleld biota was enhanced by the re-deposition of concentrations of strandline flotsam under the influence of storm-induced currents. Rapid burial is indicated by the preservation of some otherwise relatively delicate organisms such as dragonflies.

Because of the lack of surface exposures, the biostratigraphical position of the Stonesfield Slate was, until relatively recently, uncertain. However, the drilling of four boreholes in 1991 and re-assessment of old shaft and adit sections revealed that the Stonesfield Slate was originally worked from three separate levels within the Taynton Limestone Formation. Furthermore, all three levels were impersistent and localized, thus it is not possible to allocate fossils from historical collections to any particular bed because the specific horizon from which they were originally collected was not recorded. Also, insects were collected from several localities in the Cotswold region of Oxfordshire and Gloucestershire.

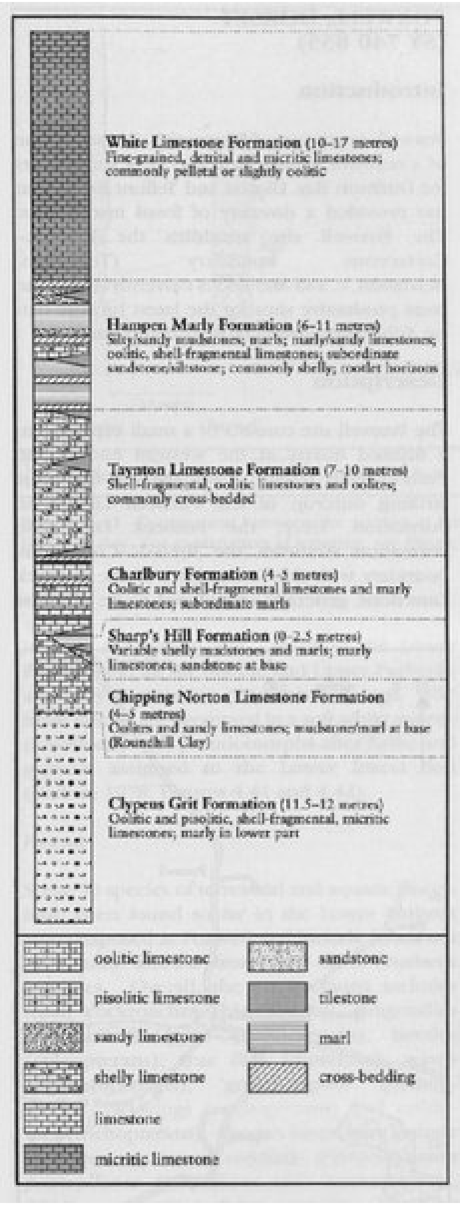
Conclusion

Although largely inaccessible today, the importance of the Middle Jurassic (Bathonian, *c.* 166 Ma) Stonesfleld Slate fossil biota is so great that the site retains considerable conservation value, especially as it retains some potential for future work. Diverse elements of the biota such as the fishes, reptiles, mammals and plants have a recognized international significance. The fauna of beetles (coleopterans), dragonflies (odonatans) and bugs (hemipterans) is of particular interest for the description of British fossil insects.

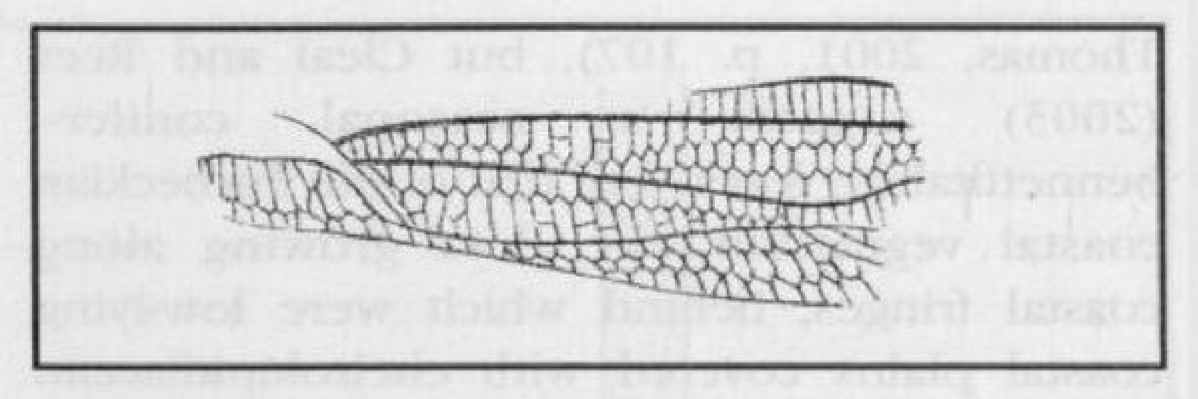
References



(Figure 4.37) Sketch map showing the distribution of the Stonesfield Slate. (After Benton and Spencer, 1995.)



(Figure 4.38) Generalized sequence through the Great Oolite Group of the Stonesfield area, showing the different levels at which the Stonesfield 'Slate' facies is developed. (After Boneham and Wyatt, 1993.)



(Figure 4.39) Wing of dragonfly Isophlebia gigantea x 0.3. (From Brodie, 1845b.)