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〈論文〉

The Development of Natural History-(1)

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Percy Bysshe Shelley was born during a period of rising interest in what was at the time termed 'natural history'. As Christopher Goulding has reminded us, a friend of Shelley's at Syon House Academy wrote that, as a boy, Shelley was interested in " something romantic or extraordinary, such as spirits, fairies, fighting, volcanoes," [1] He seems to have been fascinated by "some wild experiment" and "chemistry[2]."

Shelley reveals his love of nature in a letter to his friend Thomas Love Peacock, April 30, 1818, where he says that his "chief pleasure in life is the contemplation of nature[3]." And, as Goulding reports, he writes on July 16, 1818, and again, on July 25, 1818, that "I take great delight in watching the changes of the atmosphere[4]." One of Shelley's teachers at Syon House Academy was a Dr.Adam Walker, a friend of Dr. James Lind and Tiberius Cavallo[5]. In 1786, Cavallo writes to Lind that he has recently met Walker in Oxford, and, after Shelley left Syon House, Lind would teach the young scholar at Eton College. Goulding concludes that "Walker's lectures in particular would have awakened an interest in natural philosophy that Shelley would have the opportunity to pursue on a much more personal basis once he moved to Eton, through his relationships with Lind."[6] Another friend of Lind's, and a fellow graduate of Edinburgh University, was James Hutton, a geologist, the father of Huttonianism, while Lind also numbered among his friends Joseph Banks, the great botanist and future president of the Royal Society of London, and Erasmus Darwin, a naturalist, who founded the Lunar Society of

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[1] Christopher Goulding, "The Influence of James Lind on the Scientific and Philosophical Thought of Percy Bysshe Shelley." Doctoral Dissertation (U of New-Castle upon Tyne, 2002) 43. Print.

[2] Goulding, 43.

[3] Roger Ingpen and Walter E. Peck, ed, *The Complete Works of Percy Bysshe Shelley* (New York: Gordian P, 1965) 10 vols, IX, 308. Print.

[4] Ingpen, 312, 313-4.

[5] Goulding, 43-44.

[6] Goulding, 43-44, n5.

Birmingham, and whose members included such luminaries as James Watt, Joseph Priestley, and Josiah Wedgwood. All of them inspired the young Shelley to absorb the natural history which was at that time becoming of so much interest to men of an adventurous and scientific cast of mind.

In this chapter, we will focus on the development of natural history, so fascinating to Shelley in his childhood, tracing it from its origins at the beginning of the millennium to the development of the Grand Tour, and on to the birth of geology, sired by the Father of Volcanology, Sir William Hamilton, and his work, *Campi Phlegraei.*

As Schoffield[7] and King-Hele[8] have pointed out, the Lunar Society of Birmingham played a leading role in the development of natural history, science, and technology in 18th century Britain. Its members contributed greatly to the discoveries and inventions in science and technology. They were all friends of James Lind, Shelley's mentor at Eton, and Lind introduced Shelley to the works of these friends, all of them members or the Fellows of the Royal Society.

(1) The Beginnings of Natural History in Europe

The first European naturalists were the Greeks: Aristotle (384-322B.C.), who produced a work that he named Zoology; Strabo (ca.63 B.C.- ca. A.D. 21) who published a *Geography*; and Pliny the Elder (A. D. 23-79), who compiled a *Natural History.* In his poetic epic *The Botanic Garden*, Erasmus Darwin, a writer who, we shall learn in due time, is likely to have influenced Shelley, cited a passage from a minor Roman poet, Claudius Claudianus (ca. 395-404) in the dedication to the part of his epic that he entitled 'The Loves of the Plants':

> Vivunt in Venerem frondes; nemus omne per altum
> Felix arbor amat; nutant ad mutua palmae
> Faedera, populeo suspirat populus ictu,

[7] R. E. Schoffield, *The Lunar Society of Birmingham* (Oxford: OUP, 1963) . Print.

[8] D. King-Hele, 'The Lunar Society' (Birmingham: The Library of the U of Birmingham, 1966). Print. And 'Shelley and Dr. Lind,' *Keats-Shelley Memorial Bulletin,* XVIII (Rome: Keats-Shelley Memorial Association,1967)1-6. Print.

Et platani platanis, alnoque assibilate alnus.

Claudianus, *Epithalamion*[9]

Mankind has always recognized the medicinal value of certain plants, and, during the Middle Ages, every Benedictine Monastery grew herbs to study their medicinal properties, while the first medical school, *per se*, was established in Salerno, in southern Italy. At the same time, scholars recognized that scientific research needed freedom from interference, either from the Church or the State, and when, in 1168, Frederick 1 Barbarossa granted a charter to Western Europe's first university, Bologna, Italy (which had actually opened its doors in 1088), the charter, *Constitutio Habita*, declared it to be "a place where research could develop independently from any other power."[10] As we shall see later, this is a condition that those scholars who directly influenced the thought of the young Shelley saw as essential: to work unhindered by any 'established authority').

Later, in 1222, an offshoot of Bologna at Padua became an independent university, and scholars at Padua were the first in Western Europe to study human anatomy, while, in 1545, Padua established a Botanical Garden for the study and application of medicinal herbs. It managed to preserve some independence from the Papacy, and, like Bologna (which numbered the Pole Copernicus and the Dutchman Erasmus amongst its alumni), Padua welcomed foreign students, its motto, in English, being 'the Liberty of Padua, universally and for all'. Among the foreign students was the Englishman William Harvey (1578-1657), who later discovered that the blood circulates in the human body, and in 1628 published *The Movement of Hearts and the Blood.*

By the 16th century, those who had committed themselves to the study of nature were called "natural philosophers, or virtuoso or men of science"[11], and this terminology, along with a new interest in excavations, encouraged men of letters to study classical texts with an eye to establishing the exact location of classical sites.

Several centuries later, during the wars between England and France, archeological

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[9] Erasmus Darwin. *The Poetical Works of Erasmus Darwin* (London, 1806), Reprint, (Tokyo, 1997) II, xiii. Print.

[10] Google,http://www.eng.Unibo.It/PortaleEn/Univerity/Our+History/default.htm. Web. 22 Oct. 2008.

[11] Makoto Ono. *Gentleman and Science*(Tokyo: Yamakawa P, 1998) 5. Print.

discoveries greatly assisted the progress of scientific discovery, and gave birth, during the Romantic Era, to other studies, such as geology, botany, zoology, fossilology, volcanology, mineralogy, and chemistry, all of them included under the term 'natural history.' After Francis Bacon published his *Novum Organum* (1620), science focused principally on "natural history," [12] the science that offers the materials of knowledge, and scholars tried to gather as many facts as they could on which to base their generalizations.

Intriguingly, the progress of Natural History developed in step with the 'Grand Tour', which evolved during the latter part of the 18th century from the type of tour that had originally concentrated on such classical sites as Cumae and Lake Avernus, places mentioned by Virgil in his *Aeneid*[13] into the type that was more interested in visiting Pompeii in order to observe the local strata and the activities of such lively volcanoes as Mt. Vesuvius and the Phlegrean Fields (Campi Flegraei) near Naples.

Interest in the geological formation of the earth had begun to grow during the 18th century, and two schools of thought, those of the Plutonists and the Posidonians, disputed the issue between them of how this formation took place. These disputes were of great scientific consequence, and the English diplomat Sir William Hamilton, for many years the British Plenipotentiary in Naples, played an important role in the often-heated debates. In Britain, Hamilton is called the father of volcanology, and it is important to note that he, too, was a Fellow of The Royal Society of London, as well as being a friend of the famous early industrialist Josiah Wedgwood, one of the group of self-made industrialists whose efforts we shall look at in much more detail later.

Dr. James Lind, Shelley's mentor while Shelley was at Eton, also knew Hamilton, and the young Shelley, who had become deeply interested in natural history during his schooldays, adopted Hamilton's Plutonist views; later, by employing Plutonist terms and images in his poetry, he used them to offer an allegorical interpretation of a world that, like the physical earth, was continually ravaged by social and political problems.

According to *The Naturalist in Britain: A Social History*[14], by David E. Allen, natural history in Britain started with the study of botany, insects, shells, birds and eggs, and,

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[12] Ono, 18.

[13] Virgil, *The Aeneid,* tr. Robert Fitzgerald (New York: Vintage Books, 1990)VI. Print.

[14] David E. Allen, *The Naturalist in Britain: A Social History* (Princeton:PUP, 1976)12. Print.

later, geology and fossilology, while the influence of the Enlightenment encouraged a more objective method of study and field work, using such special types of practical equipment as "the geologist's hammer", botanist's "collecting-tins or 'vascula,'" and "the butterfly net" for zoologists. At the same time, a number of Academic Associations were established in London, Edinburgh, and other major cities and towns around the country[15]. The Royal Society was established in London in 1660, and commenced publishing its periodical, *The Philosophical Transactions*, in 1665[16].

During the 17th century, science in Britain had flourished under Sir Isaac Newton, the most distinguished President of The Royal Society, and though botany was thought useful for pharmaceutical reasons, it was in the first place actually undertaken for economic rather than scientific motives: travelers undertook adventurous expeditions and conducted research for commercial purposes. An Association for the Trade of Herbal Seeds was established in London and, in 1673, it laid out a botanic garden called the Apothecaries' Garden, now known as "the Physic Garden at Chelsea"[17] (where 'physic' refers to the science of healing). (The Chelsea Garden is the second oldest Botanical Garden in Britain, the first being the Oxford Botanic Garden, laid out in 1621.) London and Edinburgh played important roles in the development of natural history in Britain, and both cities established a public botanical garden, where students and amateurs made it a rule to carry out fieldwork in the gardens and in the open air. Erasmus Darwin was a typical example of an amateur of this kind. At his home in Lichfield, Darwin, a botanist as well as doctor, created his own garden. His friends included Shelley's mentor, James Lind, himself a doctor of medicine, while he, the older poet, would inspire the younger poet.

The years between 1725 and 1760, however, had, in Britain, been a blank period for natural history: such great scientists as Newton and Sir Hans Sloane were dead, and The Royal Society had fallen into decline. When, in 1760, Joseph Banks, later a botanist and the long-term President of The Royal Society, entered Christ Church, Oxford, he had to employ Israel Lyons, a Cambridge botanist, as his private teacher, since, in spite of the existence of the Oxford Botanic Garden, there was no good professor of botany in Oxford.

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[15] Allen, 12.

[16] Allen, 12.

[17] Allen, 5.

And though, during the latter half of the 18th century, the Enlightenment made many new scientific discoveries, natural history in Britain had to contend with the intransigence of the Church, which wished to defend the literal truth of the Bible and fiercely resisted naturalist accounts of the history of the earth, like those of Robert Hooke, who insisted that the earth had repeatedly experienced such floods as Noah's.

Yet, at the same time, natural history fascinated enquiring priests in the countryside, and while the formal associations of natural history may have fallen into temporary abeyance, members communicated with each other by means of letters[18] : and it was in this epistolary tradition that, in 1788, Gilbert White, curate of Selborne, Hampshire, published his letters to the naturalists Thomas Pennant and Daines Barrington under the title *The Natural History and Antiquities of Selborne*, still one of the greatest works of early natural history to be produced by an Englishman and a book that would go on to inspire generations of British naturalists[19].

Yet again, while the profession of natural history fell into something of an official decline, studies of nature began to attract the amateur interest of the social salons, and aristocratic ladies became great collectors not only of such artifacts as pottery but also of insects and plants. Among the ladies were Mrs. Helena Granville, Mary Somerset, The Duchess of Beaufort, and Lady Margaret Cavendish Bentinck. They also supported such entrepreneurs as James Boulton, a friend of Erasmus Darwin, and Daniel Solander, who later became the Curator of the British Museum, and was the inventor of an eponymous box still used for housing precious specimens and books.

The ladies collected insects, plants, birds and their eggs, shells, minerals, and so forth, and displayed them in cabinets in their drawing rooms. Yet, even while the Enlightenment rejected superstitions, and nature was imitated in informal gardens, Thomas Hooke and Christopher Mellet continued to insist that fossils were the dead bodies of animals drowned in the Flood.

In France, between 1749 and 1755, the Count of Buffon had published his influential *Natural History*, while, in Sweden, Linnaeus had by then already devised a new nomenclature in his Clifford Botanic Garden (1737). Augusta, the widow of Frederick Prince of Wales, developed a garden at Kew originally planned in the 1740s by her late

[18] Allen, 43-44.

[19] Allen, 44.

husband: this was to become the Royal Botanic Garden[20], and when her son ascended the throne as George III in 1760 natural history once again became increasingly popular.

During the latter half of the 18th century, London, Cambridge and Edinburgh all played important roles in the development of natural history, and in 1765 an association of men of letters and scientists was established in London, while Edinburgh organized an Association for Research in Natural History, later to become the Edinburgh Association of Natural History. In 1770, William Withering, a Birmingham medical doctor, published his *Phisiology of Plants,* which became the most popular textbook of British plants, and, around 1785, Erasmus Darwin and his friends established the Lichfield Botanic Association.

In 1782, William Forsyth set up in London an Association for the Promotion of Natural History, later (1788) to be called the Linnaeus Association. In 1808, the Edinburgh Werner Association was established, later absorbed into the Edinburgh Association of the Royal Physical Science and the Edinburgh Botanical Association.

(2) The Development of the Grand Tour

Italian culture has had a powerful influence upon British literature from the renaissance to the present day, and the grand tour was one of its manifestations, especially popular during the 17th to the 18th century with young British aristocrats keen to visit classical sites, while seeking to polish their manners and acquire at least a veneer of culture.[21] This is the old type of the grand tour.

Among the most favored sites were the Campi Phlegraei, the Phlegrean Fields, to the west Naples, and, because the place was related to such classical texts as Virgil's *Aeneid,* it became the mecca of the grand tour[22]. Aeneas and his crew had landed on the shore not far from Cumae, had met the Sybil near the lake Avernus; and, following her oracle, Aeneas had gone down into the underworld to see his father "Anchises" to learn that his own destiny was to build a new nation, Rome (Virgil, VI).

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[20] Allen, 38.

[21] A. Wilton and I. Bignamini, ed, *Grand Tour: The Lure of Italy in the Eighteenth Century* (London: Tate Gallery Publishing, 1996) 7. Print.

[22] Wilton, 144.

Since Mt. Vesuvius, which is situated to the east of Naples, began to erupt again in 18th century, expeditions to observe volcanoes also became very popular among the grand tourists, and as a consequence the study of their lava, ashes, ejecta, and meteorites advanced considerably. Soon, the strata, geology, and minerals of the ancient cities of Pompeii and Herculaneum were excavated from the ashes, and so it came about that the grand tour, which had firstly been a classical pursuit, diverged from its original purpose and turned its attention to the natural sciences, developing the related field of archaeology in the process.

Shelley, too, was one of the grand tourists, and it was while he was living in Italy that he drowned. Italy inspired many of his major poems, and the imagery that he drew from the volcanoes that he had visited near Naples plays an important role in the thematic power of their organization. During this schooldays at Eton College, Shelley had been taught the new sciences by Dr. James Lind[23] (1749-1809) , and while at school he had not only read the papers of his teacher but also those of other scientists such as Tiberius Cavallo (1749-1809) and William Herschel (1738-1822), published in the *Philosophical Transactions* of The Royal Society of London.

Early 19th century science in Britain is best represented by geology[24], and its history began with an introduction to the work of German and French geologists, but soon it became a high-level scientific specialization on its own account. Sir William Hamilton (of whom more below), the Founder of Volcanology, was the man who established geology as a major area of scientific learning in the popular mind of the British educated classes.

The German geologist K. von Zittel (1839-1904) called the 30 years from the end of the 18th century to the beginning of 19th century 'a heroic age of geology,' during which time a number of important geologists flourished: A. G. Werner (1749-1817), William Smith (1769-1839), James Hutton (1726-97), and G. Cuvier (1769-1832). During this period, too, those who began to study the earth carefully also began to doubt that it was created in the short space of time described by the book of Genesis. Leonardo da Vinci (1452-1519) had been among the first to have a correct opinion about the origin and nature of fossils.

The Dane Nicolaus Steno (1638-86) established the idea of 'an overlap,' that strata

[23] Richard Holmes, *Shelley The Pursuit* (London: Penguin Books, 1974) 24-26.

[24] T. Matsunaga, *Darwin and His Age: Science and Religion* (Nagoya: Nagoya U P, 1996) 59. Print.

are heaped up almost horizontally at the bottom of the sea, and that they are deposited by turn on the stratum that has previously been laid down. The German G. Agricola (1494-1555) recorded what was known in his own time about mining metallurgy, geology, and mineralogy.

On the cusp of the 18th and 19th centuries, William Smith worked out a law of time, before establishing 'a law of the identification of strata by fossils,' and made it possible to compare strata in areas far distant from each other, and so it was that at this time the struggle for the accurate dating and classification of geological chronology began in earnest. The German Werner investigated the mountains near Freiberg, where he was professor of mining, and concluded that such rocks as granite had first accumulated at the bottom of the sea. He insisted that the primitive earth was covered with seawater that included massive substances, and proposed the concept of Neptunism: that the original rocks like granite are chemical deposits in this primitive seawater. Although he was mistaken, Werner's achievement was to have found that there is a direction in the history of the earth and that rocks can be classified by date. Thus by the investigation of the strata all over the world, Werner laid the foundations of historical geology[25].

The Scott James Hutton, on the other hand, was a Plutonist, and he thought that the interior of the earth has a high temperature and is responsible for the various phenomena that appear on the earth's surface. Between 1785 and 1817, he studied granite deposits throughout Scotland, and proposed a theory of circulation by which the rocks on the land, after being undermined and heaped up at the bottom of the sea and changed into solid bodies and rocks by the central fire in the earth, were upheaved by fire, and turned into dry land again. Since he was a deist, he believed that although the earth was the creation of God, God did not thereafter interfere in its workings. He thus denied that there was a heavenly direction in the changes of the earth.

The dispute between the Neptunist Werner and the Plutonist Hutton had, in fact, already ended with the defeat of Neptunism at the beginning of the 19th century. It was, ironically enough, C. L. von Buch, Werner's favorite pupil, who, on having investigated the Italian and French mountains such as the Auvergne, was forced to acknowledge that those rocks were not aqueous but eruptive, as the French J. E. Guettard (1715-86) had

[25] Matsunaga, 62.

earlier insisted: von Buch proposed that magmas are developed by exceptionally high underground temperature, that they erupt through vents upon the surface of the earth and subsequently become volcanoes.

In 1808, the French scholars Cuvier and A. Brongniard (1770-1847) published their Mineral Geography of Paris and established the classification of strata by fossils by dividing the strata of the Paris valley into seven layers and subdividing each stratum by the kind of fossils they contained[26].

Like Werner and Cuvier, German and French geologists had by the end of the 18th Century freed themselves from the strictures of the Bible, but, until the middle of the 19th century, British geologists were in general still committed to a biblical interpretation. At first, W. Buckland (1784-1856), who laid the foundations of British geology, typified this approach. Later, however, he developed the historical geology of Werner and Cuvier, and established geology as a positive science independent of Christian doctrine, although at first he regarded glacial deposits and glacial topography as the signs of the Great Flood. He did not, however, remain a completely committed biblical geologist, and in 1840, after he had come to support the glacial ideas of L. Agassi, which parted completely with the idea of the Great Flood, he proposed that 'geological study should be based merely on geological facts'. Beginning in 1814, Agassi had examined the geological data of the colonies of the New World as well as of Britain and the European Continent, and had developed the universal classification of strata based on the date of formation. The table attached to his paper became thereafter the basis for the international classification of geological dates.

The seminal British geologist, Charles Lyell (1797-1875), published his vastly influential *Principles of Geology* between 1830 and 1833, and proposed that the present is the key to the past; he raised geology to the level of science on a par with other physical sciences[27]. (Charles Darwin took Lyell's book with him on The Beagle.)

(4) The Father of Volcanology, Sir William Hamilton

Sir William Hamilton (1730-1803) is known in Europe and America as 'the Founder

[26] Matsunaga, 67-76.

[27] Matsunaga, 67-76.

of Volcanology.' In this part of my paper I shall attempt to clarify his contribution to the history of volcanology and geology, and will seek to provide the first step of a new approach, one that has never really been tried in such detail before, to illustrate an important influence not only upon the poetry of Percy Bysshe Shelley, but on all the Romantic poets who, in their youth, will have read Hamilton's papers.

The Oxford Dictionary of National Biography[28] and D. Constantine's *Fields of Fire*[29] tell us that Sir William Hamilton, born in Scotland in 1730, joined the third Foot Guards at the same time as George, Prince of Wales (later King George III), and served from 1747 until 1758, when he came into a huge inheritance through his first marriage to a Miss Barlow.

For 36 years, from 1764 to 1800, Hamilton was British Ambassador Extraordinary and Plenipotentiary to the Court of the Dukedom of Naples, and during these years, he frequently climbed the volcanoes Mt. Vesuvius near Naples and Mt. Etna in Sicily.

He observed these volcanoes himself, and hired an Italian artist to record and sketch everything they observed. He reported his observations to The Royal Society, of which, in 1766, he became a Fellow, and, from 1766 to 1780, he published his papers in the Society's bulletin, the *Philosophical Transactions*. In 1767, he sent specimens of the volcanic rocks and minerals he had collected in Italy back home to The Royal Society, and finally in 1776 published his papers in a book that he entitled *Campi Phlegraei*[30].

In 1777, Hamilton became a member of The Society of Dilettanti and, 1783, a Fellow of The Society of Antiquaries. Amongst other activities, he gave advice to Thomas Bruce, 7th Earl of Elgin (1766-1841), over the purchase of the Elgin marbles. In 1766, he purchased Greek urns in Naples, and in 1772 sold them to the British Museum. In 1766-67, the publisher D'Hancarville, namely P. F. Hughes, brought out a catalogue of his collection, and it greatly influenced the potter Josiah Wedgwood (1730-95), whose cameos based on some of the designs are still popular throughout the world.

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[28] *Dictionary of National Biography* (London:OUP, 1893, 1967-68). Print, and *Oxford Dictionary of National Biography* (Oxford: OUP, 2004). Print.

[29] D. Constantine, *Fields of Fire: A Life of Sir William Hamilton* (London: Weidenfeld & Nicolson, 2001). Print.

[30] Sir William Hamilton, *Campi Phlegraei: Observations on the Volcanos of the Two Sicilies, As They Have Been Communicated to the Royal Society of London* (Naples, 1774) Reprint,(Milano: Leonardo, 1990). Print.

In 1787, J. W. von Goethe (1749-1832) paid a visit to Hamilton in Naples, looked around his collection, and commented in his *Italian Journey* (1786-88) on the charms of a lady called Emma Hart, Hamilton's mistress and later his second wife, the infamous Lady Hamilton (ca. 1761-1815).

In the following passage, Goethe describes the portraits of 'Emma as a Sybil' (c. 1788), painted by Wilhelm Tischbein, a close friend of Goethe's,

'Attitudes of Lady Hamilton' (1791), by Pietro Novelli, and Emma as 'A Bacchante" (1783-4), by Sir Joshua Reynolds. We learn, too, that Goethe knew that Hamilton had observed nature (volcanos) in Italy for many years. (It is interesting to note that Shelley later visited those volcanos such as Mt.Vesuvius and Monte Nuovo that Hamilton had observed near Naples and had published observations in his *Campi Phlegraei*.)

> Sir William Hamilton, who is still living here as English ambassador has now, after many years of devotion to the arts and the study of nature, found the acme of these delights in the person of an English girl or twenty with a beautiful face and a perfect figure. He had a Greek costume made for her which becomes her extremely. Dressed in this, she lets down her hair and, with a few shawls, gives so much variety to her pose, gestures, expressions, etc., that the spectator can hardly believe his eyes. He sees what thousands of artists would have liked to express realized before him in movements and surprizing transformations ---- standing, kneeling, sitting, reclining, serious, sad, playful, ecstatic, contrite, alluring, threatening, anxious, one pose follows another without a break. She knows how to arrange the folds of her veil to match each mood, and has a hundred ways of turning it into a head-dress[31].

Hamilton married Emma in London in 1791.

In1789, Hamilton had purchased Greek vases excavated from ancient tombs in Sicily, having, in 1785, already bought the Portland Vase, and sold it to the Duchess of Portland, Margaret Cavendish (ca. 1724-74). As early as 1772, Hamilton had been awarded the Order of the Bath, and, in 1791, he became an advisor to the Privy Council. In 1800, the

[31] J.W. Goethe, *Italian Journey [1786-1788]*, tr W. H. Auden and E. Mayer. (London: Penguin Classics, 1962) 208. Print.

Hamiltons traveled home with Lord Nelson, and from around 1802 Emma lived in Nelson's house. For a while Hamilton attempted to obtain a separation from her, but in 1803 he died, with Emma and Lord Nelson beside his death bed.

(i) Hamilton's *Campi Phlegraei*

Hamilton's scientific reports, collected as *Campi Phlegraei,* originally consisted of papers that had been published separately in the Philosophical Transactions of The Royal Society of London. They reveal Hamilton's standpoint as a Plutonist, a position that Shelley would follow him in adopting. They were so popular that they were published in two volumes in Naples in May, 1776, and subsequently republished in several further editions. The first volume, dedicated to Sir John Pringle, the then President of The Royal Society, contains five long letters, which were, in effect, five considered scientific reports.

The first half of the second volume consists of coloured illustrations and descriptions of such volcanoes around Naples as Mt. Vesuvius, Mt. Astroni, the Solfatara, Monte Nuovo, as well as Mt. Etna in Sicily, the first discovery of the Temple of Isis, Lake Agnano and Lake Avernus, and the isle of Ischia. The second half consists of sketches of specimens of volcanic rock. In 1779, Hamilton added illustrations of the great explosion of Mt. Vesuvius of the same year, with a letter to Joseph Banks (1743-1820), who had become the President of The Royal Society in 1778.

(i-a) The Fifth Letter of *Campi Phlegraei*

Among the letters printed in *Campi Phlegraei,* the fifth letter from Naples dated October 16, 1770, is of especial interest from the viewpoint of geology and volcanology. As it seems to have become the source of Shelley's ideas, we need to check it in detail. The fifth letter is a report of the geology near Naples and its original title is 'Remarks upon the Nature of the Soil of Naples, and Its Neighbourhood'.

Hamilton looked carefully at the soil which had covered such ancient cities as Herculaneum and Pompeii after the explosions of Mt. Vesuvius, a volcano located east of Naples, and he described the form and composition of a new volcano in 1538 called Monte Nuovo near Pozzuoli, at the opposite end of the bay, to the west of Naples. At the same

time, he proposed a new theory in opposition to Buffon's view that the cause of the eruptions was heat gathering at the summit (rather than in the depths) of the volcano's interior. Buffon's book is on the list of Shelley's Library.[32]

Another commonly-held theory at the time was that eruptions were caused by the movements of ground water, but Hamilton, true to the traditions of The Royal Society, placed great importance on 'observation,' and argued that the cause of volcanic explosions was 'subterraneous fire,' and that this would explain the mechanism of both volcanoes and earthquakes. He suggested that the plain around Naples called Campania was known as 'Campania Felice' (Fertile Campania), because its soil consisted of volcanic ash, which was laid down, over a very long time, by the repeated explosions of neighbouring submarine volcanoes. At the beginning of his Fifth Letter of *Campi Phlegraei*, Hamilton quoted, in support of his view, the words of Lucius Annaeus Seneca, the Younger (ca. 4 B.C.-A.D.65), in the De Terrae-motu (Earthquakes):

> "Mille miracula movet faciemque mutat locis, & desert montes, subrigit plana, Valles extuberat novas in profundo insulas eregit."[33]

> [An earthquake produces a thousand strange things and changes the appearance of places and carries away mountains, elevates plains, pushes up valleys, raises new islands in the sea.][34]

In *Campi Phlegraei*, Hamilton suggests that the whole area within a radius of 20 miles of Naples known as Campania was a product ofsubterraneous fire, and was born from the sea. He came to regard volcanoes as neither wholly 'destructive' nor wholly 'constructive,' which may remind us that Shelley uses the words 'destroyer ' and 'preserver' in the first stanza of the 'Ode to the West Wind'[35], and we may note that such an idea significantly foreshadows the views of such mid-19th century revolutionaries

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[32] *The Journal of Mary Shelley*, ed P. R. Feldman and D. Scott-Kilveert (Baltimore and London: Johns Hopkins UP, 1987) 638, 658. Print.

[33] Seneca, *Naturalis Questiones*. Tr T.H. Corcoran. Loeb Classical library (London: HUP, 1972) VI, 'Earthquakes,' 4, 1. Print.

[34] Hamilton, 53.

as Mikhail Bakunin, (1814-76), that 'the passion for destruction is also a creative passion,' while Karl Marx's favourite mythological hero, it turns out, was Prometheus, the hero of one of Shelley's greatest works. Hamilton first defined his position as a Plutonist as follows:

> ···I imagine *the subterraneous fires* to have worked in this country, under the bottom of the sea as Moles in a field, throwing up here and there a hillock, and that the matter thrown out of some of these hillocks, formed into settled Volcanos, filling up the space between one and the other, has composed this part of the continent, and many of the Islands adjoining.[36] [Italics mine.]

Hamilton next supposed that, although nature went through various phases, the processes of nature would generally be of a similar kind or type and that such major volcanoes as Mt. Etna and Mt. Vesuvius were likely to have been produced in the same manner. He defended his position by arguing that in his own time natural history, especially with regard to soil science, was not as yet particularly advanced, and that it was not so easy for human beings to catch the scene of its action, for 'Nature acts slowly.'[37] Hamilton had deduced his view of the issue, he tells us, from the nature of the soil which covers the two ancient cities of Herculaneum and Pompeii, and the form of the interior and exterior of the crater of Monte Nuovo (New Mountain), newly formed near Pozzuoli, and the kind of matter which created it. He investigates the strata under the two ancient cities and reports that Herculaneum is buried 70 to 112 feet below the present surface of the earth, while Pompeii is buried 10 to 12 feet below it.

And we know from the very precise report (letter) written by Pliny the Younger (ca. 61-112,) to his friend Publius Cornelius Tacitus (ca. 55-120), as well as from records left by other contemporary writers, and as Hamilton reminds us, that these two cities were buried by the eruption of Mt. Vesuvius in 79 A.D., at the beginning of the reign of the Emperor Titus (79-81):

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[35] *The Complete Works of Percy Bysshe Shelley.* Ed R. Ingpen and W. E. Peck, 10 vols. (New York: Gordian P, 1965) II, 294-95.

[36] Hamilton, 53.

[37] Hamilton, 54.

> As we know from the very accurate account given by Pliny the Younger to Tacitus, and from the accounts of other contemporary Authors, that these towns were buried by *an eruption of Mount Vesuvius* in the time of Titus;it must be allowed, that whatever matter lies between these Cities and the present surface of the earth over them, must have been produced since the year of 79 of the Christian era, the date of *that formidable eruption*[38] .
>
> [Italics mine.]

The fertile humus soil and burnt matter that lies above the strata of 'white pumice stones' of Pompeii is over 2 feet thick (Hamilton, 55), a soil in which grape vines now flourish. As the pavements in Pompeii are made of 'lava,' and as, moreover, 'there is a thick stratum of lava and burnt matter' under the foundation of this city, he concludes that

> 'These circumstances, with many others that will be related hereafter, prove beyond a doubt, that there have been eruptions of Vesuvius previous to that of the year 79, which is the first recorded by history.[39]

'The growth of the soil by time is easily accounted for', he tells us (Hamilton, 56), and after 'examining the cuts and hollow ways made by the currents of water' near Mt. Vesuvius and other volcanoes, he finds that 'there lay frequently a stratum of rich soil, of more or less depth, between the matter produced by the explosion of succeeding eruptions.' He thinks that 'such a stratum' grew in the same manner as that which covers the pumice of Pompeii (Hamilton, 56-57).

This reveals that Hamilton followed Werner's historical geology.

> I do not pretend to say, that a just estimate can be formed of the great age of *Volcanos* from this observation; but some sort of calculation might be made: for instance, should an explosion of pumice cover again the spot under which Pompeii is buried, the stratum of rich soil mentioned above would certainly lie between two beds of pumice; and if a like accident had happened a thousand years ago, the stratum of rich soil would as certainly have wanted much of its present thickness, as

[38] Hamilton, 55.

[39] Hamilton, 56.

> the rotting of vegetables, mature, & c. is ever increasing a cultivated soil. Whenever I find then a succession of different strata of pumice and burnt matter, like that which covers Pompeii, intermixed with strata of rich soil, of greater or less depth, I hope I may be allowed reasonably to conclude, that the whole has been the production of a long series of eruptions, occasioned by subterraneous fire. By the size and weight of the pumice, and fragments of burnt matter in these strata, it is easy to trace them up to their source…[40]
>
> [Italics mine.]

We will survey in more detail the influence of Hamilton upon volcanological imagery in Shelley's poetry later.

(5) The Lunar Society of Birmingham

As we have already seen, Shelley's school-day mentors, Dr. Adam Walker at Syon House Academy and Dr. Lind at Eton, had a number of important friends, to whom Dr. Lind appears to have introduced Shelley while Shelley was still at Eton. Most of these friends were members of the Lunar Society of Birmingham and the Royal Society of London, and it is therefore important for us to consider who these people were, what kinds of relationship they had, their activities, and their works, so that we may trace their influence upon the philosophical and naturalistic ideas of the young Shelley

(5-i) The Foundation of the Lunar Society

Shelley, it is now clear, wrote much of his poetry under the influence of contemporary scientists, engineers, and adventurers. As well as such early influences as Adam Walker at Syon House Academy and Dr. James Lind at Eton College, James Keir, Lind's cousin and close friend, was a member of 'The Lunar Society' of Birmingham, the main motive power of the Industrial Revolution in England, and the influence of its members upon technology from 18th century even to the present day has been great.
Since they gathered when the moon was at the full, they were dubbed, by the satirical,

[40] Hamilton, 57.

the Lunaticks; and as it was a private society, no public record of it has come down to us. In order to summarize their activity, we need to follow the accounts given by D. G. King – Hele, R. E. Schofield, and the *Oxford DNB*.

The Lunar Society grew out of a friendship between Matthew Boulton (1728-1809) and Erasmus Darwin (1731-1802); starting off in the 1760s, it entered its golden age in the 1770s, began to lose its edge in the 1780s, and, in the 1790s, it disappeared. Its disappearance more or less coincided with resurgence of The Royal Society of London, which had been dominant as the best scientific association in England, but between 1700 and 1750 had been in a state of decline. One of the reasons for its decline was that the great scientists of the early 17th century had died: Robert Hooke (1635-1703), a physicist and author of Hooke's Law; Sir Isaac Newton (1642-1727), the physicist and mathematician who discovered the law of universal gravitation, and was the President of The Royal Society from 1703 to1727; and Edmond Halley (1656-1742), an astronomer and mathematician, who calculated the orbit of Halley's Comet. Another reason for its decline was that the Society had begun to choose as its Presidents people who were not scientists.

It was not until Sir Joseph Banks (1743-1820) took over as President in 1778 (and remained in the post until his death, 41 years later) that The Royal Society regained its former status. Since the majority of the members of the Lunar Society subsequently became Fellows of The Royal Society, they played a leading role in the Society's revival as a scientific powerhouse, and most of them published their papers in the Society's periodical, *The Philosophical Transactions*.[41]

The members of the Lunar Society were practical men and had close contacts with the industrial world. Most of them came from the provinces and were members of that class of society that later, in the 19th century, would be known as *nouveaux riches*.

They were not members of the Anglican Church, and they opposed the Establishment, the aristocracy, and governmental power in London. Like Shelley, they welcomed the French Revolution, while Wedgwood in particular became famous for cameos that featured a chained slave which his company produced in support of the movement for the abolition of slavery.

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[41] *The Philosophical Transactions*(London: The Royal society of London) 59 (1769), 65(1775) Print.

The Lunar Society generally met in the house of President Boulton on the Sunday before a full moon. When he was away, there was no meeting. When Dr. Joseph Priestley (1733-1804) was due to attend, they met not on Sundays but Mondays. There were usually six to eight attendants, and one of those present would give a talk on some scientific subject. They suggested experiments to conduct and, before and after dinner, they would report on the results of the experiments. According to Schofield, the Lunar Society had 14 members: Matthew Boulton (1728-1809), Josiah Wedgwood (1730-1795), Dr. Erasmus Darwin(1731-1802), Dr. Joseph Priestley (1733-1804), Dr. William Small (1734-1775), James Keir (1735-1820), James Watt (1736-1819), Richard Lovell Edgeworth (1744-1817), John Whitehurst (1713-1788), Dr. Thomas Day (1748-1789), Dr. William Withering (1741-1799), Rev. Robert Augustus Johnson (1745-1799), Samuel Galton (1753-1832), Dr. Jonathan Stokes (1755-1831).

The range of their interests and abilities was wide, and they were generally reformists, enthusiastic for the arts and education as well as science and technology; they also opposed slavery. Our first important link is number 6 on the list, James Keir, the cousin and friend of Dr. James Lind, Shelley's Eton mentor, and Lind in his turn, forges another link with Sir Joseph Banks.

Lind's career had begun in 1766 as a surgeon with the East India Company, and on July 12, 1772, he joined the expedition to Iceland with Sir Joseph Banks to investigate the Icelandic volcanoes. Before presiding over The Royal Society from 1777 to 1819, Banks himself had, as a young man, joined the first expedition of Captain James Cook (1728-79) to the Antipodes as a botanist, and with Cook he had explored Australia, New Zealand, the region of the South Pole, and had observed the Transit of the Venus. While there he collected specimens of plants and seeds and took them to England, thus establishing the grounds for his later fame. Luckily for him, however, he was not given permission to join Cook's second and third expeditions, and he thus escaped Cook's grisly fate. While, during Banks' presidency, most members of the Lunar Society became successively Fellows of The Royal Society, Sir William Hamilton (1730-1803), the Founder of Volcanology, had already become a member: indeed, Banks and Hamilton became the Fellows of the Royal Society in the same year. Another friend of Lind's was Sir William Herschel (1738-1822), the discoverer of the planet Uranus, who, like Lind, lived in Windsor (the site of Eton College): Lind and Herschel, as well as Hamilton and Banks, in company

with members of the Lunar Society such as Erasmus Darwin and Joseph Priestley, are all believed to have influenced Shelley and inspired some of his scientific interests. Before going any further, however, we do need to know a little more about Dr. James Lind himself.

(5-ii) Dr. James Lind (1736-1812)

Lind and his cousin James Keir (1735-1830) were brought up together, and together entered the Medical Department of Edinburgh University. After graduation, they took different professions, but their ties of blood were strong and their friendship continued throughout their lives. Keir moved to the English Midlands in 1767, where he became one of the leaders of the Lunar Society of Birmingham, and was friendly with such eminent men as Mathew Boulton, the spiritual leader of the Lunar Society, James Watt, the inventor of the steam engine, Erasmus Darwin [the grandfather of Charles Darwin], a naturalist, doctor, and poet, who discovered the mechanism of clouds and the nature of photosynthesis, Joseph Priestley who discovered oxygen and soda, and Josiah Wedgwood, the great potter.

Later, in 1780, Keir founded the Tipton Alkali Factory and pioneered a new method of making soda: he is called the father of the modern chemical industry, and it was thus through his cousin Keir that James Lind came to learn of the new developments in chemistry and industry, while, thanks to Lind's close friendship with Watt, Lind (who was a young man of 20 when Watt invented the steam engine) became in turn connected to the Lunar Society.

In December, 1765, at the age of 29, Lind had been appointed physician of a ship belonging to the East India Company, and had consequently traveled around India, the East Indian islands, and China, where he collected marvelous examples of Chinese arts and crafts, telescopes, and the first specimen of corundum, which is the next hardest stone to diamond. He wrote a dissertation on a disease that had been prevalent in the area of Bengal, and with it took his M. D. at Edinburgh University in 1768. His thesis, in Latin, was entitled 'De Febre Remittente Putrida Paludum quae grossabatur in Bengalia A. D. 1762'. In 1769, at Hawkhill, near Edinburgh, Lind observed the Transit of Venus, and his account was subsequently published in the *Philosophical Transactions* (vol. 59) of

The Royal Society, with an editorial comment by the Royal Astrologist, Nevil Maskelyne. In 1770, Lind was appointed a Fellow of the Department of Medicine in the University of Edinburgh, and in 1772 published a translation of his dissertation in English as ' Treatise on the Fever of 1762 at Bengal'. Lind accurately measured the latitude of the island of Islay in the Inner Hebrides, Scotland, and drew a map of it. Also in 1772, he joined the expedition to Iceland with Sir Joseph Banks. According to a letter dated 30 May, 1772, from Banks to John Montagu, Fellow of the Royal Society, 4th Earl of Sandwich, and 1st Lord of the Admiralty, the purpose of the expedition was to study the Icelandic volcanoes,[42] one more link in the chain that we are seeking in these pages to string together.

Dr. James Lind accompanied Banks on the brig St. Lawrence, along with most of the party that Banks had previously assembled when assuming that he would be traveling with Cook. Parliament had made a special grant of £4,000 to Lind to sail with Banks on HMS Resolution, but, instead, Banks chartered a 190-ton brig which sailed from Gravesend for the Hebrides and Iceland on 12 July, 1772, the very same day that Cook took his ill-fated ships out of Plymouth Sound[43]. On May 11, 1775, Lind read a paper designed to measure the Harmattan in the African desert, and it was published in the Society's periodical, the *Philosophical Transactions* (vol. 65, 1775); the volume also contains a letter from Dr. Lind to Colonel Roy, in which he refers to his wind-gauge, presented to Sir John Pringle (1707-82), the then President of The Royal Society at The Royal Society. When, three years later, Banks became the President [1778-1819], Lind was elected a Fellow.

On Dec. 18, 1777, Lind was appointed a physician to the Royal Family at Windsor, and, for the next 30 years, he was to live within its precincts. Eton College lies in the shadow of Windsor Castle, and when Shelley was a pupil at Eton, he came to know Lind, who by that time was over 70 years old, but Lind's influence is well attested, by Shelley as well as by his friends.

Lind knew a good deal about meteorology and astronomy, as well as medical science, and at this time, his close friend Sir William Herschel (1738-1822), by then the

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[42] Neil Chambers, ed, *The Letters of Sir Joseph Banks A Selection, 1768-1820*, (London;The Imperial College P, 2000) 29, n. 5. Print.

[43] Chambers, n. 5.

Astronomer Royal, was a fellow resident of Windsor. Not only had Herschel discovered the planet Uranus, he had also located 2,500 galactic nebulae, and when Mr. and Mrs. Lind dined with Herschel on May 4, 1783, they joined Herschel at his telescope after dinner to watch the moon passing in front of a star, and, for the first time, observed volcanoes on the moon. That Lind and Herschel inspired Shelley to take nature and the universe based on the new astrology as themes for poetry can hardly be doubted.

Dr. Lind had a thorough knowledge of up-to-date science and technology, and enjoyed the friendship of the leading luminaries of the day. So when he invited Shelley to his house in Windsor and talked about his close scientist friends, it is clear that Dr. Lind enthused the impressionable youth with belief in the progress of science and the value of scientific contribution to the future of human beings.

When Shelley met him, the septuagenarian Lind was an old man with grey hair, whose Orientalism, fine taste and impressive behaviour gave Shelley a fancy for the Gothic. Like most members of the Lunar Society, Lind was hostile to established authority, and, in his own peculiar style, published pamphlets in secret. He introduced Shelley to Plato, and inspired him to write poetry based on the radical thought of William Godwin (1756-1836). According to King-Hele, Dr. Lind also introduced Shelley to the poetry of Erasmus Darwin, and led him into a unique world in which poetry and science could combine and work in harmony together.[44]

Thomas Jefferson Hogg (1792-1862) was Shelley's friend at Oxford, and according to his *Life* of Shelley, Shelley expressed his love for Dr. Lind with the words 'I owe to that man far, ah! far more than I owe to my father; he loved me, and I shall never forget our long talks, where he breathed the spirit of the kindest tolerance, and the purest wisdom.'[45] Even if we discount Hogg's words as perhaps a little hyperbolic, the passage clearly shows how much old Dr. Lind loved the young and sagacious Shelley, and for how long and how many times he taught him the pleasures of science and the scientific mind.

It is said that Zonoras in *Prince Athanase*, and the Hermit in *The Revolt of Islam* (1818) are both modeled on Dr. Lind. He died in the house of William Burnie, the husband of his daughter, at Russell Square, London, on the 17th of October, 1812.

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[44] King-Hele, 'Shelley and Dr. Lind,' *Keats-Shelley Memorial Bulletin*, 1967, Rome,XVIII, 1-6.

[45] Thomas Jefferson Hogg, *The Life of Percy Bysshe Shelley*. London: Edward Moxon, 1858, I, 32. Print.

[To be continued.]