# Lyme Regis (Pinhay Bay–Charmouth), Dorset

[SY 32 91]–[SY 37 93]

## Highlights

Lyme Regis is the most famous British Early Jurassic marine reptile site, and one of the best in the world. For over 200 years abundant skeletons of ichthyosaurs and plesiosaurs have been found in the cliffs near the town, and the value of the site is enhanced by additional finds of rare terrestrial animals, such as the pterosaur *Dimorphodon* and the armoured dinosaur *Scelidosaurus.*

## Introduction

The Lias exposures on the coast around Lyme Regis, Dorset (Figure 5.2) and (Figure 5.3)A, B, are world-famous for their fossil reptiles. Specimens have been collected since at least 1790 (Delair, 1969a), and from 1810 to 1840 the younger Mary Anning found many fine ichthyosaurs and plesiosaurs. These were offered for sale and formed the basis of the earliest detailed descriptions of Mesozoic fossil reptiles (Home, 1814, 1816, 1818, 1819a, 1819b; De la Beche, 1820; De la Beche and Conybeare, 1821; Conybeare, 1822, 1824). Since then many hundreds of specimens, including pterosaurs, have been collected and finds are still being made.

Lyme Regis is historically important as the place where the first unarguably complete skeletons of ichthyosaurs and plesiosaurs were found which, because of the collecting and selling efforts of Mary Anning, formed the basis for the study of Mesozoic marine reptiles during most of the 19th century (Taylor and Torrens, 1987).

## Description

There are numerous detailed accounts of the stratigraphy of the Lyme Regis section (e.g. Lang, 1914, 1924, 1932; Lang *et al.,* 1923, 1928; Lang and Spath, 1926; Palmer, 1972). The general succession (Getty, *in* Cope *et al.,* 1980a) is:

| | **Lang's Bed Numbers** | **Thickness (m)** |
|---|---|---|
| —— unconformity —— | | |
| Green Ammonite Beds | 122–130 | 32 |
| Belemnite Stone | 121 | 0.15 |
| Belemnite Marls | 106–120 | 23 |
| *Armatus* Limestone | 1050.4 | |
| Black Ven Marls | 76–104 | 43 |
| Shales with Beef Beds | 54–75 | 23 |
| Blue Lias | 25–53 | 27 |
| *Ostrea* Beds | 4 | 2.5 |
| (=*pre-planorbis* Beds) | | |

The Blue Lias is a sequence of laterally extensive, alternating thin-bedded (and nodular) limestones and shales exposed in cliffs and on the foreshore west of the Cobb, and in Church Cliffs, just east of Lyme Regis (Figure 5.4). Large ammonites and bivalves are abundant in certain limestone beds. The Shales with Beef Beds between Lyme Regis and Charmouth consist of thin papery shales, marls and limestone nodule beds with much fibrous calcite ('beef), pyrite and selenite. Fossils include ammonites, poorly preserved bivalves, belemnites and fishes. The Black Ven Marls, in the cliff and foreshore west and east of Channouth, consist of blue-black mudstones and paper shales with occasional limestones. Many species of ammonites, bivalves, brachiopods, foraminifers and insects occur. Deposition of all units was marine and, although not marginal, was probably close to shore because of the presence of insect, plant and dinosaur remains.

Reptiles have been collected from the *bucklandi* Zone (McGowan, 1989a, p. 424), the Saurian Shales at the top of the Blue Lias (Lang's Bed 52: *scipionianum* Subzone, *semicostatum* Zone, Early Sinemurian), from the Shales withBeef Beds (*semicostatum–turneri* Zones, Early Sinemurian) (Macfadyen, 1970, p. 97), Bed 85 of the Black Ven Marls (McGowan, 1993), and rarely from the *Obtusum* Shale' of the Black Ven Marls (*obtusum* Zone; Late Sinemurian) (Delair, 1960, p. 75; Martill, 1991) and the lower Belemnite Marls (Ensom, 1987a, 1989a). A partial ichthyosaur in the Philpot Museum, Lyme Regis, from Charton Bay apparently came from the *pre-planorbis* Beds, well below the usual reptile-bearing beds (Taylor, 1986, p. 312).

Specific localities include the eastern end of Pinhay Bay (Seven Rock Point) where the Saurian Shales crop out twice ([SY 3262 9277] and [SY 3277 9285]: Lang, 1924; Pollard, 1968; McGowan, 1989a, p. 424), Devonshire Point ([SY 332 913]: Delair, 1966, p. 62), Broad Ledge, Church Cliffs (which used to be quarried; [SY 346 921]; McGowan, 1974b, p. 20), Black Ven Rocks ([SY 358 930]; Delair 1960, p. 75; [SY 360 931]; Ensom, 1989a), Stonebarrow ([SY 370 929]; McGowan, 1993), Seaton ([SY 371 917]; Ensom, 1987a), Stonebarrow Beach ([SY 372 928]: Delair, 1960, p. 75), and further west [SY 376 927]. Recent collecting has focused mainly on the Charmouth end of the section, and the Charmouth ichthyosaur (BRSMG) apparently came from the same horizon, as did Owen's original *Scelidosaurus* specimen, as well as the more recent discoveries of the latter taxon (M.A. Taylor, pers. comm., 1993).

The reptile remains generally occur in the darker shale interbeds, and they may be associated with ammonites and bivalves. The skeletons, usually extremely well articulated, stand out clearly in the soft dark shale, but are rapidly broken up by wave action. Some skeletons have been obtained from impure limestone beds (Sollas, 1881). Fossilized skin of the dinosaur *Scelidosaurus* has been preserved, showing scales and internal structure, in the Black Ven Marls (Martill, 1988), and the marine reptiles may show stomach contents within the rib cage region (e.g. Pollard, 1968).

### Fauna

Delair (1958–60) reviewed the fossil reptiles of Dorset and gave an extended list of 21 species and three forms ascribed only to genera from the Lower Lias. However, this list should be much reduced to give a truer impression of the diversity of the reptiles. Ichthyosaur taxonomy is based on McGowan (1974a, 1974b), who reduced about 50 species to seven. Delair (1986) lists a number of additional ichthyosaur specimens. The plesiosaurs have not been revised recently, but the list given here is also reduced from 40–50 species. The estimates of numbers of specimens are based on collections in the BMNH, BGS(GSM) and OUM. They are intended to give an impression of the relative abundance of each species.

| | |
|---|---|
| **Sauropterygia: Plesiosauria** | |
| *Plesiosaurus conybeari* Sollas, 1881 Type: BRSMG Cb 24795 | |
| *Plesiosaurus dolichodeirus* Conybeare, 1824 Type: BMNH 22656 | 20 |
| *Plesiosaurus eleutheraxon* Seeley, 1865 Types: BMNH 39851, R227 | 3 |
| *Plesiosaurus (?)hawkinsi* Owen, 1840 | 1 |
| *Plesiosaurus macrocephalus* Buckland, 1837 Type: BMNH R1336 | 10 |
| *Plesiosaurus rostratus* Owen, 1865 Type: BMNH 38525 | 8 |
| *Eurycleidus arcuatus* (Owen, 1840) | 3 |
| *Plesiosaurus* sp. | *c.* 100 |
| **Ichthyopterygia: Ichthyosauridae** | |
| *Ichthyosaurus breviceps* Owen, 1881 Type: BMNH 43006 | 7 |
| *Ichthyosaurus communis* Conybeare, 1822 Neotype: BMNH R1162 | 45 |
| *Ichthyosaurus conybeari* Lydekker, 1888 Type: BMNH 38523 | 2 |
| *Leptopterygius tenuirostris* (Conybeare, 1822) | 9 |
| *Leptopterygius solei* McGowan, 1993 Holotype: MRSMG Ce 9856 | 1 |

| | |
|---|---|
| *Temnodontosaurus eurycephalus* McGowan, 1974 Type: BMNH R1157 | 1 |
| *Temnodontosaurus platyodon* (Conybeare, 1822) Type: BMNH 2003 | 10 |
| *Temnodontosaurus risor* McGowan, 1974 Type: BMNH 43971 | 3 |
| *Ichthyosaurus* sp. | *c.* 300 |
| **Archosauria: Pterosauria: 'Rhamphorhynchoidea'** | |
| *Dimorphodon macronyx* Owen, 1859 Type: BMNH R1034 | 50 |
| 'rhamphorhynchoid' | 1 |
| **Archosauria: Dinosauria: Saurischia: Theropoda** | |
| ?megalosaurid | 2 |
| **Archosauria: Dinosauria: Ornithischia:** | |
| Thyreophora | |
| *Scelidosaurus harrisoni* Owen, 1863 Type: BMNH R1111 | 3 |

## Interpretation

About 100 'new species' were described from Lyme Regis in the 19th century, when every specimen was given a name. According to our present taxonomic list, Lyme Regis has yielded type specimens of 14 species, and nine of these species only occur at Lyme Regis (*Plesiosaurus conybeari, P. rostratus; Ichthyosaurus breviceps; Leptopterygius solei; Temnodontosaurus eurycephalus, T. platyodon, T risor; Scelidosaurus harrisoni* and *Dimorphodon macronyx*).

The plesiosaurs from the Lower Lias of England are the earliest well-preserved specimens known (Figure 5.5)B. Specimens of comparable age consist of a few poorly preserved remains from the Schwarzjura alpha and beta of Germany. In all, only about 10 species of Lower Lias plesiosaurs are known, and the Lyme Regis material is the most abundant and varied in the world. The species of plesiosaurs are identified on characters of the pelvis and limbs, and on the relative length of the neck and size of the head. The Lyme Regis animals show a range of neck lengths from rather short (*P. rostratus*) to rather long (*P. conybeari*) and these foreshadow the later pliosaurs and elasmosaurids, respectively. The animals vary from about 2 to 6 m in total length, and the relative size of the skull and shape of the jaw indicates diets of cephalopods, fishes and marine reptiles.

The ichthyosaurs likewise are the earliest good specimens and the most abundant and well preserved from the Lias (Figure 5.5)A. Material from Lyme Regis has formed the basis of recent revisions of ichthyosaur relationships and evolution (McGowan, 1973a, 1973b, 1974a, 1974b, 1989a, 1989b). Ichthyosaurs have been classified on characters of the skull and forefin, and on this basis at least eight of the Lyme Regis taxa are presently regarded as valid. The Lyme Regis species vary in length from 0.8 m to 9 m and they clearly fed on a wide range of sizes of fishes and invertebrates, as indicated by studies of coprolites (Buckland, 1829a) and stomach contents (Pollard, 1968). Several species of *Ichthyosaurus* were common enough for studies of growth series to be carried out in *I. communis* and *I. breviceps* (McGowan, 1973b).

*I. communis* is the most abundant species of ichthyosaur found at Lyme Regis, accounting for about half of the determinate skeletons. It was a moderate-sized form, reaching a maximum total length (measured from the tip of the snout to the tip of the tail) of about 2.5 m (McGowan, 1974b). The ichthyosaur *I. breviceps is* characterized by having a short snout, whereas *Leptopterygius tenuirostris* and *L. conybeari* have longer and more slender snouts. Although *L. tenuirostris* is much less common in terms of complete skele tons, it is abundantly represented by isolated remains of humeri, partial fins and rostral segments. This form is somewhat longer than *L. communis,* reaching lengths in excess of 2.5 m, while *L solei* was over 7 m long (McGowan, 1993). The larger species of *Temnodontosaurus* are rarer. *T. eurycephalus* has a short snout and massive skull and it may have fed on other ichthyosaurs. *T. platyodon* is the second largest ichthyosaur of all time (length up to 9 m), and it occurs only at Lyme Regis. The species *T. risor* has a curved jaw-line (hence the name), but may represent immature *T. platyodon* (C. McGowan, pers. comet., 1993).

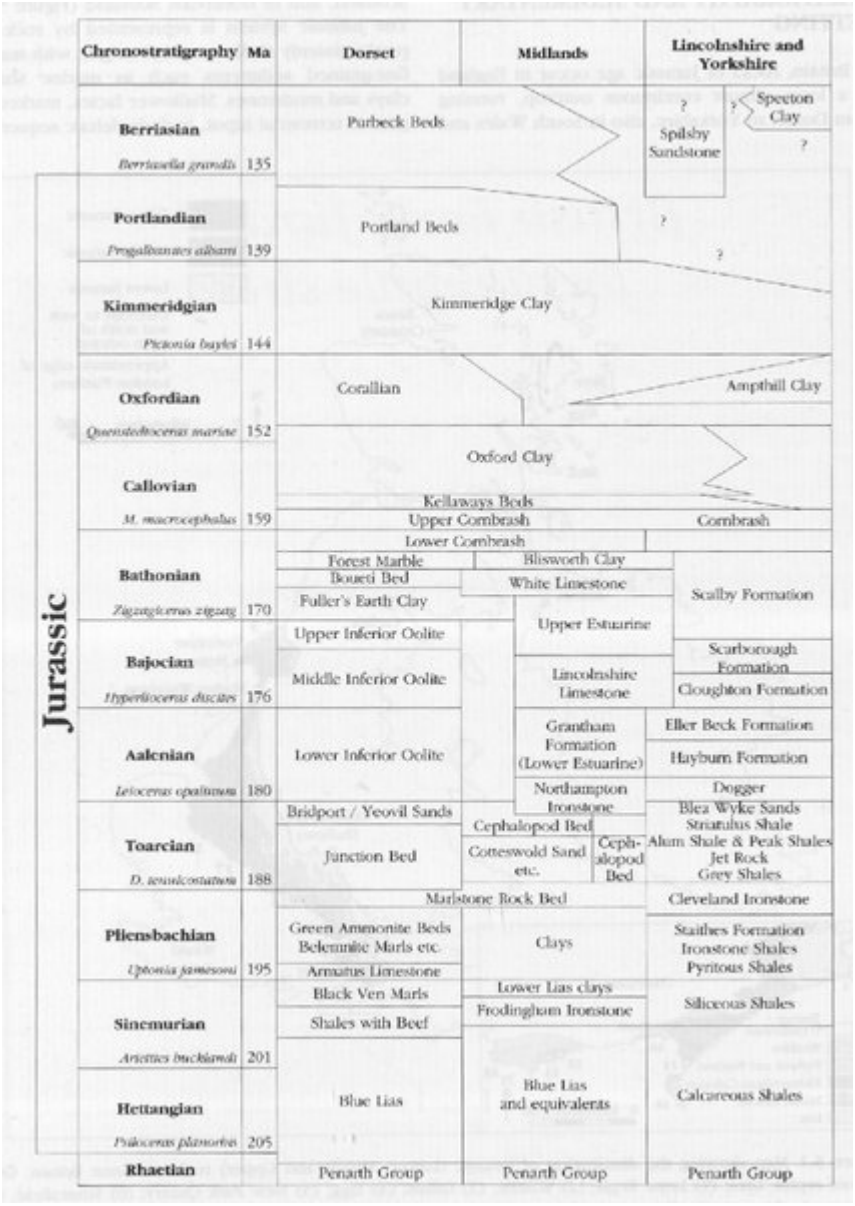
*Dimorphodon* is one of the oldest known pterosaurs, and it is represented by much skull and skeletal material (Figure 5.5)C. Its anatomy is well known (Buckland, 1829b; Owen, 1870, 1874a; Wellnhofer, 1978, p. 33; Padian, 1983; Unwin, 1988b). The skull is relatively large and high-vaulted, rather than long and pointed as in later pterosaurs. The limbs and girdles are strongly built. All of these features are primitive and *Dimorphodon* provides unique information on early pterosaur evolution. It appears to be a relative of the Late Triassic *Peteinosaurus* from Italy (Unwin, 1991).

The dinosaur *Scelidosaurus* ((Figure 5.5)D is represented by one skull and skeleton, a juvenile collected recently (BRSMG) and other isolated remains (BMNH, DORCM, Philpot Museum, Lyme Regis; Ensom, 1987a, 1989a). It is the oldest known armoured ornithischian dinosaur. Its taxonomic position is uncertain, and it has been variously ascribed to the Stegosauria, Ankylosauria and the Ornithopoda (Owen, 1861a, 1863b; Newman, 1968; Rixon, 1968; Charig, 1979; Galton, 1975; Thulborn, 1977; Norman, 1985). Recent cladistic analyses define *Scelidosaurus* as the sister group of the Ankylosauria and Stegosauria, and these taxa together comprise the Thyreophora (Norman, 1984; Sereno, 1986). Coombs *et al.* (1990) identify a motley assemblage of basal thyreophorans, including *Scelidosaurus* and *Scutellosaurus* from the Hettangian of North America, as well as other poorly represented taxa. The type skeleton is fairly complete and shows a 4 m long animal with a small skull, strong hind limbs and dermal armour. The recently found juvenile specimen preserves the forelimbs and most elements of the skull and lower jaws, including some skin (Martill, 1988), thus complementing the previously known remains, and permitting an almost complete reconstruction of the skeleton (Norman, 1985). *Scelidosaurus* is currently of great interest because of its controversial taxonomic position close to the origin of the ornithischian dinosaurs, and a redescription is underway (Charig and Norman, in prep.). Other bones once ascribed to *Scelidosaurus* include limb bones of a ?megalosaurid.

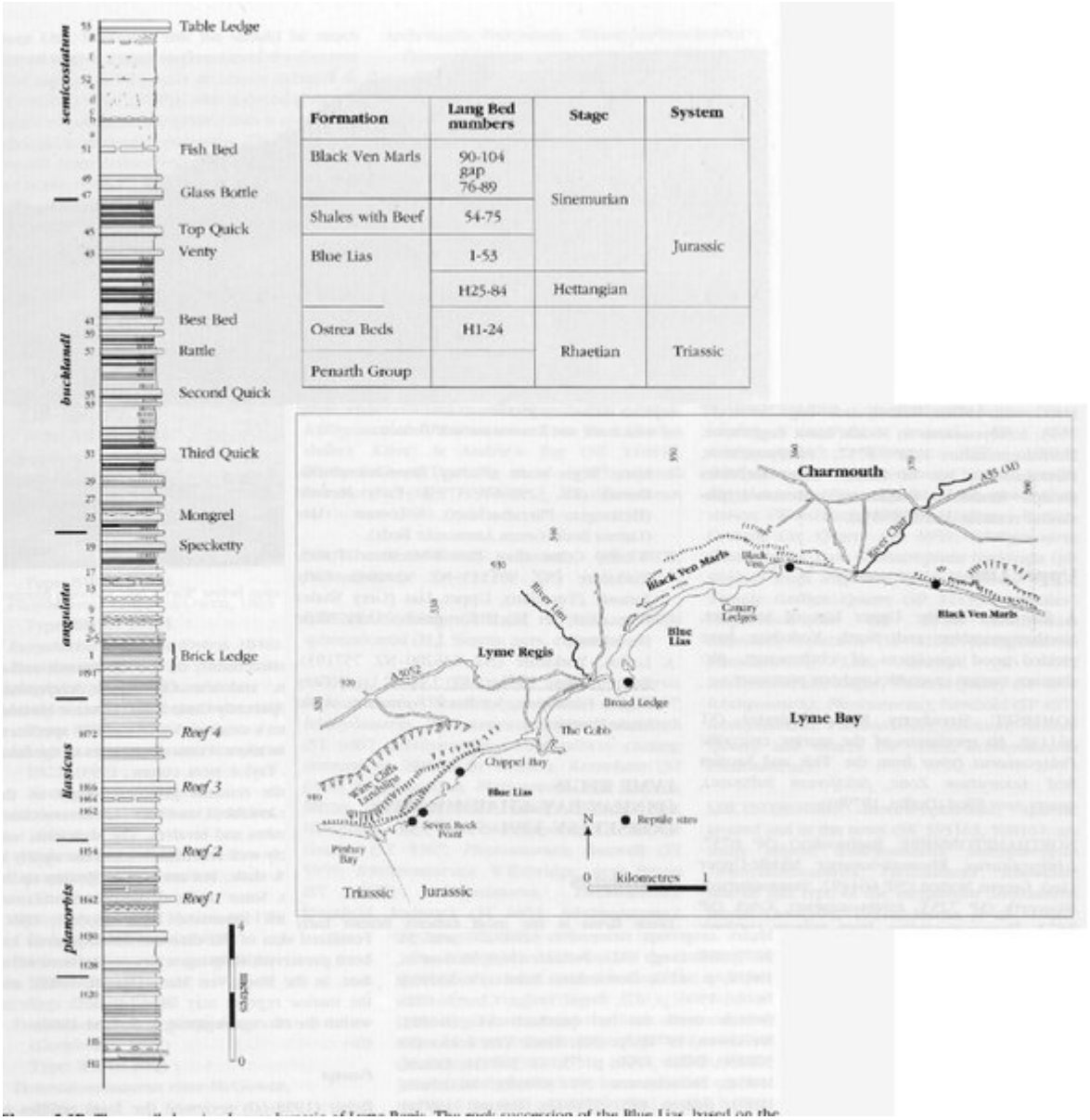
## Conclusions

For studies of fossil reptiles, the Lyme Regis coast section is one of the most important sites in Britain. It has yielded many type specimens, the remains are extremely well preserved, it still yields skeletons, and there is no comparable site of the same, earliest Jurassic, age outside Britain. The faunas of ichthyosaurs and plesiosaurs are the most diverse and abundant from the Early Jurassic of the world. The dinosaur *Scelidosaurus* and the pterosaur *Dimorphodon are* unique animals of great interest in studies on the early evolution of their respective groups. Historically, Lyme Regis is unique, its potential for future finds is excellent and so its conservation value is extremely high, even on an international level.

**References**

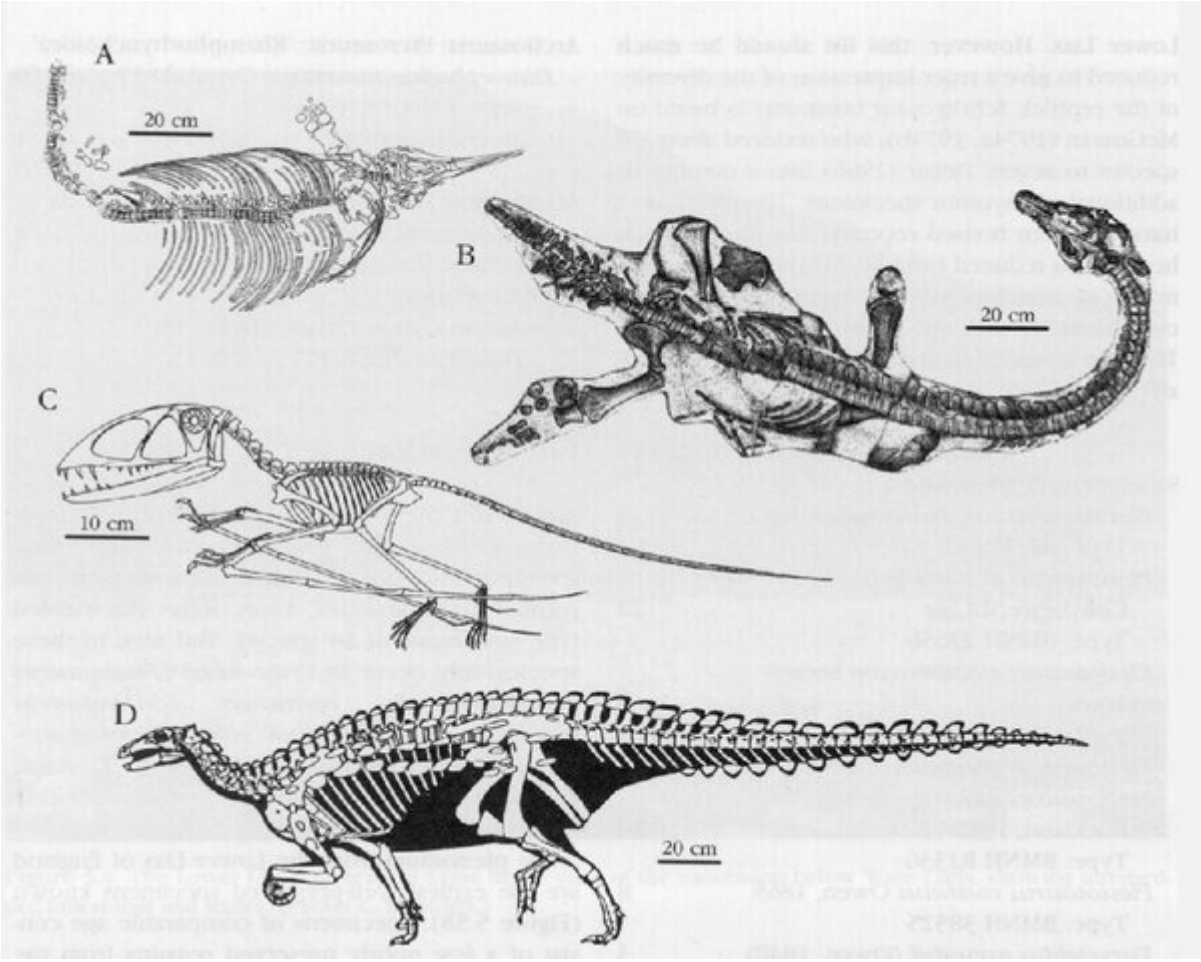



*(Figure 5.2) Summary of Jurassic stratigraphy, showing global standards and some major British formations (based on Harland et al., 1990).*




*(Figure 5.3) The reptile-bearing Lower Jurassic of Lyme Regis. (A) Map of the coastal section from Pinhay Bay to Charmouth, showing the major units, and indicating areas that have yielded fossil reptiles in the past. (B) The reptile-bearing Lower Jurassic of Lyme Regis. The rock succession of the Blue Lias, based on the work of W.D. Lang. From House (1990).*

*(Figure 5.4) The Lower Lias sediments at Lyme Regis: view of the succession below Ware Cliffs, showing interbedded limestones and shales. (Photo: G.W. Storrs.)*




*(Figure 5.5) Typical reptiles from the Lyme Regis section. Skeletons of (A) Ichthyosaurus; (B) Plesiosaurus; (C) Dimorphodon; (D) Scelidosaurus. (A) and (B) from various sources; (C) from Padian (1984); (D) from Coombs et al. (1990).*