Stonesfield, Oxfordshire

[SP 387 171]

Highlights

Stonesfield is the most important of the British Bathonian localities in the Cotswolds, and arguably the best Middle Jurassic terrestrial reptile site in the world. It is the source of over 15 species of fossil reptiles, including turtles, crocodilians, pterosaurs, dinosaurs and rare marine forms (ichthyosaurs, plesiosaurs), as well as mammal-like reptiles and mammals.

Introduction

The series of quarries and mines which formerly worked the Stonesfield Slate at Stonesfield (Figure 6.6) are famous for yielding one of the most diverse reptile faunas of Mid Jurassic time known. The remains are all isolated elements, but include those of terrestrial animals such as saurischian and theropod dinosaurs, pterosaurs and a tritylodont mammal-like reptile, as well as aquatic turtles and marine crocodilians, ichthyosaurs and plesiosaurs. Specimens include the type materials of *Megalosaurus bucklandi,* the first dinosaur to be described (Buckland, 1824). Although the quarrying industry at Stonesfield is now extinct, re-excavation could produce many more finds.

The Stonesfield 'slates', or 'tilestones' (Richardson *et al.,* 1946, p. 33) of Stonesfield have been well known for their fossils, which contain an unusual mixture of marine, freshwater and terrestrial forms (Arkell, 1947a, pp. 40–1). In Roman times local country houses were roofed with squared slabs of limestone 'slate'. In the 16th or 17th century it was discovered that when the freshly dug stone was exposed to the frost, it would split into thinner sheets. The quarries continued and expanded production, providing roofing materials for local houses and building material for more important buildings further afield (Arkell, 1947b), and they remained productive until the late 19th century. The stone was reached by vertical shafts, usually about 6 m deep, and horizontal galleries which were driven through the bed. During the 18th and 19th centuries slate-digging was a major industry (Figure 6.6) and employed numerous craftsman. The slate-makers examined each slab and put aside fossils for sale to tourists and dons at Oxford and other universities. The last mine closed in 1911 (Arkell, 1947b; Aston, 1974, p. 35).

Stonesfield has figured prominently in the history of the study of dinosaurs (Swinton, 1970; Delair and Sarjeant, 1975). The first reptile fossil to be described from Stonesfield was a megalosaur tooth figured by Edward Lhuyd (1699, pl. 16, opposite p. 63). Joshua Platt (1758) described three large vertebrae and a left femur as the 'fossile thigh-bone of a large animal', now identified as probably that of *Megalosaurus* or *Cetiosaurus.* The femur was 29 inches (0.81 m) long and was found surrounded by fossil shells of 'sickle oysters' (*Liostrea acuminata*). A partial scapula of *Megalosaurus* from Stonesfield was acquired by the Woodwardian Museum, Cambridge in 1784, but it has never been described (Delair and Sarjeant, 1975). An anonymous article published in the *Gentleman's Magazine* for 1757 (A.B., 1757) records some finds thought to be of significant note, and suggests that the site was well known to the wider public for its large fossil bones well before the 1820s, contrary to what is normally assumed: 'But I think we can boast of as great a variety [of fossils]… at a small village called Stonesfield, near Woodstock in this country'. This records sharks' teeth, fish palates, echinoids, oysters, belemnites, 'nautilites', ferns and 'bones of quadrupedes, ribs, vertebrae &c. some of birds…'. Also mentioned is Joshua Platt's 'thigh bone', as that of 'the *Hippopotamus,* or sea-horse'. The anonymous author goes on to say 'I formerly met with two pieces of bone and some vertebrae of the same kind, and of a proportional bulk, at the same place…. Those I have been speaking of must [by analogy] be the remains of some animal of greater bulk than the largest ox'.

William Buckland (1784–1856) is well known as the describer of *Megalosaurus* from Stonesfield, although it would be truer to say that he was the first person to realize its reptilian nature. He did not record details of when he acquired his specimens, as did Mantell who collected material of *Iguanodon* in 1822 and earlier. Archive evidence suggests that Buckland had good specimens of *Megalosaurus* from Stonesfield around 1818 (Delair and Sarjeant, 1975), and the 'huge lizard' was well known to Cuvier, Parkinson, Conybeare, Mantell and others before its eventual description in 1824

(Buckland, 1824). Further abundant remains of reptiles were collected during the 19th century, but finds ceased with the extinction of the quarrying industry. (Figure 6.7) shows a cleaning exercise when an adit at Stonesfield was re-opened in 1980.

Description

Stratigraphic sections through the type Stonesfield Slates have been given by Fitton (1836, p. 412), Phillips (1871, pp. 148–9), H.B. Woodward (1894, pp. 29–33, 312), Watford (1895, 1896, 1897), Richardson *et al.* (1946, pp. 29–33), McKerrow and Baker (1988, pp. 63, 64) and Bonham and Wyatt (1993). Richardson *et al.* (1946, p. 30) gave the following section from the sides of a shaft at Stonesfield:

	Thickness (ft)
[White Limestone]	
Rubbly limestone	
[Hampen Manly Beds]	
Clay with *Terebratulites*	
Limestone	
Blue clay	
Oolite	
Blue clay	in total 32
[Taynton Stone]	
'Rag', consisting of shelly oolite, with casts of bivalves and univalves	*c.* 25
[Stonesfield Slate Beds]	
'Soft stuff, yellowish sandy clay, with thin courses of fibrous transparent gypsum	0.5
'Upper Head', sand enveloping a course of spheroidal laminated calcareous gritstones which produce the slate. These are called Totlids', from their figure, and receive with the other slaty bed the name of 'Pendle' as characteristic of workable stone. The stone is partially oolitic and shelly, sometimes full of small fragmentary masses	1.5
'Manure' or 'Race', slaty friable rock	1
'Lower Head', sand and grit, including a course of spheroidal concretions of slate, as above	1.5–2
'Bottom stuff, sandy and calcareous grit, with admixture of oolitic grains	1
[Chipping Norton Limestone]	

The Stonesfield Slate (=Stonesfield Member) consists of quartz sands and siltstones with fine laminae (0.1–0.3 m apart) of ooliths. A 20 mm thick conglomerate, containing clasts of limestones from the underlying Chipping Norton Formation and bored pebbles of other oolites, occurs in the middle of the unit (Sellwood and McKerrow, 1974). The Stonesfield Slate is no more than 1.8 m thick at its type locality and it is confined to an elliptical area within 1.5 km around Stonesfield (Aston, 1974).

The fauna of the Stonesfield Slate consists of marine invertebrates (rare ammonites, belemnites, large numbers of bivalves and gastropods [80 species altogether], rarer brachiopods, crustaceans, annelids and corals), land-derived plants (13 species), insects (seven species), about 40 species of fish, including sharks, 'holosteans' and a species of *Ceratodus,* as well as reptiles, and mammals (*Amphilestes, Phascolotherium, Amphitherium*) (Phillips, 1871, pp. 167–237; H.B. Woodward, 1894, pp. 314–17; Richardson *et al.,* 1946, pp. 28–9).

The bone in the Stonesfield Slate is well preserved and rarely abraded, although delicate processes may be broken off. The remains range from small elements (e.g. teeth, scutes, pterosaur limb bones) to complete vertebrae and partial skulls. Skeletons are disarticulated. Thus, there is evidence of short-term transport and sometimes violent breakage, and the bones may be associated with other coarse clasts (pebbles, shells, etc.).

Fauna

Major collections may be seen today in the BMNH, BGS(GSM), CAMSM and OUM. Most older university, city and private fossil collections in Britain have some teeth or bone scraps from Stonesfield, but it is clearly pointless to record all of these. The type specimen numbers are noted and an estimate of the numbers of specimens of each species in major collections is appended:

	Numbers
Testudines	
Protochelys stricklandi (Phillips, 1871) Type specimen: OUM	1
Archosauria: Crocodylia: Thalattosuchia:	
Steneosauridae	
Steneosaurus boutilieri Deslongchamps, 1869	
Steneosaurus brevidens (Phillips, 1871)	1
Teleosaurus ?geoffroyi Deslongchamps, 1867	4
Teleosaurus subulidens Phillips, 1871 Type specimen: OUM J1419	1
Steneosaurus/Teleosaurus sp.	125+
Archosauria: Pterosauria:	
'Rhamphorhynchoidea'	
Rhamphocephalus bucklandi (Meyer, 1832) Type specimens: ?OUM J23043, 23047–8, 28266, 28297, 28311, 2831	250+
Rhamphocephalus depressirostris (Huxley, 1859) Type specimen: BMNH 47991 [?Stonesfield or Sarsden]	2
?Rhamphocephalus sp.	125+
Dinosauria: Saurischia: Theropoda	
Iliosuchus incognitus Huene, 1932 Type specimen: BMNH R83	2
Megalosaurus bucklandi Meyer, 1832 Type specimen: OUM J12142 (=OUM J13505)	110+
Dinosauria: Saurischia: Sauropoda:	
Cetiosauridae	
Cetiosaurus oxoniensis Phillips, 1871	3
Dinosauria: Ornithischia: Omithopoda	
'hypsilophodontid'	1
Sauropterygia: Plesiosauria	
'Cimoliasaurus'/Plesiosaurus sp.	17
Ichthyopterygia: Ichthyosauridae	
Ichthyosaurus ?advena Phillips, 1871 (*nom. dub.*)	2
Synapsida: Therapsida: Cynodontia:	
Tritylodontidae	
Stereognathus ooliticus Charlesworth, 1855 Type specimen: BGS(GSM) 113834	1

Interpretation

The highly localized distribution of the Stonesfield Slate around the village of Stonesfield (Figure 6.6) is best explained by the deposition of clastic sediments during a transgressive event within isolated hollows above an intermittent hardground which occurs at the top of the Chipping Norton Formation (Sellwood and McKerrow, 1974, p. 206). Sellwood and McKerrow (1974, pp. 204–5) note sedimentary structures indicative of deposition of the Stonesfield Slate in upper-flow regime conditions. Storm-produced scours filled with shell-lags occur.

The fossil content points to a shallow-marine environment with a large input of terrestrial material. The bones, plants and insects may have been concentrated and preserved by rapid burial in sands brought offshore by storm-induced rip-currents. The features of bone preservation in a disarticulated state and, in coarse clastic units, point to sorting and rapid deposition, possibly during storm-events.

As in much of the Great Oolite Group of Oxfordshire, the clastic sediments and the land-derived plants and animals reflect the influence of the nearby London landmass, but the ammonites indicate that the Stonesfield Member is one of the few beds in the Bathonian of Oxfordshire to be deposited in proximity to open marine conditions.

The dating and precise stratigraphic position of the Stonesfield Slate has been problematic because of its limited exposure and outcrop, and because of the small number of ammonites. Fitton (1836) placed it below the Taynton Stone (Taynton Limestone Formation) by correlating it with the Cotswold Slate. Hull (1860) and H.B. Woodward (1895) recorded information that suggested that the Slate Beds lay at or near the top of the Taynton Stone. At this time, most authors assumed that the Stonesfield Slate was laterally equivalent to the 'Stonesfield Slate' of Eyford, Gloucestershire (the Cotswold Slate or Eyford Member), and even with units near Bath and in Northamptonshire; it was regarded as a handy marker bed for the base of the Great Oolite. However, as Arkell (1947a, pp. 37–41) pointed out, the Sharps Hill Clays and thin limestones (the Sharps Hill Member of the Sharps Hill Formation; Torrens, *in* Cope *et al.,* 1980b) are present over much of north Oxfordshire while, in the vicinity of Stonesfield, the lithologically similar Stonesfield Slate (the Stonesfield Member of the Sharps Hill Formation) comprises a separate unit.

Arkell (1931; 1933, pp. 294–7) and Richardson *et al.* (1946, pp. 25–33) placed the Stonesfield Slate between the Sharps Hill Clays and the Taynton Stone on the basis of correlations with the Ashford Mill railway cutting section [SP 387 159]. The 'Coral and *Rhynchonella* Bed' there was ascribed to the 'Stonesfield Slate Beds' and the Stonesfield Slate itself, which was absent there, was supposed to occur between this and the Sharps Hill Beds below. Arkell (1947a, pp. 38–41) suggested that the Stonesfield Slate occurred immediately below the Taynton Stone and that its lateral equivalent was the Upper Sharps Hill Beds (Torrens, 1968, p. 231). Subsequently, Sellwood and McKerrow (1974) suggested that the sandy beds of the Stonesfield Member could represent the reworked top of the underlying sandy beds of the Chipping Norton Formation. They would then be expected to rest directly on sandy limestones or calcareous sandstones rather than on clays, and should thus lie below the clays of the Sharps Hill Member in those localities where both members are present. However, Torrens (*in* Cope *et al.,* 1980b, fig. 6a, column B12) was not convinced by these arguments and continued to assume that the Stonesfield Slate was above the Sharps Hill Clays.

McKerrow and Baker (1988) examined the stratigraphy of two newly opened shafts at Stonesfield (as part of the GCR programme) (Hillside, [SP 3918 1730]; Home Close, [SP 3918 1724]) and in an adit to the west of the village, and compared these with the greatly extended workings in Town Quarry, Charlbury [SP 365 189]. They corroborated the view of Sellwood and McKerrow (1974), demonstrating that when the clay-rich Sharps Hill Member and flaggy limestones of the Stonesfield Member occur together at the same locality, the Stonesfield Member underlies the Sharps Hill Member and rests directly on the Chipping Norton Formation (both in the Sharps Hill Formation), whereas at Home Close and Hillside the Stonesfield Member is overlain directly by oolitic limestones (Taynton Limestone Formation). Boneham and Wyatt (1993) suggest that the Stonesfield Slate was formerly worked at three levels within the Taynton Limestone Formation, and that the 'Stonesfield Member' can no longer be regarded as a valid subunit of the Sharp's Hill Formation.

The ammonite fauna of the Stonesfield Member consists of 10 species belonging to the genera *Clydoniceras, Microcephalites, Oppelia (Oxycerites), Paroecotraustes, Turrelites* and *Procerites (P. progracilis, P. mirabilis, P. magnificus*) (Arkell, 1951–8, p. 240). There are problems of identification of some of these, and of comparison with similar specimens elsewhere in Britain and abroad (Torrens, 1969b, pp. 71–3; in Cope *et al.,* 1980b, p. 38). This fauna has been assigned to the *progracilis* Zone (early Mid Bathonian) with the Stonesfield Member at Stonesfield as the stratotype (Torrens, 1974, pp. 586–7).

The chelonian species *Testudo stricklandi* was established by Phillips (1871, p. 182) for isolated scale-like elements found in the Stonesfield Slate (Blake, 1863). Mackie (1863) had also announced the discovery of a turtle coracoid from Stonesfield, and had named it *Chelys (?)blakii.* Lydekker (1889b, pp. 220–2) combined these in his new genus *Protochelys.* The scales are unusual in that they lack bony material, and in that they are supposedly from the crest of the back of a turtle carapace. The coracoid is probably indeed chelonian, but the scales may be remains of invertebrates, though the possibility remains that they might represent shed turtle scutes (certain extant turtles shed their carapace scutes in order to facilitate growth). We have found no recent discussion of the Stonesfield 'chelonians', although Romer (1956, 1966) classes *Protochelys* tentatively as a pleurosternid turtle, a group typical of the Jurassic. The most recent monograph on turtles (M■ynarski, 1976) makes no mention of them, and quotes *Protochelys* Williston (1901) for a Late Cretaceous American animal: clearly a preoccupied name. Turtles are rare in the Mid Jurassic but, until the exact nature of the Stonesfield specimens is reassessed, nothing can be said of their significance.

The long-snouted crocodilians from Stonesfield include four species of *Teleosaurus* and *Steneosaurus.* They had long curved teeth and were clearly fish-eaters in fresh and marine water. These genera are well known from the Bathonian of Britain and France, but the Stonesfield specimens are extremely well preserved and formed the basis of a revision (Phizackerley, 1951). *T. subulidens* Phillips (1871) may be a synonym of *T. cadomensis* Geoffroy St-Hilaire (1825). The type specimens of this species, and of the others from Stonesfield, came from the Fuller's Earth and Great Oolite of Normandy, but they were all destroyed at Caen in 1944. Thus, the Stonesfield specimens take on an added significance. Although *Steneosaurus* and *Teleosaurus are* common in the English Bathonian from localities in Somerset, Avon, Wiltshire, Gloucester, Oxfordshire and Northamptonshire, only Enslow Bridge, Oxfordshire has more than one or two species. Stonesfield represents the best site in Britain for Mid Jurassic crocodiles in terms of abundance and variety.

The pterosaur *Rhamphocephalus* is known from the Stonesfield Slate ((Figure 6.8)A and the Eyford Member (=Cotswold Slate) of the Eyford area, Gloucestershire (Kyneton Thorns Quarry [SP 122 264], ?Sevenhampton [SP 03 21], ?Huntsman's Quarry [SP 125 254]). By far the best and most abundant material comes from Stonesfield, and it may include type specimens of two or three species. The remains show a 120 mm long mandible with long pointed teeth. The restored wing is about 0.75 m long, and individual vertebrae 25 mm long. Details of the bone microstructure were also observed (Huxley 1859d; Phillips, 1871, pp. 219–29). There is a problem over the original locality of the type specimen of *R. depressirostris:* Huxley (1859d) and Wellnhofer (1978, p. 41) give the locality as Sarsden ('Smith's Quarry': [SP 300 226]), whereas the label on BMNH 47991 and Lydekker's Catalogue (1888a, p. 36) give the locality as Stonesfield. *Rhamphocephalus* is important as the only Mid Jurassic pterosaur known, apart from fragmentary remains of a single pterosaur from the Oxford Clay of St Ives, Cambridgeshire, and isolated teeth from many Cotswolds sites. The Pterosauria radiated during the Late Triassic and four main 'rhamphorhynchoid' genera are known from the Early Jurassic (*Dimorphodon* from Lyme Regis, *Parapsicephalus* from Loftus, Yorkshire, *Campylognathoides* from Holzmaden and India, and *Dorygnathus* from Germany). There is a gap in the Mid Jurassic before abundant fine remains of *Rhamphorhynchus, Scaphognathus* and *Anurognathus are* found in the Late Jurassic of Solnhofen, in particular. The crown-group pterosaurs, the Pterodactyloidea, are known from skeletons first from the Late Jurassic of Solnhofen (Bavaria), England and France (*Pterodactylus, Germanodactylus, Ctenochasma*), and by teeth from the Cotswolds Bathonian. It is not clear whether *Rhamphocephalus is* a pterodactyloid or not (Wellnhofer, 1978, p. 41).

Stonesfield is perhaps best known as the source of the original and most extensive material of *Megalosaurus* ((Figure 6.8)B; Buckland, 1824). Remains are incomplete, but most of the skull and skeleton are known. The skull was up to 1 m long, with sharp recurved teeth, each 50–150 mm long. The femur was 1 m long and the hind feet bore large recurved claws. *Megalosaurus* reached total lengths of 3.5–7.0 m, and was clearly a major and fearsome predator (Buckland, 1824; Phillips, 1871, pp. 196–219; Huene, 1906, 1923, 1926; Walker, 1964; Steel, 1970, pp. 33–4). Many more species of *Megalosaurus* have been established and *M. bucklandi* is now largely restricted to the Mid Jurassic specimens from Oxfordshire, and Stonesfield in particular. The preservation of the Stonesfield specimens is good enough to allow detailed studies of the braincase (Huene, 1906). Other species of carnivorous dinosaur from the Late Triassic of Wales, Early, Mid and Late Jurassic and Early Cretaceous of England, France, Austria, Morocco and Arizona have been ascribed to 20 or more species of *Megalosaurus.* Several of these have now been placed in other genera (Huene, 1923, 1926, 1932; Walker, 1964; Waldman, 1974; Molnar, 1990; Molnar *et al.,* 1990), but more work is needed before a true picture of the morphological variation and distribution in time and space of *Megalosaurus (sensu stricto*) can be established.

A related species is *Iliosuchus incognitus* Huene (1932), often placed in *Megalosaurus* (e.g. Romer, 1966, p. 369), based on a small ilium from Stonesfield. Galton (1976b) has argued that it is a distinct genus with a close relative in the Morrison Formation (Late Jurassic) of Utah, which would be evidence for faunal ties between Europe and North America in the Jurassic. However, Molnar *et al.* (1990, p. 202) do not confirm this assignation.

The sauropod *Cetiosaurus* is represented by only a few elements at Stonesfield, and it was either not a major part of the fauna or the elements have not been preserved. It is much better known from the younger Bathonian White Limestone and Forest Marble of other places in Oxfordshire, Gloucestershire, Cambridgeshire and Northamptonshire.

The only ornithischian dinosaur from Stonesfield is a tooth (YPM 7367) identified as that of an ornithopod, and possibly a hypsilophodontid (Galion, 1975, pp. 742, 745, 747; Galion 1980b, pp. 74–5). If it belongs to a hypsilophodontid, it is the oldest known member of that group, of an age comparable with *Yandusaurus* He (1979) from the Xiashaximiao Formation (Bathonian–Callovian) of China (Sues and Norman, 1990).

The remains of plesiosaurs and ichthyosaurs from Stonesfield have been mentioned by Phillips (1871, p. 183) and Lydekker (1889a, p. 245). They consist of teeth, vertebrae and limb bones, but they have never been adequately described. In any case, these marine forms are rare in the British Bathonian, the only other specimens being vertebrae and teeth identified as *Ichthyosaurus* sp.' or *'Plesiosaurus* sp.' from, the White Limestone, Forest Marble and Cornbrash in a few sites in southern and midland England. Stonesfield has produced the best range of specimens of these forms, even if they are not very impressive.

Finally, the tritylodont *Stereognathus* (Figure 6.8)C, represented by a jaw fragment (BGS(GSM) 113834) and one other specimen, was initially interpreted as a mammal (Charlesworth, 1855; Owen, 1857; 1871, pp. 18–21; Phillips, 1871, pp. 236–7; Goodrich, 1894, p. 424; Simpson, 1928, pp. 22–6). It is in fact one of the last surviving tritylodontids (e.g. Romer, 1956, 1966), a group which is known mainly from the Late Triassic and Early Jurassic of China, South Africa, Germany and some of the Mendip fissures (Savage, 1971; Kühne, 1956). Waldman and Savage (1972, pp. 121–2) reported several molars of a new species of *Stereognathus* from the Ostracod Limestones of the Great Estuarine Group of Skye (Late Bathonian). In addition, Ensom (1977) recorded a therapsid tooth, tentatively ascribed to *Stereognathus,* from the Forest Marble (Late Bathonian) of Bridport, Dorset, and Evans and Milner (1994) note further finds from Watton, Swyre and Kirtlington. Although fragmentary, the Stonesfield *Stereognathus* remains are important evidence of one of the last tritylodontids, and hence of one of the last 'mammal-like reptiles'. The only younger taxon is *Bienotheroides wanhsiensis* Young (1982) from the upper Xiashaximiao Formation (Bathonian–Callovian) of China (Benton, 1993).

Comparison with other localities

The fauna of the Stonesfield Slate (Stonesfield Member) is unique. However, comparisons may be made with other Early and Mid Bathonian faunas which contain some of the same species, and in particular with the Cotswold Slate (Eyford Member) of the west of Stow-on-the-Wold (*progracilis* Zone, Mid Bathonian). Localities such as Huntsman's Quarry [SP 125 254], Eyford Quarries ([SP 135 255], etc.) and Kyneton Thorns Quarry [SP 122 264] have yielded *Steneosaurus, Teleosaurus, Megalosaurus, Rhamphocephalus* and other genera. The conditions of deposition and faunal composition of the Cotswold Slate are very like those of the Stonesfield Slate, and the two units were formerly regarded as identical. The rich tetrapod fauna from the earliest Bathonian Hook Norton Member at Hornsleasow Quarry [SP 131 322] (Vaughan, 1989; Metcalf *et al.,* 1992*) is* comparable.

Some quarries in Oxfordshire have also produced similar animals. The quarry at Sarsden, near Chipping Norton [SP 300 226] produced teeth of *Megalosaurus,* a *Cetiosaurus* limb bone and bones of *Rhamphocephalus,* probably from the Taynton Stone (*progracilis* Zone). Padley's Quarry [SP 317 269] at Chipping Norton yielded specimens of *Megalosaurus, Cetiosaurus* and *Teleosaurus* from the Sharps Hill Formation (*progracilis* or *tenuiplicatus* Zones). Further similar faunas are known from the White Limestone and Forest Marble (Mid-Late Bathonian) of Oxfordshire (e.g. Slape Hill, Glympton, Enslow Bridge (Shipton-on-Cherwell; Bletchington Station), Kirtlington, Ardley and Stratton Audley), but these are often dominated by the sauropod *Cetiosaurus* and are younger in age.

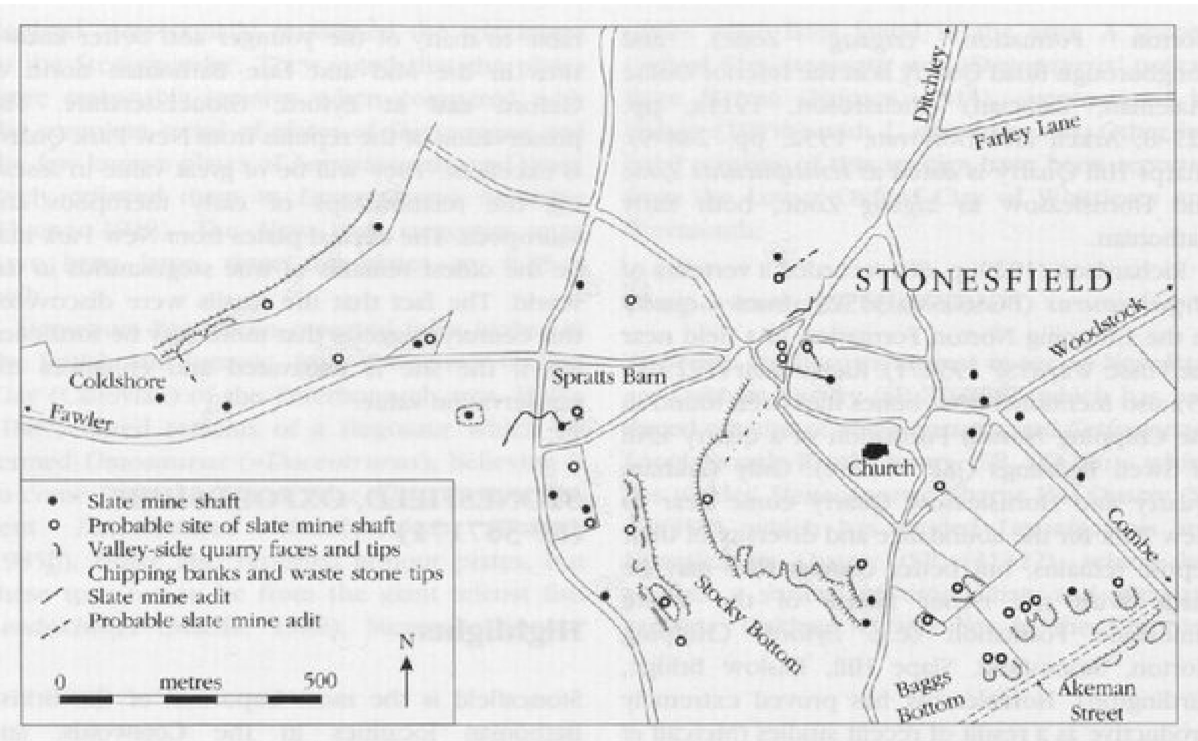
The most clearly comparable sites to Stonesfield outside the British Isles are in the Bathonian of Caen, Calvados and other sites of Normandy ('Great Oolite', 'Fuller's Earth', 'Dogger'), which are well known for several species of crocodiles *Steneosaurus, Teleidosaurus and Teleosaurus,* as well as a dinosaur *Megalosaurus.* Similar crocodilians have been found as isolated remains elsewhere in the Bathonian of France (Steel, 1973). Elsewhere, Mid Jurassic reptiles are extremely rare, with small dinosaur faunas known from the Bathonian of El Mers in the Moyen Atlas of Morocco (*Megalosaurus, Cetiosaurus*) and in the Bathonian of north-western Madagascar (*Bothriospondylus*).

Conclusions

Stonesfield is arguably the most important Mid Jurassic fossil reptile site in the world, and its fauna is diverse and abundant. The four species of *Steneosaurus* and *Teleosaurus* are represented by good material and are probably the best Mid Jurassic crocodilians in the world since most of the Normandy specimens were destroyed in the war. *Rhamphocephalus,* best represented at Stonesfield, is important for studies of pterosaur evolution since it is one of the few members of this group known from the Mid Jurassic. Stonesfield is the most important site for remains of *Megalosaurus* in the world: it yielded the first and type material in the early 19th century, and continued to produce hundreds of specimens while the mines were in operation. The ornithopod tooth, interpreted tentatively as that of a hypsilophodontid, could be the oldest representative of this predominantly Cretaceous group. Apart from these terrestrial forms, Stonesfield has also produced one of the best collections of Mid Jurassic plesiosaur and ichthyosaur remains in the world, although they are very fragmentary. Finally, the tritylodont *Stereognathus* is one of the last surviving members of its group and one of the youngest 'mammal-like reptiles' in the world. Stonesfield is important for the study of fossil reptiles for two reasons: firstly, its fauna is abundant, diverse and well preserved, and secondly, because of the rarity of Mid Jurassic fossil reptiles outside Britain.

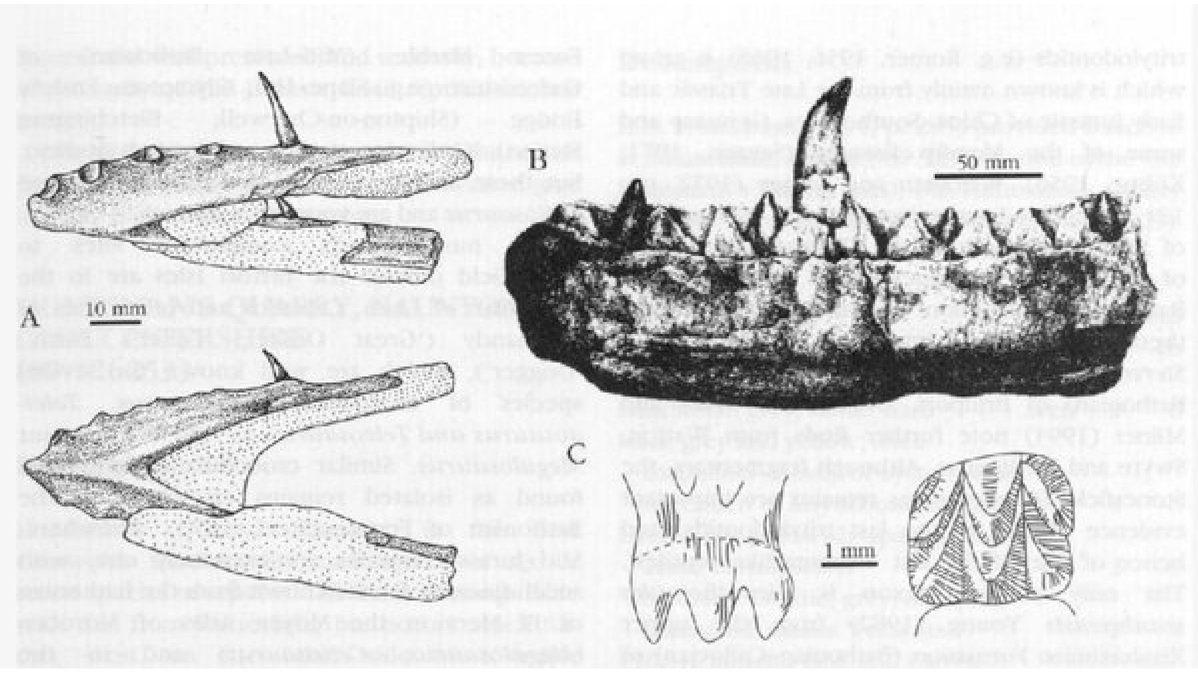
The site's historic international importance and potential for future finds from re-excavation give it a very high conservation value.

References



(Figure 6.6) The Stonesfield Slate mines. Map based on ground surveys and studies of historical records by Aston (1974).

(Figure 6.7) View of the entrance to an adit at Stonesfield, re-opened in 1980 in an operation funded by the Nature Conservancy Council. (Photo: W.A. Wimbledon.)



(Figure 6.8) Bathonian reptiles from Stonesfield. (A) The rhamphorhynchoid pterosaur Rhamphocephalus bucklandi (Meyer, 1832), anterior part of the lower jaw; (B) the type specimen of Megalosaurus bucklandi Meyer, 1832, a partial lower jaw, seen from the inside; (C) Stereognathus ooliticus Charlesworth, 1855, reconstructed right upper molar, showing posterior and crown views. (A) After Wellnhofer (1978); (B) after Buckland (1824); (C) after Simpson, 1928).