

Preface

Mankind has always been fascinated by fossils, by their beauty and their mystery, their charm and their strangeness, their mute testimony to lives and worlds lost unimaginably long ago. In prehistoric times, our forebears not only collected fossils, but evidently treated them as valued artefacts, as indicated, for example, by the discovery of an ammonite at an Upper Palaeolithic burial site in Aveline's Hole in Burrington in the West Country (Rahtz, 1993), and numerous different types of fossil at Cro Magnon sites in the Vézère valley in the Périgord region of France, truly the birthplace of European civilisation (many of which are now displayed in the magnificent Museum of Prehistory in Les Eyzies). The habit persisted both in so-called primitive and so-called advanced societies through historical times (Mayor, 2000).

Palaeontology, that is, the scientific study of fossils, may be said to have originated at least as long ago as the sixteenth century (Thackray, in Briggs and Crowther, 1990), and, obviously, continues to be practised to the present day. The earliest written observations on fossils were made by the German Bauer, or Agricola, in his book *De natura fossilium*, and the earliest illustrations by the Swiss Gesner in his book *De rerum fossilium lapidum et gemmarum*, both of which date from the sixteenth century. The usage by these and other early observers of the term 'fossil', from the Latin *fodere*, meaning 'to dig', pertained to literally anything dug up from the ground or mined, including what we would now classify as minerals, crystals and gemstones. The earliest interpretations as to the nature of what we would now accept as fossils were made by the Danish anatomist Stensen, or Steno, working in the Medici court in Florence, in his publications dating from the latter part of the seventeenth century (Cutler, 2003). Steno applied Descartes' 'method of doubt' and his own deductive logic to demonstrate that the so-called *glossopetrae* or 'tongue stones' much valued in medieval Europe for their supposed medicinal properties were in fact not the tongues of snakes turned to stone by St Paul, as

was the superstition, but the fossilised equivalents of the shark's teeth he was familiar with from his dissection work. Elsewhere in his writings, Steno established three important principles of stratigraphy, namely the 'principle of superposition', the 'principle of original horizontality' and the 'principle of lateral continuity', such that he is regarded by many as the true founder of that science. Incidentally, in later life, he renounced science for religion, and was made a saint by Pope John Paul II!

There may be said to have been three, partially overlapping, areas or phases of subsequent palaeontological study: the descriptive; the synoptic; and the interpretive (Bowler, in Briggs and Crowther, 1990; Hoffman, in Briggs and Crowther, 1990; Thackray, in Briggs and Crowther, 1990; Valentine, in Briggs and Crowther, 1990; Jones, 1996). The emphasis through the three phases has shifted from the documentation of fossils to the analysis and interpretation of their relationship to evolving earth and life history and processes and environments, and their application to the elucidation thereof; from data acquisition and processing to interpretation and integration; from pure to applied. The descriptive phase began with the first descriptions of fossil species conforming to modern standards, made following the introduction of the binomial system for the naming of species by Linné, or Linnaeus, in the late eighteenth century. The synoptic phase has continued into the twenty-first century, with the establishment of higher-level taxonomic classification systems based on morphology and phylogeny, made following the publication of *On the Origin of Species by Means of Natural Selection* by Darwin (1859) in the late nineteenth century, and the advances in cladistics and molecular biology in the twentieth. The interpretive phase, ultimately resulting in the development of, and advances in, the applied sub-disciplines of palaeobiology and biostratigraphy, began with the establishment of the ordered succession of fossils in Great Britain, and the 'law of superposition' and the 'law of strata identified by organised fossils' by William ('Strata') Smith

in the late eighteenth and early nineteenth centuries (Torrens, 2003); and by the publication also by Smith of the first geological map of Great Britain, 'the map that changed the world' (Winchester, 2001). The first application of biostratigraphy in the oil industry was by the Pole Josef Grzybowski in the late nineteenth and early twentieth centuries (Czarniecki, in Kaminiski *et al.*, 1993). At a time when (micro)palaeontology was essentially in a stage of synthesis, it was he who first used the discipline in an analytical fashion to solve geological problems encountered in the oilfields of the eastern Carpathians (those around the village of Potok being the oldest still in production anywhere in the world). His contribution to biostratigraphy and also to palaeobiology has long been recognised and justly acclaimed in his own country, but is sadly seldom acknowledged in the west.

In the future, applied (micro)palaeontology will continue to play a vital role in exploiting the world's discovered petroleum and other mineral resources, and in exploring for undiscovered reserves. In view of the growing concern about the environment,

applications in environmental science, and outwith the exploitative industries, are also likely to come to the fore.

A significant number of textbooks have been written about palaeontology, most focusing on pure rather than applied aspects.

This book covers all aspects of palaeontology, although its principal focus is on the applied. It attempts to adopt a holistic, integrated approach, highlighting the key role of palaeontology in earth and life science. It treats palaeontology not as an end in itself, but as a means to an end – of understanding earth and life history and processes, and global change. Its theme may be said to be that of 'fossils as recorders and indicators of global change'.

The following quotation from Erwin Schrödinger's book *What Is Life?* serves as a disclaimer:

A scientist is . . . usually expected not to write on any topic of which he is not a master. This is regarded as a matter of *noblesse oblige*. For the present purpose I beg to renounce the *noblesse*, if any, and to be freed of the ensuing obligation . . .