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# The Origins of Modern Geological Theory\*

by George Grinnell

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## Foreword

“I think any argument from such a reported radical as myself,” Charles Babbage wrote to the geologist Charles Lyell on May 3, 1832, “would only injure the cause, and I therefore willingly leave it in better hands.”

Charles Babbage (1792-1871) was Lucasian Professor of Mathematics (1828-39) at the time, a dabbler in geology, theology, and manufacturing, and had recently made an unsuccessful bid for a seat in parliament. In 1837, he would publish his *The Ninth Bridgewater Treatise*, an attack on the theology of the Anglican establishment, and in 1851, he would carry the attack into the Tory camp in his *Reflections on the Decline of Science in England*, the purpose of which was to argue that wealthy Tory amateurs had a stranglehold on science policy and were discriminating against socially less well positioned scientists, who were more deserving of support.

Charles Lyell (1797-1875), to whom he was writing, had just published the second volume of his *Principles of Geology* (volume I, 1830; volume II, 1832; and volume III, 1833), a work written in support of political liberalism —although ostensibly it was an

objective work in Science free from any political implications. In his letter of May 3 to Lyell, Babbage was explaining why he would not write a favorable review of the book. Quite wisely, the whig scientists, like Babbage, Lyell, Scrope, Darwin and Mantell, did not want the public to know that that which was being promoted as objective truth was little more than thinly disguised political propaganda.

The purpose of this paper is to explicate what Babbage means by the words “radical” and the word “cause,” when he writes, as quoted above: “I think any argument from such a reported radical as myself would only injure the cause, and I therefore leave it in better hands.” The first part of this paper investigates the political implications of early 19th Century Geology. The second probes into the nature of Babbage's and Lyell's “cause.”

### **THE POLITICAL IMPLICATIONS OF EARLY 19TH CENTURY GEOLOGY**

In 1807 Humphrey Davy wrote to his friend William Pepys: “We are forming a little talking geological dinner club, of which I hope you will be a member.” Of the original thirteen members, four were doctors, one an ex-unitarian minister. Two were booksellers. Another, Comte Jacques-Louis, had fled the French Revolution. Four were Quakers, and two, William Allen and Humphrey Davy, were independently wealthy amateur chemists. Only one, George Greenough, had any training in geology or mineralogy —having paid a visit to the Academy at Freiberg some years earlier along with Goethe— but he did not pursue the subject for a living by any stretch of the imagination. He was a member of Parliament. Indeed, what is extraordinary about the London Geological Society is that none of the original members were geologists. “The little talking dinner club,” as Davy put it, was a club for gentlemen given to talk, not to hammering rocks.

The following year 26 Fellows of the Royal Society' joined, including Joseph Banks, the President of the Royal Philosophical Society, and the year after the number of members had jumped to 173. The “little talking dinner” club concept became unfeasible; apartments were rented instead. There was talk of publishing transactions, and Sir Joseph Banks, fearing that the Geological Society would soon grow bigger than his prestigious and ancient Royal Philosophical Society, resigned in protest. By 1817, only ten years after its founding, the Geological Society had more than 400 members, and in 1825 it was incorporated with a membership of 637.

The founding and early growth of the London Geological Society is noteworthy for a number of reasons. Earlier scientific societies, like the Royal Academy in France and the Philosophical Society in London, had had a much broader base. There had been a few abortive attempts to start specialized scientific societies in chemistry and in botany, but they had come to nothing. The Geological Society of London was really the first specialized scientific society, and its early growth was unprecedented—in fact, very difficult to account for, especially when one recalls that its early members were almost all doctors, lawyers and members of Parliament; the Reverend William Buckland was Dean of Westminster, and Sir Roderick Murchison was an independently wealthy retired Army Officer.

That is not to say that there were no persons in England actively engaged in what we would now consider to be geological pursuits, for, indeed, England was at the time going through a crash program of canal building and mine exploration and was about to enter the railroad age; but one is hard pressed to find these working geologists on the membership list. William Smith, for instance, the most famous drainage engineer of the age, who discovered the technique of correlation of strata by means of fossils and is generally mentioned in modern geological texts as the key geologist of the era, was not invited to join the London Geological Society. Perhaps he was too busy doing geology to have time to talk about it, but if the truth be told, the London Geological Society was a group of talking amateurs whose interest in geology was for its theological and political implications, not for its application to mining and canal digging. These theological and political implications were crucial to the social stability of England and were therefore by no means irrelevant to the early history of geology.

The term “geology” had only recently been introduced by the Swiss diluvialist, de Luc. In the Medieval University curriculum one finds no place for the study of the earth, which was deemed corrupt, a product of the devil and therefore not worth studying. Geometry, numerology, harmony and astronomy better reflected the wisdom of God than did the study of things of this world, the Medieval Catholics believed, following Plato, but the Protestant Reformation had changed all that. Between the years 1680 and 1780 some five hundred books and articles were published on geology, ranging from Bishop Burnet's popular *Sacred Theory of the Earth* (which ran through seven editions between 1681 and 1753) to J. T. Klein's scholarly monograph on a single class of fossils, *Dispositio Echinodermatum* (1732). The Protestants were keen to demonstrate that God's handiwork was as easily seen in this world as in the next, and particularly they were eager to demonstrate the literal truth of a Bible which declared that God had not only created all the creatures of the earth, but had also brought down the Deluge to punish man for his sins.

Shortly after the Glorious Revolution of 1688, when the Catholics were driven out of England, a rash of works appeared reconciling the book of *Genesis* with the new research into nature. The most successful of these was John Woodward's *Essay towards a Natural History of the Earth*, in which he explained the stratigraphic sequence of rocks by supposing that during Noah's flood, all the surface rocks of the earth had been dissolved by the sea, later to be gradually precipitated out into the stratigraphic sequences which now comprise the secondary formations. Because the Woodwardian idea preserved the theme of Genesis that the flood was caused by divine decree to punish men for their sins, it was favorably received by the Anglican Church and later became, at the hands of the Tories, a major bulwark in their defense of monarchy. In 1728, the Woodwardian professorship was founded at Cambridge, the first academic recognition of the field of what is now called "geology." Woodward's ideas were articulated not only in England, but also on the continent—particularly in the popular classes of Abraham Gotlob Werner at Freiberg later in the century, where Greenough, von Buch, MacLure, Jamieson, Berger, and most of the other founders of geology studied.

In the pursuit of Woodwardian geology, a number of anomalies occurred—in particular, a lack of correlation between new and old world strata as well as overlays of basalt and granite in what were supposed to be secondary deposits. As a result, Leonard von Buch and Georges Cuvier modified the early diluvial theory into a more general catastrophic theory of the earth in which the earth was seen as not having suffered one catastrophe, but numerous catastrophes, of which the Deluge was but the most recent example. To deny catastrophism altogether was to deny the truth of the Bible, and hence the theological implications of early geology were quite clear.

In 1673 Bishop Bossuet, tutor to the Dauphin of France, had drawn up his arguments in favour of kingship into a treatise, *Politics drawn from the very Words of Holy Scripture*, in which he argued that monarchy was the most common, the most ancient, and the most *natural* form of government. The key word there was "natural." He argued that nature provided evidence of being ruled by a divine monarch, God himself, King of the Universe, and that a King was then emulating God when he ruled with absolute authority: "Thus we have seen monarchy takes its foundation and pattern from paternal control, that is from nature itself," Bishop Bossuet writes. The British spokesman for monarchy, Robert Filmore, echoed Bossuet's words. Monarchy was natural, because all of nature was ruled by a divine absolute monarch, God himself.

In the course of the 18th century, as democratic sentiments grew not only in America but throughout all of Europe, the political theory of Bossuet and Filmore was seriously

challenged. John Locke in his *Treatises on Government* and Jean Jacques Rousseau in his *Discourses*<sup>1</sup> argued against the naturalness of monarchy in favor of a social contract theory of government. But to prove that monarchy was unnatural, it was necessary to prove that the Bible's description of the Deluge was inaccurate; that God had not created the animals and plants of this earth and that he had not introduced catastrophes to punish man for his sins, for these were the biblical and geological models upon which monarchical theory was based. In 1789, on the eve of the French Revolution, accompanied by Erasmus Darwin and later by Jean Baptiste Lamarck and Simon LaPlace, the Scottish liberal geologist, James Hutton, published his *Theory of the Earth*, in which he attempted to demonstrate that Nature was not governed by a divine monarch but by fixed geological laws of volcanic uplift and erosive weathering. Hutton's friend, Adam Smith, was at the same time arguing in favor of a laissez-faire economic policy, in which paternal monarchical power was again eliminated in favor of a free-ranging liberalism.

“Some Judicious persons, who were present at Geneva during the troubles which lately convulsed that city,” the Reverend William Paley writes in a counter attack against the new liberalism in his *The Principles of Moral and Political Philosophy* (5th edition, corrected 1793), “thought they perceived in the contentions there carrying on, the operation of that political theory which the writings of Rousseau, and the unbounded esteem in which these writings are held by his countrymen, had diffused amongst the people. Throughout the political disputes,” he goes on, “that have within these few years taken place in Great Britain, in her sister Kingdom, and in her foreign dependencies, it was impossible not to observe, in the language of party, in the resolution of popular meetings, in debate, in conversations, in the general strain of those fugitive and diurnal addresses to the public, which such occasions call forth, the prevalency of the ideas of civil authority which are displayed in the work of Mr Locke. Such doctrines,” he continues, “are not without effect; and it is of practical importance to have the principles from which the obligation of social union, and an extent of civil obedience are derived, rightly explained and well understood.” Paley then went on to explain them not only in the ensuing 567 pages of his *Moral and Political Philosophy* but also in the two volumes of a much longer work on Natural Theology in which the cosmological foundations of monarchy were once again reiterated.

The “cause,” then, to which Babbage was referring when he wrote Lyell (“I think any argument from such a reported radical as myself would only injure the cause”) was that of discrediting Paley and the other Tory Monarchists through an attack on its geological and theological foundations.

## THE CAUSE

After the Napoleonic Wars, England had fallen into a severe depression. Governmental demands for military supplies ceased, and there was no market for British goods overseas. To add to the distress and general unemployment nearly 400,000 troops were demobilized with no place to go. In order to protect the British farmer from imports of cheap grain, the corn laws were instituted in 1815 preventing the import of grain until the price had reached 80 shillings a quarter, a price so high that laborers were starving without being able to pay it. Although the corn laws were passed to protect the British farmer, they had a devastating effect on British Industry and on the towns of the industrial midlands. High food prices drove not only the workers into starvation, but also small businesses into bankruptcy. The Tory solution to the problem was to advise the lower classes not to breed so copiously. Still the towns of the industrial midlands continued to grow —mostly, as it turns out, from an influx of the younger sons and daughters of poor farmers. Manchester, for instance, was a small town of 4,000 in 1688. A century later it was ten times that size, and by the time Lyell published his *Principles of Geology*, it was approaching half a million, most of whose inhabitants lived in wretched conditions. Malthus classified towns like Manchester along with wars, famines and plagues as a natural check on the population because the death rate was so high.

On August 16, 1819, a crowd of unemployed, underpaid, and underfed inhabitants of Manchester gathered at St. Peter's field to hear a speech on Parliamentary Reform and repeal of the corn laws. The local militia from the countryside, fearing a rebellion, attempted to arrest the speaker. In the fight that ensued, several were killed and many injured. The monarchist Tory government instituted the “Six Acts,” which curtailed the right of free speech and forbade the training of persons in the use of arms. England was on the verge of revolution —the liberal industrial Midlands versus the Tory monarchists; but the memory of the French Revolution was still fresh among the middle class. They wanted reform in Parliament, not riots, but to reform Parliament meant answering Paley's arguments, and this entailed destroying Paley's Natural Theology.

Paley had argued that sovereignty descends from God to the King; the people are his subjects. Because Parliament is an advisory body, if the king is content with its advice, then there is no need to reform it. The fact that Parliament did not represent the present distribution of people in England, Paley argued, was irrelevant since sovereignty did not stem from the people to begin with. Sovereignty descended from God.

Paley's arguments were amazingly effective. His treatise on *Moral and Political Philosophy*, in which he argued that “it is the will of God that the established government be obeyed,” was required for memorization (one had to know his basic argument) before

students could graduate from Oxford or Cambridge. The only way the liberals from the midlands could get Parliament reformed was to demonstrate that the scientific foundations of Paley's natural theology were false, and this meant destroying diluvial geology and catastrophism.

In 1825, Lyell's liberal cohort George Poulsen Scrope (1797 - 1876) published his *Considerations on Volcanos* in which he transformed the arguments of the Tories: every time they ascribed a natural event to God, Scrope ascribed the same event to a volcano, thereby attempting to revive the geological theories of James Hutton. So perfect were the laws of volcanic uplift and erosion which God had created at the beginning of time aeons ago, Hutton and Scrope argued, that no more had been seen of God since, nor was there any need of him to run the affairs of the universe any more than was there need of a king to interfere with the natural and intrinsic laws of economics and of society.

Scrope's book was too radical for the London Geological Society at that time, and it was dismissed without a hearing. Scrope, the son of a wealthy London merchant, bought himself a seat in Parliament and pursued the cause by more direct means. But without a cosmological proof that monarchy was unnatural and that sovereignty belonged to the people, the liberals remained relatively powerless.

Undaunted by Scrope's failure, the young whig lawyer Charles Lyell now tried his hand at destroying the geological foundation of monarchical theory. In his *Principles of Geology* he took a much more subtle line than had Scrope. In the 100-page introduction to the *Principles*, Lyell argued not so much that the diluvial theory was wrong, as that it was mythological and impeded the "progress" of geology. In the first volume he went on at great length concerning the forces of erosion and the effects of volcanic uplift in what was a brilliant avoidance of all evidence of catastrophism. It was just what the moderates were looking for. They rallied around Lyell and elected him secretary first, and then president of the Geological Society.

"By espousing you," Scrope wrote to Lyell on April 12, 1831, "the conclave have decidedly and irrevocably attached themselves to the liberal side, and sanctioned in the most direct and open manner the principal things advocated. Had they on the contrary made their election of a Mosaic geologist like Buckland or Conybeare, the orthodox would have immediately taken their cue from them, and for a quarter of a century to come, it would have been heresy to deny the excavations of valleys by the deluge and atheism to talk of anything but chaos have lived before Adam. At the same time I have a malicious satisfaction," Scrope continues, "in seeing the minority of Bigwigs swallow the new doctrine upon compulsion rather than from taste and shall enjoy their wry faces as they

find themselves obliged to take it like physics to avoid the peril of worse evils. I feel some satisfaction in this.”

In this day and age when geology is far removed from religion and politics and when political issues are settled by election rather than at meetings of geological societies, it is difficult for us to understand the extent to which the social shift in world view which took place not only in geology but in astronomy and in natural history was related to the Great Reform movement of 1832. All were part of the far more general shift in world view from paternalism to liberalism, but the persons responsible for engineering this shift were very conscious of what they were doing. “It is a great treat to have taught our section-hunting quarry men, that two thick volumes may be written on geology without once using the word “stratum,” Scrope wrote to Lyell on September 29, 1832, after Lyell’s second volume appeared. “If anyone had said so five years back, how he would have been scoffed at.” Just as the conservatives had refused a hearing to the Huttonian camp earlier, now the liberals pulled the same tactics when they got into power. The stronghold of catastrophism lay in a stratigraphy where unconformity and nonconformities, to say nothing of massive conglomerates, told of wide-ranging geological disasters in the past. Lyell, like Scrope before him, simply suppressed the evidence which did not fit in with his doctrines, and once he was voted into power, the catastrophists found it increasingly difficult to publish their research.

The liberal takeover of the geological society and the suppression of evidence favoring the catastrophist position did not come about overnight. Rather there was a slow assimilation of catastrophist data until there was virtually nothing left to the theory as a whole. When, in 1839, Louis Agassiz attempted to argue in favor of catastrophism with his theory of ice ages, the uniformitarians simply adopted all his evidence, but reinterpreted it in uniformitarian terms. Thus the data did not change, but the Gestalt by which that data was organized and given coherence was transformed from catastrophism to uniformitarianism, just as the social structure of England was changed from Tory Paternalism in which sovereignty descended from God down to the King, to the new liberalism in which sovereignty ascended up from the people through Parliament to its ministers.

Ironically enough, the political battle which underlay the catastrophist-uniformitarian debate of 1832 is now long over, but owing to the paradigmization of science, the uniformitarian Gestalt is still assiduously cultivated at universities and in professional geological societies. The “cause” for which Babbage, Scrope, and Lyell were fighting is now long since over, and we should feel free to look again at the geological evidence itself, which, if the truth be told, provides ample evidence for catastrophism, as it always has.



## AFTERWORD

In 1905, Physics had been in a dilemma; some of the evidence from optics indicated that light moved in waves, other evidence indicated that it moved in particles. The two concepts seemed contradictory, but Niels Bohr and Werner Heisenberg were able to show mathematically that the two concepts were actually complementary and provided us with a fuller picture of reality if we accepted them both. Geology is today perhaps in the same situation. We have inherited from our ancestors the idea that either catastrophism must be correct or uniformitarianism must be correct but not both. The reason they put this either/or proposition was political. Either sovereignty belonged to God and the King, or it belonged to the people, it could not belong to both; therefore Geology had either to go with the Tories to catastrophism, or to the liberals with uniformitarianism; it could not go both ways. Today we no longer have to worry about that; from the evidence of Geology, it seems quite clear that both theories are correct. The normal course of events is indeed as Lyell describes it: gentle uplift and slow erosion; but there is also ample evidence that Velikovsky is correct as well and that the earth has indeed been subject to severe catastrophes as he has so convincingly argued in his *Earth in Upheaval*.

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In this paper I have attempted to make five major points: first, the London Geological Society, which gave birth to the uniformitarian paradigm, did not originally consist of a group of practicing field geologists, but was comprised of gentlemen, members of Parliament, clergymen and lawyers who were primarily concerned with the political and theological implications of Geology at the time of the Great Reform Bill of 1832 when the concept of monarchical sovereignty was being challenged by the Whigs and defended by the Tories. Second, that the London Geological Society had been split into two camps with the Tory catastrophists prevailing before 1832 and liberal Whigs, under the leadership of Lyell, Scrope and, later, Darwin, taking over in the second quarter of the century. Third, that “uniformitarianism” was promoted by the liberals as part of “the cause” to undermine the theoretical foundations of monarchy and was not derived from field research. Fourth, because the Tories were using repressive tactics in politics to prevent the reform of Parliament, the social tension spilled over into the geological debate causing the intense interest in geology in the 1820's and 1830's and the exponential growth of the newly founded London Geological Society. The liberals, by seizing control of the London

Geological Society before the Reform Bill was passed, presaged what was soon to follow in the political arena. And, fifth, once in control, the liberals attempted to cement their hegemony by repressing the catastrophists and by assimilating their data.

In the ensuing years of the 19th century, geology became fully professional and dogmatic. It became a scientific heresy to believe in catastrophic theory; and many years later, the reaction of the scientific community was one of instinctive repression, not because Velikovsky was wrong, but because it basically feared that he may be right.

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## NOTE

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1. The “Discourses” are three: “A Discourse on the Arts and Sciences”, “A Discourse on the Originality of Inequality”, and “A Discourse on Political Economy”.

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