

British scriptural geologists in the first half of the nineteenth century: part 4. Andrew Ure (1778-1857)

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Andrew Ure was one of the top chemists of his day with an international reputation as a meticulous scientist, a prolific writer and an effective teacher. But he was also one of those brilliantly versatile men of science in the early 19th century whose understanding of many subjects, both scientific and otherwise, was encyclopaedic. Although not a geologist, he gained a good knowledge of geology by reading the works of leading geologists. In 1829 he published *A New System of Geology* in which he sought to expand the understanding of geology among the common people while at the same time defending the biblical teaching of recent creation and a global catastrophic Flood against what he perceived to be the undermining of morality and faith in the Scriptures by the writings of anti-Christian scientists. He also proposed some new theoretical ideas for the reconstruction of earth history, one of which was one of the earliest conceptions of an ice age, which he speculated would have resulted from the Flood. Though his book was appreciated by some geologically well-informed readers, it received scathing criticism from the leading Cambridge geologist, Adam Sedgwick, whose remarks may reveal as much, if not more, about old-earth geologists of that day as they do about Ure.

Biographical sketch^{1,2}

Andrew Ure was born in Glasgow on May 18, 1778,³ to Anne and Alexander Ure, a cheesemonger. He studied first at the University of Glasgow and later of Edinburgh, obtaining his M.A. in 1798-99 and his M.D. in Glasgow in 1801. After graduation, he served briefly as an army surgeon in the north of Scotland before settling in Glasgow, where he became a member of the Faculty of Physicians

and Surgeons in 1803. The following year he replaced Dr George Birkbeck as Professor of Natural Philosophy (specializing in chemistry and physics) at the recently formed Andersonian Institution (now the University of Strathclyde) in Glasgow.

As well as successful teaching there, for about twenty years he also gave extremely popular evening lectures in chemistry and mechanics for artisans in the city. Attended by as many as 500 people, including up to 50 women, these courses were influential in the development of similar institutes in Edinburgh, Paris, London and other cities.⁴ Of this work one contemporary wrote,

*To Dr. Ure belongs the honour of having taken the lead in a movement which has had incalculable influence in developing national wealth, and promoting the interests both of science and art.*⁵

In these lectures he covered such topics as electricity, magnetism, heat, light, mechanics, hydrostatics and hydraulics, pneumatics and astronomy. The lectures all included physical experimental demonstrations, so the course times were split between evening and morning lectures, since some experiments were best done by candlelight and others by daylight.⁶

Also, in 1814, he began lecturing during the summers at the Royal Belfast Academical Institution. Eventually, strained relationships with the management of the Andersonian Institution led to his resignation in 1830. He moved to London and became probably the first consulting chemist in Britain, which provided him with a comfortable living, but not great wealth. In 1834, he began to be used regularly as an analytical chemist by the Board of Customs, which did not pay him a salary, but only on a per-analysis basis.⁷ In this capacity he demonstrated that he was willing to make financial sacrifices and to risk personal friendships and professional reputation for the sake of scientific truth and the exposure of large-scale criminal activity.⁸ As a chemist, he was highly esteemed by contemporary scientists, and Michael Faraday said that not one of Ure's chemical analyses was ever impugned.⁹⁻¹¹

In 1809, after a trip to London to meet some of the appropriate leading scientists, he helped establish the Glasgow Observatory and was appointed its astronomer.¹² For several years he resided there and during this time the famous astronomer William Herschel helped him install a fourteen-foot reflecting telescope, which Ure had designed and manufactured.¹³ He was one of the original honorary Fellows of the Geological Society of London shortly after it was founded in 1807, was an original member of the Astronomical Society and became a Fellow of the Royal Society in 1822.¹⁴ He was also accepted into the membership of several foreign scientific bodies, such as the Philadelphia Academy of Natural Science and the Pharmacological Society of Northern Germany.¹⁵⁻¹⁷ He wrote extensively throughout his life: seven books and more than 53 scientific journal articles.¹⁸ The books included *A New Systematic Table of the Materia Medica* (1813),¹⁹ A

Dictionary of Chemistry (1821),²⁰ *Elements of the Art of Dyeing* (1824),²¹ *A New System of Geology* (1829, 621 pages),²² *The Philosophy of Manufactures* (1835, 480 pages),²³ *A Dictionary of Arts, Manufactures and Mines* (1839, 1334 pages),²⁴ *The Cotton Manufacture of Great Britain* (1836, 2 Vol.).²⁵

His journal articles dealt mainly with various chemical problems. But other topics included gravity, telescopes, a thermostat, methods of apartment heating and ventilation, gunpowder and detonating matches, thunder-rods, experiments on a human cadaver,²⁶ and four articles on light. A paper on the latent heat of vapours, published in 1817, was influential in the development of many modern meteorological theories. Many of these articles were republished by foreign scientific journals. He was also a linguist and a fair classical scholar, was well acquainted with English and foreign literature and had read deeply in theology and biblical criticism. All in all he was 'one of those brilliantly versatile men of science' in the early nineteenth century, who had an 'encyclopaedic understanding' covering many subjects.²⁷

His marriage to Catherine Monteath in 1807 lasted only twelve years until Andrew divorced her due to her adulterous relationship with Granville Pattison, the Professor of Anatomy at the Andersonian Institution. During those twelve years, however, the Ures had two sons and one daughter. The oldest son, Alexander, became a successful London surgeon. The other son, Andrew, died in China in 1840. His daughter, Catherine, married but also remained devoted to him, travelling with him to the continent several times later in life as he sought treatment at spas for what was then diagnosed as gout, which for many years affected the right side of his body after any physical exertion. On January 2, 1857, at the age of 78 and still maintaining mental sharpness, Ure died after a few days of illness.

Geological competence

Although in 1805 Ure had visited all the principal mines in the United Kingdom,²⁸ he acknowledged that he did not write his book on the basis of original geological investigations. Rather, he endeavoured to draw freely from every authentic source of geological knowledge within his reach.²⁹ He specifically expressed his considerable debt to Conybeare and Phillips' *Outlines of the Geology of England and Wales*, though he also 'diligently availed himself of the valuable information in Cuvier's *Ossements Fossiles*.'³⁰

Other authors, whose geological writings he referred to in the book, included Buckland, Parkinson, Mantell, Macculloch, Playfair, Scrope, Daubeny, Bakewell, Davy, Sowerby, Brongniart, D'Aubuisson, Saussure, Deluc, Malte Brun, Esmark and Pallas. In addition he cited pertinent articles in the *Annals of Philosophy*, *Transactions of the Geological Society*, *Philosophical Transactions*,

Munich Transactions, *Journal de Physique*, *Edinburgh Philosophical Journal*, *Edinburgh Journal of Science*, *American Journal of Science* and the *Quarterly Review*. Apart from reading, he collected some fossils and did a number of chemical analyses of the composition of various kinds of rocks.³¹ Also with relevance to a theory of earth history, he had very good meteorological knowledge, which he brought to bear on his discussions of the initial creation, the Flood, and the distribution of plants and animals.³²

As far as his reading of other scriptural geologists is concerned, he made a negative comment about the cosmology of Kirwan and referred positively to Hutchinson's and Catcott's views on valleys of denudation. In defence of a global Noachian Flood he said that Penn's *Mineral and Mosaic Geologies* merited 'the deepest reverence,' though he disagreed with Penn's estimate of the ratio of antediluvian land and sea.³³ He did not give any evidence of having read the works of George Young or George Bugg.³⁴

Geology and geologists

Ure wrote his book for the expressed purpose of promoting the study of geology, that 'magnificent field of knowledge.'³⁵ He was very charitable and respectful in his comments about geologists. Conybeare's and Phillips' work was 'excellent' and of 'inestimable' value, Smith's work on using fossils to identify strata was 'admirable', Von Buch was 'second to none in mountain geology', and Scrope and Daubeny had done 'ingenious' work on volcanoes.³⁶ Similar remarks were made of the sagacious work of Buckland, Lyell, Murchison and other geologists in the UK and in Europe. There is absolutely no basis in Ure's book for Lyell's charge that Ure wanted all the old-earth geologists 'to be burnt at Smithfield.'³⁷

As far as geological theory was concerned Ure made a strong effort to avoid dogmatism:

*'However momentous the interests involved in this inquiry may be, it demands, however, the utmost delicacy and circumspection. Every approach to controversial acrimony should be deprecated. The advocates of religion do not always bear in mind that compassion is the only feeling which they are allowed to entertain towards those who unhappily want the faith essential to salvation. The more violent their rejection of the Christian doctrine, the more gentle should its teachers be in addressing unbelievers. Dogmatic virulence never made a convert.'*³⁸

At several points in his argument, Ure displayed caution in his theoretical speculations and calmly presented his reasons for favouring one interpretation of the scientific observations over another.³⁹ He closed his book by saying:

'In concluding my survey of the primeval world, while I readily acknowledge that many of my views are but partially developed, or faintly shadowed

forth, and that some of them may want confirmation, yet I trust that the accordances brought out between scientific induction, and sacred history, are neither fanciful, nor overstrained.⁴⁰

E.L. Scott speaks of Ure's 'air of conscious superiority' and 'intemperate scorn for his contemporaries and the self-aggrandizement that characterized much of his writing'.⁴¹ Farrar says that Ure 'seldom expressed himself in calm and moderate terms' but rather used 'intemperate polemics' against others.⁴²

But these portrayals seem to be very exaggerated generalizations in light of Ure's above remarks and the facts that his surviving correspondence shows that he enjoyed good relations with many prominent scientists for most of his life and that he had a wide circle of friends, many of them leading scientists in the UK and abroad, who lamented his death.^{43,44} In any case, such a negative picture would not be a just reflection of the tone of Ure's *New System of Geology*.⁴⁵

Nevertheless, Ure considered Werner's theory of earth history (Neptunism⁴⁶) to be 'a world-building hypothesis, so extravagant, so visionary, and so inconsistent with every principle of mechanical and chemical science.'⁴⁷ Hutton's theory (uniformitarianism⁴⁸) fared no better in Ure's estimation. Rather, to build a sound geological theory, the example of Bacon and Newton needed to be followed.

*'Our age and nation never cease to extol Bacon's inductive logic, and the rigid demonstrations of Newton. One is naturally led to suppose, that those who so loudly profess to be their disciples, should imitate, in some degree at least, the methods of research prescribed and practised by these great masters of reason and science. We should expect to find the facts subservient to any doctrine, collected with labour and skill, examined with scrupulous caution, and lucidly arranged without deceptive art. It is only facts, thus carefully chosen and candidly compared, which can be generalized into a just theory. If we examine the ablest expositions of the Wernerian and Huttonian geologies by that philosophical standard, we shall find them to fall egregiously short.'*⁴⁹

The relation between scripture and geology

Ure believed that when both the geological phenomena and the Scriptures were rightly interpreted they would agree, since both were the work of God.⁵⁰ Like most of his old-earth contemporaries, Ure also believed that the ultimate fruit of scientific and philosophical study was to

draw man's attention to the Creator. Of the creation he said, 'All its parts display so clearly the work of an Almighty hand, as to impress moral and religious sentiments, on every unperverted naturalist.'⁵¹

In seeking to follow Bacon, he insisted that geology like any science, must be based on experimentation, careful observation and sound inductive logic.⁵² But he made qualifications to a quoted statement from Bacon's *Novum Organum*⁵³ to the effect that we should not try to 'establish a body of natural philosophy' from Genesis 1 and other portions of Scripture about creation. Ure wrote,

'The censure [of Bacon] here bestowed on those who construct schemes of philosophy on scripture texts, is perfectly just, but it does not apply to those who endeavour to prove, by inductive evidence, that the conclusions of philosophy are not discordant with the order of physical events, recorded by Moses. The object of Bacon's reprobation is not the besetting sin of the present age. Science must now be built up on its own foundations, by its own rules, and with its own materials. The individual who would attempt

*to deduce a single principle in science from any phenomenon described in the Bible, would be regarded as no friend either to philosophy or religion. But when the principles of physics are fairly established on their own bases, it becomes a subject of interest, to examine how far certain natural phenomena related by the inspired historian, are conformable to our digest of the laws of nature. If an accordance can be clearly made out between things so distinct and independent, as ancient testimony, and the results of modern research, faith and reason will enjoy a just triumph, propitious to their mutual influence on mankind. This procedure is just the inverse of what Bacon reprobates. We do not seek the living among the dead; we do not determine the existing or actual properties of matter, from a few brief notices of mighty revolutions which it anciently suffered.'*⁵⁴

Ure agreed that the Bible was not given to man as a scientific textbook:

*'Revelation was certainly not imparted to mankind, for the purpose of instructing them in any principles of philosophy, which reason can explore. When the phenomena of nature are described [in Scripture], it is always in popular language, corresponding to the information of sense.'*⁵⁵

So, he argued, the Bible does not teach us 'the actual motion or repose of the heavenly bodies; that is something



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Courtesy of Terry Mortenson

for astronomers to investigate.⁵⁵ Likewise, it does not describe the ratios of land and sea before and after the Flood; that should be considered on the basis of sound principles of meteorology, physics, geology, etc.⁵⁶

But this did not mean for Ure that the Bible was irrelevant to the question of the history of the earth. He made a sharp distinction between the present operation of the universe (and all it contains) and its past origin. In his mind, the proper domain of science is in the repeatable and experimental study of the way in which things in creation function in the observable present. But when we turn to the unobservable past we are entering into a great deal of speculation.

*'Astronomy never reverts to a state of repose, antecedent to their actual condition. It contemplates the velocities and mutual equilibrium of moving bodies, but does not venture to speculate on a former or a future state, an origin or an end of the actual appearances of the heavens. In this respect, astronomers differ widely from our two famous geologists Werner and Hutton, who do not confine their inquiries to the existing cycle of phenomena, but boldly remount to a hypothetical order very different from the present, which no human eye ever witnessed.'*⁵⁷

Because of our 'absolute ignorance concerning the origin of our terrestrial system' and because of the great moral implications of the question of origins, he continued, 'it would therefore seem not unreasonable to consider such facts as the Deity has thought fit to reveal concerning the formation and garnishing of this globe as an abode of vegetable and animal beings.'⁵⁸ The Scriptures, 'the unerring oracles of God,' were seen by Ure to set the boundaries for speculative theories about the early history of the earth.

*'That divine Revelation was not imparted to Man, for the purpose of instructing him in the recanted principles of Physics, is a proposition fully laid down in the Introduction. Yet there may be certain primary facts, beyond the horizon of science, shadowed out by prophecy, as limits to speculative temerity and resting points to the pious spirit. Without such supplemental illumination, Man can know nothing of the cause, and manner, of himself, and his companion beings, coming into existence.'*⁵⁹

His book on geology

The full title of Ure's book reads, *A New System of Geology, in which the Great Revolutions of the Earth and Animated Nature are reconciled at once to Modern Science and Sacred History.* Ure did not write his book to add to the storehouse of geological observations, but to serve as an 'introduction and incentive to the study' of other geological works. Of himself he said,

'His leading object has been to distribute the most interesting and best established truths,

*illustrative of the structure and revolutions of the earth, in the order of their physical connexions and causes; whence certain general inductions might be legitimately seen to flow.'*⁶⁰

In so doing he sought to present on the basis of physical and geological science 'a view of certain intrinsic sources of change' in the earth's constitution, which he believed other natural philosophers had not perceived.

He also wanted 'to lead popular students of philosophy, to the moral and religious uses of their knowledge.'⁶¹ He sensed that a growing number of anti-Christian natural philosophers were using science to undermine morality and faith in the Scriptures. In an allusion to the French Revolution, he said that as these sceptics gained university posts (here he named no scientists or university professors in particular) they would contribute to the 'loosening [of] the frame work of society' and 'bring down a second fearful crash of atheism and crime.'⁶² He believed that sound natural philosophy would point toward the true and living God of Scripture and so he sought to show the concordances of science and Scripture, thereby 'strengthening the faith of the pious.'⁶³

Ure's book, most of which is descriptive geology, is organized in a reasonably systematic way, with an introduction and then three major sections: 1) the primordial world, which covered creation (pages 1-129), 2) the antediluvian period, which covered the formation of the secondary and tertiary strata (pages 129-349), and 3) the Deluge (pages 350-614). It includes fifty wood engravings of fossils and geological phenomena and six plates of fossils representative of some of the geological formations. Quoted material is often in a different script and, as noted earlier, too frequently lacks detailed citation of the source.

Creation and pre-Flood history

Ure believed in a literal six-day creation of the universe, which was finished in a perfect form about 6000 years ago.⁶⁴ At the end of the book (pp. 608-15) he discussed his reasons for rejecting the Hindu chronology (of a vastly older earth) as fabulous myth. In opposition to both the day-age theory and gap theory, he argued that both the contextual use of 'day' in Genesis 1 and God's commentary in Exodus 20:8-11 prove that the creation days were 24 hours long, the length of one rotation of the earth, and that the first day was the beginning of the whole creation.⁶⁵

He contended that the notion that the earth was formed from a chaotic mass by the laws of nature over vast indefinite ages of time was contrary to reason and made God appear as an imbecile. Rather, the primitive earth (with its primitive rocks) was an instantaneous, fiat creation of God.⁶⁶ On the appointed day God also supernaturally and instantly created mature plants and animals (*i.e.*, with the appearance of age).⁶⁷

The sun, along with the other stars, was created on Day 1 with the earth, when the universal law of gravitation was

instituted. But not until Day 4 were they invested with rays of light as they '*acquired their lucid exterior*.'⁶⁸

Ure reasoned that the original earth was created instantaneously as a spheroid perfectly suited for life. It had a molten interior with a crust of concentric horizontal strata of gneiss, mica-slate, and clay-slate, with partial layers of semi-crystalline limestone, all of which was initially enveloped by a universal ocean.⁶⁹ These were the primitive rocks of Day 1 of creation, which explains why they contain no fossil remains. When God made the dry land to appear on Day 3, the transition strata began to be formed in the ocean bottom, being increasingly mingled over time with marine exuviae after they were created on Day 5.⁷⁰ The ocean at this time and prior to the Flood was smaller in surface area (equal in size to the land mass) but deeper, which contributed to warmer and drier antediluvian climate.⁷¹

When Adam and Eve sinned, God cursed the earth,⁷² one effect of which, in Ure's theory, was a long series of localized convulsive events all over the more thinly crusted ocean bottom, which culminated finally in God's judgment of a global Flood.⁷³ During this antediluvian period of 1600 years, the regular pattern of fossiliferous secondary and tertiary strata was formed on the ocean bottom, as basaltic eruptions agitated the seas causing partial destructions of the land and its inhabitants and local elevations of parts of the seabed.⁷⁴

In this regard, Ure basically accepted the old-earth theory for the deposition of these sedimentary formations over a long period of time and by many catastrophes, though in contrast to old-earth geologists he believed the biblical chronology provided the sufficient time for these events. As we have seen, Ure gave only a brief biblical argument against the gap and day-age theories. Apart from brief comments showing why he rejected the nebular hypothesis (with its gradually cooling earth) and a short discussion of how the advancing desert sands of Egypt could serve as a chronometer for measuring the date of the Flood (consistent with Genesis), he did not make much effort explicitly to refute, with geological reasons, the old-earth time-scale.⁷⁵ He did, however, add a theological argument against the old-earth view: the fossil-bearing strata and diluvium speak of the wrath of God against sin and do not reflect the creative work of God.

'Such a dismal ruin of all organic beings, such a derangement of the fair frame of nature seem to be irreconcilable difficulties in Natural Theism. For is not the wisdom of God impeached in constructing a world on foundations so infirm; his prescience in peopling so precarious an abode, with countless myriads of exquisite mechanisms; and his goodness in plunging indiscriminately every tribe and family of his sentient offspring in mortal agony and death? A creation replete with beauty and enjoyment, suddenly transformed by its Creator's mandate or permission into a waste of waters, is a moral

*phenomenon which certes no system of ethics can explain. Here, metaphysics, the boasted mistress of mind, with all her train of categories, stands at fault. But here, if reason will deign to forego its pride, and implore the aid of a superior light, the Hebrew prophet will lift up the dark veil from the primeval scene. In revealing the disobedience of Adam, the atrocious guilt of Cain, and the pestilence of sin, almost universally spread among the progeny, he shows, alas! too clearly, how justice outraged, and mercy spurned, inevitably called forth the final lustration of the deluge. This conclusion, no philosopher can reasonably gainsay, who considers man as a responsible agent, and this earth with all its apparatus of organic life, as mainly subservient to his moral and intellectual education.'*⁷⁶

The Flood

Ure devoted 240 pages to a discussion of the Flood, which included no detailed analysis of the biblical account of the event. He believed that it was a global, year-long, penal judgment of God, the last in a series of previous smaller catastrophes, which themselves were the secondary cause of the Flood.⁷⁷ These pre-flood catastrophes, though far from universal, were significant enough, in Ure's theory, to extend the area of the ocean step by step by permanently submerging some of the land. This process also had a cooling effect on the earth's climate (a subject we will return to shortly). So, in a way that he did not fully explain, the Flood was both a divine interruption and a result of the normal laws of nature. Regarding this uniformity of nature he wrote:

*'In the Newtonian Philosophy, no other causes of natural events can be admitted than what are known to be really operative, and adequate to account for the phenomena. This inductive law prohibits the employment of hypothetical assumptions, whose existence we cannot prove, such as the attraction of a comet in deranging the axis of the earth, or deluging it, by lifting the waters from their ocean bed. Nor will modern discovery suffer the theorist to summon from the bowels of the earth an ideal abyss to serve his purposes; far less allow him to get rid of a meteoric deluge imported by an aqueous coma for the occasion. Thus wisely circumscribed, but by no means fettered, we shall have no difficulty in finding actual and potential forces, capable of explaining the principal appearances, incident to the great diluvial catastrophe, and its precursor inundations.'*⁷⁸

The uniquely global Flood raised many of the secondary and tertiary strata out of the ocean as the antediluvian land sank.⁷⁹ The evidences of this event were the diluvial deposits of gravel, erratic boulders, and fossils of extinct creatures, the scratches and furrows on the surface

of many strata, the trap rocks witnessing to the intensified volcanic activity, and the pagan traditions of a such a Flood. In this view, of course, he was in complete harmony with the old-earth catastrophists of his day, such as Cuvier, Buckland, Brongniart, Conybeare, and John Phillips who published his work on Yorkshire geology the same year as Ure's book came out.⁸⁰⁻⁸² Ure's answer for why no fossil humans had been found was simple: the lands inhabited by antediluvian man were permanently submerged by the Deluge.⁸³

Ure devoted a considerable amount of discussion to the climatic impact of the Flood, giving us one of the earliest conceptions of an ice age.^{84,85} He reasoned that at the beginning of the Flood, the ratio of land to sea was probably about 1:1. This arrangement, along with a cloud canopy high in the upper atmosphere ('the waters above' of Genesis 1:7)⁸⁶ and an initially warmer ocean, had produced a very warm and uniform temperature on the earth.⁸⁷ Also as a result, he conceived that in the pre-flood world there were no winds to speak of, nor virtually any rain (nor rainbows, which Ure thought was implied by Genesis 9:11-17). Rather, a heavy dew, resulting from only the vertical movements of air causing evaporation and condensation, watered the earth (which to Ure was consistent with Genesis 2:5-6).⁸⁸

However, the Flood reordered the surface features of the earth, leaving the present ratio of land to sea (1:3). This caused a 'sudden and vast refrigeration'⁸⁹ of the earth accompanied by much precipitation. The result was a rapid build-up of glaciers in the higher latitudes.⁹⁰ Ure argued that these glaciers would have transported much diluvial gravel and would account for the woolly mammoths of Siberia and the fossilized tropical plants found in the arctic by the explorations of Sir William Edward Parry (1790—1855)⁹¹ in 1819-20. For a long time after the Flood the earth would have remained, at least in the extra-tropical zones, relatively damp and cold, gradually passing to a considerably drier and warmer climate and in places producing deserts, such as in northern Africa.

Ure said that another result of the Flood, along with the sedimentation process of the previous 1600 years, would have been a much thicker crust over the molten interior of the earth, which in turn would produce a more stable post-diluvian terraqueous system (in terms of volcanic and earthquake activity).

One other aspect of Ure's theory about the Flood was that he, like Perm, believed that God supernaturally created new animals to suit the transformed earth.⁹² The animals on the Ark with Noah would have provided food for the human survivors of the Flood. Their stock probably died out in the course of a few generations. His reasons for postulating this were that 1) extinct fossil animals were so different from existing forms, 2) this seemed to be the only way to explain why some animals are found only in one location on earth, like Australia, 3) the types of most existing races of animals are not found in the diluvial

deposits, 4) the lack of any ape fossils at the time, and 5) Psalm 104, which Ure believed seems to describe the Flood and to speak of God creating animals as He renewed the earth (v. 30).

Reviews of his *Geology*

Having examined Ure's book, we now have a context for considering the several reviews it received.

The *British Critic*,⁹³ while commending Ure's moral and religious objective for writing, considered the book to be no friend of science or Scripture. Among other things, it criticized Ure for not taking a very literal interpretation of Scripture (as he said we should). For example, Ure postulated many land-submerging catastrophes before the Flood, about which the Bible made no mention and he proposed new creations of animals after the Flood whereas the Bible said that the animals on the Ark replenished the earth.

While recognizing that geologists had a low regard for Ure's book and not being sure about the length of days in Genesis 1, the *Christian Remembrancer*⁹⁴ nevertheless felt that the book fulfilled Ure's purpose by the variety of information it contained and its 'pleasing style' and 'tone of philosophical independence'.⁹⁵

The *Quarterly Journal of Science, Literature and Art* gave a very positive review⁹⁶ calling it an 'interesting, and in many respects original, work', though it could have been better titled as 'Geological Physics' or 'Philosophy of Geology'. To the reviewer, the book displayed Ure's proven 'vigilance of observation and logical acumen' and it 'has not in the least a controversial texture'.⁹⁷ Ure's discussion of the primitive formation was praised for its reference to Macculloch's 'excellent' papers on granite (published in the same journal) and Von Buch's latest observations on volcanic rocks in the Alps. The reviewer believed that Ure's overview of the secondary and tertiary formations 'will contribute essentially to promote the popular diffusion of geological science'.⁹⁸ One of the vexing problems for geologists at the time was to explain the fossil evidence of tropical plants and animals buried in northern latitudes, which suggested to many that there had been in the past a global tropical climate. The reviewer regarded Ure's proposed explanation 'to be equally new and striking'. " He concluded by saying, 'On the whole, we regard this new system of geology, as one of the most valuable accessions lately made to the scientific literature of our country.'¹⁰⁰

The *Magazine of Natural History* carried two short anonymous letters reviewing Ure's book. One correspondent, 'H,' attacked the book as most 'injurious to the science of geology' because of the many alleged geological errors in it.¹⁰¹ The other, 'T.E.', who appears to have been well-informed geologically, responded to many of H's criticisms in defence of Ure, while at the same time hesitating to endorse fully Ure's theory of earth

history.¹⁰²

The most influential and scathing review was given by the Cambridge geologist, Adam Sedgwick, in his annual presidential address to the Geological Society.¹⁰³ He said Ure's book contained '*the worst violations of philosophic rule, by the daring union of things incongruous*' and '*the bold and unauthorized hypothesis*' that the primitive rocks were instantly created by divine fiat.¹⁰⁴ Sedgwick did not have one good thing to say about the book; he did not even acknowledge how much Ure agreed with contemporary catastrophists, as we have noted.¹⁰⁵ While many of his criticisms were valid, a general overview of them suggests that Sedgwick may have been diligently looking for nothing but errors of detail, for he made no comment on any of Ure's theoretical discussions as the review in *Journal of Science* had done.

Sedgwick was clearly irritated by what he called '*a complication of errors as nearly baffles all attempts at description*.'¹⁰⁶ However, upon careful inspection some of Sedgwick's examples of error do not appear to be errors at all, or at least Sedgwick's obvious anger about them seems out of proportion to the nature of the error.¹⁰⁷ Since Sedgwick's review was so hostile and influential, it might not be inappropriate to consider some of these cases. It will shed more light on the nature of the Genesis-geology controversy.

Without going into any precise detail about the errors Ure made in regard to the English strata, Sedgwick said simply that '*all the old errors in the arrangement of the English strata, between the chalk and the oolites, are unaccountably repeated*,' though they had been corrected in the journals ever since 1824. However, in comparing Ure's order with geologist William Fitton's list of strata in 1832 we find that they are at least in the same order, though admittedly Ure's description could have been written in a clearer form and in 1829 it maybe could have been more detailed.^{108,109} Sedgwick also asserted, correctly, that on one page the lias and oolites were put in the reverse order.¹¹⁰ But as the reviewer 'T.E.' pointed out (in responding to a similar criticism by 'H.'), '*an unprejudiced reader*' would see this as simply a printer's mistake, since elsewhere, and especially in the chapter on the lias formation, Ure presented the strata in the correct order.^{111,112}

Sedgwick also charged that '*In one place we are told, that the lower secondary rocks are characterized by the simplest forms of the animal kingdom. In another, we find fish enumerated among the fossils of the transition (or submedial) strata.*'¹¹⁵ In the first place we might say that the average reader in Ure's target audience would never have made such a connection of minute detail between such vastly separated pages (about 150). But actually, when the statements are taken in context they are both seen to be true. In the first statement, Ure was describing in two pages of the 'Introduction' a general view of the whole geological record, with relatively simple marine creatures at the bottom and reptiles, amphibians and mammals more common at

the top.¹¹⁶ The second statement was made in the context of a lengthy and detailed discussion of the transition strata and it was also true.¹¹⁷

In another example, the details are only those which an expert geologist like Sedgwick (for whom Ure expressly did not write the book) would have known and noticed. Sedgwick said that Ure had figured the '*Steeple Ashton caryophyllia (the characteristic fossil of the middle oolite)*' as '*a fossil of the inferior system*' (i.e., the lower oolite). In fact, on Ure's cited page (251) the figure is subtitled (in agreement with the wording in the paragraph next to it) less precisely as simply a '*Caryophyllia*' which Conybeare and Phillips listed as one of the fossils found in the inferior oolite.¹¹⁸ The majority of Ure's readers would likely not have even noticed, much less remembered and been terribly misguided, by such a slightly erroneous detail. Further, it seems reasonable to assume that Ure was using an available picture of a caryophyllia to illustrate for his non-specialist reader, rather than to precisely distinguish species of caryophyllia, as Sedgwick was doing.

In another example of error, Sedgwick pointed out that on page 187 Ure correctly described the magnesian limestone as '*the first floetz limestone of Werner*,' while on page 175 Ure had given that Wernerian designation to the English mountain limestone, which '*by a double blunder, is described "as the lowest sepulchre of vertebral animals."*' But with the two limestones having such similar names, it is easy to see how such a careless mistake about the German equivalent could have been made and missed in the editing process. As far as the second '*blunder*' is concerned, it would indeed show that in 1829 Ure was not up-to-date in every minor detail in a science that was rapidly accumulating new data in the 1820s.¹¹⁹ The formations directly below the mountain limestone (i.e., the soon-to-be-called Devonian, Silurian and Cambrian) only became the focus of intense study in the 1830s.

In discussing Ure's six pages of plates showing fossils, Sedgwick alleged many errors. One of them was that Ure had wrongly listed the *Scaphites aequalis* as a fossil of the Lias.¹²⁰ However, if this was an error, it was one also made by Conybeare and Phillips.¹²¹

Given the above considerations, the weight given to Sedgwick's several vague criticisms must be lessened.¹²² Many of the other specific errors Sedgwick mentioned were completely valid and did reflect that Ure's knowledge of some of the geological details was a little out of date or confused, or that he had not done an adequate job in editing before the book went to press.¹²³ But Sedgwick's severe reaction seems to warrant the same geologically informed response that 'T.E.' gave to the similarly negative review by 'H.'

'In general, indeed, I think we should be careful how we magnify molehills into mountains, and, for a few inaccuracies and marks of inattention, throw discredit on a book which, like Dr Ure's, contains so many pages of sound induction and philosophic

reasoning; and although most people will be inclined to differ, more or less, from his theory, or the arguments adduced in its support, yet, as geologists still seem inclined to adhere to one of the three hypotheses mentioned by Mr Conybeare in his Introduction,¹²⁴ a book written in support of one of them, by such a man as Ure may not be without its use; perhaps, indeed, we might all be much benefited, and our ideas enlarged, if men qualified for such speculation were to illustrate the other two, in connection with a good practical account of the present state of the science.'^{125,126}

Conclusion

Though a fellow of the Geological Society, Ure was not, and did not present himself as, an original investigator of geological phenomena. Rather he quoted, too often without adequate citation, from the works of others. In much of his thinking he was in total agreement with the leading old-earth catastrophists of the day: he accepted the distinctions and temporal separation of the different strata (though spanning only about 1600 years), as interpreted by the use of characteristic fossils, and his view of the geological effects of Noah's Flood was virtually identical to that of old-earth geologist John Phillips, who published the same year. But what he sought to do was to offer some new perspectives on the facts and incorporate into a theory of creation and earth history information which had not been previously known or applied to this question: for example, the undulation theory of light with reference to the creation of light and the celestial bodies, and meteorological knowledge in relation to the early earth, the Flood and the Flood-induced 'ice age' (as it would later be called).

He believed that the unerring Scriptures do not teach any system of science, but that they are relevant to the question of origins, which is outside the realm of experimental science which studies present-day processes. Though not working out a detailed connection between Genesis and geology, he endeavoured to speculate on the basis of current knowledge and within what for him were the limiting boundaries set by Scripture, namely, a six-day creation about 6000 years ago and a global catastrophic Flood.

Ure stated that he wrote the book to introduce people to geology and to show how it related to Scripture. His own long teaching career up to this point reflects the sincerity of his desire to advance general scientific knowledge among the common people. Nothing we know about him would cast any serious doubt on the genuineness of his Christian convictions as they are clearly expressed in his *Geology*. While some of his other writings may suggest that he had Tory party sympathies, there is no indication that such concerns were a significant part of the motivation to write on geology (or nearly any other of his

writings). And while some episodes from his life reflect pride, his *Geology* does not, so that it is improbable that he wrote it for self-glorification. In fact, he seemed well aware that he, like other Scriptural geologists, would face opposition to his ideas. His commitment to biblical truth and true scientific knowledge and his concern that atheistic science (toward which geology was tending, he felt) would be detrimental to society and the Christian faith seem to be truly the primary motives for writing on geology.

References

1. Unless otherwise noted this is based on Copeman, W.S.C., 1951. Andrew Ure, M.D., F.R.S. (1778-1857). *Proceedings of the Royal Society of Medicine*, 44:655-62.
2. Farrar, W.V., 1973. Andrew Ure, F.R.S., and the Philosophy of Manufactures. *Notes and Records of the Royal Society of London*, 27(2): 199-324.
3. Anon., 1857. Ure's obituary. *Gentlemen's Magazine*, N.S.11:243.
4. Farrar, ref. 2, p. 300. Ure attributed this in some measure to the favourable report of his teaching the artisans which was given by Charles Dupin in his *Tour through Great Britain* (1817). The schools following Ure's model included the Edinburgh School of Arts, the Conservatory of Arts in Paris, and the Mechanics' Institutions in London and other cities. See Ure A., *New System of Geology* (1829), xxxviii.
5. Ref. 3, p. 242.
6. Ure, A., 1809. *Outlines of Natural or Experimental Philosophy*. This short booklet described his lectures for those who would take the course. The topics covered reflect a great breadth and depth of scientific knowledge gained by both reading and experimentation.
7. *Imperial Dictionary of Universal Biography* (1865), 111:857.
8. See Ure, A., 1843. *The Revenue in Jeopardy from Spurious Chemistry*, especially pp. iii,v and 33. In order to serve the national interest, Ure consumed much time and money on these analyses. Such time and money could have generated more income if invested in non-government work.
9. For Michael Faraday's remarks, and a similar view expressed by E.D. Clark, see Copeman, Ref. 1, pp. 659-660.
10. A review of Ure's *New System of Geology* in *Quarterly Journal of Science, Literature and Art*, N.S. V:113 (Jan.-Mar. 1829), stated that Ure 'has been long esteemed among men of science for his able and intrepid refutation of numerous errors current in some of our chemical systems.' The review was possibly by the editor, William Brande, himself a chemistry professor at the Royal Institution, as well as a friend of Ure's.
11. An obituary, in *Gentlemen's Magazine*, ref. 3, likewise noted that Ure's 'skill and accuracy as an analytical chemist were well-known.'
12. Ward, T.H., 1885. *Men of the Reign* (1885), p. 904.
13. Copeman, ref. 1, p. 658.
14. *Dictionary of Scientific Biography* and *Dictionary of National Biography*, articles on Ure. Hereafter these well-known dictionaries will be referred to as DSB and DNB respectively.
15. Ure, A., 1839. *Dictionary of Arts, Manufacturers and Mines*, title page.
16. Anon., 1874. *Dr. Andrew Ure: A Slight Sketch*, pp. 17-18.

17. Ref. 16 may have been written by William Beattie, according to Sarjeant, W.A.S., 1980. *Geologists and the History of Geology*, 111:2310. Beattie was a Scottish medical doctor and possibly knew Ure from their early years at Edinburgh University.
18. *Catalogue of the Royal Society*. Farrar says there were many more journal articles than listed here. See Farrar, ref. 2, p. 304.
19. Ure claimed that this was the first scientific book on pharmacology. See Copeman, ref. 1, p. 658.
20. This was a virtual rewrite of William Nicholson's outdated work by the same title. Ure's version reached a fourth edition in 1835. French, German, Spanish and Russian translations were also published. The 1841 American edition became and remained the standard chemistry textbook in the USA for many years. See Copeman, ref. 1, p. 659.
21. This was a two-volume translation of the French work of Claude Louis and A. B. Berthollet.
22. Ure, A., 1829. *A New System of Geology, in which the Great Revolutions of the Earth and Animated Nature are reconciled at once to Modern Science and Sacred History*. As the focus of this study, hereafter it will be referred to simply as *Geology*.
23. This work was based on a tour Ure made of the manufacturing districts of Lancashire, Derbyshire, and Cheshire, and it embodied one of the first clear recognitions of the cultural impact of the 'industrial revolution' (DSB on Ure). In it, Ure displayed a concern that factories be places where workers were well-paid, healthy, educated (in secular and Christian knowledge) and godly in character. He was especially concerned about good education for poor children. He was convinced, and presented some of the evidence that led him to that conviction, that British factories were generally doing well in these areas, though there was room for improvement. Most historians would say that he was overly optimistic about factory conditions. See, for example, Reeve, R.M., 1971. *The Industrial Revolution 1750-1850*, especially pp. 65-66 and 76.

A third edition of the book appeared in 1847 and a reprint was done in 1967. It was also translated into French and German. See Copeman, ref. 1, p. 661.
24. This was a greatly broadened version of his *Dictionary of Chemistry*. See DSB on Ure. It went through several revisions and enlargements before the seventh four-volume edition appeared in 1875. It was translated into almost every European language, including Russian and Spanish. The vastness of research Ure put into it is reflected in the fact that the French translation involved nineteen collaborators, all expert in their own specialized subjects. See Copeman, ref. 1, p. 661.
25. This was the first and only work published in an intended series. A posthumous edition appeared in 1861 and a German translation came out in 1834.
26. This reported the results of his sensational public experiment on the electrically-induced activation of the muscles of an executed murderer. The article was republished by three French journals, according to the *Royal Society Catalogue*.
27. Copeman, ref. 1, pp. 655-56.
28. Farrar, ref. 2, p. 303.
29. Ure, ref. 22, p. vii. Though his intention was 'careful merely to quote his authorities, and to acknowledge his obligations' and generally he did mention a person's name when using their material (which was usually set in a different print type), he could have avoided one criticism of his work by footnoting the actual sources far more often than he did.
30. Ure, ref. 22, pp. vii-viii.
31. Ure, ref. 22, pp. 618, 89-90 (here he gives a quantitative description of the make-up of the major kinds of rock found in the primitive crustal rocks), and p. 165 (where he said that 'I have examined with great care many specimens of coals of the purest quality').
32. Ure, ref. 22, pp. 55-71, 481-9. In this he relied heavily on the *Meteorological Essays* (1823) of John Daniell, the leading scientist in this field at the time. Daniell was one of those influenced by Ure's 1817 journal article on the latent heat of vapour, mentioned above. See Anon., ref 16, p. 8.
33. Ure, ref. 22, pp. xiv, 366-61, 470, 481.
34. The lack of reference to Young is noteworthy considering that both were Scottish, both attended Edinburgh University and Ure, like Young, gave considerable space to a discussion of the Kirkdale Cave (Ure, ref. 22, pp. 567-80). However, contrary to Young, Ure favoured Buckland's interpretation that it had been an antediluvian hyaena den.
35. Ure, ref. 22, p. 616.
36. Ure, ref. 22, pp. 290, vii, 153, 480, 377.
37. Lyell wrote this comment about Ure in a letter to his sister just prior to the publication of Ure's book. See Lyell, K.M., 1881. *Life, Letters and Journals of Sir Charles Lyell, Bart.*, 1:238.
38. Ure, ref. 22, p. xiii.
39. In discussing the primitive atmosphere he stated, 'On a subject so transcendent and mysterious as the state of the new born atmosphere, it becomes not man to dogmatize. It is, therefore in perfect humility, that I offer the following suggestions' (Ure, ref. 22, p. 69). Of the primeval ocean and its relation to land, he wrote: 'In attempting to search into the secondary causes which may have been called into action, when the channel of the sea was hollowed out, and the mountains were upheaved from the abyss, it behooves us to walk with the most humble circumspection ... The reproach of presumption will indeed be incurred, if we do not travel closely to the inductive path. We must, above all, beware lest we be misled by vague analogy' (Ure, ref. 22, p. 73). He was also restrained in his remarks about the origin and nature of coal (Ure, ref. 22, pp. 163-74), the origin of valleys (Ure, ref. 22, pp. 355-7), and the restructuring of the earth during the Flood (Ure, ref. 22, pp. 437-8).
40. Ure, ref. 22, p. 615.
41. DSB on Ure, 547. Scott wrote the article on Ure. Scott also said that Ure wrote 'a series of tendentious pamphlets, in which his fellow scientists were frequently castigated.' But Scott cited no sources to support this assertion and I could find no such pamphlets in any library catalogue or reference made to them by any other primary or secondary sources which Scott did provide.
42. Farrar, ref. 2, pp. 301, 306. Farrar made many critical remarks about Ure's character, but more often than not they were assertions without documentation. Some of Farrar's negative assertions that I was able to check for accuracy proved to be inaccurate. For example, in discussing Ure's *Philosophy of Manufactures* (1835) Farrar (p. 318) accused Ure of asserting that working at 150 degrees (F) was not unhealthy. In fact, Ure never made such a general statement but instead described (on pages 392-93) one particular case of women, called 'stove girls,' whose job was to supervise the drying of wet dyed cloth in very hot rooms, which they were in for only a few minutes at a time. This was an enviable job among women in the factory and all such stove girls in the factories observed appeared to be in perfect health. On page 316, Farrar said that Ure's last chapter on the commercial economy of the factory system was 'a diatribe' in favour of free trade. However,

although Ure clearly favoured free trade, the tone of the chapter is calm and respectful, not bitterly critical of all other views of commerce.

On the same page, Farrar also said that in that chapter Ure gave a '*curious defence of smuggling*.' But he did no such thing. He merely described the fact that smugglers will always find ways to circumvent bad government trade laws and that ultimately their activities become the stimulus to change faulty legislation. But Ure was not advocating smuggling. Further proof of this was his chemical analyses in 1842-43, which helped the Commissioners of Customs to discover a smuggling operation. In the process Ure regrettably had to expose the errors in chemical analysis done by two prominent chemists, Professors Thomas Graham and William Brande. See Ure, Ref. 8.

Finally, on page 320, Farrar erroneously stated that, in relation to this 1843 smuggling investigation, Ure was '*an official of the Customs*.' Ure was most explicit in Ref. 8 (p. iii) that he was not and received no salary from Customs. Instead, he was paid two guineas for each individual chemical analysis, regardless of how much time and money each analysis required. Farrar continued by saying that in this pamphlet Ure had attacked his former friend and fellow chemist, Brande, with '*unnecessary bitterness*.' But the *Revenue in Jeopardy*, which is largely comprised of letters and other documents (by Ure, Brande, Graham and others), did not constitute a bitter attack by Ure against these professors. Nor was his exposure of their mistaken chemical analyses unnecessary since they had erroneously advised the Customs.

43. Copeman, ref. 1, pp. 657-58, 661-62.
 44. Another of Ure's biographers said that '*his conversation was always most interesting and instructive*.' See Anon., ref 16, p. 17.
 45. As further support for this conclusion, it should be born in mind that although Hitchcock, a prominent American geologist, largely rejected Ure's views, he did commend Ure's temperate expression of them. See Hitchcock, E., 1837. *The Historical and Geological Deluges Compared*. *The American Biblical Repository*, IX(25): 113.
 46. A.G. Werner (1750-1817) founded the Neptunist school of geology. This taught that the earth was once covered by water. As this primordial ocean receded over millions of years, the minerals were precipitated into different layers. The rival theory was Plutonism or Vulcanism, which recognised that many rocks, e.g. granite, had cooled from molten rock. See 'Werner, Abraham Gottlob', *Encyclopaedia Britannica* 12:582-583, 15th ed. 1992.
 47. Ure, ref. 22, pp. xxxiii-xxxiv.
 48. James Hutton (1726-1797) founded the classical uniformitarian theory: '*the present is the key to the past*'. This states that current landforms are the result of deposition, sedimentation, upthrusting and erosion, all happening at present rates over eons. These processes were cyclical, contrary to Werner's directional theory. See 'Hutton, James', *Encyclopaedia Britannica* 6:176-177, 15th ed. 1992.
 49. Ure, ref. 22, pp. xxi-xxii.
 50. Ure, ref. 22, p. xiii.
 51. Ure, ref. 22, p. 86, also pp. xxxix-xliii and 183-184. This was, in fact, one of the stated purposes of Ure's book (xxxviii).
 52. Ure, ref. 22, pp. x-xi, 16.
 53. Bacon, F. *Novum Organum*; translated by Johnson, A., (1859). 43 [Book I, pt. lxxv].
 54. Ure, ref. 22, pp. xiv-xv.
 55. Ure, ref. 22, p. xviii.
 56. Ure, ref. 22, p. 471.
 57. Ure, ref. 22, p. xviii.
 58. Ure, ref. 22, pp. xix-xx.
 59. Ure, ref. 22, pp. 15-16.
 60. Ure, ref. 22, pp. vii-viii.
 61. Ure, ref. 22, p. xxxvii.
 62. Ure, ref. 22, p. xxxix.
 63. Ure, ref. 22, pp. xl-xli, Iv.
 64. Ure, ref. 22, pp. 13-15, 86. He accepted Ussher's date of creation (4004 BC), knowing that people would scoff at him. But he asked, if the earth was made for man, why we need to imagine a more distant beginning for earth or the universe of stars, planets, etc., which were the result of one and the same creative mandate.
 65. Ure, ref. 22, pp. 11,82.
 66. Ure, ref. 22, pp. 7-10. In support of his notion of the primitive earth, he quoted Isaac Newton's *Opticks* (I found his quoted material in the 1931 edition of Newton's book, pp. 400 and 402). Later Ure continued, '*Had we been told that Deity, in the beginning, created a chaos out of which symmetry was to be educed through a long series of material transmutations, then philosophy might have proffered her conjectures concerning the order of evolution; but ancient chaos is merely a mythological fiction, disavowed alike by the word and wisdom of God... Chaos is, in fact, a dogma borrowed by Pythagoras from the Persian Magi*' (Ure, ref. 22, p. 12).
 67. In reference to this miraculous creation of plants on Day 3, he wrote (Ure, ref. 22, pp. 81-2) that such an idea '*does not seem to have been made a stumbling-block by the Botanical student, as the first arrangement of the mineral strata, has been by the Geologist. . . No Botanist or Zoologist, of sane reputation, inculcates that plants and animals acquired their perfect and unvarying forms, through successive organic depositions and catastrophes, as geognostic theorists have taught with regard to the primitive structure of the earth*.' In a further rejection of evolution (biological, geological or astronomical) he added, '*The achievement of creation, by distinct and independent acts, was performed on each of six successive days; demonstrating that it was not the result of a blind necessity, or a spontaneous, and therefore continuous, though irregular aggregation of chaotic atoms*' (Ure, ref. 22, pp. 86-87).
- Whether Ure denied any variation of the species is not clear. He did believe that after the Flood God created new forms of life supernaturally, the creatures on the ark only serving as food for Noah and his family until the earth was replenished with other sources of food. On the other hand, we cannot legitimately make too much of this with reference to biological variation, since Ure's view of post-flood creation was an attempt to explain the difference between the extinct fossilized creatures and existing forms.
68. Ure, ref. 22, pp. 17-51, 82. In a lengthy discussion of the undulation (wave) theory of light (with reference to M. Arago's experiments), Ure argued that light had existence before the sun became the primary light-bearer for earth on Day 4. He added that had Moses written Genesis 1 on the basis of sense perception and Egyptian education he would not have put the creation of light before the sun. Obviously, it would appear that Ure had not adequately pondered the fact that he was being a bit loose and inconsistent in his interpretation by putting the creation of the sun on Day 1 and of its luminosity on Day 4. Using the interpretation of sun spots by Herschel, a leading astronomer of Ure's day, Ure rejected Buffon's theory that the sun was the molten parent of the other planets (Ure, ref. 22, pp. xxxv-xxxvii).
 69. Ure, ref. 22, pp. 89-92.
 70. Ure, ref. 22, pp. 129-30.

71. Ure, ref. 22, pp. 495, 599-602, 51-70.
72. In support of this Ure cited Genesis 3:17-19 and 5:29 (Ure, ref. 22, pp. 274).
73. Ure, ref. 22, pp. 436-39, 470-4, 505-6.
74. Ure, ref. 22, pp. 130, 169, 594-5.
75. Ure, ref. 22, pp. 498, 602-4. Concerning the Egyptian desert, he argued that according to historical records, the fertility of Egypt was much greater at the times of Cleopatra and Caesar Augustus. If the Flood had been more ancient than the date set by Moses, then Egypt should have long before their times become an uninhabitable desert.
76. Ure, ref. 22, pp. 505-6.
77. Ure, ref. 22, pp. liii, 130, 349, 439.
78. Ure, ref. 22, pp. 373-4. In contrast, he said this about the theory of the earth evolving from a nebulous cloud: *'I am not conscious of having employed in the preceding investigation, any causes whose operation is not both actual and sufficient to explain the appearances. I leave others to speculate about the igneous origin of the globe, and its having spontaneously evolved during an indefinite period of refrigeration, successive orders of organic forms. This hypothesis is founded neither on natural or revealed knowledge; nor will it accord with those great and sudden crises of temperature, which innumerable monuments attest'* (Ure, ref. 22, p. 498).
79. Ure, ref. 22, pp. 350, 471, 475.
80. Phillips, J., 1829. *Illustrations of the Geology of Yorkshire*. Pages 16-30 present his view of the global flood.
81. William Smith, Phillips' uncle, held a similar view of the geological effects of a global flood, apparently till the end of his life, though he never equated it with the Noachian Flood. See Phillips, J. 1844. *Memoirs of William Smith*, pp. 25-26.
82. See also Sheppard, T., 1914-1922. William Smith: His maps and Memoirs. *Proceedings of the Yorkshire Geological and Polytechnic Society*, N.S. XIX: 175 and facing chart.
83. Ure, ref. 22, p. 472.
84. Ure, ref. 22, pp. 483-494, 599-603.
85. Not surprisingly, Hallum makes no mention of Ure in his history of the ice-age theory in the nineteenth century. See Hallum, A., 1992. *Great Geological Controversies*, pp. 87-104.
86. Earlier, Ure had given a rather technical discussion of this, based on Daniell's *Meteorological Essays*. See Ure, ref. 22, pp. 51-70. These clouds were not the only or even the major source of water for the Flood. Ure rejected the notion of any 'super-aerial ocean' as being contrary to the principles of meteorology. For Ure, the Flood was largely the result of the sinking of the land mass and raising of the ocean bottom by volcanic and sedimentary processes (Ure, ref. 22, pp. 475-76).
87. He estimated temperatures of about 120 °F degrees in the daytime and 110 °F at night (Ure, ref. 22, p. 599).
88. He said the phenomenon of heavy dew would have been similar to those experienced at the time in Lima and other regions of the world (Ure, ref. 22, p. 601).
89. This was far greater than the cooling effect envisaged as a result of the pre-Flood catastrophes.
90. He cited the work of Jens Esmark (1763-1839), a leading Norwegian old-earth geology professor, who on the basis of his studies in Norway had concluded that in the past, and on more than one occasion, the whole earth had been covered with ice and snow (and all the water on earth had been frozen), only to completely thaw later. Some of his research and his own peculiar theory of the earth appeared in Esmark, X, 1826-27. Remarks tending to explain the Geological History of the Earth. *Edinburgh New Philosophical Journal*, 11:107-121. Esmark likewise gets no mention by Hallum (Hallum, ref. 85).
91. Parry was a famous naval explorer who sought to find the Northwest passage from the Atlantic to Pacific. See DNB on Parry.
92. Ure, ref. 22, pp. 500-4.
93. Anon., 1829. Review of Ure's *Geology*. *British Critic*, VI(12):387-412.
94. Anon., 1829. Review of Ure's *Geology*. *Christian Remembrancer*, XL584, 589.
95. This rather positive review by the *Christian Remembrancer* is in stark contrast to its scathing reviews of Bugg's *Scriptural Geology* in 1826 (VIII: 53 0-32) and Fairholme's *Geology of Scripture* in 1833 (XV:390-399).
96. *Quarterly Journal of Science, Literature and Art*, N.S., V: 113-132 (Jan.-Mar. 1829). The review is not signed, but like the previously noted reviews of Granville Penn's work, I think (for the same reasons as in Penn's case) that it was probably done by William Brande, the long time editor of the journal. Farrar suggested, solely on the basis of the style of language used in the review, that Ure wrote the review himself. See Farrar, ref. 2, p. 312. Assessing style, however, is a very subjective task. Though Ure contributed a number of articles to the journal and was a personal friend of Brande's, such a serious allegation seems a fanciful speculation, and quite out of keeping with the tenor of his life, as remarked by other biographers, and reflected by his Christian convictions as expressed in his *Geology*. Farrar's idea would also implicate Brande, who as editor would have approved the review. But he offered no evidence that Brande would be an accomplice to such a deception.
97. Ref. 96, pp. 113-115.
98. Ref. 96, pp. 123-24.
99. Ref. 96, p. 126.
100. Ref. 96, p. 132.
101. 'H', 1829, Anonymous letter to the editor. *Magazine of Natural History*, 11:465-6.
102. 'T.E.', 1830. Anonymous letter to the editor. *Magazine of Natural History*, 11:90-92.
103. Sedgwick, A. 1830. Presidential Address to the Geological Society. Reprinted in *Philosophical Magazine*, VII(40):289-315. Sedgwick's criticisms of Ure's *Geology* are found on pp. 310-13.
104. Sedgwick, ref. 103, pp. 310-11.
105. We must remember also that in 1829, neither Sedgwick, Conybeare, nor Buckland had publicly rejected the Flood as the cause of the diluvial deposits and valleys of denudation. Such a totally negative critique was also in sharp contrast to Sedgwick's 1834 edition of his *Discourse on the Studies of the University*, in which he considered as dangerous many of the ideas in William Paley's *Principles of Moral and Political Philosophy*, while still showing respect for the contribution that Paley had made to the topic (see pp. 126-142 in the *Discourse*). It might be supposed that Sedgwick was more respectful in his criticisms of Paley than of Ure because Paley was a revered, deceased thinker whose books were set texts for Cambridge. Ure, on the other hand, was not as well-known and respected as Paley, though his status as a prominent member of the scientific community and member of the Geological Society made his book a betrayal of both, in Sedgwick's opinion.

106. Sedgwick, ref. 103, p. 312.
107. Sedgwick's censure was especially harsh in the light of his own recantation of what he called 'geological heresy' (belief that the Flood was the cause of the diluvium), which he made just one year later from the same chair of the Geological Society.
108. Ure, ref. 22, pp. 272-278.
109. Fitton, W.H., 1833. Notes on the History of English Geology. *Philosophical Magazine, N.S.*, 11(7):55.
110. Robert Bakewell focused on this same mistake in a letter to the American geologist, Benjamin Silliman, charging Ure with being 'profoundly ignorant of practical geology.' See Farrar, ref. 2, p. 323, footnote 55.
111. 'T.E.', ref. 102, p. 90.
112. After citing a couple of other similar mistakes Sedgwick waxed eloquent, but with excessive exaggeration, *'The goodly pile, Gentlemen, which many of you have helped to rear, after years of labour, has been pulled down and reconstructed: but with such unskilful hands that its inscriptions are turned upside down; and its sculptured figures have their heads to the ground, and their heels to the heavens; and the whole fabric, amid the fantastic ornaments by which it is degraded, has lost all the beauty and the harmony of its old proportions.'* See Sedgwick, ref. 103, p. 312.
113. Ure, ref. 22, p. xlix.
114. Ure, ref. 22, p. 143.
115. Sedgwick, ref. 103, p. 312.
116. This is precisely how Sedgwick himself described the geological record when writing in 1845 to Agassiz about his disdain for the theory of evolution. *'Now I allow (as all geologists must do) a kind of progressive development. For example, the first fish are below the reptiles; and the first reptiles older than man.'* See Clark, J.W. and Hughes, T.M., 1890. *The Life and Letters of Rev. Adam Sedgwick*, 11:86.
- It is also how Buckland presented the geological record pictorially in his *Bridgewater Treatise* (1836), II:Plate 1. *The Edinburgh Journal of Natural History*, 1:68 (1836), concurred that *'the various marine shells which are found in the strata of the different formations, all of them having existed in the ocean at different epochs of time, and varying in their structure according to the various eras when they existed, the most simply organized being buried in the most ancient beds, and the most complicated in the most recent.'* Though denying any evolutionary progression, Miller also described the geological record this way. See Hugh Miller, 'Geological evidences in favour of Revealed Religion,' in his *The Old Red Sandstone* (1873), 285-96.
117. Buckland said fish were found in the transition strata in his *Bridgewater Treatise* (1836), 1:294.
118. Conybeare, W.D. and Phillips, W., 1822. *Outlines of the Geology of England and Wales*, p. 245. Conybeare and Phillips did not name the species of Caryophyllia. The fossil also was found in lower Mountain Limestone (p. 359).
119. Ure's statement did reflect accurately the views of William Smith in 1817 and of Conybeare and Phillips in 1822. See T. Sheppard, 'William Smith: His Maps and Memoirs,' *Proceedings of the Yorkshire Geological and Polytechnic Society, N.S.*, XIX (1914-1922), opposite page 137. The mountain limestone was the lowest formation containing any fossils, according to Smith in 1817. Conybeare and Phillips said that *'vertebral remains are very rare'* in the Mountain Limestone and the Old Red Sandstone below this formation *'is generally destitute of organic remains.'* The only fossils they mentioned were anomiae and encrinurites, which are both invertebrates, and some unspecified plants. See Conybeare and Phillips, ref. 118, pp. 356, 363.
120. Sedgwick, ref. 103, p. 313.
121. Conybeare and Phillips, ref. 118, p. 268. The reviewer 'T.E.' (ref. 102) had led me to discover this by his reply to 'H.' (ref. 101), who had made the same criticism as Sedgwick did.
122. For example, regarding Ure's plate 4, Sedgwick said, without giving any explicit details, that *'of twelve species, seven are positively misplaced, the others are ill selected, and one of them is wrong named.'* See Sedgwick, ref. 103, p. 313.
123. In spite of his reputation for meticulous accuracy in his science, evidently he frequently sent his manuscripts off to the printer in haste, without adequate proofreading. See Copeman, ref. 1, p. 660.
124. Conybeare and Phillips, ref. 118, pp. lix-lx. The three views Conybeare discussed were:
- the theory, like Ure's, that the primary rocks were formed in the initial creation of the earth on Day 1, the transition, secondary and tertiary strata were formed during the 1600 years between Day 2 and the Flood, and the diluvium were laid down and the general appearance of the present continents were formed by the Flood,
 - the gap theory in which the primary to tertiary were formed in the millions of years between Genesis 1:1 and 1:2 and the rest was attributed to the Flood, and
 - the day-age theory in which the primary to tertiary were formed during indefinitely long creation days of Genesis 1 and the rest by the Flood.
- Of course, as in the case of George Young, there was also a fourth view held by some geologists at the time, namely, that the Flood produced the secondary, tertiary and diluvial deposits.
125. 'T.E.', ref. 102, p. 91.
126. The harshness of Sedgwick's criticism also seems exaggerated in light of his own statement in the paragraph immediately following his critique of Ure, where he said, *'It is indeed true that in the very classification of our facts and of our phenomena, there are difficulties connected with all parts of natural history, which for ages yet to come, may continue to require for their solution a combination of the greatest industry with the greatest skill.'* See Sedgwick, ref. 103, p. 313.

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