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Charles Lyell and the Story of Modern Geology

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Abstract

Poetry and science are usually considered to be at opposite ends of the spectrum of human endeavour. And yet, at a critical point in the history and development of geology as a science, Charles Lyell, its most famous early practitioner and author of the geological classic *Principles of Geology* (1830-33), was also to be found writing reviews of poetic and historical works, parading his abilities as a poet to his future wife, and quoting from poets ancient and new throughout his writing. As a young man, Lyell's first choice of career had been poetry, and this article argues that, far from turning his back on poetry as he attempted to develop a secure methodological footing for geological science, Lyell's immersion in contemporary poetic debate actually helped him give shape to his most important scientific work. Far from being antithetical to good scientific thinking, the contemporary fashion for mock-epic poetry and the poetry of Lord Byron were of use to the geologist in the 1830s as he sought to imagine millions of years of history with only a fragmentary and ruinous rock record to go by.

Keywords: Geology, poetry, history, earth sciences, scientific method, Charles Lyell, William Buckland.

On November 11, 1817, three days before his twentieth birthday, an aspiring poet sent his father his latest literary effort from his undergraduate lodgings at Exeter College, Oxford. The poem was written in Spenserian stanza, a form of poetry most famously associated with Edmund Spenser's poem *Faerie Queene* (originally published in parts between 1590 and 1596, ed. by Hamilton 1980), but which had recently been revived and transformed by Lord Byron in his epoch-making poem *Childe Harold's Pilgrimage*, a poem which had, at least apocryphally, seen Byron "wake up famous" when its first canto was published in 1812.¹ Spenserian stanza was at the height of poetic fashion in the late 1810s: John Keats and Percy Bysshe Shelley were among those experimenting with the form. Our young undergraduate's attempt at it romantically recalled his trip to the Hebridean island of Staffa during the university vacation two months earlier. But it was also written in the wake of a series of disappointments. As his engagement with fashionable versifying might attest, he took himself seriously as a poet. In both 1816 and 1817 he had entered verses for Oxford's prestigious Newdigate Prize, won later in the century by John

Ruskin, Matthew Arnold, and Oscar Wilde (Ruskin for "Salsette and Elephanta" (1839), Arnold for "Cromwell" (1843) and Wilde for "Ravenna" (1878)). But his poems on the annually set topics – the horses of Lysippus in 1816, the Farnese Hercules in 1817 – had not come close to clinching the honours, and even his father had pronounced that his son's work was "not above mediocrity and certainly ought not to gain a prize," though he added in paternal tone, that it "is not destitute of *estro poetico*" (Lyell Sr. 1816 in Wilson 1972, 38). Checked but undaunted, the young man would submit his verses for the prize once again, and again unsuccessfully, in 1818, this time some Latin verses and some lines on the Coliseum (see Wilson 1972, 58). In November 1817, then, he was already beginning to doubt that he would ever make it as a poet, and it was not without some self-consciousness that he sent his father his newest piece of verse. The poet was the man now famous as one of the founding fathers of modern geology, often credited with having a powerful influence on the scientific imagination of the young Darwin, and with having been the first – in Britain, at least – to give the young science of geology a firm methodological footing. Living through a period in which the term "geology" was invented, in which the methods, research questions, and practices of the science were given definition, and in which almost all the major subdivisions of the stratigraphic column were thrashed out, Lyell is often remembered in Britain as the father of modern geology, the greatest hero of geology's "heroic age".

¹ Spenserian stanza uses stanzas of nine lines each, the first eight of which are in iambic pentameter (five stresses per line), and the last in iambic hexameter (six stresses per line). It has the rhyme scheme ababbcbcc. Spenser's use of it mixed Italian ottava rima (eight lines of iambic pentameter) and rhyme royal, associated with medieval poets including Chaucer.

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(For the heroic biographies, see esp. Wilson 1972 and 1980; also Bailey 1962; Bonney 1895; for some of the more prominent revisions or qualifications of this include Gould 1987, chap. 4; Porter 1976; Morrell 1976; Rudwick 1970, 1971, 1975, and 2007, esp. 243-96.)

The story of Lyell's poem (see appendix) sees "deluded Fancy's child" spellbound by the "wizard" magic of an "Eastern tale." In the first stanza of the poem, "fairy worlds" ring with magical effects. We are quickly introduced – with heady alliteration and evocative internal rhyme – to "beings bright" – a phrase borrowed from the fourteenth stanza of the third canto of Byron's *Childe Harold's Pilgrimage* – to "realms rich with unborrowed light," to a "noon... which never knew the night". The first stanza also includes four negative constructions in four successive lines, evoking an ethereal or paranormal light that emanates from sunbeams that "never fell," "unborrowed," "unquenchable," in an unknowing noon. As the poem continues, the speaker turns from the visionary dreams of Arabian fiction to the real world, from the exotic East to the barren Scottish landscapes before him, and he feels himself a hero from Dante, exiled in "a desert bleak and wild." But the disappointment is only temporary, for Nature, summoning the world into being through her voice, has a secret that the child of Fancy might hear only once the speaker of the poem is aesthetically competent enough to detect her "strain," a secret the poet shares with the reader in conspiratorial fashion. The secret is Staffa, a "massy pile" of pillars raised from the ocean by an omnipotent but artistic goddess. The goddess's world operates in a different, more picturesque aesthetic register than the sensuous world of the Arabian Nights, but its hidden charms, slowly perceived by the speaker of the poem, softly echo the aural effects of the first stanza, with more alliteration – this time of the softer, fricative consonants /s/ and /f/ rather than the harsher plosive /b/ and /r/ sounds of the first stanza: we have the cavern's "sculptured side," the "favoured foot of Mortal yet to come," and another, softer pair of negations which rather deny than evoke the paranormal – here there are "no shapes of Terror," "no guardian dragon." So as the speaker turns his vision from the imagination of the East to the "real" encounter with the North, we get little echoes of those more spectacular sounds and more uncanny negations in the eastern tale. Staffa might not have the glamour of Arabia, but, repeating a word from the first stanza in the last, it is no less

"enchanted" for all that. There is the hint of a familiar moral dimension to this conclusion: the speaker of the poem and his ideal reader overcome the childish delusions of exotic fiction to develop a more intellectual sensitivity to a north whose charms are less obvious but which, for that reason, is superior to the merely sensory pleasures of the east. Indeed, this is a standard lesson in Romantic poetry: Byron would draw a parallel conclusion in the fourth canto of *Childe Harold's Pilgrimage*, published in 1818, a year after Lyell wrote "Lines on Staffa": in that poem, the structures of Venice rise out of the waters like Lyell's pillars, "As from the stroke of an enchanter's wand" (Byron 1818, I.4). Byron's speaker remembers how "the exhaustless East" had "Poured in" Venice's lap "all gems in sparkling showers" (1818, II.6-7), and reminds himself that, though those eastern enchantments are no longer to be found in the ruins of the watery city, "Yet there are things whose strong reality/Outshines our fairy-land" if one is willing to look hard enough for them (1818, VI.5-6). In Lyell's poem, the imaginative and moral achievement of the speaker, and of the careful reader of the poem, brings power: the mighty voice of the goddess Nature may be read as an allegory for the poet's force as he too summons up the natural world with his all-powerful voice.

It is tempting also to read "Lines on Staffa" as a somewhat earnest performance of Lyell's approach to adulthood. Sending the poem to his father, the young man attempted to prove that at Oxford he had learned a gentlemanly sensitivity to the natural world and attained the poetic accomplishment to compose stanzas in the style of the most fashionable of contemporary poets. It was not the first poem he had sent home seeking approval from a father who had taken great care over his son's education, nor would it be the last reference to poetic matters in that correspondence: while visiting Venice the following summer, for instance, Lyell wrote of seeing Lord Byron rowing in his gondola every morning after breakfast (Lyell 1818, in K.M. Lyell 1881, 1:105).² But if the poem partly expresses the undergraduate's gentlemanly panache, it also tentatively expresses his growing interest in a new pursuit, geology. Between 1830 and 1833 Lyell would publish arguably the most important geological work of the nineteenth century, *Principles of Geology*. *Principles* sold some fifteen thousand copies in eleven extensively revised editions before Lyell's death in 1875, and it was read by many more (see Secord 1997). But as a young man at Oxford, Lyell was just one of many to have been drawn to the fashionable, powerful and often witty geological lectures of William Buckland, a leading member of the Geological Society of London and the university's Reader in Mineralogy (Edmonds and Douglas 1976, 141-67). It was partly on a geological

² See Lyell 1817 in K.M. Lyell 1881, 1:54 for the only other of his published poems. It is possible that there is other poetry in the Lyell archive at Kinnordy, but I have been so far unable to gain access to this archive.

errand for Buckland that Lyell had visited Staffa later in the university vacation of 1817, verifying for him that Fingal's Cave had "broken tops" rather than smooth ones, disconfirming the theory of Leopold von Buch, a former student of the Prussian geologist Abraham Gottlob Werner, that the cave had been formed by deposition along a dyke of softer lava that had since been eroded (Wilson 1972, 50). The serrated tops of the columns, suggested instead that they had, as "Lines on Staffa" agrees, been formed by rapid intrusion from below rather than gentle deposition from above. In his poem, Lyell cautiously articulates the seriousness of his budding geological interests to his father, a man who would later disapprove of his son's turn from a career in the law to geology, and who considered science a distinguished but disinterested gentlemanly pursuit and not an appropriate source of income or a paying career: "Whatever you may think of the poetry," Lyell added in a somewhat apologetic note to his father, "you will agree with me in regretting that Werner should have died without the knowledge of this geological discovery concerning the origin and formation of basalt" (in K.M. Lyell 1:56). Werner, recently deceased, certainly would have disagreed that nature had "bade uprising lift the massy pile" from beneath the ocean (he and his proponents had argued that basalt had slowly settled from a thick aqueous solution that they thought had constituted the primeval globe, rather than that it had been forced upwards by the power of the earth's internal heat, as had been espoused by the followers of the Scottish theorist James Hutton (Rudwick 2005a, 90-94, 158-72; Laudan 1987, 89). Werner might also have raised an eyebrow to learn that the controversial basalts at Fingal's Cave in Staffa were neither the products of fire or water, but an artistic creation of the fairy goddess Nature.

More to the point, perhaps, Lyell used poetry here to tentatively frame a serious scientific speculation in fashionable Spenserian stanza and within a Romantic "fairy scene," enabling him to hint at his new geological interests without explicitly vocalizing whatever deeper ambitions the science may have been awakening in him. In even this Lyell was not alone: at Oxford in this period high aspirations for geology and for the physical sciences were developing (Rupke 1997) and poetry – a more prestigious and gentlemanly discourse than science – was a key medium by which those aspirations could be voiced in a potentially hostile environment. As many historians have noted, for instance, Buckland's lecture performances and his geological writings were filled with allusion to the epic poets Homer, Virgil, Dante, and Milton, suggesting compatibility between geological science and the study of ancient classical and biblical texts on which Oxford's reputation rested, and also suggesting that geology was a 'poetic' science – even an 'epic' one,

which promised (at least one day) to tell the greatest story ever told – the story of the history of the earth (Rupke 1997; Rupke, 1983, 51-63; O'Connor 2007, 71-117; O'Connor 2009, 207-23; Sommer 2003).

It may seem counterintuitive to discuss the juvenile poetry of a leading scientific figure with this degree of seriousness. Neither Lyell's father nor the prize committees at Oxford considered him a great poet, and however stylish or impassioned we might find "Lines on Staffa" it is clearly derivative of both the poetry of Byron and the spirit of Buckland's lectures. Lyell did not write enough poetry – or not enough of it has survived from the archive – to be able to tell what kind of poet he may have become in later life. Nor has it regularly been considered a relevant part of his scientific biography. Indeed, his biographer – one of the only historians to mention Lyell's poetic interests at all – implies that as Lyell grew up his adolescent fantasy of a poetic life finally and sensibly gave way to the mature, scientific apprehension of the natural world for which he would become famous (Wilson 1972, 27-28, 41, 58). And yet, this is an old Enlightenment story, the story of progression from a primitive age of poetry to an enlightened age of reason, in which poetry is superseded as an instrument of knowledge by science and philosophy as civilization advances. It is, in fact, the same story told in "Lines on Staffa", as the speaker turns from exotic, delusory and childish fiction to a more sober but morally and intellectually superior view of things: here, poetry is superseded as an instrument of knowledge by science and philosophy not as civilization advances, but as the hero of the poem reaches maturity.

Moreover, this was precisely the story Lyell told about his "principles" in *Principles of Geology*. Famously beginning with five chapters outlining a "historical sketch of the progress of geology" Lyell claimed to debunk the mythic and fallacious content of the classical, oriental, and recent cosmologies that had hitherto "retarded" the science (Lyell 1830-33, I: 85). As he put it:

■ In an early stage of advancement, when a great number of natural appearances are unintelligible, an eclipse, an earthquake, a flood, or the approach of a comet, with many other occurrences afterwards found to belong to the regular course of events, are regarded as prodigies. The same delusion prevails as to moral phenomena, and many of these are ascribed to the intervention of demons, ghosts, witches, and other immaterial and supernatural agents. (Lyell 1830-33, I:86)

After the discovery of "fixed and invariable laws" of nature, "The philosopher at last... rejects the fabulous tales of former times, on the ground of their being irreconcilable with the experience of more

enlightened ages.” The philosopher, like the speaker of “Lines on Staffa”, turns away from the oriental, from fiction and superstition, turns to science, and grows up. In fact, the story has shifted a little here. Unlike in “Lines on Staffa”, which endorsed a Huttonian, anti-Wernerian position on the formation of the early rocks, Lyell now includes both Werner and Hutton in the science’s poetic prehistory, imagining them as “cosmologists” and “cosmogonists” in the early chapters of *Principles*, as purveyors of stories of earth history too synthetic, too deductive, and too sweeping, to be credible. In this, he was very much in line with contemporary geological thinking in Britain in the 1830s. The Geological Society of London, of which he (along with his former teacher, Buckland) was a prominent member, had been formed in 1807 in order to salvage a science from the wreckage of Enlightenment “theories of the earth” like Hutton’s theory or interpretations of Werner’s work (Geological Society 1808; Rudwick 1963 and 2005a, 460-65; Buckland 2013 chaps. 1 and 2). These theories had promised to tell the entire story of earth history – but in doing so had engendered damaging scientific controversy as rival theories. The gentlemen of the Geological Society set out to define the new scientific discipline of “geology” as a non-story-telling science, a science which would not attempt (at least yet) to tell the story of the earth but would turn to pure description. They claimed that they would turn from large-scale theorizing to enumerative induction, to the patient amassing of small, detailed facts without reference to the bigger story those facts might one day be made to tell (Geological Society 1808; Laudan 1997 and 1987, chap. 9). Theorizing had a place in the science, but it would be restricted to the making of geological maps and the creation of a stratigraphic column which would faithfully describe the rocks and fossils of the earth’s surface (on stratigraphy, see Rudwick 1985; Secord 1986; Oldroyd 1990; also Smith 1985 and Weindling 1995). Thus, the overarching paradigm on which British geology had built its early successes by the time Lyell came to write *Principles of Geology* was stratigraphic, and wedded to the method of enumerative induction.

Lyell’s division of poetic and scientific ages of geology, however, was put in the service of his advocacy of a different method than that routinely advocated by leading members of the Geological Society. Lyell’s *Principles* was devoted to the study of *vera causae*, causes that could be directly observed in nature, as the only means by which the millions of years of geological history that had never been observed by man could be “found to depend on” those “fixed and invariable laws” (see Laudan 1982, 216 and also 1987 chap. 9). The unobservable world, the millions of years of prehistory, were to be understood by analogy

with the observable world. Only the kinds of causes that had been witnessed within human history were adequate explanations for the geological past – no supernatural agents here – but also only events of the same intensity as those now currently operating on the earth’s surface could be used to explain the past. The method of enumerative induction had not required that the present be a template for the past in this way; it simply involved studying the evidence that the past had left behind, and those evidences had seemed to reveal a greater intensity of geological processes in the deep geological past. For Lyell, while it was not impossible that floods or earthquakes or volcanoes had ever been violent enough to devastate the entire globe in a single episode, the fact that such episodes had not occurred within the span of recorded human history made this a merely metaphysical speculation, as was the notion that the earliest preserved rocks marked the beginning of earth history (see Lyell 1830 in K.M. Lyell 1881, 1:268). The oldest rocks were merely the oldest surviving rocks, beyond which the history of the earth may have extended for an unimaginable length of time. Their apparent lack of fossils did not mean that the earth at that period had been devoid of life, which would, again, have marked a beginning, but rather that, through the millions of years that had passed since their deposition, those rocks had been crushed and melted in a process Lyell named metamorphosis until they bore no relation to their original states and all their fossils had been destroyed. The fatal flaw of enumerative induction, for Lyell, was its reliance on the notion that the record of the earth’s past stored in its strata was relatively complete, that description of that record would tell the geologist enough about the deep past. Enumerative induction was an inadequate model once the geologist realized that the strata represented only a few pages of a vast geological volume whose many chapters had largely been ripped out, damaged, defaced and lost. Promises by men like Buckland that they would now forgo telling the story of earth history only until their patient amassing of details through enumerative induction gave them enough information to reconstruct that story, were false promises in this view of things. The story could never be retold – there simply was not enough recoverable evidence. Though he did not name them directly, by this formulation many of Lyell’s colleagues – including Buckland – now appeared not as rigorously inductive men of science but as old-style cosmogonists in a poor disguise, believing that the rock record revealed a beginning and a middle (if not, of course, the end) of earth history – believing in a story against their better judgment. Though the gentlemen of the Geological Society considered themselves to have ushered in a newly scientific dawn for the study of the earth, reading between the lines of Lyell’s history of geology, they were now recast,

against their will, as protagonists of its poetic prehistory. The scientific age of geology, he implied, had begun with the publication of his *Principles*.

But we should not take Lyell's seemingly anti-poetic view of science at face value. As he penned *Principles*, in fact, Lyell continued to take a lively interest in poetry, and poetry continued to actively shape his views on the best scientific methods by which to imagine, comprehend, and give form to the geological past. In one of his several articles for the prestigious *Quarterly Review*, written in the late 1820s when Lyell was attempting to forge a career "in that class of society who, possessing moderate means, are engaged in literary and scientific hobbies" (Lyell in K.M. Lyell 1881, 1:171), Lyell had written that, though geologists had not gathered enough data to create an epic story of earth history just yet, once all the data had been gathered and compiled, the geologist's students would be able to "confide themselves to his guidance, as Dante in his sublime vision followed the footsteps of his master, and beheld, with mingled admiration and fear, in the subterranean circles environing the deep abyss, the shades of beings" who could "recal from oblivion the secrets of the past" (1827, 473; Lyell also quotes from Milton in 1826, 538). By 1829 Lyell had both begun to lose faith in the possibility of the geologist as Dantean hero, able to reconstruct a "sublime vision" of the history of the earth, and had also had a more trouble encounter with Dante as an infallible poetic master. In that year, Lyell's father asked him to review Gabriele Rossetti's controversial *Comento Analitico* on Dante's *Divine Comedy*, partly in order to defend it against the vitriolic reviews it had already received in the major quarterly reviews (Rossetti 1826-27; for some of these reviews see Anon. 1826, Anon 1827a, Anon 1827b, Anon 1828; see also Caesar 1989, 501-3. For an account of its supporters see Friederich 1949, 51-52). Rossetti, who named his son Gabriel Charles Dante Rossetti partly after Lyell snr. (Gabriel grew up to become the pre-Raphaelite poet and artist Dante Gabriel Rossetti), had argued that Dante's poem was not an epic in the true sense but a coded allegory designed to communicate secret antipapal messages between members of an ancient heretical sect preserved in the rites of the Freemasons. The sect communicated, often in poetry, via "a secret conventional language," its "gergo," of which the *Divine Comedy* was a mastertext and to which it could therefore function as a key ([Lyell] 1830, 437).³ In this account, Dante, the greatest Catholic poet in Western history, was at best a heretic, at worst a faithless fraud

(Rossetti 1832, trans. Ward 1834). Moreover, if a text as canonical as the *Divine Comedy* was just a code, why not conclude "that theology [itself] has been always a Masonic trick," as one reviewer put it, and that the Bible itself was nothing more than a coded document by which heretics had communicated? (Hallam 1832, 58). Despite acknowledgments that he had thrown some light on many inexplicable passages of Dante's work, Rossetti stood accused of what, at first glance, appear to be mutually exclusive offences. The first was of an excess of unlicensed imagination, a wild temptation to indulge in fantastical theories ungrounded in "inductive" proofs; the second a sneering "skepticism" that threatened to destroy not only the affective value of Dante's poetry but the very fabric of the faith on which that poetry rested, reducing Dante's vision of "the things of eternity" to a "spiteful satire under a fictitious covering." (Hallam 1832, p. 54; see also Anon 1828).

This problem, how to strike a balance between inductive proof and historical imagination, and the charge of skepticism that this could lead to, particularly preoccupied Lyell as he planned *Principles of Geology*. For Lyell, geology was an inherently imaginative science, since so much of its evidence had been lost to human comprehension. It would need to combine evidence and speculation if it were ever to attain truly dignified scientific status. Moreover, there was another figure who was at that time claiming, in much more overt terms, to have written history stripped of the supernatural and sweeping machineries of epic poetry and to have created a "scientific" method by which to imagine the past, whom Lyell appears to have found much more convincing than Rossetti: Barthold Georg Niebuhr, whose *Römische Geschichte* had recently been translated into English by Connop Thirlwall and Julius Charles Hare, friends of the geologist Adam Sedgwick, and of William Whewell, at Trinity College, Cambridge (Niebuhr 1828). This text was also causing a furore on the pages of the *Quarterly Review* in 1829 (see Porter 1976, 96-97; Rudwick 1977, 1997, and Vance 2000). Deeply critical of classical sources, and especially of Livy and Dionysus, Niebuhr had interpreted their histories not as actual records of the Roman people but as myths and unreliable fragments. Niebuhr's treatment of those classical sources engendered the same criticisms provoked by Rossetti's reading of Dante: that he was overtly imaginative, reconstructing the Roman past from shards of evidence that he controversially deemed reliable, but also that he was too sceptical, raising the possibility of similarly critical treatments of biblical as well as classical texts (see Ledger-Lomas, forthcoming 2014).

Livy, Niebuhr said, had been "moved... to write" not as an historian but as an epic poet: "He had brought down the marvels of the heroic ages into the sphere

³ Lyell talks about the gergo at length in his review but does not mention the Egyptian and Masonic history of this sect, which is described more fully in his father's work, Charles Lyell Sr., *Poems of the Vita Nuova and Convito* (1842), xlvi.

of history; as was commonly done even by those who in what belonged to their own times and experience were far from credulous, at a period when the thoughtless belief of childhood continued undisturbed throughout life. Even those primitive ages when the gods walkt [sic] about among mankind, he would not absolutely reject" (Niebuhr, 1828, 3). Similarly, when Lyell quoted from the *History of Rome* at the end of the fifth and final historical chapter of *Principles*, he implied that his own project had been to uncover that credulous faith in heroic myths and legends that had continued to dominate thinking in geology, itself in a hitherto primitive stage. The historical writing the Romans had bequeathed the present, Niebuhr said, constituted "an epical narrative of actions and events" and not a historical one, an all-encompassing story rather than the necessarily incomplete and fragmentary shards of evidence that true historical analysis would bequeath. Niebuhr would move the history of Rome into a newly and self-consciously "scientific" age, as Lyell was proclaiming to do for geology, by ridding it of this epical dimension. "In order that the heroes and patriots of Rome may rise up before our view, not like Milton's angels, but as beings of our own flesh and blood, – we require more and something else, over and above what we find in his [Livy's] inimitable narrative," a "scientific" method that was critical of sources, stripped back their epic values and forms, and reconstructed both a richer and a more probabilistic account of the past from the fragments of evidence that survived this scrutiny (Niebuhr 1828, 4-5, 25). It was this reconstructive aspect of Niebuhr's work that had opened him also to charges of an excessively speculative imagination. Most importantly, it was this that Lyell quoted in the *Principles*, leaving his readers with a Niebuhrian parting shot at the end of a dramatic chapter: "He who calls departed ages back again into being, enjoys a bliss like that of creating" (Lyell 1830-33, I:84). Lyell's view that the archive of earth history represented by the strata was mutilated and lost beyond comprehension meant that his geology would need to be as imaginative as Niebuhr's reconstruction of the history of the Roman people from a radically deconstructed record. In citing Niebuhr, Lyell tethered this reconstructive imagination to the self-consciously "scientific" criticism that had been lacking from Rossetti's *Comento Analitico*, grounding imagination in a method that rang true with the values of scientific induction.

In a more private setting, moreover, Lyell was still proud of his early poetic exploits. In 1831, shortly after the first volume of *Principles* was published he was attempting to win the hand of his future wife Mary Horner, and she asked him to write her an account of his life by which she might more fully judge his character. In this autobiographical text

Lyell told stories about the precocious young boy-poet he had been before his disappointment with the Oxford prizes. On one occasion he had submitted a versification of Scott's *Lady of the Lake* for a school prize on the theme of "Local Attachment," and had won despite having flouted an unwritten rule that all such poems would be composed in rhymes of ten syllables. Bearing in mind that Lyell was now a thirty-four-year-old man, I think we can forgive ourselves a smile at his continued pride that the ten-syllable rule had had to be formally instituted after his transgression of it (Lyell in K.M. Lyell 1881, 1: 24-25). With even greater *amour propre* Lyell recalled a Latin copy of verses he had written just before he went up to Oxford. The verses were "on the fight between the land-rats and the water-rats, suggested by reading Homer's battle of the frogs and mice – a mock-heroic." One of Lyell's teachers "had just drained a pond much infested by water-rats," Lyell recalled, and they had been stealing food and running amok all over the school ever since. The incident, Lyell wrote, trying very hard to impress Mary now, "convinces me that I must very early have felt a pleasure not usual among boys of about sixteen in exerting my inventive powers voluntarily" (Lyell in K.M. Lyell 1881, I:25-26).

Mock-heroic, or mock-epic poetry was, in fact, a part of the fabric by which Lyell presented himself as an urbane reader of the geological archive and created an aesthetic value for geology that gave it modern, enlightened, and erudite appeal. To take one of many examples from the text, Lyell quotes from Dante's great epic to poke fun at the followers of Werner and their belief in granite as "the rock of ages," as he punningly put it, their belief that granite was the oldest rock Lyell's description of granite as a rock of ages, the rock "we turn to in our time of need" in Isaiah 26:4, subversively hints that there is a Christian temporality lurking beneath what is supposed to be a merely descriptive Wernerian geology. When Werner is in scientific need, Lyell argues, he hides behind the notion that we can ever know the beginning of the rock record. What is more, he and his followers saw written on granite "in legible characters, the memorable inscription

*Dinanzi a me non fur cose create
Se non eterne. (Lyell 1830-33, I:62).*

The translation is "Before me things create were none, save things Eternal," and these characters they "regarded as sacred" (Lyell 1830-33, I:62). Read straight, this quotation from Dante's *Divine Comedy* appears as a literal description of granite considered as the first rock, before which nothing existed and which has endured through all the ages of the earth. But as Lyell, in provocative mood, evidently expects

his readers to know, this “memorable inscription” is from the *Inferno*, and is written on the gates of hell. An extended version of the passage reads,

*Through me you pass into the city of woe:
Through me you pass into eternal pain:
Through me among the people lost for aye...
Before me things create were none, save things
Eternal, and eternal I endure.
All hope abandon ye who enter here. (Dante
1994, 10).*

For the reader of Lyell who also knows his Dante, then, and this is perhaps the most famous of all quotations from Dante’s work, there is another reading to be had. Uncovering the hidden cosmology underpinning Werner’s seemingly secular geology, in which time is “eternal” rather than genuinely temporal, Lyell turns epic eschatology against this geological view: think like Werner, he suggests, and you are entering dangerous philosophical territory. Here is Werner’s mode of reasoning, “All hope abandon ye who enter here.”

Presenting Werner as a would-be epoist, then, Lyell revisited the geologist who had just died as he composed “Lines on Staffa” in a different genre. Just twenty pages later the satiric persona Lyell develops in these early chapters of the *Principles* finds its fullest expression in a thought experiment by which he demonstrates that human beings, inhabiting only a quarter of the earth’s surface, are at a disadvantage when it comes to analyzing geological processes. “There can be little doubt,” he writes, “although the reader may, perhaps, smile at the bare suggestion of such an idea, that an amphibious being, who should possess our faculties, would still more easily arrive at sound theoretical opinions in geology” than we can, for that creature could see to the depths of the sea, as humans, limited to the regions of the air, cannot. But even the amphibious creature could not “reason on rocks of subterranean origin” from direct observation:

■ But if we may be allowed so far to indulge the imagination, as to suppose a being, entirely confined to the nether world – some “dusky melancholy sprite,” like Umbriel, who could “flit on sooty pinions to the central earth,” but who was never permitted to “sully the fair face of light,” and emerge into the regions of water and of air; and if this being should busy himself in investigating the structure of the globe, he might frame theories the exact converse of those usually adopted by human philosophers. (Lyell 1830-33, 1:82-83).

This is another mock-epic, for the sprite to whom Lyell refers is Umbriel, the gnome of the earth from Alexander Pope’s *Rape of the Lock* (1712-17), a poem that had applied epic machinery to compare the contemporary scandal of the public lopping of a

lock of a young woman’s hair to the rape of Helen of Troy, poking fun at the triviality of the incident through mock-epic grandeur. Lyell invokes Pope in order to subtly critique all those whose geology was supposed to be inductive, but which he suspected of being underpinned with mythological frameworks. Buckland had claimed for geologists the status of expert Virgilian guides to the underworld; for Lyell there could be no such reliable expertise on an underworld that was essentially unobservable.

Milton and Dante figure prominently in the *Principles*, as we would expect from a former student of Buckland and an Oxford-educated liberal. But they often appear in what might be considered Niebuhrian fashion. Again and again Lyell, like Niebuhr, bemoans the inadequacy of his sources – the lack of geological information in Homer, or Pliny, Tacitus, Suetonius, Martial, Dion Cassius, who ignore geological events or record “without discrimination ... facts and fables” as if each were reliable as the other (see Lyell 1830-33 1:238, 331 for examples). But out of these mythic histories, epic poems, and superstitious traditions, Lyell reconstructs truth, divining fact from fable in the textual record, in an analogy for the methodical imagination that can be relied upon to reason sensibly about evidence that has been lost in the earth’s archive as well as in the historic one. Writing on the destructive geological power of the floods of the river Po, Lyell notes, “The practice of embankment was adopted on some of the Italian rivers as early as the thirteenth century; and Dante, writing in the beginning of the fourteenth, describes, in the seventh circle of hell, a rivulet of tears separated from a burning sandy desert by embankments [quoting Dante] ‘like those which, between Ghent and Bruges, were raised against the ocean, or those which the Paduans had erected along the Brenta to defend their villas on the melting of the Alpine snows.’” That last is Lyell’s translation for the following passage, which he also gives in the Italian (Lyell 1830-33 1:184), and which he quotes not for the mythic journey of its protagonist but for its ability to yield important historical information significant for the geologist. “Some speculators ... who disregard the analogy of existing Nature,” Lyell later writes on the earthquake at Calabria of 1783, “and who are as prodigal of violence as they are thrifty of time, may suppose that Calabria ‘rose like an exhalation’ from the deep, after the manner of Milton’s Pandaemonium” – thus briefly invoking the poetry of hell yet again. “But such a hypothesis will deprive them of that peculiar removing force required to form a regular system of deep and wide valleys, for *time* is essential to the operation.” (Lyell 1830-33 1:431-32). While Milton’s epic machinery is an effective tool for the geologist who needs to describe the unobservable underworld, it is also a mythic machinery whose power of evocation is

much greater than its power to frame a complex understanding of the natural world and its processes.

Lyell does not turn from poetry to science, then, so much as from epic to mock-epic, from the epic grandeur of telling the story of the history of the earth to a much more prosaic, less complete, poetic vision of a world in ruins. And his choice of poet for the task of reenvisioning the world in this way was, perhaps unsurprisingly, Byron. Geologists, Lyell tells us, had formerly believed that it was the sea that altered its level over time, while the land remained stagnant. “But it is time that the geologist should in some degree overcome those first and natural impressions which induced the poets of old to select the rock as the emblem of firmness – the sea as the image of inconstancy. Our modern poet,” he says, alluding to Byron, “in a more philosophical spirit, saw in the latter ‘The image of Eternity,’ and has finely contrasted the fleeting existence of the successive empires have flourished and fallen on the borders of the ocean, with its own unchanged stability.

– – *Their decay*
Has dried up realms to deserts: – not so thou,
Unchangeable, save to thy wild waves’ play:
Time writes no wrinkle on thine azure brow;
Such as creation’s dawn beheld, thou rollest now.
 CHILDE HAROLD, *Canto iv.* (Lyell 1830-33, 1:530).

This paean to the sea, which concludes *Childe Harold’s Pilgrimage*, was felt by the poet Percy Bysshe Shelley to be the redeeming feature of a poem which had revelled too much in moral and psychological ruin, and whose pessimistic attention to the ruins of the classical world is directly quoted by Lyell as he impresses upon his readers of the utter ruin of the former ages of the earth and of the almost total ruin of the geological archive. This was fundamental to his articulation of a new methodology for the science. Byron, the “philosophical” poet who could tell that the sea, perhaps paradoxically, is the image of constancy, while the land is utterly fickle, later helps Lyell to describe the manner in which seeds can be flung by winds prevailing in one direction, or by hurricanes, almost without limit, thus diffusing themselves over the earth so that their points of origin are indecipherable: “All are familiar with the sight of the floating sea-weed ‘flung from the rock on ocean’s foam to sail, / Where’er the surge may sweep, the tempest’s breath prevail,’ ” Lyell writes (1830-33, 2:78; for an important discussion of Lyell’s second volume see Corsi 1978; for an alternative discussion of Byron and Lyell, and Byron and geology more widely, see O’Connor 2007, 174-76 and chap. 8). Byron breathes of submission to forces beyond one’s control, self-abandonment, and self-forgetting in this passage from *Childe Harold*, a passage that is

emblematic of the directionless, anti-epoizing quality that had given his poetry such potency in the years of Lyell’s adulthood. It was “the present moment” that was “Byron’s strong suit,” as one historian of epic poetry has recently put it, not the diachronic and cosmological plotting of the past that belonged to epic (Tucker 2008, 192): with no “evident motive, bearing, or goal” Byron’s heroes drifted about the world: “Here ... was a venue where epic need not apply” (Tucker 2008, 234). Indeed, it has been argued that, in the wake of Byron’s achievement, epic poetry became a heroic impossibility in the 1820s – something nobody could hope to attempt successfully, except for apocalyptic and deluge poets from whom Lyell, for obvious reasons, would have been sensible to distance himself and his science (Tucker 2008, 236-51).

It is on the model of Byron’s seaweed, flung about the ocean with abandon, on the model of Byron’s aesthetic of inconstancy, that Lyell fashioned his own vision of an earth history that was modern, advanced, and all grown-up in the late 1820s and early 1830s. One of Byron’s favourite verbs in the fourth canto of *Childe Harold* is “to repeople”: for those who have read Shakespeare’s *Merchant of Venice*, he suggests, it doesn’t matter that Venice is in ruins, for the literary imagination is, more powerfully than any other form of imagination, reconstructive: “For us re-peopled were the solitary shore”, Byron writes confidently of those who have undertaken such reading (Byron 1818 IV.36); later, his speaker proclaims powerfully that “I can repeople with the past” (Byron 1818 XIX.163). Later, at Rome, he does just that, breaking into a visceral present tense as he immerses himself fully in the chaos and drama of the lost worlds that the ruins of the Coliseum suggest to him:

I see before me the Gladiator lie:
He leans upon his hand – his manly brow
Consents to death, but conquers agony,
And his droop’d head sinks gradually low –
And through his side the last drops, ebbing slow
From the red gash, fall heavy, one by one,
Like the first of a thunder-shower; and now
The arena swims around him – he is gone,
Ere ceased the inhuman shout which hail’d the
wretch who won. (Byron 1818 CXL.1252-60)

In his second volume, for instance, Lyell catalogs the dispersal of species across the earth’s surface in a bid to demonstrate that their points of origin are often undetectable. Describing the dispersal of seeds over the surface of the earth, Lyell suddenly breaks, like Byron, into the present tense:

■ A deer has strayed from the herd ... [and] is suddenly alarmed by the approach of his foe. He instantly plunges through many a thicket, and swims through many a river

and lake. The seeds of the herbs and shrubs adhere to his smoking flanks, and are washed off again by the streams. The thorny spray is torn off and fixes itself in his hairy coat, until brushed off again in other thickets and copses. Even on the spot where the victim is devoured, many of the seeds which he had swallowed immediately before the pursuit may be left on the ground uninjured. ... A tempestuous wind bears the seeds of a plant many miles through the air, and then delivers them to the ocean; the oceanic current drifts them to a distant continent; by the fall of the tide they become the food of numerous birds, and one of these is seized by a hawk or eagle, which, soaring across hill and dale to a place of retreat, leaves, after devouring its prey, the unpalatable seeds to spring up and flourish in a new soil. (Lyell 1830-33, 2:79, 81).

These moments of profound imaginative immersion, registered by a break from a considered contemplation of the past from the fragmentary and ruined remains of it into a shocking present tense, shape Lyell's prose and his articulation of the new kind of scientific imagination it would require to be a good geologist. Throughout *Principles*, Lyell asks us to imagine worlds we have never seen. We move backward through the geological record, from the worlds we know to the worlds we don't, or outward from the geology of Britain, or the French and Italian landscapes familiar to so many through the Grand Tour, to the Africas or Ganges or the New World. But these are the patterns by which we can know the world, and not the pattern of the world itself. Lyell's *Principles*, like the dispersal of seeds or the Byronic hero, offer us a world whose patterns can never fully be known or managed.

We constantly enter and reenter a dazzling array of perspectives in *Principles*, each of limited range: an alien being, a satiric gnome, a seed passing through the body of a deer, or a piece of driftwood turning into an island as it moves toward the land. The progress implied by the fossil record is a sham, Lyell insists, for only a very limited number of species are preserved, and the epic potential of the rock record, its promise of a total vision of earth history, is a myth. The record is simply too fragmentary for its full story ever to be reconstructed. Alternatively, Lyell sometimes suggests, progress in the fossil record is a sham not because of the record's incompleteness, but because the slab of time it represents is only a tiny speck in a much larger history whose overall pattern is unknowable. In this view, the epic vision promised by earlier geologists is parochial, limited by the vagaries of human perspective. There is always a larger view that could be taken, and a smaller one, a view in short that would imply a different story altogether. Lyell's world was a Byronic "anti-narrative," a mock-heroic fit for a cosmopolitan geologist in the early 1830s seeking to make his mark on the world, win a wife, and bring his science to feel the force of its own conclusions. Lyell, I argue, did not offer a rival plot of earth history to his geological opponents, and he did not push poetry from his science. Instead, in *Principles*, Lyell finished the job, already started by his colleagues, of unmaking the story of the world in prose.

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Appendix

Lines on Staffa

CHARLES LYELL

Ere yet the glowing bards of Eastern tale
Had peopled fairy worlds with beings bright,
Roamed o'er the palace and enchanted vale,
And dreamed a heavenly vision of Delight,
And told of realms rich with unborrowed Light,
On which the needless sunbeams never fell,
Whose noon of splendour never knew the night,
Illumed by lamps that burnt unquenchable,
And dazzling hung in air, upheld by magic spell:

All these and more, with which their wizard strain
Led far away deluded Fancy's child,
Till he would turn on Nature's self again,
And deem her charms a desert bleak and wild,
Himself from visionary heavens exiled;
While yet unheard that strain, the Time had been
When Nature's hand as if in sport she toiled
To build e'en more than could the thoughts of man,
Amid the Ocean vast, had framed a fairy scene.

For she had found a lone and rocky isle,
And at her voice a thousand pillars tall,
She bade uprising lift the massy pile,
And far within she carved a stately hall
Against whose sides the entering waves did fall,
While to their roar the roof gave echo loud –
And she had hid each column's pedestal
Beneath the depths unseen of Ocean's flood,
While towered their heads on high, amid the passing cloud.

And she had fashioned with an artist's pride
The dark block rock where hung the sparkling foam,
And many a step along its sculptured side
Had hewn, as if to tempt some foot to roam,
Some favoured foot of Mortal yet to come.
She had no shapes of Terror there abound,
That pillar'd hall no guardian dragon's home,
But Ocean rolled his mighty waves around,
To guard from vulgar gaze her fair enchanted ground.

(Lyell in K.M Lyell 1881, 1:55-66).

