Three early arguments for deep time—part I: time needed to erode valleys

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Recent historical studies have identified and clarified original geological arguments for deep time. These were developed between 1750 and 1850 by leading naturalists. One of the three primary arguments was that valley erosion would require more time than allowed in the biblical narrative. Current knowledge shows significant empirical and logical flaws in that argument, minimizing its value as evidence and illustrating that anti-biblical bias and an early form of positivism caused early naturalists to misunderstand the nature of the question. This suggests that the idea of prehistory functioned as an axiom, and was not an empirical conclusion flowing from geological data.

The transition from belief in a young to old earth marked a fundamental change in Western culture. Mortenson[1] called it "the great turning point" in the church, marking the rise of secularism at the expense of orthodoxy. For nearly two centuries, the 'secular fortress' of prehistory was protected by a distorted history of geology—primarily the myth that geology came into being by the efforts of Hutton, Playfair, and Lyell. As the tale goes, they braved reactionary theologians and defeated them with dispassionate scientific evidence. But even many secular historians now flee that old tale.[2]

One consequence of this origin-of-geology mythology is today's widespread ignorance of the pedigree of deep time—an idea popular in the salons of Paris in the mid-1700s. Not only were the intellectuals of that time,[3] often referred to as 'savants', confident that the earth was old long before Hutton or Lyell published, but most individuals working in the emerging sciences of the earth were not English. Continental savants were geology's pioneers. In fact, the term 'geology' was coined by the Swiss naturalist, Jean André de Luc (1727–1817). These continental savants argued for an old earth from three primary lines of evidence: (1) valley erosion, (2) volcanism, and (3) the sedimentary record.[4]

Geology as we understand it today is anachronistic to the sciences of the earth of the 1700s, which were divided into three broad categories: natural history, natural philosophy, and geotheory (figure 1). None of these correlate exactly to any modern disciplinary niche.

Today, we use the term 'natural history' to denote the biohistorical and geohistorical path of the planet. During the 1700s, it was a descriptive discipline. Natural philosophy was concerned with the causal explanation of the features described by natural history, and it has been combined with the descriptive emphasis of natural history in today's earth sciences. Geotheory was the high level integration of existing knowledge of phenomena and speculation about their causes. Hutton's title, *Theory of the Earth*, was ubiquitous and diagnostic of that genre.[5]

Much of the historical material cited herein is from the works of Dr M.J.S. Rudwick, especially his recent two volumes on the development of geohistory. Rudwick is one of the foremost historians of geology and has done much to clear away secularist myths shrouding the origin and development of that science. Both volumes are encyclopedic in their scope and depth, and provide a new benchmark for historians of science. He also provides detailed documentation and bibliographies for any interested in greater depth of study.

The argument from the erosion of valleys

Geography has influenced society from its inception. Valleys were significant geographic features affecting agriculture, travel, and communication. It is no surprise, then, that they would be of interest to natural historians in the 1700s. One significant question was whether all valleys were formed by streams or whether some preceded their fluvial features. In accordance with natural philosophy, causal explanations were sought, but valleys remained enigmatic:

> "A case that belonged more specifically to physical geography was the vexed question of the causal origin of valleys. Valleys were observed to be of many forms. A few could plausibly be attributed to erosion by the streams that flowed in them, but most could not … ."[6]

Geographers noted the tremendous variation in size, configuration, elevation, and setting. A specific problem for European savants was the difference between U-shaped (figure 2) and V-shaped valleys. The latter often appeared to have been formed by the streams or rivers of their watersheds, but by the scientific method of the day the former could not:

> "If the latter [V-shaped valleys] were attributed to erosion by the stream, the same agency could hardly be invoked to explain the former [U-shaped valleys]: by the principles of natural philosophy enunciated by the great Newton himself, like causes should have like effects."[7]

Two schools of thought (figure 3) debated the origin of valleys during the late 1700s and early 1800s—gradualists and catastrophists. But even the catastrophists

who argued for a geologically rapid formation of valleys did not do so within the framework of biblical history, but instead within that of a secular catastrophism on an old earth. Gradualists attributed all valleys to fluvial erosion over long periods of time. Catastrophists attributed some valleys, especially the U-shaped ones, to rapid erosion by catastrophic 'diluvial' currents, typically from mega-tsunamis, or to catastrophic 'aqueous currents' associated with past 'revolutions'.

Though the catastrophists were not arguing for geomorphic evidence of Noah's Flood, their 'revolutions' were based on the premise that the scale of past processes could have been greater than that observed in the present. Secular naturalists often invoked ancient catastrophes with little regard for biblical history, and early 'diluvial' proposals for valleys were typically regarded as one of many such events in the history of an old earth.

> "To attribute these features to some kind of natural 'deluge', usually in the form of a mega-tsunami, was a generally acceptable feature of the practice of earth physics, and was not necessarily linked to any religious agenda."[8]

Modern confusion between secular catastrophism and biblical history springs from the later tactic of early uniformitarians, who attempted to tar their secular catastrophist opponents with the brush of 'scriptural geology'—a position rejected by both groups, often with much hostility.

Lyell was not the only or the first naturalist to conflate gradualism and actualism. Others used the same argument, assuming a uniformity of rate to argue for the prehistorical origin of eroded valleys. Soulavie, Desmarest, Montlosier, Scrope, and Lyell all applied the same reasoning. Many of the theories of valley formation were derived from fieldwork examining the river valleys of Auvergne (figure 4), a favorite field location for early geologists. They extrapolated both process and rate from their observations, discovering the need for a lengthy timescale:

> "River valleys were … likewise invoked as evidence to suggest that the traditional short timescale was inadequate … it seemed possible that at least some valleys could be attributed to erosion by the streams that still flowed in them. On a summer's day a stream might look to be too placid to do anything of the kind, but after a winter storm the swirling water might be seen to be scouring its banks and carrying away mud, pebbles, and even boulders. In principle, such erosion could have carved out a whole valley, though it would have had to be continued for an almost inconceivably long time."[9]

An early explorer of the region was Nicholas Desmarest (1725–1815), who believed the eroded valleys of Auvergne demonstrated a lengthy prehistory. He was a noted expert for the region and his map (figure 5), published in 1771, served as a guide for many later savants visiting the region. He was convinced early on that the area's geologic past was far more remote than humanity:

> "But his [Desmarest's] history referred to times far earlier than even the oldest human records. He stressed that his epochs had 'nothing or almost nothing in common' with those of [human] historians … . Even the most recent of the volcanoes in Auvergne had, he believed, become extinct long before the earliest human records in the region; human history could be tacked on at the end of his geohistory, but there was no overlap between them (except in the sense that the slow erosion of the valleys was still continuing as it had done in the distant past)."[10]

Note the gradualist approach of Desmarest predated Lyell by more than fifty years. Desmarest's geohistorical outlook was shared by Francois-Dominique de Montlosier (1755–1838), another French naturalist who studied the Auvergne volcanics and valleys, and who

(1) Natural History.	"description and classification of the diversity of terrestrial things" (Rudwick, ref. 2, 2005, p. 59).
(a) mineralogy	The collection, identification, and classification of specimens of minerals, rocks, and fossils; knowledge distributed by exact pictures
(b) physical geography	The study of the major features of Earth's surface, primarily through fieldwork, such as mountains, rivers and volcanoes, with an emphasis on pictures and maps.
(c) geognosy	The study of the structure of Earth's crust; emphasizing cross sections to depict the third dimension and closely associated with mining. It was developed most strongly in German mining schools.
(2) Natural Philosophy '*earth physics*'	The casual explanation via natural laws of terrestrial phenomena described by the sub-disciplines of natural history, and consciously distinct from the description and classification of those endeavors.
(3) Geotheory '*Theory of the Earth*'	A high-level theory or system of Earth as a whole, derived from unifying the causal explanations of earth physics into a coherent whole. The goal was to discover the one overarching cause of Earth's phenomena. just as Newtom had done for the cosmos with gravity.

Figure 1. Sciences of the earth during the eighteenth century as described by Rudwick. Note the absence of familiar boundaries between geology, biology, physics, and chemistry, which were not recognized at the time. (From Reed and Klevberg, ref. 5.)

Figure 2. U-shaped glacial alpine valleys, similar to this example from Banff, Alberta, were difficult to explain by fluvial erosion.

also agreed that the valleys cut into the volcanic flows demanded long periods of time operating at present-day rates.

Another early example of the gradualist erosion school was the French naturalist Jean-Louis Giraud-Soulavie (1752–1813):

> "… Soulavie … cited the case of the remote part of Vivarais where he had earlier served as a parish priest. On the floors of some of the valleys there were unmistakable lava flows, which had been eroded into small gorges since their eruption. Soulavie claimed that he could 'calculate the time' required for this erosion, and hence the age of the eruptions. He estimated that it would take 'several centuries or thousands of years' just for angular fragments of the hard volcanic rock to become by attrition the smooth rounded pebbles found in the river beds further downstream; privately he estimated from this that some six million years must have elapsed since the lavas were erupted. Yet these were some of the most recent of the volcanic rocks in the area."[11]

Soulavie's estimates were quasi-scientific: he looked for a natural chronometer, but did not scientifically investigate the question to supply experimental evidence in support of his assertion.

On the other side of the argument (figure 3) were men like the French naturalist Déodat de Dolomieu (1750–1801). Dolomieu agreed with de Luc and Cuvier that there was a fundamental break between the modern world and the ancient, with a boundary set by a 'deluge', which Dolomieu saw as a mega-tsunami, similar to, but on a larger scale than that generated by the Lisbon earthquake of 1755. In any case, he thought these kinds of catastrophes occurred throughout deep time, and he was comfortable speculating that the most recent might be somehow linked to the Genesis Flood. Therefore, he tied the geomorphic features to human history. Being only a few millennia old, valleys must then have been eroded by singular high-energy events.

Leopold von Buch (1774–1853) was interested in geomorphic features of the Alps, which included many large, U-shaped valleys. He was convinced that stream erosion could not have created the morphology he saw at such a large scale. He was also interested in the associated erratic blocks, and to account for both he posited large 'aqueous events', which included mudflows to transport the erratics, some of which were the size of a house.

Erosion by catastrophic events was also advocated by William Buckland (1784–1856), who was heavily influenced by Cuvier. Buckland had seen the alpine valleys and similar features in England, but like many of the gradualists, he also examined the classic outcrops at Auvergne. Unlike gradualist savants, he concluded that the Auvergne outcrops supported his 'diluvial' theory:

> "In the summer of 1820 … Buckland made a second Continental tour with Greenough … he and his companions gave the extinct volcanoes of Auvergne first priority … . Buckland had already been primed for this classic and contentious ground by his younger Oxford colleague Charles Giles Brindle Daubeny (1795–1867), who had toured the area the previous summer … . He knew of Montlosier's classic work on Auvergne and had, for example, gone to see for himself the famous case in which the [River] Siole had been diverted by a 'modern' lava flow. But he was not convinced by Montlosier's … claims that the main valleys had been eroded gradually by the streams that still flow in them. Instead he had adopted something like Dolomieu's alternative, inferring that a sudden episode of violent valley erosion had been interposed between the ancient flows and the modern ones. Not surprisingly, in the wake of Buckland's inaugural lecture,

Daubeny identified that erosive event as 'the Mosaic deluge'. When Buckland himself reached Auvergne and saw the volcanoes and valleys for himself, he added them at once to his tally of diluvial evidence, judging them 'the finest thing by far in Europe'. He incorporated them subsequently into his lectures, distinguishing the older and newer lavas as 'antediluvial' and 'postdiluvian'; since he believed that the latter had not been eroded at all since their eruption, they counted as evidence that 'modern Causes [i.e. the present streams] will not make Vallies' [sic]."[12]

Note here the incredible underestimation of the hydraulic and tectonic nature of the biblical Flood. After his visit to Auvergne, Buckland followed up on that work by applying his theory to other valleys:

"Buckland's fieldwork the following summer … gave him an opportunity to collect evidence for the diluvial erosion of valleys on the south coast of England. The fine coastal cliffs of east Devon and Dorset showed unambiguously that the valleys running down to the sea had been excavated through almost horizontal formations; at least in these cases valleys were evidently not the result of any crustal disturbance. However that still left open the question whether they had been eroded swiftly by a violent diluvial current or very slowly by the small streams that still flowed in them."[13]

By the 1820s, the catastrophist view of valleys appeared to have gained the upper hand, supported by such luminaries as von Buch, Cuvier and Buckland:

"… however, the pendulum had swung the other way. As Fitton noted in his review of Buckland's work, almost all well-informed geologists … had now concluded that the observable process of fluvial erosion was not adequate to the account for 'valleys of denudation'. Certainly the small narrow valleys of V-shaped profiles that many existing streams were observably continuing to excavate bore little resemblance to the most striking kinds

Gradualists

Charles Lyell (1797–1875)

Insisted that an actualistic method demanded a gradualist system.

Studied the valleys of Auvergne; agreed with Scrope, Desmarest, and Montlosier.

George P. Scrope (1797–1876)

Famous for insisting that erosion was explained by time alone.

Extensive study of Auvergne; river valleys were slow, uniform process of erosion.

Nicolas Desmarest (1752–1813)

Early investigator of valleys of Auvergne.

Valleys formed by slow, gradual erosion over long time, along with episodic eruptions.

Jean-Louis Soulavie (1752–1813)

Studied valleys in Vivarais.

Estimated valleys were 6 million years old based on time needed to round pebbles.

Francois de Montlosier (1755–1838)

Amateur naturalist with estates in Auvergne.

Supported Desmarest's view of long, slow, gradual erosion.

Catastrophists

Georges Cuvier (1769–1832)

Saw catastrophic break between modern and ancient worlds; from the latest periodic 'revolution', based on fossil evidence.

Déodat de Dolomieu (1750–1801)

Thought valleys had been eroded by a relatively recent mega-tsunami, similar to that seen after the Lisbon earthquake in 1755.

Leopold von Buch (1774–1853)

Studied valleys in Alps.

Thought alpine valleys had been eroded by a 'large aqueous event' that included mudflows.

William Buckland (1784–1856)

Advocated 'diluvial' theory that was similar to Cuvier's.

Studied valleys at Auvergne and thought they supported his idea at a recent 'deluge'.

Figure 3. Key figures in the early debates over the origin of valleys.

of valley topography, particularly the huge deep valleys, common in mountain regions, that had a broad U-shaped profile."[14]

However, the gradualist school was ready to make a comeback, primarily through the work of two English geologists in the late 1820s—George Poulett Scrope (1797–1876) and Charles Lyell (1797–1875). Once again, a pilgrimage to Auvergne to examine the volcanoes and valleys would be a crucial factor in the theorizing of both men:

> "Scrope argued forcefully that the observable actual cause of fluvial erosion was quite adequate to account for even the deepest valleys; and that the occasional eruption of lavas in central France was a happy accident that had preserved many successive phases in an otherwise steady and uninterrupted process. The moral was clear: 'surely it is incumbent on us to pause before we attribute similar excavations in other lofty tracts of country, in which, from the absence of recent volcanos, evidence of this nature is wanting, to the occurrence of unexampled and unattested catastrophes, of a purely hypothetical nature!' A diluvial explanation of valleys was, he argued, certainly inapplicable to the Massif Central; and at the very least this undermined claims (such as Buckland's) for the general or universal validity of the theory."[15]

Scrope's influence was expanded significantly by the 1827 publication of a book on the volcanics of Auvergne,[16] which included many detailed and compelling landscape drawings of the area (figure 6). He provided men who could not travel with a sense of the locales, which, when combined with his detailed descriptions, swayed many to the speculative theories embedded in those descriptions.

So we can see that the origin of valleys was debated extensively between 1750 and 1850 by gradualists and diluvialists. Both schools failed to provide a comprehensive explanation because there was not one single causal mechanism for all valleys. Although fluvial erosion could account for some valleys, others, such as the large U-shaped alpine valleys required another cause. By 1850, glacial erosion was widely accepted as the mechanism for their erosion. However, the paradigm of gradualism had been so thoroughly integrated into geology that the unique Ice Age was said to be simply one of many, probably caused by global climate change. Both schools proclaimed adherence to the actual cause method associated with Newtonian physics, but catastrophists insisted that method was flexible enough to accommodate high-energy events as well as low-energy processes, a position recaptured by modern neocatastrophism.

Discussion

There are many lessons that can be drawn from the history of the debate over the origin of valleys; three will be examined here: (1) the relative roles of data and belief, (2) valley formation from a modern perspective, and (3) confusion over the method and nature of the emerging historical geology.

Evidence vs faith

Although the time supposedly needed to explain the erosion of valleys was used to argue for an extended prehistory, another lesson leaps out of this historical summary—an inability on the part of researchers to distinguish their theories from their observations. Skilled scientists drew very different conclusions from the same data. No better illustration of the driving role of presuppositional bias could be had. In every case recorded by Rudwick, theorists were compelled by their pre-existing commitment to either a gradualist or catastrophic paradigm to interpret data in that fashion. Buckland went to Auvergne expecting to see evidence of his 'deluge' and Scrope expected to see evidence for vast lengths of time. They both saw the same physical evidence—often the same outcrops—and derived wildly divergent explanations for their origin.

Furthermore, it is hard to see valley erosion as evidence for prehistory, since it seems clear that there was a pre-existing belief in deep time by both gradualists and catastrophists. The latter were not arguing that rapid valley erosion proved a young earth; they were arguing that the valleys were recent features on an old earth! All of them had decided to ignore Genesis as history in favor of their new 'science'. In many cases, freedom from biblical history brought a justification for an even greater

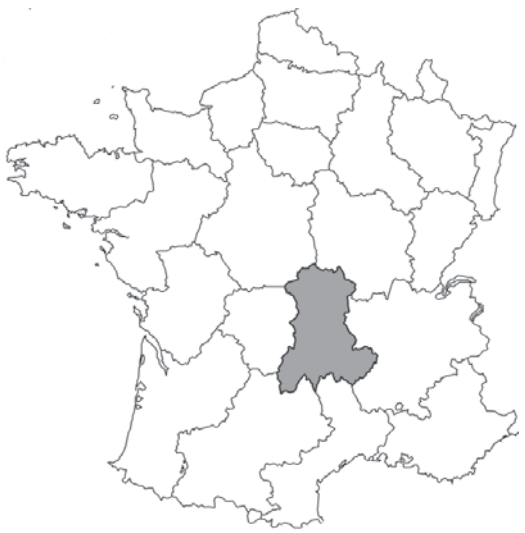

Figure 4. The Auvergne Region of France was a prominent field area for early naturalists, thanks to its volcanic terrane and eroded river valleys.

freedom from the constraints of biblical ethics. It was no accident that the atheism of the French Revolution was in the center of events during this time. Rudwick called their belief a 'perspective':

> "There is no good historical evidence that any of the leading savants, in any part of Europe, were constrained in their theorizing by a shortage of 'deep time'. They just took the new perspective in their stride and allowed for the possibility of vast spans of time—literally inconceivable in human terms—in the earth's remote past."[17]

Thus, Genesis as history was ignored by both sides of the debate, despite compelling internal and external arguments for its reliability and accuracy.

A related problem was that of sample bias, driven by ignorance of large parts of the world. Naturalists working between 1750 and 1850 thought they traveled widely, and they did … within the confines of Western Europe. Their 'grand tour' generally took in France, Switzerland, and Italy. That is a small data set compared to the vast variety of valleys we know today. Clearly, streams and rivers erode channels and small valleys, and just as clearly, that is not the causal explanation of many valleys. Another aspect of this sample bias was on the theoretical end; these men were as limited by their ignorance of modern hydraulic and sedimentological principles[18] as they were by examples outside their experience, some of which would falsify their arguments completely.[19]

Formation of valleys

The term 'valley' is a generic term, defined as:

> "(a) Any low-lying land bordered by higher ground; esp. an elongate, relatively large, gently-sloping depression of the Earth's surface, commonly situated between two mountains or between ranges of hills or mountains, and often containing a stream with an outlet. It is usually developed by stream erosion, but may be formed by faulting. (b) A broad area of generally flat land extending inland for a considerable distance, drained or watered by a large river and its tributaries; a river basin … ."[20]

Valleys can be formed by a variety of causes, including erosion, folding, and faulting. Valleys come in a variety of scales and their causes probably vary with scale. One of the legacies of gradualism is the attempt to apply observed processes to features of much different scale. For example, Grand Canyon is commonly explained by river erosion in the same way that a small stream valley would be because that mode of explanation fits both the gradualist template and the actualist method. However, as Oard[21] showed, none of the various fluvial explanations satisfy field data. His explanation[22] illustrates how scale can affect the cause; there is a vast difference between erosion by the present Colorado River and erosion by channelized currents of the retreating waters of Noah's Flood.

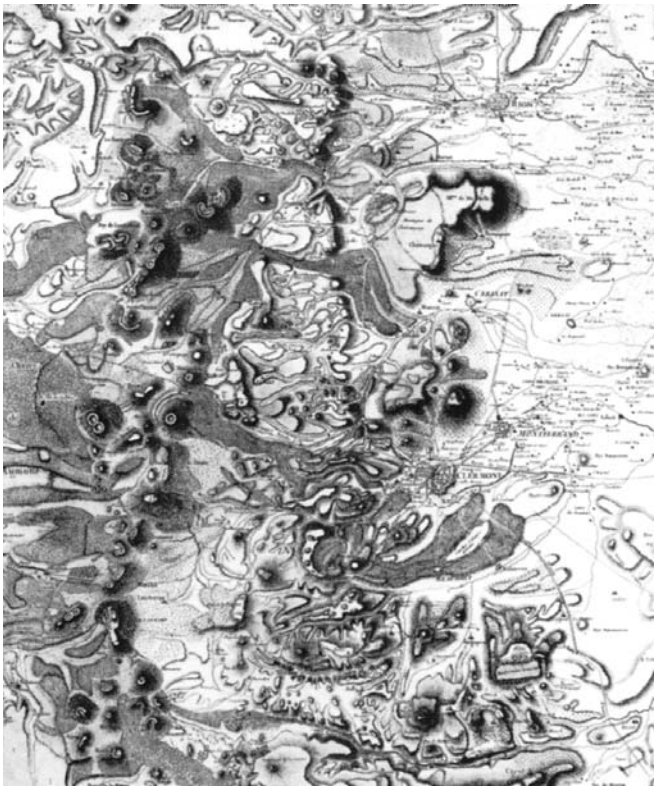

Image courtesy of www.historyofgeology.blogspot.com

Figure 5. Map of Auvergne region by Nicolas Desmarest (1771) showing volcanic features and eroded river valleys.

These problems are manifested when we evaluate the actual arguments made by the early naturalists for vast ages. The first was the rate of erosion as seen in modern-day streams. Since most streams are underfit, in that they are much smaller than the valleys they flow in, an assumption of constant rates demands a long time. But energetic currents erode much more quickly, as modern examples of flooding have shown. Also, valleys formed by erosion have been observed to occur rapidly by a variety of causes; catastrophic flooding and lahars seen at Mount St. Helens; wind, like that of the 'Dust Bowl' of the 1930s creating gullies; various modes of erosion associated with glaciation; and runoff and groundwater sapping seen at Providence Canyon, Georgia,[23] among others.

The second 'proof' of old age was Soulavie's estimate of thousands of years to round pebbles and the inference that the rest of the valley features would require far longer. This is falsified by observations at Surtsey;[24] by the time constraints of rounding of clasts during the Glacial Lake Missoula flood and at similar meltwater floods like those at Rio Santa Cruz;[25] and by the time constraints of rounding rapidly transported and deposited gravel beds in the northern Rocky Mountains, Arizona, and Alaska.[26–29] If experimental evidence is desired, then we need look no further than the practice of tumbling semi-precious stones,

which, given the right conditions, can take less than one month (in a relatively low-energy setting).

The third line of evidence for vast age was the supposed time for emplacement of basalt flows in Auvergne that eroded into modern valleys. But the actualistic method of the early savants has failed them in retrospect. Volcanic eruptions and basalt flows occur at widely varying rates; constraints on ancient flows inferred from physical properties show even greater flow volumes at surprisingly rapid rates. Desmarest, Soulavie, Scrope and other early geologists did not understand the mechanics of volcanism and the chemistry of magmas sufficiently to support their speculations. Today we understand that time is not the primary factor in the rate of basalt volcanism.

Thus, the primary arguments for the vast length of time required by erosion are all falsified. The singular example of the Columbia River Plateau is sufficient to contradict *all three*. Its basalt flows were most likely emplaced in a very short time; some individual flows taking as little as a few hours,[30] similar to the calculated rates of the flows at Midcontinent Rift System.[31] After the Columbia River basalts were emplaced, the Glacial Lake Missoula flood scoured giant canyons and other interesting features deep into the basalt, also in a matter of hours.[32] During that event, eroded basalt clasts were rounded during transport toward the Pacific Ocean and deposited in giant gravel bars along the way. This forensic reconstruction contradicts the ideas of the gradualist savants (figure 3), among them Charles Lyell.

Forensic natural history and its method

As seen above, the mistakes of the early savants flowed from their view of natural history. Deep time was not something to be tested; its presumed reality was a faith construct looking for actual evidence. Gould[33] criticized Lyell for conflating method and system in his gradualist view of geology, but the same criticism could be leveled against any of his gradualist predecessors in figure 3. They all defended their static rate estimates by claiming they were observing the principle of actual causes, which they derived from Newton's 'true cause' method for physics.

However, physics and natural history are not one and the same. Their differences are significant and foundational; the position of these early savants was tantamount to the positivism that remained popular through the 19th century. Confusion about method and system remained a poisonous effect of Lyell's synthesis, and remnants still infect the earth sciences. That confusion is illustrated in the semantic knots created by secular geologists[34] and underlying conceptual contradictions between the nature of science and the worldview of Naturalism.[35]

Natural history is a mixed question, blending science in a forensic manner to augment testimonial evidence. Often these scientific tests are to assess the feasibility of past events. That is not the same thing as proving their *reality*. Theologian Robert L. Dabney noted this problem and identified the logical error:

> "Thus, many geologists, seeing that sedimentary action by water now produces some stratified rocks, claim that they are entitled, by the similarity of effects, to ascribe all stratified rocks to sedimentary action. This, they say, is but a fair application of the axiom that 'like causes produce like effects', which is the very corner-stone of all inductive science. *But the real proposition they employ is the converse of this: that like effects imply like causes.*"[36]

Early geologists thought they could apply the method of Newtonian physics to natural history. Instead of respecting the chasm between the different objects of study—timeless universal principles vs unique unobserved past events—the savants ignored it. Their disregard for the inherent weaknesses of their method was exacerbated by their ignorance of many of the potential parameters affecting the phenomena. The degree to which their theory drove their conclusions is illustrated by the fact that

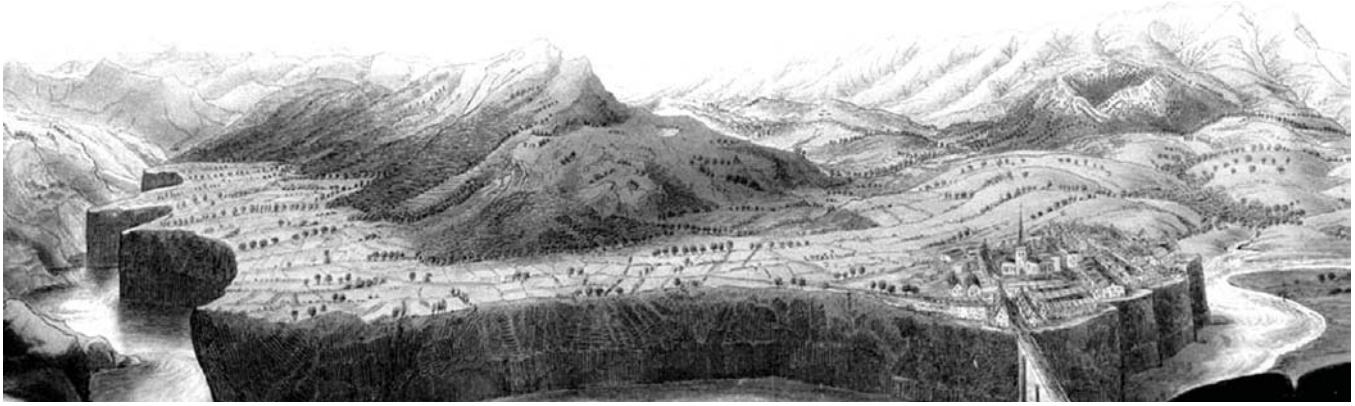

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Figure 6. Illustration in Scrope (ref.16) showing an eroded river valley in basalt flows near the town of Jaujac in the Ardéche region of France (from www.volcanism.wordpress.com).

neither gradualists nor catastrophists even considered a glacial origin for the large U-shaped alpine valleys until the mid-1800s. By 1850, geologists recognized that many of these valleys had been carved by glaciers much larger than those seen at present. Catastrophists had been right that streams were not an adequate causal explanation, but their enthusiasm for 'diluvial' currents and mega-tsunamis had blinded them to evidence suggesting an ice age.

The myopic fixation on valleys also blinded many to the larger topic of geomorphology. Many landforms present similar problems to secular geologists; they are not easily explained by existing causes, even operating at increased rates. Oard[37] has shown that many of these features, which have puzzled secular geologists for more than a century, are readily explained by the retreating stage of the Genesis Flood, in its two-stage sheet flow and channelized flow sequence. The dramatic misapprehension of the true nature of the Flood continues to stand as a roadblock to its use in geological explanation:

> "Valleys and erratics looked as if they were of rather recent origin. So it is not surprising that they were widely attributed to the most drastic physical event of which there was some *human* record, namely Noah's Flood or the 'Deluge' recorded in Genesis. A century earlier, this kind of '*diluvial*' explanation had often been used, for example by Steno, and later by the London naturalist John Woodward to account for *all* the Secondary rock masses; but by Saussure's time its application was far more specific, and confined to what seemed to be this relatively recent event. Although diluvial theories invoked a biblical source, they demanded a far from literal interpretation of the text: the story in Genesis, taken at face value, did not suggest anything as violent as a mega-tsunami."[38]

Rudwick's final comment illustrates a profound misunderstanding of the biblical text, not to mention the reams of creationist literature that have explained the potential cataclysmic geological effects. Like Buckland and other 'diluvialists' of his time, the minimization of the Flood was the first step on the road to its dismissal. Rudwick attempted to explain away their (and his?) biblical illiteracy:

> "… this was no problem, even for savants who regarded themselves as Christian believers, since it was widely recognized that the story of creation in Genesis should not be, or at least did not need to be, interpreted literally."[39]

It is clear that the historian has not done his homework. The 'literal' interpretation of Genesis, which Rudwick treats as a bogey man throughout his two volumes, was the orthodox position of the Christian church up into the 1700s.[40] As with his Enlightenment forefathers, Rudwick insists that in the area of natural history human knowledge should be exalted above divine revelation. Paul predicted this tendency in Romans 1, including the stinging, though accurate, outcome, "professing to be wise, they became fools".[41]

Conclusion

An extended prehuman prehistory, so foreign to Western thinking prior to the 18th century, claimed the minds of intellectuals in the 18th century and the educated public in the 19th century. It has since become so ingrained into the collective consciousness that people who question it are considered anti-intellectual and worthy of persecution.[42]

But what compelled Western intellectuals to cast off centuries of established historical tradition in favor of a speculative prehistory? Clearly, the subjective bias of the emerging secular worldview played a larger role than most would admit. The remainder was the physical evidence. How did it prove so convincing to naturalists of that day? The initial evidence was from the erosion of valleys, volcanic eruption rates, and the thickness of the sedimentary rock record. In the case of valley formation, it is clear that no compelling evidence was presented to demonstrate deep time; in fact, the application of the actualistic method to the Columbia River Plateau falsifies all of the original arguments from eruption rates, erosion rates, and rounding rates. Early intellectuals overestimated their objectivity, starting down the dead-end path to positivism in their confidence that the association of 'science' with their work ensured its objectivity. Déodat de Dolomieu grasped what was happening, but his insightful analysis was rejected by his peers:

> "In other words, Dolomieu argued that the prejudices of those who had their own agenda for opposing traditional theism were what led them to argue for a vast antiquity for the continents as land areas … . Here was a striking reversal of stereotypical roles: Dolomieu claimed that it was the critics of religion who were blinkered by prejudice, not the believers; it was the skeptics who indulged in irresponsible speculation."[43]

The argument for an old earth from valley erosion fails to meet minimum standards of evidence. Thus, one of the three significant 'proofs' for an old earth in the latter half of the 1700s is falsified. If it can be shown that similar arguments from volcanic eruptions and sedimentary rocks were likewise unconvincing, then the acceptance of deep time in the late 1700s would be shown to have been an error. More importantly, the failure of earth scientists to *ever* re-examine deep time suggests that later 'proofs' were circular, since the assumption of prehistory became an ingrained foundation of natural history—a presupposition—as these later lines of evidence were

developed. Rather than proving prehistory, it appears that the early savants simply presumed it was true because it freed them to speculate outside the bounds of divine revelation.

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