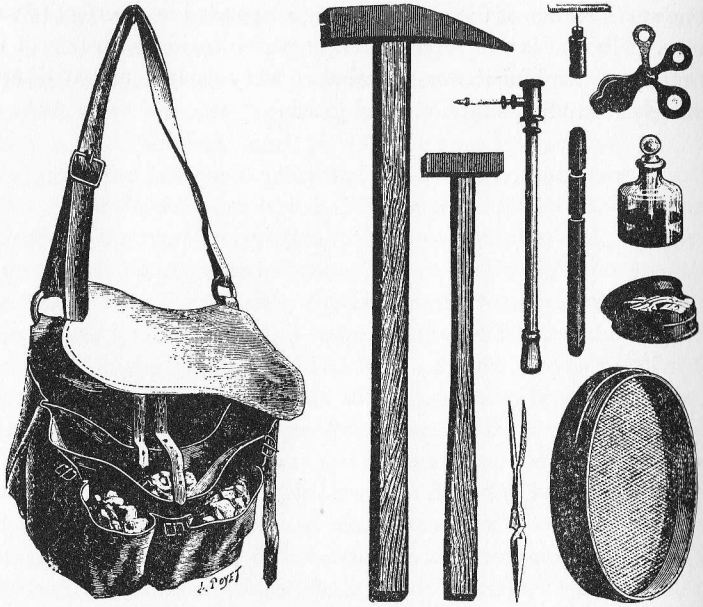

WONDERS OF THE PAST

The Natural History of Selborne must also be viewed within the wider context of its time. If there were few as yet willing or able to look at nature with the extraordinary maturity of Gilbert White, there were many gradually awakening to the attractions of natural scenery – if not always to the details which largely concern the naturalist – and learning to respond with steadily increasing assurance. The playful rusticity of the 1730s was turning into something much deeper and at the same time more ecstatically pleasurable and more disturbing. These emotions were finding their expression in the arts and, in keeping with the fondness for system of that age, giving rise to new and complex formulas of taste. Wealthy noblemen, returning from the Grand Tour with their standard quota of Italian masters, began to discover a preference for one or two artists in particular, Claude and Poussin and Salvator Rosa, who had chosen to paint scenes of nature: landscapes of the Roman Campagna, in which for once human figures, if present at all, were subordinate. From this the notion took hold that natural scenery too, if looked at according to certain simple rules, if arranged and composed in the mind's eye just as in a painting, could be relied on to induce a mood of gentle, pleasing melancholy. Nature, by

this new criterion, was most admirable when most amenable to imitation by art, when most 'picturesque' – a term already used for several years by the time William Gilpin's essay *Upon Prints* in 1768 finally brought the principles of landscape analysis into general notice. Gardens, traditional testing-grounds for such ideas and already under pressure from the mounting tide of informality, now succumbed wholesale and fell prey one by one to 'Capability' Brown and the professional improvers. Trees were carefully grouped for effect, vast rockeries constructed, lakes filled in, anything that failed to conform with the painterly canons ruthlessly altered or eliminated. And tours, the preserve of earnest fact-finders, like Pennant, since before 1740, now became tours in search of 'views': little fragments of rural beauty, contemplated from behind, maybe, through a 'Claude-glass' or painted down in words after the manner of Bernardin de Saint-Pierre's *Études*.

This discovery of the Picturesque, we can now see, was the essential preliminary to that far wider, and subsequently far more profound, reformation in taste that we term the Romantic Movement. It represents the quiet exordium, the gentle *avant-propos*, even as the wilder outpourings of, say, the 1830s – to which some would restrict the term 'Romantic' – represent merely the over-inflated peroration. In so far as it reflects a very gradual restructuring of the mind, bringing about an entirely altered attitude to nature, the whole period forms a single continuum. In these early years the imagination was still being unharnessed, Reason still being renounced. These are the years of the cult of shallow Sentiment, of a lapsing into vagueness so enchantingly personified by Jean-Jacques Rousseau himself, the master of these ceremonies. Rousseau's extreme short-sight was such that at the best of times he saw the landscape only as a blur, while his wife, in similar fashion, never knew which day of the week it was and never even learned to tell the time.

By reason of its very character, involving a change in perception of the world all around, an interest in nature was a prime ingredient in the Romantic outlook. Never before or since has natural history been so much to the forefront in general aesthetic advance. (And never before or since, it might be added, has the average naturalist been someone of such all-round cultivated distinction.) It may well be that the quickening of interest in the subject that coincided with the acceptance of the Linnaean System in this country helped to bring on the new Romantic movement faster than might otherwise have happened. Certainly, it is noticeable how many of those who played a

key role in propagating the new tastes and philosophy, particularly in the formative early stages, were also practising naturalists. Rousseau's lasting fondness for field botany is comparatively well-known, and it was from the precise study of natural forms that Goethe derived that notion of a certain ordered arrangement running through all living things that so profoundly influenced the thought of his contemporaries. Thomas Gray, another threshold Romantic, whose famous *Elegy* was published in 1751, had been accustomed since boyhood to hunting butterflies and plants. These were only the first of many for whom the study of nature as a science and the study of nature as an aesthetic exercise were to seem inseparable and remain subtly interfused.

The results of this for natural history were not altogether happy. In a few, rare cases the power of observation, and even more the later recording, remained as unclouded and undistorted as it did for Gilbert White. Far more often the eye misted over, the pen trembled, Sense gave out as Sensibility came in. The accepted approach to nature had become no longer to set down what one saw plainly and accurately; the aim now was to record one's reactions – and the livelier these reactions appeared, the more beneficial, the more exalting, the more 'tasteful' the contact with nature was assumed to have been.

By about the time of the French Revolution the Romantic Movement had worn its way down to a deeper, more elemental level. Rousseau, in his admiration of scenery, had looked enthusiastically at mountain-sides but had rarely, if ever, extended his gaze above the tree-line. In this new phase the ultimate, avoided part of nature was now to be examined. The cultivated mind had come to terms with the tamer enchantments of the countryside: it now had to confront the portion that still remained – that part 'below the threshold', which went by the name of the Sublime. With this, the dimensions changed. The primitive core of the earth had emerged into vision: the troubling Id of nature, with its wild, uncertain tempers and in all its boundlessness of space and time. With the Sublime, Romanticism finally struck rock: stark, rugged peaks and the bare floor beneath the valley-bottoms, the age-old realm filled with dark mystery, desolate, unexplored, and 'horrid'. And with this, natural history began to turn its main attention to the lately christened science of geology.

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While Da Costa and his contemporaries, in the middle years of the century, were forming their great collections of minerals and fossils, at least two other individuals were active whose curiosity led them into

making more careful, more properly scientific investigations. Except for Ray these two must rank as Britain's first genuine field geologists – as opposed to mere searchers for specimens.

The first, James Hutton, a man of powerful intellect, trained in turn for the law and for medicine, had inherited a farm in Berwickshire and, with his scientific mind, had seen fit to go south and take up residence in Norfolk for a time in order to learn the latest improvements in agriculture. While there, in 1752–4, he made numerous journeys on foot into various parts of England, studying the make-up of the surface deposits. In one of his letters he relates how he made a point at this time of peering inquiringly into every pit, every ditch and every river-bed that he chanced to come across. About 1768 he retired from farming and from his other business interests and gave himself full-time to a more congenial life of the intellect in the stimulating atmosphere of Edinburgh. Here, after thirty years of continuous reflection resting on a basis of rigorous field-work, he laid before the scientific world in 1785 his classic *Theory of the Earth*.

In this, laying stress, in a thoroughly modern manner, only on what was 'observable' (one of his favourite words), he propounded the doctrine of 'actualism' – or, as it came to be better known, 'uniformitarianism' – maintaining that all the changes that had taken place throughout the whole history of the earth were most readily to be explained in terms of the 'actual' processes occurring all around us every day. These processes – denudation, transportation, deposition, consolidation, folding, uplift – he saw as ordered in one vast cycle of ever-continuing change. In consequence, the time-scale of the world extended so immeasurably as to appear almost without limit. In the light of all he had perceived, he was driven to confess, he could detect 'no vestige of a beginning – no prospect of an end'.

It was a conclusion both heretical and (unwittingly, no doubt) redolent with Romantic allure. Dimly foreseen already by bold thinkers like da Vinci and Buffon, and later to be re-stated, in far more compelling terms, by Lyell, it brought to the surface a haunting awareness of unbounded time, a sense of breathtaking scale, a fatalistic mood of being but an instant in the slow, majestic unfolding of Creation's inexorable plan. Long, gloomy corridors seemed to open out, reaching back into eternity, echoing with bestial cries. The terrible other face of nature, the brutal truth that lurked behind the sentimental mask, was painfully laid bare by geology. And out from beneath it, gradually emerging into view, loomed a raw and far more harsh reality: a nether world of awesome precipices, of bottomless

swamps, of terrible scaly reptiles floundering around in stygian gloom. The 'struggle for existence', that bleakest of concepts, was to be taken by Darwin not, as so many have supposed, from the pages of Malthus, but from those of a geologist – Lyell.

But the learned world, at first, was largely deaf to Hutton. Unhappily, his style was obscure and not immediately appealing. Few read the two weighty volumes that finally appeared in 1795, only two years before his death; and those who did read or listen were tempted to revile him as a voicer of dangerous thoughts, a free-thinker. It was left to John Playfair, Professor of Mathematics in the University of Edinburgh, to interpret his views in 1802 in prose that has rarely been surpassed, in his *Illustrations of the Huttonian Theory of the Earth*, a work which gained a wide circulation among contemporary readers of geology.

The Huttonian conception of a grand sequence of change occurring throughout the history of the earth appealed to the tidy-minded, who looked always for order and system in nature. It accorded well, in particular, with the regular succession of strata then being worked out and progressively mapped, primarily in France and Germany, based on the study of the mineral composition of the rocks and the relative positioning of the different levels – and without reference to fossils. This degree of regularity in the record seemed to the majority satisfactorily accounted for by the current volcanic theory of mountain structure. First, rudimentary attempts at classifying strata had been supplied by Buffon in France in 1749 and by Kant in Germany in 1755; and advance in this direction proved to be so rapid that by 1766 a mineralogical map of northern France, in forty-four sheets, was able to be published.

The other British field pioneer, the Rev. John Michell, was our lone contributor to this early pathfinding in stratigraphy. The years in which he came to maturity were those years when science as a whole in Britain was very largely stagnant. Woodwardian Professor of Geology at Cambridge in 1762–4, he retired to marry and to spend his last thirty, highly active years as rector of a secluded country parish in Yorkshire, occasionally journeying up to London, on horseback or by coach, to attend the meetings of the Royal Society. In 1760, in a lecture to the Society on the subject of earthquakes, he revealed sufficiently extensive knowledge to be able to list the main divisions of the bedded rocks occurring across the country; and in later years, as we know from his manuscript notes, he succeeded in elaborating this in considerably greater detail. Unfortunately, due to modesty or mere

inertia, he published next to nothing; and these invaluable results, for all the arduous work put into obtaining them, were lost to the generation that particularly stood in need of them – a story, alas, which in the history of science is only too familiar.

Not long before the deaths of both Michell and Hutton another lone worker had embarked on a lifelong study of the country's stratigraphy. This was a young, self-educated surveyor with the appealingly John Bull-ish name of William Smith – 'Strata' Smith, as he was later to be known to his fellow geologists. It was Smith's great achievement to provide the essential groundwork of knowledge that permitted the two quite separate lines of geological inquiry, the high-flown speculations of grand theory and the humdrum poking around for fossils, to be welded together into a unified tradition. This he did by establishing over a period of years, with the necessary wealth of supporting data, not only that the different geological formations succeed each other in a well-defined sequence of age and in a certain predictable order, lying upon each other all across the country, in his vivid phrase, 'like slices of bread and butter' (which, independently and unknown to him, the mineralogists had demonstrated earlier); but also that each stratum can be readily identified, wherever it may occur, by the presence of certain characteristic kinds of fossils, thereby enabling beds in different areas to be correlated without much trouble and the place of any bed to be located with confidence within any particular succession. This key concept of 'guide' fossils was to revolutionize geology. On the one hand, it gave a sense of constructive endeavour to the hitherto unanchored joys of fossil-hunting; and, on the other, it brought the previously isolated science into a meaningful relationship with botany and zoology.

Smith first formulated his concept in a fully developed manner in 1796, the same year in which he conceived the idea of writing a major treatise on the subject of strata. But for a long time his discoveries remained more or less unknown. He had got it into his head, unfortunately, that his data were of great commercial value, and he accordingly tried to keep them a close secret until his final *magnum opus* should appear (which he was sanguine enough to believe would bring him not only reputation but substantial riches). As with another great discovery later, the Wardian Case, news was leaked out only very gradually, in tantalizing fragments. The first ration to appear in print was an account of the succession of the local strata in his friend the Rev. Richard Warner's *History of Bath* (1801). By the time this was published, we now know, Smith had mapped the entire oolitic

series as it runs through England, and in the middle of that very year prepared for his private use the first-ever map of the whole of England and Wales with the main formations hand-coloured on to it. The final version of this map, considerably more perfect, he did not release to the public till as late as 1815, three years after Greenough had exhibited a rival map compiled under the auspices of the Geological Society which threatened to steal his thunder (and indeed, when Greenough's map too was finally published, five years after his, it did effectively put an end to the sales of its predecessors).

The great treatise on strata, started at last in 1805, made exceptionally slow headway. Smith found writing far from easy, and publication on the grandiose scale on which he had set his heart threatened to be so expensive that he went so far as to try to sell the whole of his property in order to raise the necessary funds. His mind was undisciplined and he was constantly tempted to digress from his central, arduous task into easier and slighter alternative undertakings. The 'Great Book' fixation also set his mind against bringing out his knowledge by instalments, in the form of several, shorter contributions, in, maybe, a learned periodical. In the end, inevitably, this was what he was forced to, and between 1816 and 1819 two separate, smallish works, *Strata Identified by Organized Fossils* and *Stratigraphical System of Organized Fossils*, made their long-delayed appearance, embodying his detailed researches and following immediately upon his map. Only then did the full significance of his achievement begin to become generally appreciated.

This was not the end of Smith's public services. In addition to his national map he conceived the further idea of issuing for sale a geologically coloured map of every county in England and Wales, which when fully published would combine to form a complete geological atlas of the whole country. Twenty-one counties were duly covered in this way in the five years up to 1824, but financial difficulties then intervened and compelled him to cease further work on the venture. The plates of the maps so far published, however, were treasured by the printers, and versions of them continued to be sold till as late as 1911, when they were still much in demand by cyclists and ramblers.

Smith is significant for quite another, non-theoretical reason. He owed his original discoveries to the great network of canals then in course of construction in many parts of England, a disturbance of the country's surface on a scale and to a depth up to that time without parallel. His profession, in fact, involved him full time in their study,

and it was while Resident Engineer to the Somerset Coal Canal Co. that he gathered the material for his earliest map. We know that Michell, likewise, was a sharp-eyed patroller of the brand-new canal cuttings during the 1780s; and it is pleasant to think that the two might well have passed on some bank or other – and each remained unrecognized.

The economic motive as a reason for the great upsurge of interest in the subject is traditionally made much of by historians of geology; yet it is difficult to decide on its precise effect at this early period. For the first time, certainly, men of education were able to make a living in this field by hiring out their technical knowledge: Robert Bakewell, for example, whose *Introduction to Geology* (1813) proved exceptionally popular, acted as an out-and-out consultant in the subject, providing the landed gentry with reports on the mineral and soil potential of their estates. It is obviously true that the massive excavations prompted by the great industrial expansion provided enticing opportunities, hitherto undreamed of, for hunting for fossils and for investigating sections. The occasional spectacular finds, of skeletons of mammoths or of a puzzling cluster of large and unknown bones, could always count on catching the headlines; and in the prevailing Romantic atmosphere, with its fashionable interest in the past, they no doubt attracted many fresh workers to the subject. It is also true that the regular anxieties aroused by the Benthamites about the 'usefulness' of such pursuits as natural history must have been most helpfully allayed by the blatant commercial potential of geology. Even so, it seems too much to assume that all, or even most, of the great new interest in the subject was mercenary. The sheer intellectual fascination, the wonderment caused by the freshly opened vistas, the greatly enhanced appeal of one of the longest-established collecting hobbies: all these are reasons enough in themselves to account for its popularity.

Yet the confident feeling that, at base, the subject was of great practical importance may well have played a part in winning the remarkable following that geology gained from the first among the aristocracy and the upper echelons of the gentry. There was nothing remotely effeminate about it; it fostered noble speculation; it made a man seem forward-looking and economically constructive. As geologists, men could see themselves as princely benefactors and at the same time as lords of learning: well-rounded personalities in true Renaissance style. By means of this science it was possible to parade both a lofty, dignified brow and commendable horny-handedness.

This social elegance that the subject quickly came to acquire can

scarcely be stressed enough. A glance at its early most prominent figures is telling in itself: Greenough sat in Parliament at the same time as he directed the affairs of the Geological Society almost single-handed; De la Beche, Murchison and Lyell each received a knighthood (the second and third of these rising further still to baronetcies); Buckland and the younger Conybeare ended up as Deans. Murchison, the grandest of them all, was steered into the subject by an intellectual wife after – like De la Beche – retiring early from the army and his very fashionable regiment with the ending of the Napoleonic Wars. The news of his appointment as the Geological Survey's next Director-General was received in the Commons, we are told, with 'general cheers'; and at his funeral the Prime Minister, Mr Gladstone, was among the very many who paid honour to him by accompanying his bier to the grave.

These men, it should be noted, were not the mere titled ornaments with which many a subject or society customarily chose to elevate its social stature, but the accepted leaders of the science, who had personally earned their standing by the long and steady toil of their hammers. Geology attracted men not merely of mental distinction but, almost more important, of personal weight and influence. Even if themselves at a loss, they generally had friends in all or most of the appropriate places, very often personal connections by blood or marriage. One Member of Parliament was both the brother of Leonard Horner, a president of the Geological Society, and the uncle by marriage of Lyell; another, Lewis Weston Dillwyn, himself a leading botanist, had a son married to De la Beche's daughter. In the Commons of that day there was clearly the makings of a powerful geological lobby.

Herein lay one reason, at least, for the head-start over all the other branches of natural history that geology was to have in winning effective government backing. Men like De la Beche and Murchison lay already conveniently to hand: they were known quantities to those who had the decisions to make in such matters: and they were able to match the experience and dedication of professionals in an age that preferred to see its institutions headed by reassuring gentlemen-amateurs.

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As an organized entity, geology had its birth in the two or three years immediately after 1800. Its start was abrupt – and surprisingly fully-formed from the first. In 1804, at the age of thirty, very soon

after returning to this country from a prolonged immersion in the over-seductive teachings of Werner, Robert Jameson, the son of a prosperous soap manufacturer, found himself appointed to the Chair of Natural History at Edinburgh. Here he at once set to work to found a school of mineralogy directly modelled on the one in Germany that his master had made so celebrated. Amongst the items that this involved was the introduction of formal field classes, on the pattern developed already by Werner with great and continuing success. These were the first such classes in this science in a British university (if we except the informal outings with his pupils that Lhwyd was in the habit of making in the Oxford of the 1680s) – though there were, of course, several precedents in botany, some of them even at Edinburgh and as recently as 1801, under John MacKay. Among the many students who, over a period of many years, were thus to hear Jameson lecture in the open air at Arthur's Seat or Salisbury Crags – or even, on occasions, as far afield as the Western Isles – were Charles Darwin, Sir William Jardine, Hugh Falconer, Charles Daubeny (Professor, successively, of Chemistry and Botany at Oxford), Robert Grant (first Professor of Zoology in the University of London); many leading geologists such as Lyell, Charles Maclaren, W. H. Fitton, the Swiss H. B. de Saussure and the Frenchman Ami Boué; and, by no means least, great numbers of the surgeon-naturalists and explorers sent out on government expeditions, which Edinburgh long held the lead in supplying from among its former students of medicine. William MacGillivray, too, evidently found these field classes useful enough to introduce their counterparts at Aberdeen, when he went there as Professor of Natural History in 1841. 'These excursions', one of Jameson's obituarists was later to affirm, 'did more towards the making of geologists than any instruction that had been given within the century'.

In these early days, at the peak of his energies, Jameson appears to have been a stimulating teacher, full of quiet enthusiasm, if rather pedestrian and unimpassioned; but compelled, for financial reasons, to hang on to his Chair for far too long, he found his influence eventually tapering off and ended, miserably, in a bumbling dotage. Already, by the mid 1820s, Darwin found his lectures insufferably dreary: 'that old brown dry stick' he called him impolitely. Carlyle, the historian, another of his students, was no more complimentary. By the fifties, when Ramsay was to write of him in scathing terms as 'just like a baked mummy', he had finally grown so frail and doddery that his lectures were having to be read for him by a deputy.

It was a pathetic finish to what started out as a career of much gusto and vigour which almost amounted at times to a crusade. For, from the first, in his early years of office, Jameson had conceived it as his duty to try to convert all and sundry to the so-called 'Neptunist' doctrine as enunciated by Werner. These ideas (which were actually older than Werner) demanded the existence of a once-universal ocean, out of which the earth had emerged by a process of crystallization. In the waters of these primordial seas a long series of sediments were assumed to have been deposited; and these, it was held, explained the successive strata now to be observed in the rocks.

To the Neptunists the rival explanation current, born in 1756 and lately stated afresh so forcibly by Hutton – that the earth had been mainly formed through the action of volcanoes – was complete anathema. It found a no less vigorous champion, however, in the person of Jameson's colleague and arch-enemy, John Playfair, who by then had exchanged the Chair of Mathematics for the rather more pertinent one of Natural Philosophy. Playfair and all who shared his views were dubbed, for contrast, the 'Vulcanists'. For several years they were a decided minority. Jameson had the chance to mass-indoctrinate his students in a manner hardly open to his opponent; he was able, furthermore, to use the Transactions of his new Wernerian Society as a kind of stentorian mouthpiece for relaying his creed to a far wider public. Not content with this, he also propounded Werner's teachings in book after book, beginning with a three-volume *System of Mineralogy* (1804–8). 'No devotee ever more zealously maintained the infallibility of the Pope than Mr Jameson has done that of his master', the *Edinburgh Review* observed acidly, in noticing the first volume.

Despite the uneven struggle, the very whisper of two rival professors locked in a gladiatorial combat without apparent end was enough to set the whole University agog. Few things appeal to Youth so much as the sight of two of its elders hurling abuse at one another – and especially if these elders are its teachers and it senses a certain intellectual stake in the outcome. For a period of years, in consequence, geology at Edinburgh roused a quite exceptional enthusiasm, as student after student was drawn towards the subject by the sound of academic gun-fire.

Though Jameson's views were wrong and succeeded in retarding geology at least from a theoretical aspect, the great benefits he brought to the science as a teacher and a publicist easily outweighed the temporary harm he may have caused otherwise. It was entirely due to him, for instance, that the University Museum was built up

to its very substantial size. He made great use of this for teaching, holding classes there several times a week. In 1819, with Sir David Brewster, he also started the *Edinburgh Philosophical Journal*, which published much of value on natural history generally and of which for many years he acted as sole editor. In short, he instituted an enduring tradition. As Edward Forbes, his successor, was to ask rhetorically in his Inaugural Address in 1854: 'Where else in the British empire, except here, has there been for the last half-century a school of Natural History?' – a broad school, that is, and one not merely confined to geology.

In the meantime a pronounced revival was taking place at Oxford. In 1805 John Kidd, the Professor of Chemistry, began giving lectures on mineralogy as well, and a group of enthusiasts who attended these proceeded to band themselves together into a small club. The mainspring of this was the Rev. W. D. Conybeare, later to win great fame in the subject; while among the others were his elder brother, the Rev. J. J. Conybeare, soon to be Professor of Poetry at Oxford, and a young student of theology who had come up in 1801, William Buckland. Buckland had been a keen collector of birds' eggs as a boy and had moved on from these to fossils by a kind of natural progression. Remaining in residence at the University and continuing to display a highly active interest in the science, he was duly rewarded with the Readership in Mineralogy in 1813 and six years after that became the first holder of the newly endowed Chair of Geology.

Buckland's lectures – which owed, it seems, more to the stage than to normal academic usage – quickly became a legend. According to Lyell, he 'would keep his audience in roars of laughter, as he imitated what he thought to be the movements of the Iguanodon or Megatherium, or, seizing the ends of his long clerical coat-tails, would leap about to show how the Pterodactyl flew'. The description reminds us at once of a certain kind of schoolmaster most of us at one time or another have encountered: the self-dramatizing 'character', the ham actor in a gown, who manages to use to quite brilliant effect as a teacher a certain quirkishness of personality that in almost every other walk of life would be reckoned a serious handicap. His is not behaviour that at once commands respect, but it is behaviour that can hold the eyes and ears of an audience where all other approaches fail.

Some people found Buckland's perpetual posturing distasteful. To Darwin, for one, he seemed 'a vulgar and almost coarse man', 'incited more by a craving for notoriety, which sometimes made him

act like a buffoon, than by a love of science'. Many a Victorian – in spirit if not yet in fact – with the earnestness that increasingly characterized the age, found it all too hard to accept that such a justly serious subject received no injury from so unserious a style of treatment.

Buckland worried people, too, because he lacked altogether the demeanour of the typical geologist: there was no hint of distant reverberations in his personality, no suggestion of ageless time, no ring of iron on stone; all people saw was a kind of learned clown. And in many ways he was undeniably a very curious person: an oddly truncated man, who appears to have trimmed intellectually and, as though in compensation, kept himself in mental health on a diet of wordly plaudits and a constant traffic in eccentricities . . . He sported childish jests and puns, devised peculiar contraptions, went in for the weirdest kinds of food. It was typical of him that he drove around in a special kind of carriage, strengthened in an ostentatious manner for the heavy loads of minerals and fossils that it regularly had to bear and fitted on the forepart with a furnace and implements for carrying out assays and analysis – probably the first really substantial piece of specialized equipment in the annals of natural history. It was typical of him that he carried around a mysterious blue bag, out of which, at opportune moments, he would draw bone after thought-provoking bone, like a conjuror at a party. It was typical, too, that he led his students on excursions into the field wearing quite incongruously formal clothes.

The field lectures that he instituted, like Jameson, as an adjunct to his course were perhaps his supreme accomplishment: an outdoor setting must have been best fitted to his histrionic talents, toning down those parts of his performance that indoors would have seemed too contrived and forced. 'The next lecture,' he liked to startle a roomful of his students by announcing, 'will take place in the fields above the quarry at Stonesfield'; or 'Tomorrow the Class will meet at the top of Shotover Hill at ten o'clock.' These lectures were sometimes conducted on horseback – and were then known as 'geological rides'.

In June 1832, when the British Association held its annual meeting at Oxford, Buckland laid on one of these rides in its honour. Gideon Mantell, who happily captured the occasion in his journal, relates that a large concourse of people began assembling on the bridge at the London entrance to Oxford, some in carriages, some on horseback, the rest on foot. The party then set off for Shotover Hill, where tents

were pitched, refreshments taken, and fossils purchased off the local labourers, while the Professor of Geology regularly discoursed on the scientific sights to the crowd.

At a later meeting of the Association, at Birmingham in 1839, Buckland attracted an audience totalling several thousand for a lecture in the famous Dudley Caverns, specially illuminated for the occasion. Carried away by the general magnificence, he was tempted into rounding off with a shameless appeal to the audience's patriotism. The great mineral wealth lying around on every hand, he proclaimed, was no mere accident of nature; it showed, rather, the express intention of Providence that the inhabitants of Britain should become, by this gift, the richest and most powerful nation on earth. And with these words the great crowd, with Buckland at its head, returned towards the light of day thundering out, with one accord, 'God Save the Queen!'

Cambridge, not to be outdone, eventually replied in kind – with field lectures by Adam Sedgwick, Buckland's friendly rival. Sedgwick, a mathematician by training, had been invited in 1818 – one year before Buckland's Professorship – to take the Woodwardian Chair of Geology (till then a notorious sinecure), despite the fact that it was a subject about which, as he frankly admitted, he knew absolutely nothing whatsoever. Declaring 'Hitherto I have never turned a stone: now I shall leave no stone unturned', he was soon to make amends for the somewhat outrageous manner of his appointment and more than justify the astonishing faith of those who sponsored him.

In 1835, after a great deal of field experience acquired in various parts of the country, Sedgwick started the practice of giving lectures out-of-doors, on horseback, which at once proved extremely popular. Parties of up to seventy mounted students would regularly turn out and go cantering across the Fens, to listen in the course of the day to five different lectures – the last of which, on fen-drainage, was traditionally delivered from that matchless point of vantage, the cathedral roof at Ely. The idea for these occasions was doubtless inspired more immediately by the antics of Buckland; but field classes were in fact an established practice at Cambridge already in the sister science of botany, introduced at the instance of Sedgwick's fellow-professor and lifelong intimate, Henslow. Interestingly, we have it on the evidence of a fairly near contemporary, Professor T. G. Bonney, that in the Cambridge of those days riding by undergraduates was not general, for only a limited few could afford the expense involved. As Henslow's botanists (and, often, entomologists too) were in the

custom of hiring a stage-coach for their outings or a barge down the river to the Fens, or, failing these, made do with a long tramp there and back on foot, the much more dashing mode of conveyance that the students of geology went in for is yet one further indication of the distinctly more elevated social level attained by this study.

The other important event of the first years of the new century was the founding, in 1807, of the Geological Society of London. This arose, in a quite haphazard way, out of the gatherings of a small group of mineralogists who had formed the habit of meeting together occasionally for breakfast. Humphry Davy, one of their number, had been driven to propose a change of time to the evening:

> The chills of Nov[r] mornings [he objected] are very unfavourable to ardor in the pursuit of science, and I conceive we should all think better and talk better after experiencing the effects of Roast Beef and wine than in preparing for tea, coffee and Buttered Buns.

At one of the dinner meetings that duly resulted, at the Freemasons' Tavern in Great Queen Street (where the Linnean Society also dined, once a year, to celebrate its anniversary), a Geological Society was formally constituted, on the thirteenth day of November, in the presence of thirteen persons – which, for the superstitious, can hardly have seemed a promising start.

To have begun in this manner was a strange reversal of the traditional train of events. Most of the large London societies gave rise to dining clubs as subsequent offshoots, but it was almost unheard-of for formality to be born from informality, for learned papers to materialize out of relaxation and gossip. That it should have happened at all, and in so contrary a fashion, is perhaps some measure of the urgency of the need then felt by geologists for a regular forum in the Capital.

At the Society's first session it was resolved that the members should dine together at the Tavern on the first Friday of every month from November to June inclusive, at a cost on each occasion of fifteen shillings per head. Because of the expense of the meal on order, any member unable to attend had to notify the secretary three days beforehand or else incur the massive fine (for those days) of ten-and-sixpence. 'Dinner', read the rules, was 'to be on the table at five o'clock precisely', to be followed by the business of the evening on the dot of seven. The high cost of belonging, despite the fact that most of the founder-members were under forty, indicates a high average social rank. And it may have been on this account that for its first

few years the Society was subjected to fairly severe pressure from the Royal Society, which evidently saw in this body an unnecessary and potentially dangerous new rival.

The first president, George Bellas Greenough, a young man of twenty-nine who had inherited a large fortune while still a schoolboy, was himself largely responsible for the Society's early rise to influence. Though he published very little, study of his numerous letters has recently made clear that his work behind the scenes, on the Society's behalf, was not only energetic and wide-ranging, but conceived with foresight and intelligence. Under his guidance the Society was spared the sterile Neptunist–Plutonist disputes and steered instead into a much more promising channel: no less than the first attempt at nation-wide cooperative research ever to be undertaken by a natural history body.

From its earliest days the Society saw as one of its tasks 'ascertaining what is known in [the] science and what yet remains to be discovered'. To this end, within five months of its founding, a series of questions – compiled by Greenough and a chemist, Arthur Aikin – was drawn up and printed, and distributed to all members in the form of a small booklet with the title *Geological Inquiries*. Thus was born 'network research'. The method itself was not entirely new: a few years before, Dawson Turner and Lewis Weston Dillwyn had circulated around the country a printed four-page questionnaire in seeking records for their valuable *Botanist's Guide* (1805), a topographical handbook, and there is an obvious parallel in the lists of questions sent round to local clergy and gentry by Pennant on his many fact-finding missions earlier in the previous century. The Geological Society's project, however, was the first to be initiated by a permanent, organized body – with the implication that, if successful, it could be perpetuated indefinitely and that there were properly qualified persons ever to hand who could be relied on to handle the material sent in and see that it was made available in a fitting form for the general benefit of fellow workers in the science.

The Society's booklet amply served its purpose and a great deal of information on local deposits flowed in to Greenough from its recipients, by no means all of whom were members. By way of following this up, he then made numerous tours around the country calling on these local informants, no doubt partly to satisfy himself about their competence and accuracy, but partly also to put them into touch with the London-based Society. Seeing the need to build up a national chain of observers, inexperienced though many of these

might be, he made it the Society's policy to enrol as many as possible of these local workers as formal members. The Society was thereby enabled, in a very short time, to acquire a reasonable outline knowledge of the geology of much of Britain, culminating in the production of a national map within only five years of having started. In the process, almost accidentally, it turned itself into a large and flourishing body with a keen national following instead of, as might well have happened otherwise, a tight little London clique more concerned to ostracize unwanted strangers than to foster the wider spread of learning.

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Around 1820 a pronounced shift of interest away from its former preoccupations began to become visible in British geology. Seas and earthquakes, the bleak elemental forces working to mould the surface of the planet, ceased to be the dominant, overriding concern; in their place, fascination began to grow for the myriads of creatures, often eerie and unfamiliar, that had once populated the earth in the earlier phases of its existence. With this, geology turned more and more into a kind of petrified zoology; and a new name, 'palaeontology', was coined in 1825 (by Cuvier's disciple, de Blainville) to take the place of the more restricted 'oryctology', by which the study of fossils, in a non-dynamic sense, had up to then been commonly denoted.

While Smith's discoveries and mapping still remained virtually unknown, several other works on fossils had been making their appearance, which subsequent historians, with eyes only for the well-known and weightier volumes emanating from France, have been led into seriously underrating. The earliest, and the most important, was James Parkinson's *Organic Remains of a Former World* (in three volumes, 1804–11). The first popular work to be devoted to fossils, providing the reader with ample illustrations and descriptive matter and including a careful discussion of their nature, its publication has lately been acclaimed 'the outstanding event in the history of our scientific knowledge of British fossils'. It cannot have met with overmuch success, however, for Gideon Mantell refers to the subject in 1811 (when Parkinson showed him his cabinets) as being 'a department of natural knowledge at that time but little cultivated in England'. Undeterred, in 1818 Parkinson brought out a second book on the topic entitled, rather forbiddingly, *Outlines of Oryctology*.

The author was the Hoxton surgeon and apothecary whose name is commemorated in Parkinson's Disease. Besides being an able field

geologist and a noted social reformer and political pamphleteer, he is also of interest to naturalists as the inheritor, in an appropriately abrupt and cataclysmic manner, of the enormous collections of animals and minerals amassed by Sir Ashton Lever and put on public display, from about 1775, in a building in Leicester Square. Financially embarrassed, Lever was forced into selling his museum and hit on the idea of disposing of it by lottery instead of, as was usual, by public auction, in the belief that his life's work stood more chance of being preserved and perhaps built up further if it passed to a new owner as a single entity. The holder of the winning ticket, as it turned out, was Parkinson, who thus found himself the proprietor, for some twenty years or so, of what was almost certainly the finest zoological collection in the country. When in the end he, too, was reduced to selling it, bidders arrived from all over Europe and the cream of the material – such was its value – was carried off to grace the Imperial Museum in Vienna.

Parkinson's pioneering work was gradually joined by others. *Outlines of an Attempt to Establish a Knowledge of Extraneous Fossils on Scientific Principles* (1809), by William Martin, an actor and drawing-master, was the first true textbook on the topic; it was also of special interest for anticipating William Smith in print by a good seven years in drawing attention to the usefulness of fossils as a means of dating the stratified rocks. *The Mineral Conchology of Great Britain*, a lengthy series of attractive plates of fossil shells, started by James Sowerby, the founder of a well-known dynasty of natural-history draughtsmen and dealers, and later carried on by one of his sons, began its thirty-four-year existence in 1812.

In that same year the French anatomist Georges Cuvier published his *Recherches sur les ossemens fossiles de quadrupèdes*, a work which was quickly to have a profound influence on thought in Britain, in that it confirmed, in no uncertain manner, the inkling that Ray had obtained many years earlier that a good many of the creatures occurring as fossils belong to species now no longer extant. A firm believer in the fixity of species, Cuvier sought to explain this awkward fact in terms of a number of severe 'catastrophes' which he saw as having overwhelmed the earth at certain periods in its history. On each of these occasions, the most recent of which was the Biblical Deluge, he suggested that the extinction of life had never been absolutely complete, just sufficient creatures escaping to be able to re-populate the world anew.

This theory seemed to reconcile, once and for all, the findings of

geology and the teachings of orthodox religion, and on that accounts it gained unusually wide publicity in Britain. The immediate result was that people now felt freed to study fossils without any tormenting pangs of conscience. Indeed, as Buckland contended in his much-read volume, *Reliquiae Diluvianae* (1828), on the fossil relics of what he supposed to have been the Biblical Flood – and again, even more unequivocally, in his famous Bridgewater treatise of 1836 – the researches of geologists appeared to confirm the early history of the earth as recounted in the Scriptures in such gratifying completeness and detail that inquiry into these long-lost periods of our past might well be regarded as a mere extension of religious duty.

Unfortunately not everyone saw it quite like this. For many years a large body of British public opinion held to the absolutist view, typified by George Bugg and his *Scriptural Geology* (1826), that the sole account of the early history of the earth that could possibly have any validity whatever was that to be found contained within the covers of the Bible. A wordy pamphlet-war long continued in this vein; and though it must have troubled a few consciences, the fact that this caused a larger and larger section of the public to try to keep within earshot of the developing science suggests that no real harm to geology resulted.

The 'Catastrophist' theory was taken up with gratitude by Buckland, Sedgwick, Murchison and other giants of the science, attracting also a very big following among amateurs. Throughout the 1820s and 1830s it formed the central topic of geological discussion, and its proponents and adversaries lined up in battle with much the same intensity – and, more usefully, with much the same publicity – as in the now-expiring Neptunist–Vulcanist contentions, the theological undertones of Catastrophism making up in fervour for the absence of quite so sharply personalized a drama. Once again, tempers were frayed; once again, outsiders poured in to sample the science in order to discover what could possibly cause such turbulence and clamour. As Lockhart, the editor of the *Quarterly Review*, who made a habit at this time of attending the Geological Society's meetings, used to remark to his friends: 'Though I don't care for geology, I do like to see the fellows fight.'

To help in holding this already exceptionally attentive audience, British geology at this point had a further piece of luck: the turning up, in reasonably quick succession and with mounting attendant publicity, of a series of desirably horrible prehistoric monsters.

The first, the Ichthyosaurus, entered the full glare of science some

time before the others, in 1814. The first skeleton of one of these in anything like a complete condition had been discovered five years earlier, in the highly productive Liassic cliffs near Lyme Regis, by the young son of a local cabinet-maker who, before his untimely death, had introduced his children to the delights of hunting for fossils. The eldest of them, Mary Anning, had taken to collecting, and used to offer specimens for sale to visitors, displaying them alongside the fresh fish in her mother's tiny shop in Lyme. It seemed natural to her to excavate her brother's find, and the sale of this to the lord of the manor for £25 spurred her on to further searches.

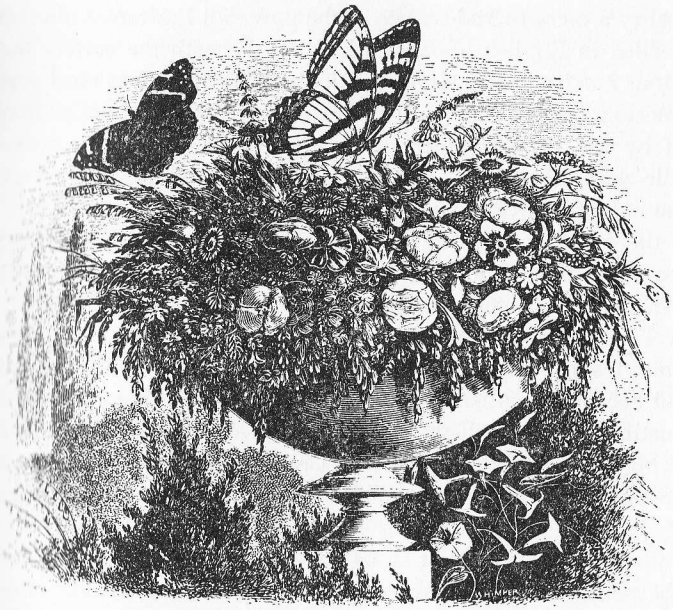
In 1821 she had her due reward by discovering the first nearly complete skeleton of a Plesiosaurus, which this time was sold to the Duke of Buckingham – for the startling sum of £200. The evident cash value of her pursuit, the scientific importance of her finds, the fact that she was a young girl and not a greybeard professor, and her use of the earnings from her fossils to help to support her widowed mother, all made perfect copy for the press and brought the study to the attention of people who up till then can never even have heard of it.

Almost simultaneously, in a book on *The Fossils of the South Downs*, news was leaked out of the bones of 'one or more gigantic animals of the lizard tribe' that had lately been discovered in the Weald of Sussex. The author, Gideon Mantell, a busy surgeon in Lewes, had received his early encouragement in the study from James Parkinson and was, thanks to his medical background, a more than capable comparative anatomist. In 1824 he recognized that some teeth found locally two years earlier by his wife closely resembled those of an iguana. Cuvier, to whom these had first been submitted, had dismissed them carelessly as the teeth of a rhinoceros; and so it was not without some boldness, in the face of such weighty authority, that Mantell proceeded to describe them as those of an entirely new creature. This he called the Iguanodon. Conceived of at that time as merely a gigantic form of lizard, its subsequent discovery in further places, combined with finds of other, obviously related forms, gradually made it clear that this was a completely different type of reptile from any now existing. The collective name *Dinosauria* – or 'Terrible Lizards' – was accordingly coined for them by Richard Owen (in 1842): a name, with its flesh-creeping suggestiveness, perfectly chosen to evoke a modish Romantic flutter.

Luckily, besides being a palaeontologist of real ability, Mantell was also a man of verve and enormous restless energy: he needed,

it is said, no more than four hours' sleep each night. He was also a compulsive showman – with a weakness for flourishing his personal coat-of-arms and given to lashing out beyond his means on domestic magnificence and a fashionable carriage. Knowledgeable, eloquent, endowed, above all, with the precious gift of enthusiasm, he made a superb public lecturer, in which capacity he was soon greatly in demand. Latterly, he was also the author of a predictably best-selling work, in two volumes, *The Wonders of Geology* (1838) – in his own words, 'the *romance* of the science', which he had it in mind to try to capture on paper. *The Medals of Creation, or First Lessons in Geology* followed in 1844. In the long run his influence as a winner of converts to the subject may have outstripped even Buckland's.

One final reason for the popularity of geology still remains to be mentioned. This is the almost uncanny way in which the more progressive thinkers of the age – and even the unprogressive, prompted by a kind of intellectual prurience – scented in the dust from the subject's seemingly unglamorous chippings the warfare over Evolution which was yet to come. Lyell's great classic, *The Principles of Geology*, a massive work of synthesis set forth in glorious prose, published in three volumes in 1830–33, was the cornerstone of Darwin's eventual theory. It has been described as *The Origin of Species* minus only the Natural Selection hypothesis. Geology, of all branches of knowledge at this period, seemed to be advancing fastest and farthest towards the bedrock of ultimate, incontestable truth. Those who felt compelled to enter on this journey took care, accordingly, to place themselves among the van.



THE VICTORIAN SETTING

The nineteenth century, while less complex than the eighteenth as far as natural history is concerned, was by no means so uniform as is commonly supposed. Nevertheless, certain of the basic strands that went to form its distinctive pattern did manage to last out unbroken for what seems in retrospect an impressive period of years and gave to the greater part of it an easily perceptible unity which greatly helps us in our study of it today.

These strands constitute the essence of what we have come to call 'Victorianism', even though they were recognizable in being for the most part a full decade or more before the Queen's accession. They were partly new and partly adaptations – in some cases almost out of recognition – of various dominant concerns inherited from the previous era. They held together because they sprang from an inner consistency, from a set of assumptions founded in a certain well-defined emotional-cum-religious attitude which, for want of a better word, we may identify as Evangelicalism – using the word in a non-sectarian context.

The Evangelical Revival, which had made its presence felt in the closing years of the eighteenth century, most notably in the speeches of William Wilberforce and in the crusades of the Clapham Sect, was