Caverns of the Mind:Exploring the Relationship between Science, Aesthetics and Ethics in Eighteenth-Century Representations of the Underground

Frank Pearson
Department of English and Creative Writing, University of Lancaster
Bailrigg, Lancaster LA1 4YW, England
Email: d.pearson1@lancaster.ac.uk

Abstract Throughout the eighteenth century cave science and aesthetics developed in association with each other. Scientific writing was delivered in a subjective narrative, understanding the scientific details of the cave environment and the dynamic interrelations of the elements within it intensified aesthetic responses and entering the cave environment in order to explore it meant an engaged, rather than disinterested, aesthetic. The foundations of environmental ethics, nature perceived on its own terms, can be traced from James Hutton's geological theories of earth processes and deep time further removing humanity from the centre of natural processes and William Wordsworth's radical use of ordinary language in poetry to imaginatively explore the place of common humanity within nature. It is through the many scientific and imaginative responses to subterranean cave space that such traces can be identified.
Key words caves; geology; aesthetics; poetry; ethics
Author **Frank Pearson** is a PhD Researcher in the Department of English and Creative Writing at the University of Lancaster, UK. His research interest is in scientific and cultural representations of the cave environment in the eighteenth and early nineteenth centuries. He is an active cave explorer in the UK, Spain, China and Malaysia.

Introduction

This paper explores the relationship between cave and karst science and poetry engaged with the underground environment and how the two of them merge

to present a subterranean aesthetic that goes some way to defining cave space. Caves as they are a part of the natural environment that remains largely unseen, unvisited and unexplored. This paper also intends to explore to articulate an ethical understanding of the environment that incorporates appreciating nature on its own terms as well as through our experience, our understanding of cave science and our imagination.

The guiding principle behind this view of merging perceptions of the underground is that provided by geographer, Doreen Massey, through her three propositions about the definition of space as a location of change, of continuous and varied processes; firstly, as a process of interrelations between people and their ideas; secondly, as a process encompassing a variety of distinct trajectories, a range of theories, descriptions and representations; thirdly, as a process that is continually under construction, as once prevailing definitions are absorbed or superseded by others (Massey 9). By approaching the development of ideas concerning cave space by way of Massey's propositions, we can assess the variety of explorations during this period as well as the ideas already established. Massey's cultural approach through the concept of process is one that suits the physical, material essence of a cave as well. A cave is, put simply, a space or a gap in solid rock that is formed through erosion and solution that is then subject to the process of resealing through collapse, deposition of sediments and permeation, and further processes of erosion and deposition throughout geological time. A cave is always in the process of gaining and losing existence, the human visitor enters in the relatively brief period of access in the space between rocks and sediment, or between rocks and water. Even within the human experience of time the cave can change through the common occurrences of flooding or catastrophic collapse. Cave space is a wild space, a space that may be visited but always left; approachable, perhaps, but always inhospitable, potentially hostile. The culture and nature of a cave is that of process, of change. A cave is at once a product of the imagination and culture as well as an environment that exists within the bounds of natural forces.

The present writer's interest is in the period when the Enlightenment and the rise of science coincide with the Romantic imagination; when a relatively static, and occasionally catastrophic, Biblical view of the earth's geomorphology is transformed into a dynamic process, when the earth's deep time breaks free from the Biblical clock, when poets urged readers to use their imagination to look beyond the familiar, the habitual and the mundane to see the wonder of the human place within nature, when they pressed us to reject hierarchies and look again at the simple, the overlooked. These are the various trajectories. The work of the

geologist, James Hutton, and the poet, William Wordsworth are two of the essential interrelations. They ensure our perception and understanding of natural phenomena and spaces generates a scientific, aesthetic and ethical way of perceiving the cave environment on its own terms.

Changing Perceptions of the Underworld

The classical and Christian ideas of the underground being the underworld location of Hades, Tartarus, or Hell had been largely dismissed by the end of the seventeenth century, though this did not stop cave visitors and writers from making use of the descent narratives of Virgil, Ovid or Dante; as Henri Lefebvre argued, there was a difference between representational space, where the underworld was Hades, and representations of space, where Hades is a myth that enables us to perceive and understand our fear of the underground (Lefebvre 33). Milton's hell in *Paradise Lost* is an off-world cosmic geode, whereas Tobias Swinden, in his *An Enquiry into the Nature and Place of Hell* (1727), locates it in the Sun, the sun-spots being the portals into an eternity of hell-fire. Possibly the key text at this time (1691) was Thomas Burnet's *A Sacred Theory of the Earth* which had the underworld as the storage place for the waters of the Biblical Deluge, the once smooth surface of the earth, he argued, was broken up prior to the flood and the waters released. When they subsided, they left mountains and caves in their wake. The caves being the conduits for the retreating waters. Burnet's *Sacred Theory of the Earth* was one of several grand theories of the earth, such as those proposed by William Whiston (1695) and John Woodward (1696), which relied on the first book of Genesis and the catastrophe of the deluge for inspiration. Of these theories it was Burnet's that endured throughout the eighteenth century. The basic premise of all these theories was that the mountains and caves that remained after the flood were the ruins of a previous world. The earth was young at an estimated 6,000 years and was not subject to erosion. It was not created in order to be worn down; though rivers clearly carried sediment to the sea, this was to create fertile deltas for human cultivation. The earth, according to Biblical authority, would not change until the great conflagration brought about its destruction. It existed in a fixed, steady ruinous state. The geologist and early cave explorer John Whitehurst wrote in 1778: "The mountains in Derbyshire appear to be so many heaps of ruins, the strata lie in the utmost confusion and disorder. They are broken, dislocated and thrown into every possible direction, and their interior parts are no less rude and romantic, for they universally abound with subterraneous caverns; and, in short, with every possible mark of violence" (Whitehurst 51).

Most of the descent narratives of the eighteenth century refer at some point to Burnet: Charles Leigh, Daniel Defoe, George Berkeley, Alexander Catcott, John Hutton and even Samuel Taylor Coleridge who praises his poetic prose style in his Biographia Literaria. However, in 1830, geologist Charles Lyell had this to say about Burnet and the other catastophists: "Never did a theoretical fallacy, in any branch of science, interfere more seriously with the accurate observation and systemic classification of facts" (Lyell, 29). Burnet's grand theory approach to natural science distorted all the subsequent research and fieldwork, as geologists and geographers tried to account for all their empirical observations by way of the Biblical flood. As far as cave and karst science in particular was concerned, no real development of our knowledge of cave or speleothem formation could take place without an understanding of limestone solution, and this did not occur until later in the nineteenth century (Shaw iv). However, cave passages had clearly formed in all shapes and sizes — and were still forming all over the world. Cave science, and geology generally, had been overlooked in the initial development of science as it was difficult to apply the newly engineered telescopes and microscopes to such study. The study of caves was not easily transferred to the laboratory, neither was it initially a study that leant itself to classification, it was a science that had to develop in the field, in an often challenging and hostile one. John Playfair, the colleague of James Hutton, wrote of geology: "no research is more arduous than this; none certainly where the subject is so complex; where appearances are so extremely diversified, or so widely scattered, and where the causes that have operated are so remote from the spheres of ordinary observation" (Playfair 2). Geology and cave science needed fieldworkers and it was during the eighteenth century that travel, accommodation and time became sufficiently good enough to produce them. Many of the early travellers and explorers wrote up their adventures in journals, diaries or letters to the Royal Society, published in its *Philosophical Transactions*. The Royal Society having devoted many of its early editions of *Philosophical Transactions* to encouraging and instructing travellers how to record accurate measurements and observations on their journeys and, importantly, to share them through publication.

Scientific Configurations and Representations

Descent narratives start to appear regularly in the scientific press towards the end of the seventeenth century. John Beaumont's lonely descent into Lambs Lear Hole in the Mendip Hills in 1680 is a good early example, he descends where the miners refuse to follow though his description is almost entirely made up of estimated measurements. He records nothing of what the cave was like, or what

he experienced down there. This configuration of the dark, ill-illuminated space is also apparent in Robert Southwell's 1680 account of Captain Sturmy's descent of Pen Park Hole in Gloucestershire in 1669. Sturmy measures his way down the shaft in fathoms, he measures the passages below and the breadth and depth of the subterranean river running through the lower passages. It is here that he undertakes an experiment; it has been said that the cave is connected to the nearby River Severn and that the subterranean river, with high water marks of mud and debris on the cave walls, ebbs and flows along with the tidal rhythms of it. Sturmy descends the hole and waits to observe the ebb and flow in accordance with the tide tables of the Severn estuary: the tide comes and goes with no effect on the subterranean river. This may appear a minor observation though it is a first step in understanding the hydrology of limestone caves. The old underworld interferes with Sturmy's exploration: the miner who accompanies him exits a high passage claiming he has seen an evil spirit there, Sturmy dismisses this as superstitious though leaves with the disturbed miner. Four days later, Sturmy suffers a head-ache, then fever and finally death. Agricola, in the sixteenth century, said demons in caves and mines should be propitiated with fasting and prayer, by the end of the seventeenth century it was with the power of mathematics (Agricola 217). Captain Collins and his team descend the hole in 1682 to further explore the cave and this time they measure every passage they can access in yards; there is no demon down there, and to seal its fate, to disenchant the cave, they produce what is thought to be the first survey of a natural cave in Britain (Southwell 3).

The accumulation of measurements and observations began to change the way the earth was understood. Patterns and associations in beds of rock were recognised, the rock record was established, cave explorers observed incontrovertible signs of erosion, transport and deposition of sediments. John Whitehurst devoted much of his time to exploring the mines and caves of Derbyshire and measuring the proportions and angles of the strata he found there and drew up cross-sections of them. Alexander Catcott observed that streams in relatively small cave passages flowed into much larger chambers that they could not possibly have formed – recognising that other passages must be responsible but are now concealed by debris. He observed that many limestone caves were filled with large sandstone cobbles that must have been eroded from over lying beds and transported into the caves. John Hutton began to understand limestone hydrology by speaking to farmers in Yorkshire and learned where and how subterranean streams sank and rose in Horton and Bransgill Becks, and in Chapel-le-dale. Experimental natural philosopher, Adam Walker wrote how pouring acid onto limestone caused

a chemical reaction, "the effervescence was excessive strong," and he made an early suggestion as to the formation of speleothems, arguing that the rain soaked through the overlying earth and oozed through cracks in the limestone "imbibing or dissolving fine particles in their descent" leaving the "stony particle" in place as the water enters the cave.

The initial explorers satisfied their curiosity of the underground by limiting their experience and study to the already established "show caves," for example, Wookey Hole in Somerset, the three caves that were a part of the tour of Derbyshire, "The Wonders of the Peak:" Peak Cavern, Poole's Cavern and Eldon Hole, Yordas Cave and Weathercote Cave in Yorkshire and, in Scotland, Fingal's Cave on the Isle of Staffa. As these became commonplace, other caves were found by miners and farmers who recognised the growing interest in visiting them. Experiences started to go beyond the safety and easily accessible boundaries of the show caves, and writing began to reflect this.

Aesthetic Perceptions

These early accounts record little of the nature of the cave space other than its estimated, non-standardised measurements. The measuring and configuring of caves provided a limited understanding of them, such measurements could easily have been applied to another of the "Wonders of the Peak," Chatsworth House, for example. How could these early explorers really convey the irregularity of cave space with a few measurements? How could they estimate measurement in the darkness, in deep water, in what stretched away into the unknown? During the early years of the eighteenth century this was beginning to change, cave explorers started to describe what they saw and felt, as many of them were writing for both fellow scientists and, increasingly, the tourist and traveller. The accounts they recorded are situation dependent, the correspondent is fully involved with the experience; though observations and detailed measurements are included they are done so as part of subjective narratives. The experience presents a verbal narrative based on the actions of the correspondent rather than a nominal one based on the information. The more objective, nominal non-narrative account of cave exploration and science would start to appear a century later. For now the style and structure of fiction and non-fiction overlapped. The challenging and often alien nature of the subterranean environment would continue to be perceived as unique by eighteenth century scientists and travellers, who would struggle to detach their experience from the observations and measurements they were making. The lines of cave dimensions, the gradients and contours, vanished by candlelight as they attempted to orientate

themselves.

A renewal of interest in theories of the sublime during the eighteenth century, expressed by Shaftesbury, Addison and Burke, among others, started to merge with the scientific configuration of cave space to provide a more engaging representation.

Edmund Burke developed the notion of the sublime aesthetic (1757), which started to find its way into the writings of the cave explorers. Superficially, it provided a suitable discourse to account for the experience of the underground environment. Burke argued that "the passion caused by the great and sublime in nature … is astonishment. (…) In this case the mind is so entirely filled with its object, that it cannot entertain any other, nor by consequence reason on that object which employs it" (Burke 101). Burke makes a distinction between reason and the imagination and in these moments of sublimity, both fail. For Burke, aspects of the sublime include terror, obscurity, privation (vacuity, solitude, silence, darkness), vastness, infinity, sound and loudness, all of which could be found in the cave environment. However, the drawback for cave exploration from Burke's theory is that he states such an aesthetic appreciation can only come from a position of disinterestedness or detachment. This is understandable when looking at a painting, reading a book or gazing at a mountain or waterfall from a safe distance but much harder for a cave explorer who, in order to see the sublime underground, must actually be in it; to have any grasp of such challenging three-dimensional space, the observer has to be in it, to pass through it, to feel it.

It would appear from a number of writers who recorded their explorations underground that they had read Burke and he gave them the vocabulary and discourse they needed to express their experience. Richard Sulivan wrote of his visit to Wookey Hole in 1780; "Here indeed we might say, that we experienced the whole effect of the sublime and the beautiful." In Peak Cavern he writes that it had "the appearance of another world, as to form a perspective which the imagination quickly paints to have no end." John Hutton in the introduction to his *A Tour of the Caves* in 1778, wrote: "Some may be as much entertained with the profound, as others with the lofty; and some may be as much amused with the sublime, as others with the beautiful." The experimental scientist, Adam Walker, describes his descent into Weathercote Cave: "To a mind capable of being impressed with the grand and sublime of nature, this is a scene that inspires pleasure chastised by astonishment!" While descending into the cave, the 70 yard high waterfall falls close by in a confined space and "confounds and astonishes the most intrepid ear." How detached is Walker at this point? A sense of danger can add to the sublimity of the

perception, as Walker states: "Personal safety also insinuates itself into the various feelings, where both the eye and the ear are so tremendously assailed." Sulivan in Speedwell Caverns relates how his curiosity "had warped his rational faculties" and that "danger had become familiar to us." George Catcott's account of his descent of Penpark Hole in 1779 describes the awesome views down into "yawning caverns," "dreadful precipices" and "deep water" that are heightened and intensified by a "few faint glimmering rays of light" than if they were obscured by total darkness. Fragments of vision, objects partly obscured, are perceived to have a greater degree of sublimity.

The subterranean space demanded more than a spectator, it demanded a participator and we can see from these early accounts that the travellers did become so. John Lloyd was among the first people to descend Eldon Hole in Derbyshire, lowered down the huge shaft by eight local men: "For the first twenty yards I was let down, I could assist myself with my hands and feet … thence down, the breadth was about three yards, and the length at least five or six, through craggy irregular slits in the rock, which was rather dirty, and covered with a kind of moss, and pretty wet." When he is hauled back up the shaft he cannot easily communicate with the men above who pull him up as quickly as they can: "The rope was drawn into clefts betwixt the fragments of the rock, which made it stick; and my body jarred against the sides, and the rope loosened the stones above my head, whose fall I every instant dreaded." Adam Walker describes his descent into Weathercote Cave in Chapel-le-dale, Yorkshire, beyond the point of the usual show cave spectator: "On one side you may descend, by crawling from one broken stratum of rock to another … and creep many yards horizontally … and descend from ledge to ledge in a retrograde motion, through arches of prodigious rocks." Richard Sulivan in his trip down into Speedwell Cavern with local miners also fully engages with the environment: "we forced our way with infinite struggles, through narrow space, between two rocks, and thence getting on our hands and knees, were, for the full distance of a mile, obliged to crawl without ever daring to lift up our heads, the passage being too low. Filled with mud, dirt and a multitude of bits of rocks, our progress was painful indeed." Later they reach the underground river in the system and "plunged into the river above our waists, we cautiously picked our steps." Sulivan catches his knee on a rock and exits the cave with great difficulty: "It now became scarce bearable; out however I was to crawl, and that too upon this tortured limb. The retreat accordingly began; but no anguish could surpass the excess of torment I was in." These descriptions are interwoven with the measurements they record and the observations they make, both scientific and aesthetic. What

they describe is how they felt as their body passed through the subterranean environment.

These descriptions of the cave sublime and actual process of passage within them, take us into what the philosopher, Arnold Berleant, calls the aesthetics of engagement. His reading of Burke's and Kant's notion of the disinterested sublime, which releases the spectator from any distraction from their sense or reason and therefore allows them to appreciate the object or representation, creates a problem with appreciating the natural environment. As the writers above show, they are hardly disinterested in the space they describe as sublime. Berleant writes: "The boundlessness of the natural world does not just surround us; it assimilates us" (Berleant 82). The cave explorers experience the damp, cold and physical contact and pain, when they touch the rock, it touches them. Possibly more than any environment in nature the cave space demands engagement. Berleant argues that such engagement encourages a degree of unity with nature: "the perceived sense of continuity of our human being with the dynamic forms and processes of the natural world is a central factor in the aesthetic appreciation of nature, and it accounts for a touch of the sublime in the feeling of awe that accompanies the occasion" (Ibid 86). This is, perhaps, an attitude that would elude the casual traveller who remained at a distance from the sublime in nature.

These early cave travellers were confronting the unknown and increasingly willing to go way beyond the familiar and safe boundaries, John Hutton wrote about Ingleborough in 1778: "Indeed the whole limestone base of this monster of nature is perforated and excavated in all directions like a honeycomb." Hutton's thinking is now driven as much by what he cannot see, as by what he can. It is not just cave science but imagination too, that is urging them on. To Hutton and his contemporaries, caves were no longer the ruinous legacy of God's wrath, they were now the glorious labyrinths of awe and mystery and a space for empirical understanding.

This empirical, scientific understanding is a knowledge that, according to Allen Carlson, can work to intensify the aesthetic experience of the sublime. Carlson writes that all objects of aesthetic appreciation require some degree of knowledge for the spectator to fully appreciate them. Art, literature and music has form and exist within boundaries and it is knowledge of form within these boundaries that enables the spectator to appreciate and judge the work. As we have seen with all environments, though particularly the cave environment, they have indeterminate form and have no boundaries, however, we can have knowledge of an environment, of its various parts and their dynamic interrelations, and this

scientific knowledge provides us with the necessary focus. Carlson argues that, "knowledge and intelligence transform raw experience by making it determinate, harmonious and meaningful" (Carlson 71). Carlson, along with Berleant, add aspects of aesthetic appreciation to the way in which early cave explorers experienced their environment. Though eighteenth century writers on aesthetics, especially on the sublime, did not articulate such approaches, it is evident that the explorers experienced them and recorded them.

Changing Perceptions in Science

Though Burnet's interpretation of the Genesis story appeared to be the prevailing earth narrative, it was not the only one. The philosopher David Hume rejected the catastrophists" theory and presented a gradual approach to change in accounting for the form of the earth. In his *Dialogues Concerning Natural Religion,* first written in 1751, though published after his death in 1779, he wrote that evidence can be traced across the globe that much of the surface has been beneath the sea for ages and has undergone great transformations: "matter is susceptible of many and great revolutions, through the endless periods of eternal duration" (Hulme 50). Within the constant changes existed an order that maintained the endless cycle of denudation and renovation. Hume's theory of the "eternal duration" of the earth was one proposed by Aristotle and Heraclitus, though rejected by the Christian church. It was a position also strongly argued by George Toulmin in *The Antiquity and Duration of the World* (1780) and strongly rejected by the Rev. Ralph Sneyd who argued that radicals like Toulmin should be locked up in "an hospital, under the regulation of men of distinguished piety and learning, where by proper discipline, a lowering diet, and a well-directed course of study, rigorously inforced on all notorious delinquents for a certain time, much mischief might be prevented" (Sneyd 5).

Both the Biblical 4004 BC age of the earth and the "eternal duration" theory were questioned by natural philosophers whose observations suggested limited time but of greater length than the Bible readings. Edmund Halley's 1713 research into the sea's salinity suggested a time much greater than 6,000 years, though he could not specify how much. In 1770, Canonico Recupero's research into the layers of lava from Mount Etna discovered in a well dug at the foot of the volcano, suggested at least 14,000 years. Recupero is embarrassed by his discovery as he tells the British traveller Patrick Brydone: "Moses hangs like a dead weight upon him, and blunts all his zeal for inquiry; for that really he has not the conscience to make his mountain so young, as that prophet makes the world" (Brydone 70).

Around the time John Hutton was writing about his experiences and proposing theories of cave formation, his namesake, James Hutton, was presenting his ideas outlined in his *Theory of the Earth*. Published shortly after the French Revolution in 1795 but researched for decades, it suggested that mountains, caves and the wider landscape as we see them now were formed by erosion, transportation and deposition of sediment and recycled as heat from within the earth generated mountain building over a vastly longer period of time than 6,000 years. He argued that the "the operations of nature are equable and steady" (Hutton, 1788, 10). What we see gradually occurring in caves and the wider landscape in the present is the key to understanding the processes that took place in the past. To observe the erosion of underground streams and the deposition of sediment, to observe the uplift of the earth during earthquakes, is to observe processes that have occurred for what Hutton called an "indefinite" period of time. Unlike the natural philosophers who believed in the eternal duration of the earth, such as Toulmin, Hutton did not give a time for these processes, famously writing that: "The result, therefore, of our present enquiry is, that we find no vestige of a beginning, no prospect of an end" (Ibid 80). He argued that if you do not know the cause of a phenomena, mark it as unknown until you do.

Hutton's colleague, John Playfair, rejected Burnet's theory and all of those that attempted to explain the origin of the earth and championed Hutton's approach: "if it is settled, that a theory of the earth ought to have no other aim but to discover the laws that regulate the changes on the surface, or in the interior of the globe, the subject is brought within the sphere either of observation or analogy" (Playfair 511). This notion of observing the complex, dynamic interrelations and processes of the natural world we exist in and using this to interpret the rock record of the past, what has since been called "uniformitarianism," is a revolutionary idea, and radically transforms the way we see the earth and our place in natural processes; they show us how we exist in cyclical processes not in a linear progression. Nothing in nature can be too small or insignificant anymore, it is here, perhaps, we can begin to see the first glimpses of ecological unity.

Releasing the constraints of time is equally transformative, it takes our understanding away from the anthropocentric boundaries of scripture into deep geological time. We begin to see the earth and its dynamic processes more on its own terms, rather than ours. This is intensified, as has been shown by the early pioneers of cave science, through an aesthetic engagement with the environment while attempting to understand the processes that form it. Geologist and philosopher, Robert Frodeman, has written of this: "geologic seeing is poetic

vision constrained by the sobriety of science, a series of daring imaginative leaps disciplined by examination and measurement. Geology is a type of walking meditation" (Frodeman 115). He adds further about the effect of geologic time: "walking the earth and thinking in terms of deep time profoundly affects the way one experiences the world" (Ibid 123).

Changing Perceptions in Poetry

While these revolutionary concepts were being fought over there appeared, in 1798, Wordsworth and Coleridge's collection, *Lyrical Ballads*, which, along with the *Preface*, was equally revolutionary and, alongside Hutton's theories of deep time and earth processes, further change the way we see the earth. In the *Preface* Wordsworth argued for poetic content to be drawn from simple common life and for the poetic diction to be closer to the language of common speech. His poems addressed people, places and objects that were overlooked, unseen, and imbued them with significance, such as a thorn bush, yew tree or piles of stones. Wordsworth urged his readers to "see into the life of things" (*Tintern Abbey* l. 49). Shelley also encouraged such a way of seeing in his *Defence of Poetry* (1821), where he argues that poetry should "create a new universe, after it has been annihilated in our minds by the recurrence of impressions blunted by reiteration" (Shelley, 2012 52). The poets directed our gaze back to the familiar, the mundane and the habitual in order to see them afresh, as something startling, unfamiliar.

Wordsworth would have read John Hutton's *Tour to the Caves* as it was added to the appendix of Thomas West's second edition of *A Guide to the Lakes* (1780), a book he was familiar with. Mountain as well as cave measurements were on his mind in his poem, *Written with a Slate pencil on a Stone, on the side of the Mountain of Black Comb* (1813), Wordsworth presents the "geographic Labourer" surveying with his books, map and instruments who, when darkness falls, is left "blinded" with "unclosed eyes" unable to imagine the mountain he is sat upon. When distracted with measurements, perhaps, we eventually lose sight of what we are actually measuring. He is illuminating on this point when he describes his visit to Yordas Cave, described by Hutton, in Book VIII of *The Prelude* (1805): "He looks and sees the Cavern spread and grow, / Widening itself on all sides, sees, or thinks / He sees, erelong, the roof above his head, / Which instantly unsettles and recedes / Substance and shadow, light and darkness, all / Commingled, making up a canopy / Of shapes and forms and tendencies to shape, / That shift and vanish, change and interchange / Like spectres, ferment quiet and sublime" (l. 715 – 23). Wordsworth presents the struggle with what can be seen and measured in a cave.

What do you measure as your candle flickers in the darkness? For Wordsworth this experience in Yordas Cave is the spark for his imagination, this play of light and shadow in the wildly irregular shape and form of a cave liberates him in to seeing it afresh. The measurements and cave surveys produced by the cave explorers were guides to those who followed but they were not the territory. Poets fired the imagination to look beyond the measured, the very thing travellers like Hutton, Walker and Sulivan were doing. In his poem, *Kubla Khan* (1797), Coleridge presented us with the now famous description of "caverns measureless to man; in *Prometheus Unbound* (1820), Shelley refers to the "bottomless void," "unfathomed wells," and "the deep air's unmeasured wilderness." This is imagination is shared with Hutton when he ponders the labyrinthine "honey-comb" beneath the slopes of Ingleborough in Yorkshire. Here the visible and the invisible coexist, the cave explorer constantly moves into the invisible, engaged with its dimensions. Hutton describes a moment in Catknot Cave when he stands on the brink and holds back: "Perhaps if we had mustered humility and fortitude enough, to have crouched and crawled a little, we might have come to where the roof again would have been as high as we should have desired" (Hutton, 1970 40). What lies beyond in the dark unknown is always tantalisingly close.

Wordsworth presents us with another "trajectory" of cave space as process, for him it is the source of the imagination, in Book XIII of *The Prelude* he writes: "We have traced the stream / From darkness, and the very place of birth / In its blind cavern, whence is faintly heard / The sound of waters; followed it to light / And open day, accompanied its course / Among the ways of nature, afterwards / Lost sight of it bewildered and engulphed, / Then given it greeting, as it rose once more / With strength, reflecting in its solemn breast / The works of man and face of human life" (l. 172–81). The stream leaves the "blind cavern" only to vanish into caverns downstream and then reappear, repeatedly. In his sonnet on Weathercote Cave (*Suggested by Mr Westall's Views of the Caves*, 1819), also in Hutton's guide, Wordsworth writes of the profusion of life at the spring, or resurgence, of the subterranean river: "Pure element of waters! Whereso'er / Thou dost forsake thy subterranean haunts, / Green herbs, bright flowers and berry-bearing plants, / Rise into life and in thy train appear." It is a process shared also by Coleridge in *Kubla Khan*, where "Alph, the sacred river, ran / Through caverns measureless to man / Down to a sunless sea." As it flowed through the "measureless caverns" it briefly reappeared as a spring before it "sank in tumult to a lifeless ocean." Shelley too has the River Arve, in his poem *Mont Blanc* (1817), burst out from beneath the glacier and flow back through caves, on its way down the Chamonix valley; "Where

Power in likeness of the Arve comes down / From the ice gulphs that gird his secret throne, / Bursting through these dark mountains like a flame / Of lightning thro" the tempest" (l.16–19). Though this appears as anthropomorphism, or an associationist aesthetic, such imaginative moments are bound to re-visioning real subterranean environments and though the initial value of the cave is evoked through its association with the human imagination, it does begin to free the underground from hundreds of years of cultural oblivion. Re-imagining the underground and making it once more a human environment rather than the realm of gods, site of death and darkened torments, and, at the same time, a wild, fascinating and ultimately unknowable environment that one yearns to explore is the key achievement here.

Ethical Perceptions

The aesthetic of the sublime and the beautiful that was developed through the eighteenth century had another element as well that appeared to fall between them, the picturesque: a scene with beauty, ruggedness and irregularity. Thomas West's *Guide to the Lakes* was instrumental in furthering the fashion for the picturesque view of the landscape with his itemising of the preferred "stations" in the Lake District from which to look upon the view through a Claude Glass. Though the traveller is being encouraged to look at the natural environment it is in a fragmented manner; not as an integrated whole but as a careful selected fraction. In a sense, it was like the classification processes of science which looked to identify ever more isolated segments of nature, a process Wordsworth had commented on in *The Tables Turned*: "We murder to dissect," when in fact we should engage with the world around us with a heart that "watches and receives" (Saito 142). In both cases there was, what Yuriko Saito argues, a failure to see nature on its own terms. It is this attempt to see nature on its own terms that leads us to an ethical perspective of the natural environment.

James Hutton's observation of the interrelated nature of natural processes in earth sciences and a recognition of deep geological time had further removed human beings from the centre of creation and made us participants in those processes. As the early cavers had shown, an understanding of science had not removed the sensuous experience of nature, if anything it had intensified the engagement. As Hutton encouraged us to see how natural processes interact, so too did Wordsworth; in *Home at Grasmere* he refers to the place he lives in as: "A Whole without dependence or defect, / Made for itself, and happy in itself, / Perfect Contentment, Unity entire" (168–170). Both writers encourage readers to recognise their existence within place, within nature.

The aesthetic convention of the view from the summit of a mountain was commonplace in the pastoral poetry of the eighteenth century, and even extended to cave systems. James Thomson, in his 1744 poem, *The Seasons*, had imagined the surface of the earth being peeled away to show the caverns beneath: "Oh! Lay the mountain bare, and wide display / Their hidden structure to the astonished view" (l.779–780). This was fine to imagine but the situation in reality always required you to enter, to engage with the environment in order to understand the processes of nature. Thomas Dixon's poem, *A Description of the Environs of Ingleborough* (1781), has the male protagonist climb to the summit of the mountain and describe all he sees. It is a sublime view that extols the virtues of the area in which he lives and it includes the valley of Kingsdale, partially concealed by the ridge of the mountain Whernside. Dixon describes the caves of Yordas (see above), Gingling Cove (Jingling Pot) and Routing Chasm (Rowten Pot) as seen from the summit. Though the slopes of the mountain they are in, Gragareth, can be seen from Ingleborough, the caves cannot; it must be assumed Dixon visited them on another occasion and marked their location in his memory. In Dixon's poem there is no laying bare the subterranean caverns, they remain out of sight: water pours in or out of them, falling rocks echo, their depths are unknown. None, he claims, dare venture in. The caves are in the view but at the same time remain elusive, unless the spectator choses to become a participator and engage with the subterranean environment.

It is this engagement with the formlessness and disorder in the subterranean space, the freedom of imagination and the discipline of science, the sensuous experience and the rational detachment, that enable us to find value in nature, not instrumental or utilitarian, not as a resource, such as a mine, but through its aesthetic qualities. If we can adapt Aldo Leopold's epithet, "Think like a mountain," to "think like being within a mountain," and, perhaps, Wordsworth's placing of his imagination deep in the "blind cavern" is a step towards it, then we are generating an environmental ethic that perceives the natural environment on its own terms (Leoplold 129).

Conclusion

Using the framework of Massey's three propositions to help define cave space, it is possible to recognise a number of ideas and processes that, though distinct, are related. The growth of the earth sciences through its fundamental requirement for fieldwork and people able to carry it out, alongside the growth in travel and tourism and greater access to remote mountain areas, is clearly related to the development

of aesthetics, and in particular the sublime. The work of Burnet, as well as Whiston and Woodward, inspired people to visit mountains and caves and to observe natural phenomena, and record what they saw. The great breakthroughs in geological understanding by James Hutton were aided by the fieldworkers writing up their observations and measurements in journals such as the *Philosophical Transactions*. The work of Addison and Burke, in articulating an aesthetic that addressed the wild and remote landscapes of mountains and caves, established a discourse that was engaged with and expanded upon by the early cave explorers and poets alike. These ideas generated through the eighteenth century on aesthetics and earth sciences, in regard to the underground, and conveyed to us through descent narratives and poetry, have laid the foundations for a contemporary environmental ethic.

There is no conclusion, as Massey argues, the space is constantly undergoing construction. The natural philosophers and poets of the period did not create the ecology movement, Darwin's contribution was still to come. However, during this period something very exciting began to occur, Judeo-Christian humanity took another step back from their perceived central position in the natural world and in so doing began to see the natural world on its own terms. The spatial and temporal context of our lives took on a fresh meaning. I would argue that one of the essential elements to this change in consciousness and discourse came through our engagement with an overlooked, though crucial, region of the earth: the underground. If, therefore, there is no conclusion, no clear certainty, only the "simultaneity of stories so far" (Massey 9), let us end where we began with Thomas Burnet's *A Sacred Theory of the Earth:* "The subterraneous cavities that we have spoken of hitherto, are such as are visible in the surface of the earth, and break the skin by some gaping orifice; but the miners meet with many more in the bowels of the earth that never reach the top of it: burrows, and channels, and clefts, and caverns, that never had the comfort of one beam of light since the great fall of the earth … We do not know when and where we stand on good ground" (Burnet 96).

Works Cited

Agricola, Georg. *De Re Metallica.* Trans. H. C. Hoover. London: Mining Magazine, 1912.

Beaumont, John. "A Letter Giving an Account of Ookey-hole, and Several Other Subterranean Grottoes and Caverns in Mendip-hills in Somersetshire" *Philosophical Collections* (2) 1681. Royal Society Publishing org, pp1-8, Web 15th April 2015.

Berleant, Arnold. "The Aesthetics of Art and Nature" in Allen Carlson and Arnold Berleant (eds). *The Aesthetics of the Natural Environment.* New York: Broadview Press, 2004. 76-88.

Brydone, Patrick. *A Tour through Sicily and Malta.* London: 1792. Gale ECCO Print Edition.

Burke, Edmund. *A Philosophical Enquiry into the Sublime and the Beautiful.* London: Penguin, 1998.

Burnet, Thomas. *The Sacred Theory of the Earth.* 2nd ed. London: Centaur, 1965.

Carlson, Allen. "Appreciation and the Natural Environment." *The Aesthetics of the Natural Environment.* eds. Allen Carlson and Arnold Berleant. New York: Broadview Press, 2004. PP.63-75.

Catcott, Alexander. *A Treatise of the Deluge.* London: 1761. Gale ECCO Print Edition.

Catcott, George. *A Descriptive Account of a Descent made into Penpark Hole.* Bristol: 1792. Gale ECCO Print Edition.

Coleridge, Samuel Taylor. *Poetry and Prose.* Eds. Nicholas Halmi, Paul Magnuson and Raimonda Modiano. New York: Norton, 2004.

Dixon, Thomas. *A Description of the Environs of Ingleborough.* Bentham: Mewith Publications, 1994.

Frodeman, Robert. *Geo-Logic: Breaking Ground between Philosophy and the Earth Sciences.* New York: State U of New York P, 2003.

Hume, David. *Dialogues Concerning Natural Religion.* Cambridge: Cambridge UP, 2007.

Hutton, James. *Theory of the Earth: Investigation into Laws Observable in the Composition, Dissolution, and Restoration of Land upon the Globe.* Edinburgh: 1788. Forgotten Books Edition.

Hutton, John. *A Tour to the Caves, in the Environs of Ingleborough and Settle, in the West Riding of Yorkshire.* Wakefield: SR Publishers, 1970.

Lefebvre, Henri. *The Production of Space.* London: Blackwell, 1991.

Leopold, Aldo. *A Sand County Almanac.* Oxford: Oxford UP, 1949.

Lyell, Charles. *Principles of Geology.* Vol. 1. London: John Murray, 1830.

Lloyd, John. "An Account of Elden Hole in Derbyshire." *Philosophical Transactions* (61) 1771:250-268. Royal Society Publishing org. Web 14th April 2015.

Massey, Doreen. *For Space.* London: Sage, 2005.

Playfair, John. *Illustrations of the Huttonian Theory of the Earth.* Edinburgh: 1802. British Library Historical Edition.

Saito, Yuriko. "Appreciating Nature on its own Terms." *The Aesthetics of the Natural Environment.* eds. Allen Carlson and Arnold Berleant. New York: Broadview Press, 2004.141-155.

Shaw, Trevor. *History of Cave Science: The exploration and Study of Limestone Caves to 1900.* Sydney: Sydney Speleological Society, 1992.

Shelley, Percy Bysshe. *A Defence of Poetry and Other Essays.* Ed. J. M. Beach. Austin: West by Southwest Press, 2012.

—. *Poetry and Prose.* Eds. Donald Reiman and Neil Fraistat. New York: Norton, 2002.

Sneyd, Ralph. *A Letter to Dr. Toulmin, MD.* London: 1783. Gale ECCO Print Edition.

Southwell, Robert. "A Description of Pen-Park-Hole in Gloucestershire" *Philosophical Transactions* (13) 1683. Royal Society Publishing org, pp.2-7, Web 14th April 2015.

Sulivan, Richard. *Observations Made during a Tour through Parts of England, Scotland, and Wales in a Series of Letters.* London: 1780. Gale ECCO Print Edition.

Swinden, Tobias. *An Enquiry into the Nature and Place of Hell,* London: 1727. Gale ECCO Print Edition.

Thomson, James. *The Complete Poetical Works.* Ed. J. Logie Robertson. Oxford: Oxford UP, 1908.

Toulmin, Georg. *The Antiquity and Duration of the World.* London: 1780. Gale ECCE Print Edition.

Walker, Adam. "A Description of Some Natural Curiosities in the Western Edge of Yorkshire." *A Guide to the Lakes.*Ed. Thomas West. London: 1784. 227-234.

Whiston, William. *A New Theory of the Earth.* New York: Arno Press, 1978.

Whitehurst, John. *An Inquiry into the Original State and Formation of the Earth.* London: 1778. Gale ECCO Print Edition.

Woodward, John. *An Essay towards a Natural History of the Earth*. London: 1723. Gale ECCO Print Edition.

Wordsworth, William. *The Poetical Works.* Ed. Thomas Hutchinson. Oxford: Oxford UP, 1923.

—. *The Major Works.* Ed. Stephen Gill. Oxford: Oxford UP, 2000.

责任编辑：李敏锐