

a28 Lyell's influence (legacy) beginning 1830

< *Principles of Geology* >

One must look not only at the waves he made, but the ocean in which he made them. —Marschall, 1998.¹

... because the most extravagant systems were often invented or controverted by men of acknowledged talent. A sketch of the progress of Geology is the history of a constant and violent struggle between new opinions and ancient doctrines, sanctioned by the implicit faith of many generations, and supposed to rest on scriptural authority. The inquiry, therefore, although highly interesting to one who studies the philosophy of the human mind, is singularly barren of instruction to him who searches for truths in physical science. —Lyell.²

Lyell felt that Buckland was betraying geology by lending the scientific authority of his position ... to make geology conform with scripture [but in fairness, in accord to Paley's natural theology and *not* to revealed theology as did Frederick Nolan (1784-1864) in his Brampton lectures, which Buckland himself deplored]. —Rudwick.³



Charles Lyell (1797-1875)

"... is of the middle size ... small eyes, fine chin and a rather reserved expression of countenance," penned Gideon Algernon Mantell (1790-1852) of his unexpected visitor at Castle Place (his Brighton house) evening of 4 October 1821.¹³

"The science of geology is enormously indebted to Lyell—more so, as I believe, than to any other man who ever lived." —Darwin.¹⁴

York City in 1843 were widely disseminated as text editions.¹⁰ Just as well, for Lyell was a poor speaker John C. Thackray informs in *To See the Fellows Fight*, 2003.¹¹ In 1845, Lyell published an essentially modern "Geological Map of the [eastern] United States, Canada, &c., compiled from the State Surveys of the U.S. and other sources."¹² In fighting the good fight against intolerance for the concept of an ancient Earth that uniformitarianism demands, Lyell had difficulty in accepting the concept of an Ice Age, which smacked of catastrophism. In *The Geological Evidences of the Antiquity of Man*, 1863, Lyell's Pyrrhic victory is to find for that time evidence of ice sheets on a vast Greenland-like scale in Europe and North America.

Thus, Huttonian theory that allows geology to be a hypothetico-deductive science was received in the English speaking world. Lyell would that geology be rid of speculations both cosmologic and Mosaic—which

Charles Lyell championed Hutton's concept of uniformitarianism (as extracted by Playfair who had simply, pointedly, quickly, and cleanly restated what in Hutton's prose is ponderous, round, slow, muddled by metaphysics (**Footnote a28.1**) and is liberal in quotations of original descriptions from foreign sources, mainly French and Swiss.

Lyell's abiding contribution was through his geological textbooks: 1) *Principles of Geology*, vol.1, 1830, vol.2, 1832, vol.3, 1833 (and 11 revisions to 1872), that gained credence by observational verifications that he made at famous geological sites⁴ and from original observations that he had made in 1828 in the company of Murchison and wife on the geology of Auvergne, Velay, Vivarais, Riviera, Turin, Verona, and Padua, and alone on the Tertiary formations of Parma, Bologna, Florence, Siena, Rome, and the active volcanoes of Naples and Sicily, and 2) *Elements of Geology*, 1838 and 1841, which extol (with inadequate acknowledgment given Hutton, scolded William Henry Fitton (1780-1861) in 1839)⁵ the Huttonian uniformitarian principle of incremental change and, in thrall of John Herschel's insistence on *verae causae* (strictly *observable* causes),⁶ rightly reject for all (excepted though is man's origin) supernaturalistic explanations.⁷

Benjamin Silliman (1779-1864) who in 1818 founded the *American Journal of Science* and, beginning in 1807, was the first to teach earth science in America, adopted at Yale *Principles of Geology*—its anti-Mosaic message diluted by Silliman's separately published addenda that introduced Christian themes.⁸ Lyell's enthusiasm for uniformitarianism as a guiding principle is announced in *Principles*'s subtitle: *Being an Attempt to Explain the Former Changes of the Earth's Surface by Reference to Causes now in Operation*.⁹ On visits in 1841 and 1842 to the United States, Lyell traveled widely to view the geology. His *Lectures on Geology* delivered at the Broadway Tabernacle in New

had been the style, as in *Telluris theoria sacra* (*The Sacred Theory of the Earth*) by Thomas Burnet (ca. 1635-1715), a best seller for a hundred years,¹⁵ and which, well received by Newton (1643-1727), explained in the purported light of The Revelation (Apocalypse) of St. John the Divine (Apostle) how the dreadful “undigested heaps of Stones and Earth” called *mountains* came to blight the gentle perfection of the Created world.

At Oxford (Exeter College, 1816-1819) prepped by having read from his father’s library Robert Bakewell’s (1768-1843) *Introduction to Geology*,¹⁶ lectures delivered by William Buckland had persuaded Lyell to the full-time study of geology after a brief stint of practicing law for which he had otherwise trained. Evidences of catastrophes by those worthies were proffered *damnosa haereditas* that Lyell would come to reassess as fillable gaps in rock-recorded time. By analogy, the pyramids of ancient Egypt must astonish any convinced by a lack of historical documentation that these could be raised in a day. In particular, Diluvial sediments in Lyell’s uniformitarian perspective became records of local events. Robbed of its Flood explanation, the subject was no longer grist for his friend Gideon Mantell’s popular accounts of geology and that prolific author by 1838 finds no space for it in *Wonders of Geology* in which he summarized Lyell’s description of contemporary causes as sufficient for all of time.¹⁷ A just-as-well forgotten theme of Lyell’s *Principles* was that land emergence and submergence engendered climatic cooling and warming and this, matched by migrations and selection for which species were locally abundant, could account for the fossil record.

Holdouts against the value of uniformitarianism were those for whom progressivism was not an anathema; notably: Leopold Freiherr von Buch (1774-1853), Roderick Impey Murchison (1792-1871), Adam Sedgwick (1785-1873), Léonce Élie de Beaumont (1798-1874), Louis Agassiz (1807-1873), and U.S. Geological Survey founder Clarence King (1842-1901) who reasonably found gratuitous the strict assumption of historical rates of change in prehistory.¹⁸ Lyell’s putdown was that in their work “we see the ancient spirit of speculation revived, and a desire manifested to cut, rather than patiently to untie, the Gordian knot.”¹⁹

On the Continent, an empirical, deductive geognosy, with Wernerian postulates as axioms, was much preferred. Indeed, arguments for Werner’s geognosy as interpreted by Cuvier continued until the end of the 19th century. This difference in geological methodology led to the liveliest of debates. However, for the American audience interest in the details of the debate dwindled as the foreign language side of the discussion was quite frankly foreign. American mineralogists had a whole new continent to explore and Wernerian lithological formations had application for reconnaissance mapping, a first being a colored geological map of the region east of the Mississippi in William Maclure’s (1763-1840) *Observations on the Geology of the United States*, 1809 (revised 1817).²⁰ The terra incognita of the Rocky Mountain thereafter became known from mountain men who after the decline of the beaver population (that they had trapped for fur from 1820s to the 1840s) became guides to survive. Jedediah Smith’s disclosure of South Pass, a relatively easy crossing of the Rocky Mountains, opened up the West to the immigrant wagon trains.²¹ American geology advanced independently and rapidly on many fronts. Again, sequences of rocks of western American physiographic provinces were wholesale assigned to Wernerian formations; expedient for getting the job done in reconnaissance prospecting, albeit deaf to Lyell’s warning:

Never did a theoretical fallacy, in any branch of science, interfere more seriously with accurate observation and the systematic classification of facts. In recent times, we may attribute our rapid progress chiefly to the careful determination of the order of succession in mineral masses, by means of their different organic contents [fossils], and their regular superposition. But the old diluvialists were induced by their system to confound all the groups of strata together instead of discriminating, ... to refer all appearances to one cause and to one brief epoch, not to a variety of causes acting throughout a long succession of epochs. They saw the phenomena only as they desired to see them, sometimes misrepresenting facts, and at other times deducing false conclusions from correct data.²²

Alarmed, the distinguished American geologist Grove Karl Gilbert (1843-1918) stressed that geological induction should be testable by deduction of observable consequences.²³ This is the modern scientific method. □

Footnote a28.1 In Hutton’s metaphysics, the final cause of the physical world is life. Life, perfect in its forms, is self sustaining through procreation, and all is based on soil. The paradox of the soil is that it is not self sustaining. It, the product of decay, is washed away to the sea in a wearing down landscape. Newton’s physics, Hutton knew, allows the planets, set in their orbits, to circulate eternally. Surely, in the perfection of Creation, an eternal Earth has a way of cyclically restoring the land and the rocks that weather to soil. Deep time, according to S. J. Gould’s analysis in *Time’s Arrow/Time’s Cycle* (1987), was an a priori component of Hutton’s armchair speculations. Hutton’s field geology documented land and rock restoration. His geology, not his metaphysics, was furthered by Playfair.²⁴