

“THE POETRY OF SCIENCE”: CHARLES DICKENS, GEOLOGY, AND VISUAL AND MATERIAL CULTURE IN VICTORIAN LONDON

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DESPITE THE WELL-ESTABLISHED CONNECTIONS between Dickens's novels and Victorian popular entertainment, and between Victorian show business and the display and dissemination of science, critics have not yet explored the possible links between scientific shows and Dickens's fiction. Work on Dickens and science has proliferated since George Levine's work in *Darwin and the Novelists*, but its central problem has been the fact that, as Francis O'Gorman described it, Dickens's scientific reading was “nugatory” (252). The most well-represented branch of science on his bookshelves was natural history; in even this, Dickens displayed only the “intelligent interest that would be expected of a man of the world” (Hill 203). Levine's influential “one culture” model surmounted the problem by pointing out the similar structural patterns implicit in the worlds described by Dickens and Darwin, but in an attempt to develop more direct links between Dickens's work and evolutionary science, almost all subsequent studies have focused on Dickens's 1860s novels, written after the publication of the *Origin of Species* (1859) (Morris 179–93; Fulweiler 50–74; Morgentaler 707–21). There has not been a study that explores Dickens's acquaintance with natural history at different points in his career, or through the visual and material cultures with which he was so familiar.

In Victorian London, the panorama, the diorama, the cyclorama, and the burgeoning museum and exhibition culture of the 1840s and 1850s presented a very different view of geology from that offered by Darwin in the *Origin of Species*. Its industrial and practical applications were emphasized, there were sensational and spectacular displays of dinosaurs and other “monsters,” and something like “catastrophism” was a popular visual form in the city's many earthquake and volcano shows. Catastrophism is the umbrella term for several nineteenth-century theories in which the fragmentary geological record, and the presence of now-extinct creatures, was accounted for by a narrative of earth history as a series of catastrophes, sometimes (but not always) with emphasis on providential design and Divine miracle. Some (though by no means all) catastrophists attempted to defend the story of Creation as recounted in Genesis, with a particular focus on Noah's Flood. Central to catastrophism was the notion that the earth had once been more catastrophic than it presently was. It was opposed, most famously, in Lyell's *Principles of Geology* (1830–33) which put forward “uniformitarianism,” a gradualist earth history in which catastrophes

had always been, were, and would always be, events of the same scale as those currently operating. For Lyell, there was no difference in intensity between the events of the past and the present state of the earth, and it was on this notion that Darwin's evolution rested. Though, as Adrian Desmond puts it, "Catastrophism had waned long before the fifties," his evidence comes from papers given at the British Association for the Advancement of Science (*Archetypes* 58). But popular entertainments maintained the popularity of geological catastrophes long into the nineteenth-century. Catastrophist geologists such as Hugh Miller, Gideon Mantell, and Adam Sedgwick wrote bestsellers in the 1850s, and Dickens himself owned Louis Figuier's catastrophic, post-Darwinian *The World Before the Deluge* (1863) (see Stonehouse).

Literary critics have not yet given enough emphasis to the scientific elements of the popular shows and entertainments Dickens attended and wrote about throughout his career. Furthermore, in the emphasis on evolutionary theory and Victorian literature, criticism has tended to overlook Dickens's acquaintance with important non-evolutionary scientists of the day. Goldie Morgentaler, K. J. Fielding, and Levine have all mentioned (but not explored) Dickens's close friendship with Sir Richard Owen, the illustrious Victorian palaeontologist who named the "dinosaur," and ran the Hunterian Museum, the Crystal Palace prehistoric garden, and the Natural History Museum (Morgentaler 161; Fielding 206–07; Levine, *Darwin* 122). Owen was at the forefront of attacks on evolutionary theory, including Lamarckism and, later, Darwinism. Dickens and Owen read each other's works, attended each other's lectures, and visited each other's homes (Dickens, *Letters* 1852, 780). Dickens only agreed to contribute to a lecture series (which did not go ahead) for the anti-Sabbatarian Sunday League on the condition that Owen would also contribute (Dickens, *Letters* 1865, 105). *Household Words* ran several articles in the late 1850s explicitly supporting Owen's science and its belief in the archetype – an "ideal form" for each species on which all variations were based – and in God's plan manifested in the work of Nature (Hart 511–13; Linton 481–84; Mann 451–53). Despite the much stronger body of evidence linking Owen and Dickens, nobody has explored the effects of this professional and private friendship on Dickens's work. As Desmond puts it, "history only honours those who fight on the winning side" and until now, there has been no exploration of Dickens's links with culturally important non-evolutionary scientists or theories (*Hot-Blooded Dinosaurs* 17).

It is my contention, then, that discussions of Dickens's conception of science have been based on flimsy textual evidence which has ignored the importance of his personal networks with scientists like Owen and Sir Roderick Murchison, the imperial geologist who predicted the discovery of gold in Australia (Dickens, *Letters* 1852, 739; 1855, 638; 1855, 654; 1870, 505; 1857, 675). These discussions have also ignored the importance of material and visual cultures, which Dickens participated in, contributed to, and was influenced by. An exploration of these material and visual forms not only provides more concrete evidence of Dickens's awareness of Victorian scientific theory, but will reveal the social and aesthetic impetuses for the allusion and inclusion of scientific discourses within the novel: what (and who) exactly was Dickens alluding to when he included scientific tropes and metaphors? What types of cultural experience does Dickens assimilate into the reading process through his allusion to scientific ideas and images that were derived from popular shows? Correspondingly, aside from the broad structural similarities between his entangled plots and multitudinous characters, and Darwin's tangled bank, what aesthetic value does science have in his fiction?

In Dickens's review of Hunt's *Poetry of Science*, he sets out enthusiastically his ideal version of science and its relatedness to artistic and creative endeavour:

Science has gone down into the mines and coal-pits, and before the safety-lamp the Gnomes and Genii of those dark regions have disappeared . . . Sirens, mermaids, shining cities glittering at the bottom of quiet seas and in deep lakes, exist no longer; but in their place, Science, their destroyer, shows us whole coasts of coral reef constructed by the labours of minute creatures; points to our own chalk cliffs and limestone rocks as made of the dust of myriads of generations of infinitesimal beings that have passed away; reduces the very element of water into its constituent airs, and re-creates it at her pleasure. Caverns in rocks, choked with treasures shut up from all but the enchanted hand, Science has blown to atoms, as she can rend and rive in the rocks themselves; but in those rocks she has found, and read aloud, the great stone book which is the history of the earth, even when darkness sat upon the face of the deep. Along their craggy sides she has traced the footprints of birds and beasts, whose shapes were never seen by man. From within them she has brought the bones, and pieced together the skeletons, of monsters that would have crushed the noted dragons of the fables at a blow. ("Poetry of Science" 179)

This ideal science is geology, rather than evolutionary biology. Dickens takes us "hundreds of fathoms underground," and describes the formation of coral reefs, chalk cliffs, the rocks which reveal a primeval "history of the earth," and dinosaurs. He acknowledges the ways in which science is a "destroyer," annihilating belief in myth, legend, and fantasy with its empirical outlook. But its destruction is in fact a form of re-absorption: mermaids, for example, are replaced directly with "whole coasts of coral reef constructed by the labours of minute creatures." Science does not merely "destroy" fantastical and aesthetic elements of mythology but reconverts them, complete with a sense of wonder and awe, into observationally-verified, scientific sets of facts. Equally, Dickens manipulates the standard geological image of "the great stone book" to characterize science as "read[ing] aloud." Like Dickens himself at his famous public readings, and like his lecture-giving friend, Richard Owen, "Science" is a performer in this description. Science has an awe-inspiring power to "rend and rive" in the rocks, to "blow" caverns "to atoms," and to "re-create," through performance, the natural world. In this sense, Dickens seeks objective, scientific, and accurate observation of the natural world, but equally attempts to retain the pleasures of superstition and spectacle through a poetic vision of geological Science.

In London representations of the natural world often took catastrophic form and often formed part of exciting, spectacular performances. At just one venue, the Surrey Zoological and Botanical Institution, near central London, volcano panoramas, with sound effects and fireworks, were displayed in 1837–38 (Vesuvius), 1839 (Mount Hecla), 1846 (Vesuvius), and 1852 (Etna) (Altick 324). The 1839 Mount Hecla had been seen by 578000 people by its hundredth show (Altick 325). As Altick states, "One of the biggest hits of the whole Victorian era" was *The Ascent of Mont Blanc* panorama at the Egyptian Hall in the mid-1850s, which included a depiction of Naples and Vesuvius by 1857, coinciding with a series of earthquakes at the site in the same year (477). *Household Words* covered these earthquakes in Henry G. Wreford's leader article "Earthquake Experiences" on 29 May 1858 (553–58). The Colosseum at Leicester Square, a dome-shaped building that regularly housed popular panoramas, had a huge hit with the "Cyclorama," an elaborate 360° panorama, in the late 1840s (Altick 157–58). The cyclorama in London opened with a recreation of the Lisbon earthquake of 1755, including rumbling floors, violent light, and sound effects. It caused a

sensation in London in 1848 and continued shaking into the 1850s, when it was replaced by pictures of the Crystal Palace and then, lo and behold, an erupting Vesuvius (Altick 158–61).

A related form of the panorama, the diorama, was struggling for business by the 1840s.¹ And yet it regained success with Parisian transformation scenes, the first of which was a recreation of an avalanche (another catastrophic geological event) that buried a Swiss town in 1820 (170). By 1848, in a final bid for financial success, the diorama returned to the faithful volcano format with an eruption of Mount Etna. The show was a popular success, and ran for three years. In 1851, unable to compete with the Lisbon earthquake at the Colosseum, and with similar (and better) entertainments on display at the Great Exhibition and elsewhere, it closed down (171).

Dickens utilized the diorama as a structural device in his chapter “A Rapid Diorama” in his 1846 travel book *Pictures from Italy*. He describes his trip to the catastrophic region of Naples, and his ascent of Vesuvius (1846 233–55). Such narratives were themselves a popular form in the 1840s and 1850s. Following Edward Bulwer-Lytton’s *The Last Days of Pompeii* (1834), London periodicals, including Dickens’s own magazine *Household Words*, frequently ran travel pieces describing the ascent and descent of Vesuvius, alongside trips to Pompeii (Dulton 234–36; Wreford 435–39). Dickens’s “rapid succession of delights” offers a variation on the theme that references the London shows with his use of the diorama. His description is replete with shifts of scenery that fade in and out of view, overlaying images and scenes in a montage-like transformation of the initial view just like the diorama. In “the morning, just at daybreak,” for example, “the prospect suddenly becoming expanded, as if by a miracle, reveals – in the far distance, across the Sea there! – Naples with its Islands, and Vesuvius spouting fire” (*Pictures from Italy* 234–35). Once the image of Vesuvius has been superimposed on this scene, it fades away again: “Within a quarter of an hour, the whole is gone as if it were a vision in the clouds, and there is nothing but the sea and sky” (235). As in the diorama, the view enlarges and recedes before his static eye; the entire Naples area passes before him, sitting stationary in his carriage, in a succession of scenes just like those of the diorama that repeatedly transform the landscape in front of his very eyes.

Dickens also wrote on “the gigantic-moving panorama or diorama” in *Household Words* in 1850:

It is a delightful characteristic of these times, that new and cheap means continually being devised, for conveying the results of actual experience, to those who are unable to obtain such experiences for themselves; and to bring them within the reach of the people – emphatically of the people; for it is they at large who are addressed in these endeavours, and not exclusive audiences . . . Some of the best results of actual travel are suggested by such means to those whose lot it is to stay at home. New worlds open out to them, beyond their little worlds, and widen their range of reflection, information, sympathy, and interest. The more man knows of man, the better for the common brotherhood among us all. (“Extraordinary Traveller” 77)

For Dickens, these forms of visual representation derive their worth from their ability to provide the masses with an imaginative means of travel, a kind of vicarious tourism without the cumbersome material problems involved in travel. The moving images of the diorama cause other, less transient shifts in perspective: the imaginative movement they suggest in providing vicarious travel, could “widen” the emotional and intellectual “range” of the imaginary travellers. The imaginative journey across geographical space involves an

intellectual journey that expands the spectator's moral perspective and the panorama, with its extended field of vision, equally extends "the common brotherhood among us all."

The London public, by the late 1840s, had an appetite for imaginative journeys through exotic, Arctic, and historical landscapes, partly satiated through panoramas and dioramas. In 1851, the Great Exhibition gave even more direct access to worlds that the average London showgoer could not reach. Competing with London's numerous volcano shows, the Exhibition included a Pompeian Court: "the lava-buried city, the city of the dead – at the epoch of its destruction by a sudden eruption of Vesuvius" (Cruchley 310). Visitors could stroll through Egyptian, Greek, Roman, Byzantine, Alhambra, French, Italian, German, Elizabethan, and Renaissance courts, and could see animals, plants, and industrial products of Australia, America, and the Orient. There were 600 geological exhibits at the Exhibition, including fossilised fish, trees, and forests; geological maps; marbles, limestones, and petrified eggs; models of Britain's deepest mines, and cross-sections of geological strata revealed through railway cuttings (Yapp 1–21). Its view of the world past and present, with its claims to be all-encompassing, prompted the inventor Charles Babbage to call it "A Diorama of the Peaceful Arts" (qtd. in Altick 457).

Dickens, of course, displayed an initial ambivalence about the Exhibition:

There is a range of imagination in most of us, which no amount of steam-engines will satisfy; and which The-great-exhibition-of-the-works-of-industry-of-all-nations, itself, will probably leave unappeased... The Polytechnic Institution in Regent Street... is a great public benefit and a wonderful place, but we think a people formed *entirely* in their hours of leisure by Polytechnic Institutions would be an uncomfortable community. (qtd. in Schlicke 201)

His ambivalence here, however, was both short-lived and a by-product of his fears about utilitarian science denounced in *Hard Times*. Natural history, particularly geology, frequently offered him an alternative to utilitarianism by giving scientific credibility to myth, superstition, and spectacle. Thus, when the Crystal Palace was reconstructed at Sydenham (1854), complete with prehistoric garden, Dickens and *Household Words* were both far more enthusiastic: one article described the garden's recreation of "those antediluvian days when there were giants in the land" as a "Fairyland" and "pleasure ground for those whose lot it is to labour" (Wills and Sala 313–17). Owen directed the sculptor Benjamin Waterhouse Hawkins to ensure that the dinosaurs he had named, including the megalosaurus, the iguanodon, and the pterodactyl, were accurately recreated. Improving on earlier dinosaur reconstructions at the Hunterian Museum and the Antediluvian Room at the Egyptian Hall, the garden caused a public sensation, prompting a spate of dinosaur illustrations in the popular press. Together, Owen and Hawkins invented the image of the dinosaur for a whole generation of Victorians (see Desmond, *Hot-Blooded* 24–27 and Altick 484). All over London, then, visual and material cultures pictured a prehistoric world characterized by spectacular monsters, and the natural world as intrinsically catastrophic: size, spectacle, and the pleasures of fear in the face of calamitous disasters and gigantic creatures turned nature into performance, familiarizing their crowds with exaggerated versions of popular science.

In 1846, the year of the Surrey Gardens' Vesuvius panorama, the real Mount Vesuvius was active all summer. Dickens had climbed the volcano in 1845, burned his feet on its lava and ashes, and had described his experiences in *Pictures from Italy*. This was also the year in which he began writing and publishing *Dombey and Son* (1846–48). The catastrophes that he

had seen in Italy become one of the central motifs of that novel as he describes the building of the railroad in a London suburb:

The first shock of a great earthquake had, just at that period, rent the whole neighbourhood to its centre. Traces of its course were visible on every side. Houses were knocked down; streets broken through and stopped . . . Everywhere . . . carcasses of ragged tenements, and fragments of unfinished walls and arches, and piles of scaffolding, and wildernesses of bricks, and giant forms of cranes, and tripods straddling above nothing. There were a hundred thousand shapes and substances of incompleteness, wildly mingled out of their places, upside down, burrowing in the earth, aspiring in the air, mouldering in the water, and unintelligible as any dream. Hot springs and fiery eruptions, the usual attendants upon earthquakes, lent their contributions of confusion to the scene. Boiling water hissed and heaved within dilapidated walls; whence, also, the glare and roar of flames came issuing forth; and mounds of ashes blocked up rights of way, and wholly changed the law and custom of the neighbourhood. (*Dombey* 67)

Just like “the earthquake which preceded the eruption” of Vesuvius that buried Pompeii in *Pictures from Italy*, Stagg’s Gardens has been hit by both earthquake and volcano (the “hot springs and fiery eruptions” that are “the usual attendants upon earthquakes”) (*Pictures from Italy* 247). The “conical-shaped hill” and “great sheets of fire . . . streaming forth” in Italy have become the “unnatural hill” and the “glare and roar of flames . . . issuing forth” in London (*Pictures from Italy* 250). Dickens’s Italian town has “great walls of monstrous thickness . . . obtruding their shapeless forms in absurd places, confusing the whole plan, and making it a disordered dream” (245). In his description of London in *Dombey and Son* there are, similarly, “a hundred thousand shapes and substances of incompleteness, wildly mingled out of their places” making the scene “unintelligible as any dream.” The close parallel between these dream-like landscapes of shapeless, incomplete, disordered forms and substances reveals that Dickens created his image of Victorian London in *Dombey and Son* directly from the materials furnished by his trip to Vesuvius. The influence of the dioramic mode of perception that structures Dickens’s presentation of the disaster in *Pictures from Italy* informs its re-presentation in this novel. In *Pictures from Italy* Dickens travels, via railroad, to the catastrophic landscape surrounding the volcano. In *Dombey and Son* the situation is almost the reverse: the static observer in the centre of London does not travel on the railroad – the railroad comes to him. Like the observer at a diorama, the reader of Dickens’s description of London watches the transformation of a scene through the actions of a devastating volcano.

This scene of “dire disorder” is implicated in a broader narrative in which the inhabitants of Stagg’s Gardens perceive their neighbourhood to be under threat, a perception which seems to be supported by this catastrophic imagery. Though it is “regarded by its inhabitants as a sacred grove not to be withered by railroads” and other “such ridiculous inventions,” the pre-railroad Stagg’s Gardens is in fact, the site only of “frowzy fields, and cow-houses, and dunghills, and dust-heaps,” prefiguring the dunghills and dust-heaps of the wasteland London of *Our Mutual Friend* (*Mutual Friend* 69). With its “rotten summer-houses” this “unhallowed spot” is hardly the Edenic “sacred grove” its inhabitants claim it to be. Dickens extends this gentle parody of the Stagg’s Gardens population by mocking its naïve natural history of its landscape. Some hold it to have been constructed by “a deceased capitalist”; “others, who had a natural taste for the country, held that it dated from those rural times

when the antlered herd, under the familiar denomination of Staggses, had resorted to its shady precincts" (69). Dickens presents a pseudo-aristocratic register in the noun phrases "familiar denomination," "antlered herd" and "shady precincts," with their connotations of hunting and hereditary lineage. But the cacophonous word "Staggses" sounds like a Dickensian-Cockney mispronunciation of the plural for the hunted "stags" and punctuates this flow of descriptive language, revealing it to be mere hyperbole. Dickens uses the comic intrusion of dialect to prove the partiality of the inhabitants of the gardens; he reminds us that this is not Eden, but a shabby working-class London district.

The old-fashioned natural historians who live at this catastrophic site use anecdotal evidence and inherited aristocratic and Biblical traditions to depict Stagg's Gardens as an Eden (a "sacred grove," a "shady precinct") in the process of being lost (69). In this essentially linear account, the narrative of the Fall reconfigures the coming of the railway as an irreversible event that emphatically destroys the landscape. But Dickens's narrator searches for "Traces of [the earthquake's] course," using the present, chaotic scene to understand the prior actions of the catastrophe like any mid-Victorian geologist (68). The geological language here is developed in direct opposition to the Biblical earth history offered by the London inhabitants. Dickens's narrator in *Dombey and Son* closely observes "traces," "fragments," and "treasures" in disarray, "wildly mingled out of their places" like fossils scattered out of place in a moment of catastrophic upheaval. The "giant forms" and "carcasses of ragged tenements" resemble the giant dinosaur carcasses famously discovered in the 1840s as navvies cut the railways themselves – an iguanodon was found at Bletchingley and an ichthyosaurus in the Oxford, Worcester, and Wolverhampton line (Freeman 48). In this passage in *Dombey and Son* Dickens's pseudo-scientific language reveals that the railroad connects the city with geographically-distant places and the temporally-distant monsters that lurk beneath its soils.

When we return to Stagg's Gardens we find that there is, in fact, "no such place as Stagg's Gardens" (233). Its "giant forms" have actually become the "tame dragons," the "monster train[s]" which have "swallowed up" the old waste-ground; "mountains of goods" have grown and stand "bubbling and trembling there, making the walls quake, as if they were dilating with the secret knowledge of great powers yet unsuspected in them" (234). The catastrophic and the spectacular, unearthed in the railway's construction, have become a feature of its ongoing progress. Progress and catastrophe are inseparable in the endlessly-shifting urban world Dickens depicts.

London in the mid-to-late 1840s was full of these images of spectacular disaster, to which the pages of Dickens's *Pictures from Italy* and *Dombey and Son* contributed, and out of which they were fashioned. In 1848, the Cyclorama was recreating the Lisbon earthquake four times daily, and it seems more than coincidental that Captain Sol's rooms in *Dombey and Son* are described as being "very small . . . but snug enough; everything being stowed away, as if there were an earthquake regularly every half-hour" (126). Dickens appeals to the visual imagination of the popular audiences who attended dioramas, panoramas, and the Great Exhibition and encourages in his readers the same kind of expansive, all-encompassing view that those entertainments offered. Utilizing the catastrophic elements of those visual forms, Dickens taps into the realms of popular mythology and the pleasures of spectacle, but nonetheless maintains a sense of the scientific, stressing, above-all the importance of accurate observation and dramatizing its broadening of social vision for the inhabitants of Stagg's Gardens. Geology allows Dickens access to popular myth, fantasy, and spectacle in

Dombey and Son, but, like the visual forms he draws his geology from, allows his readers to travel imaginatively, suggesting his broader social purpose. Dickens finds in catastrophe a form for the chaos of modernisation and urbanisation: like the notoriously incomplete, fragmented fossil record, it too needs reorganisation. Catastrophe brings order, a sense of history, and a broad, expansive temporal-geographical vision that, for Stagg's Gardens and for Dickens's readers, promotes social harmony: "the common brotherhood among us all."

Bleak House (1852–53) was written on the other side of the Great Exhibition, when the Crystal Palace prehistoric garden was being constructed by Dickens's friend Richard Owen. In this novel the dinosaurs uncovered by the railway in *Dombey and Son* move centre stage:

London. Michaelmas Term lately over, and the Lord Chancellor sitting in Lincoln's Inn Hall. Implacable November weather. As much mud in the streets, as if the waters had but newly retired from the face of the earth, and it would not be wonderful to meet a Megalosaurus, forty feet long or so, waddling like an elephantine lizard up Holborn-hill . . . Foot passengers, jostling one another's umbrellas, in a general infection of ill-temper, and losing their foot-hold at street-corners, where tens of thousands of other foot passengers have been slipping and sliding since the day broke (if the day ever broke), adding new deposits to the crust upon crust of mud, sticking at those points tenaciously to the pavement, and accumulating at compound interest. (*Bleak House* 11)

This opening passage, like the images of Stagg's Gardens in *Dombey and Son*, presents a specific area of London as intrinsically catastrophic. The megalosaurus on Holborn-hill "waddles" out of the receding tide of the Biblical Flood ("the waters" that have "but newly retired from the earth"). Like Stagg's Gardens, recovering from "the first shock of a great earthquake," this landscape is also recuperating after a geological catastrophe. But on our return to Stagg's Gardens, its new "mountains" have been formed in our absence: it has been entirely remade. The London streets in *Bleak House* are in the middle of this process, accumulating ever-upwards: the "deposits" of "crust upon crust of mud" pile up like geological strata, offering an alternative earth history to the Biblical Flood.

The novel's geological language has been pointed out by Lawrence Frank and George Levine but, again, its catastrophic implications have been disregarded by both. Levine negates its impact on the text: "His Neptunism and Vulcanism are a literary convenience that required no belief," he writes, referencing (and dismissing) early-century debates about the respective roles of flood and fire in geological history (1988 122). For Frank the novel is implicated in the debates surrounding the publication of the proto-evolutionary *Vestiges of Creation*: Chambers's evolutionary arguments represented by the anonymous narrator who, with his present-tense opening, "will enact the excavation of . . . Victorian London" in a Godless world; the catastrophists who opposed it with their arguments about Providence and teleology are represented by Esther's narrative (71–99).

Frank, like other critics, sees the present-tense opening as a rejection of the possibility of a "divine Author" controlling the text. Furthermore, Martha A. Turner concurs on the disorienting effects of the opening paragraph when she describes its megalosaurus as an "incommensurable image" (97). But London inhabitants who attended the panorama, the Great Exhibition, or read *Household Words* might have known better: the megalosaurus was just one of many images of primeval monsters available to consumers of popular entertainments in 1852–53, at the Hunterian museum and the Egyptian Rooms, for example (Altick 1978). It was also found on the pages of popular periodicals including *Household*

Words (Hunt 121–30). Of course, Owen was associated with the discovery and display of the dinosaurs, and had used the megalosaurus as evidence that the Lamarckian sense of an always-improving evolution, could not be true, for it was a much greater form than representatives of its species in the modern day. In an 1851 *Household Words* article the megalosaurus was a central character. The article begins:

Now that we can visit any portion of the globe by taking a cab or an omnibus to Leicester Square, who wants a Phantom Ship to travel in? The world, as it is, has taken a house in London, and receives visitors daily. Nothing remains now for the Phantom, but sail into the world, as it was, or as it will be . . . we mean to sail quite out of human recollection, to the confines of human existence, and remain in dock among the Graptolites.

So we walk down Cheapside, bustle aboard at London Bridge, and sail out, leaving man behind us. Leaving man behind us; for a thousand years roll back upon themselves with every syllable we utter; years, by millions and millions, will return about us, and restore their dead. (Morley 166)

The “Phantom Ship” articles, like the panoramas to which they are indebted, were a series of descriptions of other parts of the world, unreachable to the average *Household Words* reader, including China and the Arctic. But, alongside the throng of the Great Exhibition, which has brought “the world” to London, which “receives visitors daily,” and which Morley desires to escape, the rival attraction of Wyld’s Globe in “Leicester Square” pictured “any portion of the globe” its spectators might wish to see. Morley competes with the Exhibition and the Globe in offering this alternative journey, but in doing so he also attempts to escape from the busy London world they had created.

Morley’s journey into the prehistoric past allows his reader the comfort of remaining in “Cheapside” while he spins geological epochs, each more distant and strange than the last, past his/her vision: the reader is in the position of panoramic or dioramic spectator. Morley relies on panoramic and dioramic mechanisms of vision for shaping the reality of the other worlds that he describes, allowing his reader to travel without moving, making real other worlds in space and time without, as Dickens would put it, the inconvenience of travelling there oneself. In doing so, Morley anticipates what would be the next master-stroke of the Exhibition itself: the recreation of the megalosaurus and its fellow-creatures for the pleasure of the London throng.

And just a week before *Bleak House* was re-published in single-volume format, Francis Trevelyan Buckland’s article “Old Bones” reported on the discovery of dinosaur bones found beneath the ground outside St. John’s College in Oxford and contrasted the modern world of 1853 with “the apparition of that great leviathan [the megalosaurus] on the top of Heddington [sic] Hill” (Buckland 83–84). The alliterative recall of Dickens’s “Holborn Hill” in Buckland’s Headington Hill and their semi-comic juxtapositions of dinosaurs with modern streets sets up a mutual allusion between *Bleak House* and *Household Words*. Each advertises the other. This network of references and exhibitions of the dinosaur reveal that Dickens was, in fact, participating in a culture in which the image of the dinosaur and the geological past was made commensurable to a paying public. At the very least he advertises the work of Richard Owen. In this context, the megalosaurus can be read as a popular, popularising image, a dramatic effect targeting the popular paying publics currently discovering the dinosaur for themselves. For the 1850s reader this is not a wholly disorienting passage, but it is a specifically orienting one: with its dioramic vision, the scene’s present-tense language

reads like a set of stage directions ushering in the dinosaur image that overlays the Holborn district, holding modern London and a prehistoric swamp in one view.

The novel repeatedly returns to the language of geology, from the references to Noah's Flood, to the image of Professor Dingo "disfigur[ing] houses and other buildings, by chipping off fragments of those edifices with his little geological hammer," a model of professional tenacity in contrast to Richard Carstone's frequent changes of vocation (*Bleak House* 246–47). Judy Smallweed attains to "a perfectly geological age" (313); images of volcanoes and earthquakes are regularly used to describe the Smallweeds (398, 698). The slum at Tom-all-Alone's is characterized by "stagnant channels of mud" "blasted by volcanic fires" recalling the "deposits" of "mud" in the opening scene. These images reinforce a sense of the catastrophic nature of urban poverty (657, 654). In doing so, they seem to confirm the argument put forward by Ann Wilkinson that these images of flood and fire have an apocalyptic basis, for they indict modern culture and, investing the world of the novel with a sense of its immense age, seem to suggest the end of the world (Wilkinson 238). Furthermore, this apocalyptic language counters Lawrence Frank's (and other) arguments which suggest that the third-person, anonymous narrative stands in ironic relation to Esther's narrative, making her Providential world-view seem weak and outdated. The apocalyptic images of flood and fire are both Biblical and geological in *Bleak House*. In fact, they most often occur within the anonymous, third-person narrative. They confirm both a sense of his accurate, scientific observation of events *and* the forces and importance of mythological, unscientific history. Together, these double images of science and apocalypse suggest millennialism: as *Bleak House* closes there is both extinction and death, and a new, reborn world emblemized by the new Bleak House in which Esther will live, and the end of the Chancery case. Catastrophe in *Bleak House*, as in *Dombey and Son*, draws on the city's proliferating images of volcanoes and earthquakes as display and is essential to the novel's conception of progress and change. It invests the scientific observations and descriptions of the anonymous, impersonal narrator with a sense of the forces of myth and history through allusion to popular spectacle. In doing so, it competes directly with the popular scientific shows and spectacles it employs throughout is narrative and maintains popular beliefs in Noah's Flood and Biblical history through catastrophic geology.

In his geological description of Stagg's Gardens in *Dombey and Son*, Dickens revealed (and expanded) the narrow perspective of its inhabitants; "open[ing] out" "new worlds" to them as he suggested the diorama did. In *Bleak House*, Sir Leicester Dedlock, more fatally than those London residents in *Dombey and Son*, fails to attain an expansive vision of his world:

Sir Leicester Dedlock is only a baronet, but there is no mightier baronet than he. His family is as old as the hills, and infinitely more respectable. He has a general opinion that the world might get on without hills, but would be done up without Dedlocks. He would on the whole admit Nature to be a good idea (a little low, perhaps, when not enclosed with a park-fence), but an idea dependent for its execution on your great county families. (18–19)

Dedlock's faith in his uncontested privilege is similar to those images of the "antlered herd" in the London of *Dombey and Son*: both suggest an aristocratic, traditional model of history. The phrase "His family is as old as the hills" articulates this sense of privilege through proverbial language that, like aristocratic history itself, is inherited and naturalised. Of course, in a

geological world, hills erode and are remade continually. And, just as the people of Stagg's Gardens had to accept the panoramic broadening of vision that geological science and the railroad combined to create, Dedlock too must learn, like Dickens's readers before him, to accept his place in a cyclical history, a natural world that extends back much farther than "your great county families." Only then will he accept the links between himself and the volcanic slums at Tom-all-Alone's, and only then will "the common brotherhood of man" be fully affirmed. In this novel catastrophe is both one of the novel's structural pleasures, and gives a cultural warning: when Krook arrested the flow of information, he exploded; the lack of awareness of the "connections" between all the characters has led directly to the volcanic slum at Tom-all-Alone's and to Judy Smallweed's "geologic age." The remaking of worlds in the cyclical, progressive history of *Dombey and Son* is reformed in the popular-scientific world of *Bleak House* as an almost mythic form of retributive punishment for the excesses of urban culture.

By the time Dickens came to write his final completed novel, *Our Mutual Friend* (1864–65), both the panorama and the diorama had closed down for good (Altick 505, 173–83). Dickens reflected its decline in popularity when, in 1868, Dickens wrote in *All the Year Round* that "I systematically shun pictorial entertainment on rollers" (qtd. in Altick 505). Concurrently, the public enthusiasm for the 1851 Great Exhibition and the 1854 recreation of the Crystal Palace in Sydenham (with different exhibits) had been replaced by the pessimistic response to the 1867 Paris exhibition, which consolidated growing fears that Britain was losing its cutting technological edge. By 1864 the optimistic heyday of the 1850s was over, and London was beginning to imagine itself in starkly different terms.

The scientific climate had shifted too. *Our Mutual Friend* was written six years after the publication of Darwin's *Origin of Species*; five years after the controversial *Essays and Reviews* (1860) which, at least to some readers, seemed to contain views that might lead to endorse a Godless Darwinistic universe; and two years after Sir Charles Lyell had analysed the evidence for prehistoric man in *The Antiquities of Man* (1863). In the midst of this fermenting climate *All the Year Round* had carried favourable reviews of Darwin and Lyell's works. Howard Fulweiler has persuasively suggested that *Our Mutual Friend*'s vision of London as "a dismal swamp" was like Lyell's prehistoric England in *The Antiquity of Man* (Fulweiler 54). This England was described in *All the Year Round* as "a steaming morass . . . its awful silence only broken by the hum of the shardy beetle, the rush of hideous flying-lizards through lofty woods of ferns and reeds" ("England Long and Long Ago" 562). These primeval beetles and pterodactyls ("flying-lizards") crawl and fly through the streets of *Our Mutual Friend* alongside alligators, prehistoric fish, and "amphibious human creatures" scavenging survival from the refuse of the river (259, 352, 356, 69, respectively). London itself is described as a "mountain range," thrown up "like an old volcano, and its geological formation was Dust" (13). As Morgentaler puts it, "from this geological perspective, the mounds" are "a demonstration of the manner in which life quite literally lives upon death. What lies beneath our feet is the history of the Earth, a history made up . . . of the accumulated waste of generations" (179–80). London is now a post-catastrophic space: there is no longer any sense that the world can be exploded and made anew.

In *Bleak House* and *Dombey and Son*, Dickens's readers were encouraged to read the scene of the city as a geological fragment of a much broader spatial and temporal vision. But the act of reading "nature's stone book," as Dickens put it in his review of *The Poetry of Science*, is no longer capable of broadening the vision of either Dickens's characters

or his readers. In this Darwinian world, there are no more “sermons in stones.” Bradley Headstone first meets Lizzie in a square “in the centre of which . . . is a very hideous church with four towers at the four corners, generally resembling some petrified monster, frightful and gigantic, on its back with its legs in the air” (221). In this Darwinian landscape, Dickens presents the Church itself as a fossilized relic through this hideous image. And Charley Hexam, attempting to “better” himself through education, crushes his sister’s “romantic ideas,” the fantasies of the future that she sees in the flames of the hearth, through a phallic display of his educational superiority that draws directly on the language of geology, “That’s gas, that is. . . coming out of a bit of a forest that’s been under the mud that was under the water in the days of Noah’s Ark. Look here! When I take the poker – so – and give it a dig” (28). When Charley “give[s] it a dig” this violent disturbance of Lizzie’s dream relates him to all the other diggers and delvers sifting through the “geological formation[s]” for economic success in this dark portrait of London. Boffin’s illiteracy in this world becomes a token of his virtue: “it’s too late for me to begin shovelling and sifting at alphabets and grammar-books,” he says, in a grim parody of geological “shovelling and sifting” (50). Books are “stones” that teach miserliness and petrify their readers (49): one of Boffin’s books on misers contains “a remarkable petrefaction” and Bella accuses Boffin of being “changed . . . to marble” by his miserly reading (485, 599). The text, then, marks Dickens’s disillusionment with his preferred science of geology in the face of its culmination in Darwin’s theory.

The Veneerings, the Podsnaps, Silas Wegg, the Lammles, Bradley Headstone, Charley Hexam – all seek to inhabit and appropriate the dust mounds for economic gain, and the novel charts their struggles for survival in this Darwinian landscape. Pam Morris sees Darwinism as Dickens’s vehicle for social critique: for her, the novel is “Darwinian in its diagnosis of a degeneration of cultural vitality” (180). I agree more fully with Fulweiler, who sees the novel as a critique of Darwinistic materialism itself, linking the self-governing natural world of the *Origin of Species* with laissez-faire economics. For him, the novel is replete with “individuals seeking their own advantage and acting without either a superintending intelligence or a common end” (51).

What has not been explored by any of these writers is the alternative moral order Dickens points to within the novel which partly counters the materialism of Darwin’s vision. “You could draw me to fire, you could draw me to water,” Headstone tells Lizzie (397). This catastrophic language symbolizes his oppositional nature, which in turn forces Lizzie through exactly those catastrophes of flood and fire: “with the breaking up of her immobility came the breaking up of the waters that the old heart of the selfish boy had frozen.” Lizzie’s flood of compassion for the brother that has betrayed her connects her to her past on the banks of the river, and with this catastrophe comes “the end of our pictures in the fire!” (404).

After this experience, Lizzie absorbs the metaphor “flood and fire” into her own vocabulary: attempting to convince Bella that she has learned her lesson, she reminds her of a vision she had of her in the fire: of “A heart well worth winning, and well won. A heart that, once won, goes through fire and water for the winner, and never changes, and is never daunted” (529). Bella later thinks “how right she was when she pretended to read in the live coals that I would go through fire and water for him” (686). Lizzie’s images “in the live coals,” set against her brother’s scientific explanation of them, are fanciful and imaginative, like Dickens’s sense of geology in his review of *The Poetry of Science* almost twenty years earlier.

This is where I challenge Fulweiler's sense of the novel's Darwinian "chaotic environment" of "individuals acting without either a superintending intelligence or a common end." The repeated images of flood and fire in *Our Mutual Friend* again recall the Scriptural apocalyptic narrative and the floods and fires of the catastrophist geology that preserved the possibility of divine miracles in earth history. Flood and fire bring back a sense of millennialism to the text – a sense of the possibility of rebirth or regeneration. But, unlike in *Bleak House*, that possibility is not a set of controlling metaphors that dominate the landscape of the text and enter into the plot itself, as it did with Krook's spontaneous combustion or the almost-flooded landscapes of London and Lincolnshire. References to flood and fire are only found in the speech acts of the characters themselves in *Our Mutual Friend*: the remaking of worlds is a purely rhetorical alternative to this essentially Darwinian landscape.

This language of catastrophe acts as a purifying agent for Lizzie and Bella, allowing them both regeneration and proving their ability to remain unchanged. Both transcend, rather than adapt to, their environments. Bella, learning this lesson, preserves her essential goodness through the catastrophes that the volcanic "dust-heaps" have thrown in her way, and produces the novel's only offspring. "It was charming to see Bella contemplating this baby," we are told, "finding out her own dimples in that tiny reflection, as if she were looking in the glass without personal vanity" (755). This image of Bella and her child is emblematic of non-Darwinian reproduction: it is an essential image that stresses continuity rather than change. Transcending the glinting reproductive images of the mirror, those polished surfaces of the superficial Veneerings set, it also stresses the novel's central theme of mutuality – a dissolution of the self into an acknowledgement of what is the same in the other. Bella's baby reproduces Bella's form so that it becomes the true mirror of her essential nature: an archetypal vision of reality that transcends the mirrored, polished realities of the Veneerings set.

Bella's non-Darwinian reproduction makes her like Richard Owen's notion of the archetype – a kind of ideal form of her species, and this is supported by the multitude of direct allusions to Owen throughout the text. When Mr. Podsnap is spied "prosperously feeding," his wife is "a specimen for Professor Owen," now heading the anti-evolutionary side of the debate (16). Owen is mentioned several times in the course of the novel: the text pokes gentle fun at him for liking "a quantity of bone" (his nickname in the popular press was "Old Bones"), and again with a reference to "elderly osteologists" (Cotsell 27, 146). Fulweiler even suggests that the skeleton outside Venus's shop might be a version of Owen, and that his shop might have reminded readers of Owen's Hunterian Museum (63). As it was described in *Household Words*, the Hunterian contained "skulls from all parts of the globe . . . brains of various creatures, beautifully preserved . . . and stomachs sufficient to startle any number of aldermen," along with inaccurate but popular reconstructions of the mylodon and glyptodon (Hunt 125). Venus describes his shop's wares similarly in *Our Mutual Friend*:

Bones, various. Skulls, various. Preserved Indian baby. African ditto. Bottled preparations, various. Everything within reach of your hand, in good preservation . . . Say, human various. Cats. Articulated English baby. Dogs. Ducks. Glass eyes, various. Mummied bird. Dried cuticle, various. Oh dear me! That's the general panoramic view. (81)

"The general panoramic view" in Venus's shop is in itself out-of-date, for the panorama was clearly out of fashion in 1864–65, just as its contents hark back to the old-fashioned

Hunterian Museum, once presided over by Owen, now an “elderly osteologist” arguing against evolution. The text repeatedly alludes to Owen directly, in a period in which Dickens was reading and re-reading Owen’s works with alacrity and supporting his views on the construction of a Natural History Museum (Dickens, *Letters* 1862, 68; 1862, 117; 1863, 327; 1865, 69; 1865, 105). Owen’s notorious anti-evolutionary stance had earned him unpopularity in scientific circles but he was still one of the most famous, and illustrious, scientists in Victorian England. Dickens repeats his earlier allusion to Owen through the megalosaurus in *Bleak House* to present him as a benevolent, if now somewhat obsolete, figure of scientific authority in *Our Mutual Friend*. Using these images of Owen to suggest Bella’s essentially-good nature, Dickens is able to imagine an alternative to the materialist vision of self-evolving mutations between species that he could not accept in Darwin’s theory. Through these references to flood, fire, and Richard Owen, Dickens reaches back to a pre-Darwinian scientific world, when geology had a general appeal that made it accessible to a broad public, and symbolised his hope, as it did in his review of *The Poetry of Science*, for science-as-entertainment, emphasizing “the common brotherhood in us all.”

A precise analysis of the visual and material cultures through which Dickens engaged with nineteenth-century science reveals that his interest in its developments was far from “nugatory.” Instead, these contexts reveal Dickens’s ongoing attraction, both before and after Darwin’s *Origin of Species*, to geological ideas and images. Indeed, an appreciation of these different material contexts has also revealed a much richer spectrum of scientific imagery in Dickens’s work, including elements of catastrophic geology and Owenite biology, than that analysed by scholars whose main focus has been on purely textual evidence and has largely explored the relationship between Dickens and Darwin only.

Furthermore, geological models of history and nature contributed to Dickens’s presentation not of the natural world, as might be expected, but of the changing landscapes and exploding histories of urban London. In the multi-layered and fractional images and histories offered by the diorama, panorama, and the exhibition, geology afforded Dickens a structure and a metaphor for describing natural processes at work in the midst of industrial urban settings whose histories and landscapes were themselves made multi-layered and fractional by rapid change. Consistently representing geological science as a kind of spectacular performance of the natural world, Dickens could register geology as a form of popular entertainment, making the seeming chaos of the natural world accessible to paying urban publics. In its capacity to make nature entertaining science could sometimes, therefore, transcend the utilitarianisms and materialisms Dickens had derided in *Hard Times*. The intrinsic worth of entertainment in morally elevating the public drew him to geology’s spectacles and catastrophes in his presentations of mid-century London. It is in this sense that catastrophe always remained at least an imaginative possibility for Dickens, whether scientifically credible or not, for it was both a pleasurable spectacle with the capacity to move audiences to shock and sympathy, and a moral category laden with Old Testament and mythic imperatives through which to warn and threaten those he held responsible for laissez-faire utilitarian evils. In these senses, then, geology, with its catastrophic natural spectacles, its narratives of historical progress and disorder, and its connection to Dickens’s own travel writing, retained the moral value and pleasure of the spectacle and also offered him a device for structuring his presentation of a changing urban world.

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NOTE

1. Altick writes that the panorama, as it was at other venues and at the Surrey gardens, was a broad scene painted on the inside of a 180° or 360° cylindrical canvas (136). The moving panorama, or diorama, was “a flat picture with an illusion of depth” given to it by “changes in lighting” that “alter[ed] its whole aspect” was moved past its spectators (163). Lines, cords, pulleys, and counterweights “activated an elaborate system of screens, shutters and curtains positioned at both sources” of light (skylights and windows) (165).

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