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Making and circulating knowledge through Sir William Hamilton's *Campi Phlegraei*

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Abstract. William Hamilton's celebrated letters, articles and publications embodied his experiences as a direct observer of nature. This paper tracks their different courses through preparation, production, distribution and consumption to expose the networks through which Hamilton's knowledge was made and moved. It makes a detailed study of the changes incurred when his experiences were translated between written, oral, painted and printed formats. Sensitive to contemporary notions of curiosity, it then links these changes to the distinct audiences that each embodiment found. The paper frames each piece as an opportunity for beholders to become virtual witnesses in order to describe people's diverse encounters with Hamilton's work. This model is developed to highlight the agency and diversity of readers and the importance of physical format for the movement of witnessing tools. The exploration of *Campi Phlegraei* demonstrates how this method of communications study can be a valuable approach to the history of science.

For Sir William Hamilton (1730–1803), curiosity about nature inspired observation. To observe was not to perceive passively but to undertake particular practices of focused attention and detailed description, the two activities required of a vigilant eyewitness.[1] Hamilton's activities produced accounts that allowed others to share his observational experiences. These physically embodied acts of attention and description rendered curiosity, not just curious phenomena, mobile. Experiences of nature then moved far beyond the consciousness of the original observer, as they were repeatedly transformed from letters into oral spectacles, journal articles, extracts, reviews and luxury publications.

This essay analyses how practices of attention and description were re-created for various audiences in the second half of the eighteenth century. One way of thinking about this in historical writing has been the notion of a 'virtual witness' – someone in whose mind an image is produced that obviates the necessity for him or her to become a direct witness. Multiplying witnesses requires various social, literary and material technologies, as Steven Shapin and Simon Schaffer have described in relation to seventeenth-century experimentalists.[2] By Hamilton's time the Royal Society had an

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1 The significance of attentive observation was explored in 'Attention and the creation of value in Enlightenment natural history', seminar by L. Daston, Cambridge, 2002.

2 S. Shapin and S. Schaffer, *Leviathan and the Air Pump: Hobbes, Boyle, and the Experimental life*, Princeton, 1985, Chapter 2, especially 60–9.

institutionalized mechanism for the consideration and reproduction of knowledge claims. But the ways in which technologies for reporting experience were incorporated into its material, oral, formal and informal practices have been little studied.[3] More significantly, accounts of the creation of virtual witnesses have tended to imply a homogeneous, passive audience. They assume that with a single effective mechanism, the number of witnesses to any phenomenon can be multiplied indefinitely.

I expose a different story, based upon physical encounters between active recipients and techniques of persuasion. The movement of witnessing tools was materially constrained, such that natural and experimental observations circulated through numerous social and physical spaces only because they were given diverse manifestations. Taking the experience of witnessing beyond the observer's immediate community therefore required that particular audiences undertake autonomous acts of translation and redistribution. By tracing the course of Hamilton's embodied acts of description, this essay engages with communications history. The communications circuit proposed by Robert Darnton rightly identifies many factors, besides authorship, that govern any reading experience.[4] It therefore explains certain unintended consequences of written activity. But by placing 'the readers' at the end of a line of processes, albeit with a dotted loop back to the start of that line, this account fails to recognize the intermediate contributors as readers and active interpreters in their own right. While publishers, printers, shippers and booksellers are granted agency, they are denied autonomy. The result is a deterministic model in which circulating texts alter greatly in form and little in content. However, as Richard Yeo has shown for Enlightenment encyclopedias, the structure and format of books can shed precious light upon the very nature and organization of knowledge.[5] I endorse and give evidence for the claim that 'literature … belongs to a culture in which media of all sorts – printed, written, oral and visual – interconnect'.[6] With this approach, I hope to win a more constructive role for the history of material literature within the history of science.

My focus is the relationship between the material form and social location of Hamilton's observations. Although many entities came to embody and re-create Hamilton's initial experience of witnessing, each displayed them in significantly different ways. As they circulated and were consumed, they all made the same acts of attention and description available to new audiences, but the physical interaction

3 See D. P. Miller, '"Into the valley of darkness": reflections on the Royal Society in the eighteenth century', *History of Science* (1989), **27**, 155–66, 156. However, R. Sorrenson, 'Towards a history of the Royal Society in the eighteenth century', *Notes and Records of the Royal Society of London* (1996), **50**, 29–46; and A. Rusnock, 'Correspondence networks and the Royal Society, 1700–1750', *BJHS* (1999), **32**, 155–69, both indicate useful starting points.

4 For a recent exposition of the communications circuit see R. Darnton, *The Forbidden Best Sellers of Pre-Revolutionary France*, London, 1997, 182–4. This model has proved useful for explaining conflicting reader interpretations. See, for instance, J. R. Topham, 'Beyond the "common context": the productions and reading of the Bridgwater Treatises', *Isis* (1998), **89**, 233–62, 235–7.

5 R. Yeo, *Encyclopaedic Visions: Scientific Dictionaries and Enlightenment Culture*, Cambridge, 2001.

6 Darnton, op. cit. (4), p. xxii. For more on the interaction between histories of the book and of the sciences see M. Frasca-Spada and N. Jardine, 'Introduction: books and the sciences', in *Books and the Sciences in History* (ed. M. Frasca-Spada and N. Jardine), Cambridge, 2000.

through which each operated was unique. Beginning with the earliest surviving record of his observations, I study Hamilton's correspondence from 1766 to 1780 and examine why the recipients of certain letters decided to communicate them further. I follow these selected letters to the Royal Society where, read aloud at weekly meetings, they became focal points of attention at a sociable London club. Next, I trace the translation of Hamilton's experiences into articles for *Philosophical Transactions* and the new avenues of circulation that this brought. My attention then turns to the magnificent *Campi Phlegraei: Observations on the Volcanos of the Two Sicilies* (1776) and its *Supplement* (1779). This exceptional publication dramatized his observations in new ways and altered their appeal once again. Finally, case studies reveal *Campi Phlegraei* as far more than a 'witness replicator'. Through this book, Hamilton's embodied curiosity became a curious object in itself.

Writing letters

Sir William Hamilton was posted as British Envoy to Naples from 1764 to 1800. As soon as he arrived he was captivated by Vesuvius. The mountain's flames, fumes and fireworks attracted many travellers on the Grand Tour. These travellers' gripping tales aroused interest across Europe in the causes of volcanic action. Eruptions and earthquakes were generally linked either to open caverns where vapours could accumulate or to deposits of flammable rock. Combustion required underground air or water or both and, once triggered, would force molten lava to the surface in an explosion. Some located the heat source near the centre of the Earth, while others contended it was towards the summit of a cone. Neither account threatened the established view that volcanoes had a relatively superficial impact on their environment, limited to events documented by human records. The Earth had only existed for a few thousand years and would exist for just a few thousand more.[7] Reluctant to engage immediately with these theoretical debates, Hamilton took every chance to see the signs of volcanic action for himself by spending many hours on the often inhospitable slopes of Vesuvius, reaching the crater more than sixty times.[8] Believing that describing the world was a necessary part of observing it, he carefully documented what he found.

After a lifetime full of diplomatic, social and literary activity, the work for which Hamilton is now best remembered consists of a handful of letters written to members of the Council of the Royal Society on the topic of volcanic phenomena.[9] In them he used words and pictures to narrate the eruptions of Vesuvius, discuss lavas and compare landforms, emphasizing his direct engagement with nature throughout. Initially he wrote, 'I shall confine myself merely to the many extraordinary appearances that

7 J. Thackray, '"The Modern Pliny": Hamilton and Vesuvius', in *Vases and Volcanoes: Sir William Hamilton and His Collection* (ed. I. Jenkins and K. Sloan), London, 1996, 65.

8 *Philosophical Transactions* (subsequently *PT*) (1780), **70**, 44 fn (b). Wherever possible I reference letter texts as they appeared in *PT*.

9 For consideration of these letters in isolation see D. T. Moore, 'Sir William Hamilton's volcanology and his involvement in *Campi Phlegraei*', *Archives of Natural History* (1994), **21**, 169–93, 177–80; and M. Krafft, *Volcanoes: Fire from the Earth*, London, 1993, 79.

have come under my own inspection, and leave their explanation to the more learned in natural philosophy.' Gaining confidence in later letters, he began interpreting his findings. From the huge quantities of lava that could reach the surface during an eruption, he concluded that a volcano's source lay deep underground. According to his examination of the strata, volcanic cones grew through the accumulation of layers of ash and lava flows, separated by soil deposits. The landscape was in a continual state of flux, so large and inactive volcanoes provided evidence of events 'so very ancient as to be far out of the reach of history'.[10] To contemporary readers these were controversial claims, but over time they became accepted truths.

My interest here lies less with Hamilton's personal beliefs and sensations than with the material embodiments he employed to create virtual witnesses. His letters were persuasive because they enabled specific distant readers to experience for themselves the observations he had made on a Neapolitan mountainside. By designing certain letters to be read aloud to the Royal Society and then published in *Philosophical Transactions*, he also influenced the further distribution of this witnessing experience. To identify the practices of writing and reading, through which his letters acquired significance, I locate them within a web of learned correspondence before focusing upon their detail.

Despite his distant location, Hamilton's diplomatic work and amateur interests demanded that he remain connected with London life through the movement of various publications, packages, guests and letters.[11] Hamilton was a prolific collector of objects including archaeological fragments, statues, vases, jewellery, gemstones, books, paintings and drawings.[12] His assortment of rocks and soils therefore suggests natural history was one of many overlapping pursuits. The contemporary explorations of Pompeii and Herculaneum yielded relics of human and natural origin, which sat side by side in his collections. Documenting the excavations helped him to become a prominent antiquarian at a time when studying ancient cultures was complementary to investigating the Earth's past. Through classical scholarship, Pliny's first-century account of Vesuvius became a constant source of reference for his own. As a connoisseur and active patron of landscape art, Hamilton was well positioned to employ its visual methods on his volcanic project. Maintaining his collections involved extensive networks of excavators, dealers and museums, many of whom became audiences for his work.

Hamilton developed his passion for volcanoes through the Royal Society of London, of which he was elected Fellow (FRS) in 1766.[13] Although a member of several London clubs, including the Society of Antiquaries and the Dilettanti, it was with the Royal Society that he became most actively involved. Over the years before returning to London in 1800, he had contacts with several senior members, including the Earl of

10 *PT* (1767), **57**, 192; *PT* (1769), **59**, 7.

11 For an account of the use of dispatches in early modern diplomacy see G. Mattingly, *Renaissance Diplomacy*, Middlesex, 1973, 229–42.

12 For surviving objects from his collections see I. Jenkins and K. Sloan, 'Catalogue', in *Vases and Volcanoes: Sir William Hamilton and his Collection* (ed. I. Jenkins and K. Sloan), London, 1996, 106–304.

13 Sackler archives, accessible from the Royal Society website: www.royalsoc.ac.uk.

Morton (president of the Royal Society (PRS) 1764–8), Mathew Maty (secretary to the Royal Society 1762–76), Sir John Pringle (PRS 1772–8) and Joseph Banks (PRS 1778–1820). Matters of correspondence ranged widely. For example, Maty arranged by letter for his son, on the Grand Tour, to enjoy Hamilton's hospitality in Naples.[14] Correspondents expressed concerns about Catherine, Hamilton's ailing first wife, and conveyed news of mutual acquaintances, including Hamilton's nephew, Charles Greville, himself a Fellow. Natural history was not the only topic discussed in Hamilton's contacts with Fellows, nor was mention of volcanoes restricted to these correspondents. Stephen Sullivan, an aspiring British diplomat, criticized Hamilton's enthusiasm: '[you] might have had Spain long ago but [you] was then too immers'd in Volcanoes to bear the idea of quitting Naples'.[15] So natural history was one of a wide range of subjects about which learned men simultaneously conversed in letters.

The scholarly letter of this period was a hybrid of personal and public, composed with a particular reader and a general audience in mind.[16] This duality was manifested in the form, content and circulation of Hamilton's accounts. Some mentions of volcanoes met only the attention of the initial recipient. For instance, Hamilton's letters to Greville include various comments about his volcanic rock collections, observations and beliefs. We have no evidence to suggest these were communicated further.[17] Meanwhile, some of Hamilton's letters were relayed by the Royal Society to its extended membership. Between these two extremes stood a debate about what was intended for, desired by and suited to circulation within and beyond the society. By studying archived manuscripts, I have identified key factors that determined the audience for Hamilton's letters.

The researches of any correspondent were only conveyed to the Royal Society at their recipient's discretion. Maintaining good communicative links involved so many letters that selectivity on the part of recipients was induced by sheer volume. It was also encouraged by closely intermingled passages of general and personal interest. Hamilton was keenly aware that the power to choose and deliver reports, upon which a good reception could depend, rested firmly in London. Accordingly he asked Maty, 'should you find this memoir in its present state too tedious … to pass on to our respectable Society, you will make only such extracts from it as you shall think will be most agreeable and interesting'.[18] Short extracted passages from Hamilton's letters were often communicated when another of his letters was being read in full. For instance, when Morton presented an account describing the 1767 eruption of Vesuvius, he followed it with previously undisclosed letter extracts that Hamilton cited

14 Maty to Hamilton, 5 July 1768, British Library, Additional Manuscripts (subsequently BL.Add.MS) 40 714, f.47.

15 Sullivan to Hamilton, 4 January 1776, quoted by B. Fothergill, *Sir William Hamilton: Envoy Extraordinary*, London, 1969, 147.

16 L. Daston, 'The ideal and reality of the Republic of Letters in the Enlightenment', *Science in Context* (1991), **4**, 367–86, 371.

17 See A. Morrison, *Catalogue of the Collection of Autograph Letters and Historical Documents Formed by Alfred Morrison: The Hamilton and Nelson Papers*, 2 vols., London, 1893–4, i, 21, 25, 37.

18 *PT* (1771), **61**, 43. See also *PT* (1770), **60**, 1.

in support of his developing views.[19] The meaning imposed on old passages by Hamilton's later references rendered them fit for new readers.

Despite the recipient's power of decision, Hamilton was able to influence the distribution of his work. To recognize his persuasive techniques we must follow Bruce Redford's claim that 'the eighteenth-century letter is a performance … an "act" in the theatrical sense'.[20] Although each of Hamilton's letters initially seems to concern only the addressee, they were individually and collectively structured to give some of their number an extended audience. Throughout, Hamilton achieved a smooth and unaffected appearance of epistolary grace. But careful reading reveals the subtle strategies employed to encourage the further dissemination of certain accounts: he chose suitable recipients, sent covering letters, attended to presentation and adopted a distinct rhetorical structure. As Hamilton sought to influence the Royal Society, he turned these seemingly routine elements of communication into powerful tools, showing himself master of the gentlemanly 'art of seeming artless in letter writing'.[21]

Although any FRS could have presented his accounts to the society, Hamilton chose to entrust them to certain council members with whom he developed a prolonged relationship. As secretary, Maty was ideally positioned to understand the expectations surrounding correspondence and employ his powers of selection and representation to maximal effect.[22] His treatment of Hamilton's letters in the following episode shows how he also relied upon his independence as a reader to inform an autonomous, constructive approach.

On at least one occasion, Hamilton attempted to organize the further circulation of his work by dividing his correspondence into two physically distinct parts. In October 1769 he wrote to Maty about assorted matters and enclosed a second letter, which described a journey to Etna, bearing the same date and addressee.[23] This double dispatch indicated that one letter was intended for distribution throughout the society, while the other was a covering note for the secretary alone. Records of both survive today because Maty disagreed with Hamilton's categorization. Having passed on the account of Mount Etna at one society meeting, Maty followed it two weeks later with an extensive extract from the other letter, mentioning the Italian climate, the effects of a tarantula's venom and some further circumstances of Vesuvius's last eruption. As an active selector, rather than passive transmitter, of information, Maty challenged Hamilton's division between material intended for two types of

19 See Hamilton to Morton, 7 April and 6 October 1767, Royal Society Letters and Papers (subsequently RS.L&P), V.3.

20 B. Redford, *The Converse of the Pen: Acts of Intimacy in the Eighteenth-Century Familiar Letter*, Chicago, 1986, 2.

21 W. H. Irving, quoted by A. S. J. Ribiero, 'Real business, elegant civility and rhetorical structure in two letters by Charles Burney', in *Sent as a Gift: Eight Correspondences from the Eighteenth Century* (ed. A. T. McKenzie), Athens, GA, 1993, 93. For the eighteenth-century gentleman's need to appear artless in every social circumstance see S. Shapin, '"A scholar and a gentleman": the problematic identity of the scientific practitioner in early modern England', *History of Science* (1991), **29**, 279–327, 289.

22 Maty was the addressee of eight letters from Hamilton that were read to the society between 1768 and 1773, the most intensive period of Hamilton's society correspondence.

23 See Hamilton to Maty, RS.L&P, V.148 and RS.L&P, V.155.

consumption. Because this is the only documented case, we cannot be sure how many of Hamilton's letters for the society were originally accompanied by more private papers. But assuming this episode was not unique, the non-survival of covering notes indicates the general success of this technique for determining the distribution of his work. When recipients accepted his segregation of material, the covering letter was not read to the society and its existence never logged. Here the historian depends upon disruption within the communications network to discover a system only evidenced by its failure.

Hamilton also insisted on an aesthetic distinction between letters intended for individual and collective audiences. Five out of his seven volcanic letters to the society before 1780 were penned beautifully by an amanuensis on large double-sided pages, to which Hamilton only added final regards and signature (see Figure 1). However, of his numerous letters to Banks that were not passed on, all were hand-written, mostly on small, single-sided paper (see Figure 2).[24] Using an amanuensis for letters intended for the whole society gives evidence of careful preparation and removed idiosyncratic spelling, punctuation and grammar, while references to forthcoming accounts provide further evidence of planning. Two days after one eruption Hamilton wrote to Greville, 'I shall, at my leisure send Bankes a minute account of this most beautifull but really allarming phenomenon.' This 'minute account' took time to produce, but he was able to make brief mention of it to Banks in an informal note one month ahead of his eventual report.[25] This shows that Hamilton invested greater time and effort on those letters he wanted relayed.

The rhetorical structure which Hamilton used when writing for the Royal Society framed his business in deliberate ways. Each letter displayed symmetry about a central axis similar to that identified by Alvaro Ribeiro in the contemporary correspondence of Charles Burney.[26] Commencing 'Sir' (or 'My Lord' when addressing the Earl of Morton), the first paragraph announced Hamilton's own position (grateful receipt of previous letters, publications and guests; recent engagement with volcanoes) and the aim of this letter (transmission of matters of interest, response to requests for information). These sentiments were echoed by the final paragraphs, which summarized Hamilton's intentions (the amusement, satisfaction, entertainment of his readers) and often mentioned further communications (objects or pictures he has sent), before concluding, 'Your most obedient/humble servant/William Hamilton'. Rather than being unnecessary expressions of flattery and ingratiating etiquette, these opening and closing sections illustrated that, although remote, Hamilton was still in touch with the social trends and physical activities of London. As displays of self-revelation ('I am alarmed at the length of this letter … '[27]), they were acts of intimacy that differed from the central narrative's focus on nature. For the reader, these marks of the epistolary genre constructed a credible sense of interaction with the author. By contrast, the

24 For more letters to Banks see BL.Add.MS.34 048.

25 Hamilton to Greville, 10 August 1779 in Morrison, op. cit. (17), i, 59; Hamilton to Banks, 5 September 1779, RS.L&P, VII.129; Hamilton to Banks (full report), 1 October 1779, RS.L&P, VII.130.

26 Ribiero, op. cit. (21), 97.

27 *PT* (1771), **61**, 42.

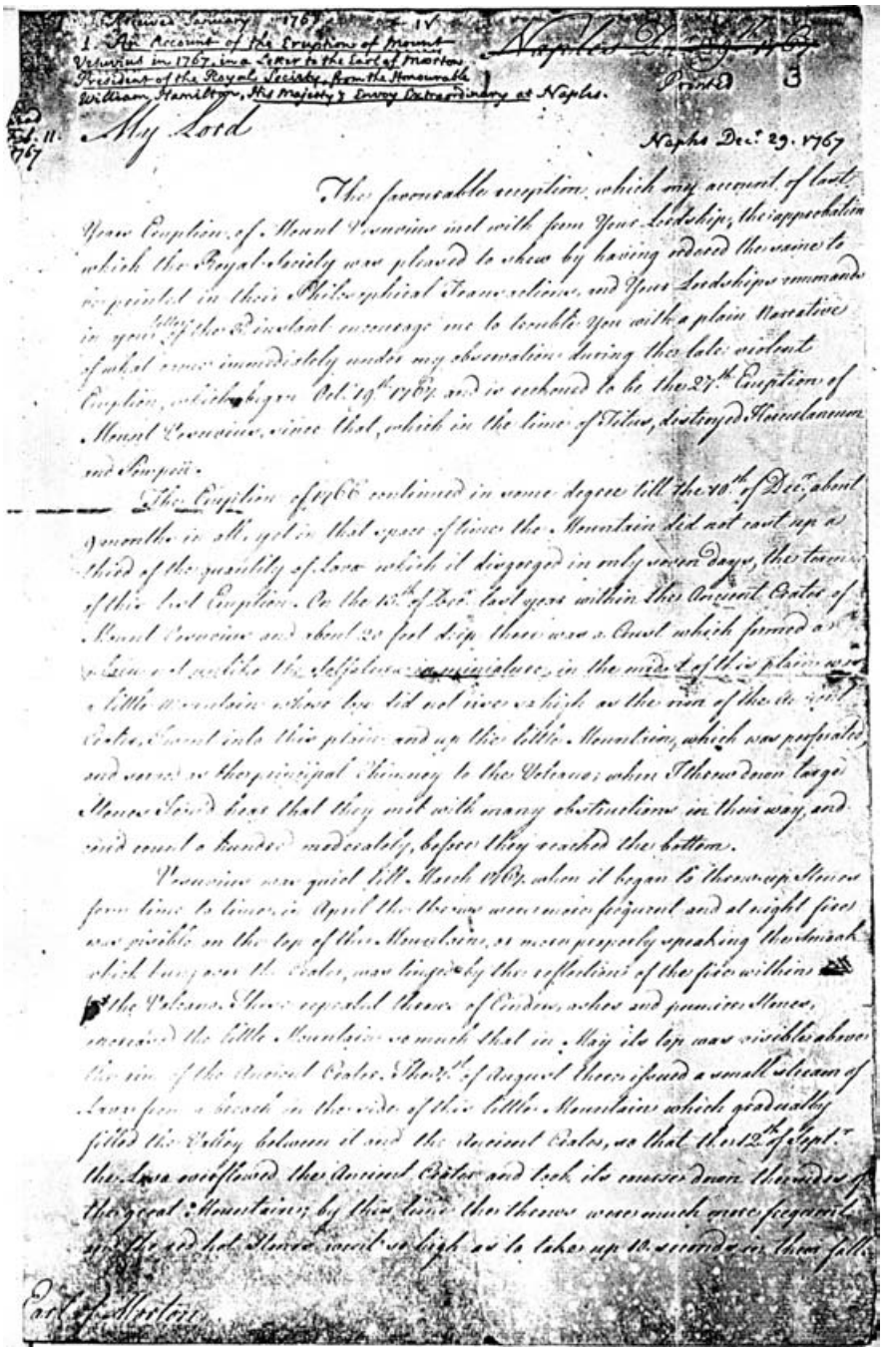

Figure 1. Hamilton to the Earl of Morton, 29 December 1767, RS.L&P.V.3, f. 1 (22.5 × 37.5 cm). ©The Royal Society. This elegant script is by Hamilton's amanuensis. The Royal Society annotations at the top record the dates on which it was received and read, its approval for printing and the title under which it appeared in *Philosophical Transactions*.

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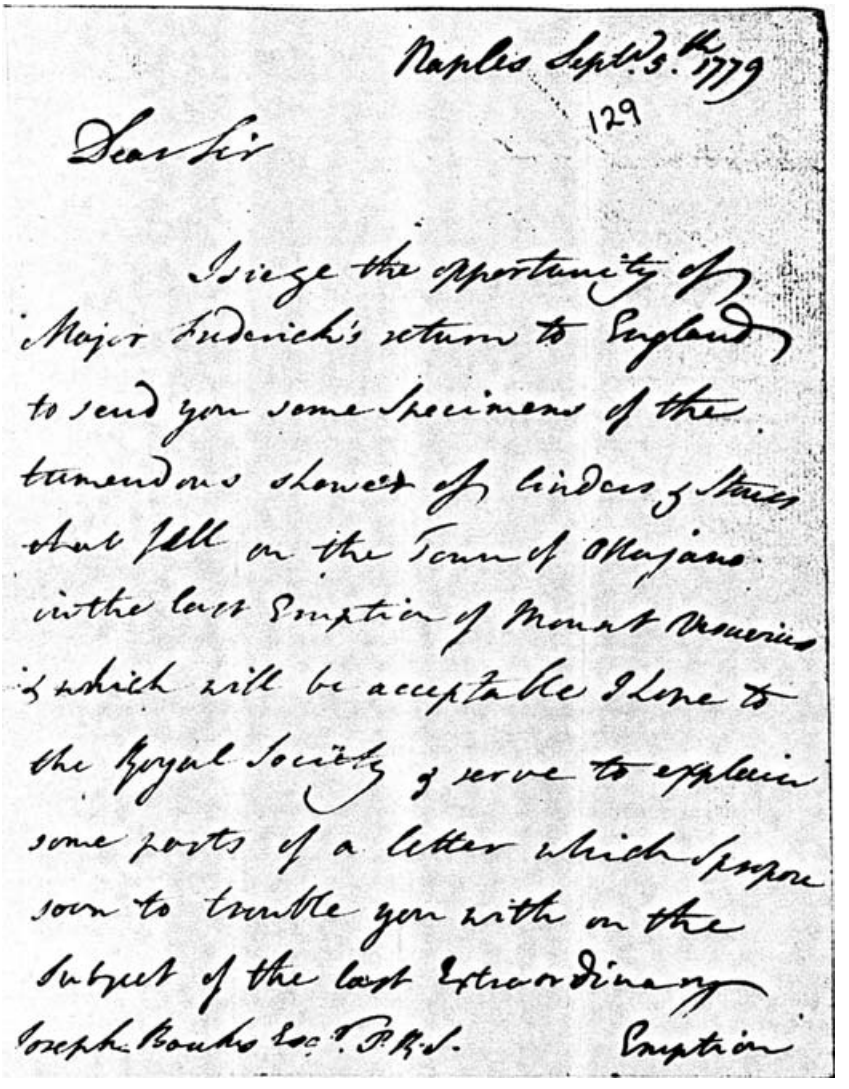
Naples Sept.r 5.th 1779
129
Dear Sir
I seize the opportunity of
Major Frederick's return to England
to send you some Specimens of the
tremendous shower of cinders & Stones
that fell on the Town of Ottajano
in the last Eruption of Monte Vesuvius
& which will be acceptable I hope to
the Royal Society & serve to explain
some parts of a letter which I propose
soon to trouble you with on the
subject of the last Extraordinary
Joseph Banks Esq.r F.R.S. Eruption

Figure 2. Hamilton to Banks, 5 September 1779, RS.L&P.VII.129, f. 1 (19 × 22.5 cm). ©The Royal Society. In a hasty letter to Banks, Hamilton describes some specimens he has collected and a letter he will send soon with details of the recent eruption. The handwriting, line spacing, paper size and linguistic tenor all contrast with other accounts he sends for the Royal Society, for example Figure 1.

conclusive complements and signature in Hamilton's more informal letters were often foreshortened due to lack of space.[28] Intimacy was established through handwriting and frequent reference to mutual acquaintances and interests. With many diverse topics given equal weight, there was often no narrative focus and a highly

28 For example see Hamilton to Banks, 18 January 1785, BL.Add.MS. 34 048, f.20.

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variable structure. The consistent format of letters received by the society therefore reflects Hamilton's use of a distinct style, carefully honed for its rhetorical effect.

Hamilton chose his recipients, wrote covering letters, attended to presentation and structured his accounts to encourage certain distributive practices in his recipients. The success of these techniques testifies to a shared understanding of the conventions governing letters for individual friends and those for a learned society. Working together, parallel networks of published and personal correspondence guided the course of Hamilton's communications. He cited the approbation given to his accounts both by the society as a whole, indicated by publication in *Philosophical Transactions*, and by individual members, who wrote to him personally, as encouragement to send further reports.[29] He also asked 'whether you think this project of mine will be useful; and, if you do, the result of my observations may be the subject of another letter'.[30] This call for personal responses to widely distributed reports shows how private letters conferred meaning on more public ones, while these latter provided subjects and purpose for personal communications.

Creating a spectacle

Having examined the negotiations surrounding the distribution of Hamilton's letters to the Royal Society, let us now consider their course after arrival. Society meetings were an institutionalized mechanism for witness multiplication and the assessment of testimony.[31] Accounts, artefacts and demonstrations were routinely presented to an initiated audience and judged for reliability, authenticity and truth. Although experiments were often witnessed by many people, large groups could not read one letter simultaneously. In the absence of their authors, written reports were therefore read aloud by the secretary. When those present listened to these spoken words, they collectively relived Hamilton's experiences of attention and description. His letters thus became events that can be described as oral spectacles.

Letters for the Royal Society were read during weekly meetings, held on Thursday evenings in Crane Court or, after 1780, in Somerset House. Sixteen of Hamilton's letters were read, in whole or in part, at these gatherings prior to 1780, the longer contributions being spread over two or even three weeks. Minutes record these presentations and show a typical attendance of between ten and twenty 'strangers' (non-members). Although the number of members present went unrecorded, we might estimate an average total attendance of fifty or more. These apparently transparent procedures were facilitated and maintained by more informal networks, which are easily effaced by the focus on institutional structures that the Royal Society invites.[32]

29 For example *PT* (1768), **58**, 1–2.

30 *PT* (1769), **59**, 21.

31 On spaces for collective witnessing see Shapin and Schaffer, op. cit. (2), 336.

32 Minutes are preserved as manuscripts in the Royal Society's *Journal Book* (subsequently RS.JBC). For details of meetings see H. Lyons, *Record of the Royal Society of London for the Promotion of Natural Knowledge*, 4th edn, London, 1940, 98. Meticulous institutional histories include Lyons, above, and C. R. Weld, *A History of the Royal Society*, 2 vols., London, 1868.

Private correspondence supported official readings to the extent that a lack of personal response to one of his papers roused Hamilton's significant concern.[33] Frequent dinners, evening receptions and breakfast parties all helped to nurture private associations between members, alongside society business. Although the society's social composition broadened during the eighteenth century, it retained certain characteristics of an exclusive gentlemen's club.[34]

Society gatherings facilitated a form of collective attention that turned the oration of letters into a literary performance.[35] Hamilton's words, read out over rock specimens, drawings, maps and paintings, sustained a visual focus that invoked the theatricality of a real volcanic scene. The readings were further staged in the sense that many of those present were already familiar with Hamilton's news. Once letters arrived in London, a backlog of business usually produced a period of delay prior to their presentation at meetings, during which reports circulated by other means. Banks, for instance, loaned letters to gauge opinion before they were formally considered.[36] Topical revelations, such as news of a recent eruption in Naples, would rapidly spread through London's conversational networks. Combined with Hamilton's growing reputation, these factors created an expectant and excited audience for his letters.

Holding society practices firmly in mind, Hamilton structured his letters to suit uninterrupted spoken delivery. Each main narrative was a monologue, whose relatively simple chronological scheme banished all enquiries and details of correspondence to the opening and closing paragraphs. This was quite unlike the interactive conversational style typical of less formal letters.[37] Hamilton also designed his prose to be accessible to people beyond the initial recipient. Careful positioning of the term 'you' served to include listeners not explicitly addressed, by asking them to identify with a presupposed ideal virtual witness: 'You have now, Sir, before you the nature of the soil, from Caprea to Naples.'[38] Unable to rely on personal acquaintance, Hamilton established audience rapport through extensive reference to classical authors and texts, familiar resources for any learned gentleman. He emphasized loyalty: 'I should think myself in some degree guilty of a neglect towards the Royal Society … if I did not … relate to them such remarkable circumstances as attended the late tremendous explosions of Mount Vesuvius.'[39] If society membership entailed communicative duties, Hamilton's location and experiences obliged him to correspond. As Hamilton strove for recognition, he argued that exacting observational practices were essential for any reliable witness. Both attention and description were skilled practices for which

33 Hamilton to Greville, 8 June 1773, in Morrison, op. cit. (17), i, 21.

34 Sorrenson, op. cit. (3), 33–7; M. B. Hall, *All Scientists Now: The Royal Society in the Nineteenth Century*, Cambridge, 1984, 1, 4.

35 Miller, op. cit. (3), 155–66, 162.

36 For an example see W. R. Dawson, *The Banks Letters: A Calendar of the Manuscript Correspondence of Sir Joseph Banks*, London, 1958, 347.

37 See B. Rizzo, 'Banter and testimony, supplication and praise, in the letters of Christopher Smart', in *Sent as a Gift: Eight Correspondences from the Eighteenth Century* (ed. A. T. McKenzie), Athens, GA, 1993, 84.

38 *PT* (1771), **61**, 15.

39 *PT* (1780), **70**, 43.

he was well qualified: 'After having ... been accustomed to these observations, I was well prepared to visit the most ancient, and perhaps the most considerable volcano that exists.' Through rhetoric – 'Who that has had an opportunity of making observations on volcanos does not know ... ?' – he insisted that only observation combining acts of attention and description brought progress in natural history.[40] By carefully recording his own practices, he distinguished himself from lesser observers.

To pay full attention to some object was to focus concentration entirely upon it and become absorbed to the exclusion of everything else.[41] Attending properly to nature was not an event but a way of life. Hamilton's first published letter thus appropriately opened as follows: 'I have attended particularly to the various changes of Mount Vesuvius from ... the day of my arrival ... '. Hamilton was an interactive witness, taking samples and instrumental readings, and probing nature with sticks and stones. He described volcanic study as an occupation of leisure, but stressed the value of unrelenting diligence. That he made such remarkable observations was indeed 'owing to ... perseverance, and some degree of resolution'.[42] This emphasis on gentlemanly but persistent and methodical pursuit would have endeared him to a society known to value a patient commitment to first-hand observation.[43]

To accumulate and communicate knowledge through observation required description. On this subject, too, Hamilton's letters were designed to appeal to his distant audience. Good descriptions captured in textual, numerical, pictorial or physical forms everything the attentive observer had seen. Hamilton's 'particular' accounts claimed to be 'plain', 'truthful' and 'exact': 'my description ... I assure your lordship, is not exaggerated'.[44] Recording circumstantial details implied accuracy and reliability,[45] while extensive use of metaphor helped readers to envisage unfamiliar phenomena. Using animistic vocabulary to express the activity of subterranean forces, he recorded mountains that had 'fever-fits' and 'vomited flames'.[46] With an audience in industrializing England clearly in mind he asserted that the ground quivered 'like the timbers of a water-mill'; while the surface of lava was rough 'like the cinders of scoriae from an iron foundery'. One lava stream apparently ran 'with a velocity equal to that of the river Severn, at the passage near Bristol', whose surface 'had the appearance of the river Thames ... after a hard frost and great fall of snow'.[47] To emphasize the strangeness of his experiences, Hamilton counteracted these familiar associations with some more bizarre analogues: 'this lava resembled a rich Parmesan cheese, which,

40 *PT* (1770), **60**, 2; *PT* (1771), **61**, 29.

41 For a fascinating account of the cultural significance and representation of absorption see M. Fried, *Absorption and Theatricality: Painting and the Beholder in the Age of Diderot*, London, Berkeley and Los Angeles, 1980.

42 On attention see *PT* (1767), **57**, 192; on measurement see *PT* (1770), **60**, 15; on interactions see *PT* (1768), **58**, 2 and *PT* (1767), **57**, 196; on leisure see *PT* (1769), **59**, 21; on resolution see *PT* (1780), **70**, 46.

43 Sorrenson, op. cit. (3), 32.

44 Last quotation from *PT* (1767), **57**, 200.

45 K. Whitaker, 'The culture of curiosity', in *Cultures of Natural History* (ed. N. Jardine, J. A. Secord and E. C. Spary), Cambridge, 1996, 82.

46 *PT* (1780), **70**, 61; *PT* (1771), **61**, 36.

47 *PT* (1767), **57**, 196; *PT* (1771), **61**, 19; *PT* (1767), **57**, 196–7.

when broken and gently separated, spins out transparent filaments from the little cells that contained the clammy liquor of which those filaments were composed'![48]

Hamilton complemented this literary apparatus with other descriptive media, derived from his passion for landscape art and rock collection.[49] He sent paintings, line drawings, a map and various lava and soil samples for people to refer to whilst they read. The meetings actively encouraged this by speaking his words aloud, freeing the audience's eyes to examine his other exhibits. Thereafter they were to be displayed at the Royal Society museum. The society regularly received such gifts, but Hamilton made an unusually specific claim: 'Though I have endeavoured to be as particular and clear as possible in the description I have given of the curious substances … specimens of those substances will explain more at one sight than I can pretend to do by whole pages in writing.' Whether in good faith or with false modesty, Hamilton still admitted to limitations: 'I am sensible of what I undertake in giving you, Sir, … a very imperfect account.'[50] His continual search for new descriptive techniques resulted in one image, no longer extant, 'painted with transparent colours, and, when lighted up with lamps behind it, gives a much better idea of Vesuvius, than is possible to be given by any other sort of painting'.[51] Pringle's response testified to this unprecedented method's power to create virtual witnesses: 'The representation of that terrible scene by means of transparent colours was so lively and so thinking that there seemed to be nothing wanting in us distant spectators but the fright that anybody must have been seized by who was near.'[52]

To characterize his own observational practices, Hamilton carefully contrasted them with alternative behaviour. When Edmund Burke defined the sublime aesthetic he characterized its effects by feelings of astonishment in which the mind was overcome and rendered incapable of reasoning.[53] But despite being awe-struck by certain scenes, Hamilton resolved to document his experiences by identifying and describing the exact features of each phenomenon's rarity. For instance, 'The sun arose and displayed a scene that indeed passes all description', but describe it he did, filling the next two pages with detail. As an attentive observer, Hamilton thus responded to sublimity with reasoned, articulate wonder, rather than the dumb bewilderment he identified in others. At a time when speechless wonder was a hallmark of the barbarous, Hamilton appropriately found it amongst the unruly inhabitants of Naples.[54] Their habitual lack of attention apparently perpetuated 'the vulgar and false supposition that volcanos burn much more violently at night than in the day-time'. Similarly, by using

48 *PT* (1780), **70**, 81.

49 The descriptive power of picturing is usefully examined by S. Alpers, *The Art of Describing: Dutch Art in the Seventeenth Century*, Chicago, 1983.

50 *PT* (1780), **70**, 83; *PT* (1771), **61**, 3.

51 *PT* (1768), **58**, 12. See also M. A. Cheetham, 'The taste for phenomena: Mount Vesuvius and transformations in late eighteenth-century European landscape depiction', *Wallraf Richartz Jahrbuch* (1984), **14**, 131–44, 134.

52 Pringle to Hamilton, 1768, BL.Add.MS.42 069 f.61.

53 E. Burke, *A Philosophical Enquiry into the Origin of Our Ideas of the Sublime and the Beautiful*, London, 1757.

54 *PT* (1770), **60**, 12–13; *PT* (1768), **58**, 9; *PT* (1780), **70**, 55, 56.

the term 'meteors' for 'what are vulgarly called falling stars', Hamilton distanced himself from conventional wisdom to assert the superiority of his own views and practices.[55]

Heavily reliant upon his own interests being shared by his audience at the society, Hamilton chose curious observations as the pretext for all his letters. Following a long tradition in which 'singular', 'unusual' and 'extraordinary' were stock adjectives of scientific journals, he described 'extraordinary appearances', 'curious substances' and 'remarkable circumstances'. Hamilton's letters drew readers into their narrative by mentioning something uncommon at the opening and reiterating its novelty at the close. Each contained the observations of several days, and so foreshortened the experience of direct witnessing by condensing numerous acts of attention and measurement into one document. The magnifying effect of such densely packed detail heightened the fascination of each phenomenon described.[56]

The Copley Medal, the Royal Society's most prestigious annual award, was awarded to Hamilton 'for his curious observations repecting Mount Ætna and published in the Transactions for the year 1770'. His lengthy article narrated a three-day tour of Sicily undertaken by Hamilton with two companions. Comparing the soils, vegetation, rocks and caverns of Etna with those of Vesuvius, he found similarities that confirmed him in his beliefs about 'the formation of very considerable mountains by meer [*sic*] explosion'.[57] During the presentation speech, James West, PRS, commended Hamilton's 'diverse curious observations and experiments greatly tending to the illustration of natural knowledge, the proper business of this society'.[58] This helps to explain why his letters attracted such attention. Hamilton used a common language of curiosity that gave members of the Royal Society both the incentive and the ability to interpret his work. Convinced by his purpose and methodology, readers were then more likely to accept a theory of constructive volcanic action and its radical implications for the age of the Earth.

Producing the *Transactions*

After society meetings the Committee of Papers considered all reports that had been read aloud for publication in *Philosophical Transactions*. Here Hamilton's letters were scrutinized, edited and translated into a printed form which took his observations to a larger audience. Rather than simply replicating existing documents and the witnessing experiences they provided, *Philosophical Transactions* re-embodied Hamilton's observations. Let us examine the material changes that occurred when his reports were prepared for publication. More than mere accidents in the transmission

55 *PT* (1780), **70**, 42, 49; *PT* (1769), **59**, 18. On different types of curiosity and wonder see Whitaker, op. cit. (45), 80–2; and L. Daston and K. Park, *Wonders and the Order of Nature, 1150–1750*, New York, 1998, 328, 343–4.

56 *PT* (1767), **57**, 192; *PT* (1780), **70**, 83; *PT* (1780), **70**, 43 – these selected from abundant examples. Daston and Park, op. cit. (55), 231, 312.

57 *PT* (1770), **60**, 2.

58 RS.JBC, 30 November 1771. On the medal see Weld, op. cit. (32), i, 385.

of individual texts, these editorial decisions shaped both the witnessing experience delivered by specific articles and the characteristic tone, structure and format of the journal.[59]

Portraying itself as a neutral disseminator of work, *Philosophical Transactions* followed the 'established rule of the Society … never to give their opinion as a body upon any subject, either of nature or art, that comes before them'.[60] This stance distanced the journal from disputes but disguised its more constructive roles as the primary forum for scientific papers in England at this time.[61] By featuring only a selection from the many reports considered, it did confer a measure of legitimacy upon its contents. Articles in *Philosophical Transactions* both shaped readers' understanding of learned discourse and governed the Royal Society's reputation. In preparing this journal, the Committee of Papers therefore exerted considerable influence over the status of individual authors, their work and the society as a whole. The committee was composed of the elected council, chaired by the president and strongly guided by the secretary, sole co-ordinator of the journal prior to 1752.[62] Members familiarized themselves with reports through the mechanisms already described. But at committee meetings they redirected their attention towards critical evaluation. Instead of personally reliving encounters, their task was to translate them into articles that conveyed a virtual witnessing experience to new readers. Their products included eight papers in *Philosophical Transactions* before 1780 under Hamilton's name.

Fortunately for the historian the society took the unusual step of retaining original copies of its published work. Filed in the library, these 'Letters and Papers' were and remain available for Fellows and guest applicants to consult.[63] Just as the society museum housed a reference collection of curious objects, its library functioned as a museum of letters. Indicative of a perceived need for authentic records to protect against fraudulence and dispute, this practice also evidenced reverence for the written word. As embodiments of individual labour, these letters were literally 'sent – and received – as gifts'.[64]

Detailed comparison between published and archived documents reveals how *Philosophical Transactions* reflected society mechanisms for managing testimony and specifically the activities of the Committee of Papers. The committee's actions now still mediate any encounter with Hamilton's original letters. Thick black ink indelibly marks a date and title upon each front page (see Figure 1). Untidy lines designate certain passages for exclusion, correct spelling and grammatical errors; divide convoluted sentences into two; move long quotations into footnotes; and indicate

59 For the significance of editorial details see L. Price, *The Anthology and the Rise of the Novel: From Richardson to George Eliot*, Cambridge, 2000, 10.

60 Royal Society advertisement, quoted in Weld, op. cit. (32), i, 521.

61 R. Porter, 'The making of the science of geology in Britain 1660–1815', Ph.D. dissertation, number 9193, University of Cambridge, 1974, 116.

62 Hall, op. cit. (34), 9–10.

63 All papers read at meetings became society property. See Lyons, op. cit. (32), 314; Hall, op. cit. (34), 7.

64 This phrase taken from Bruce Redford.

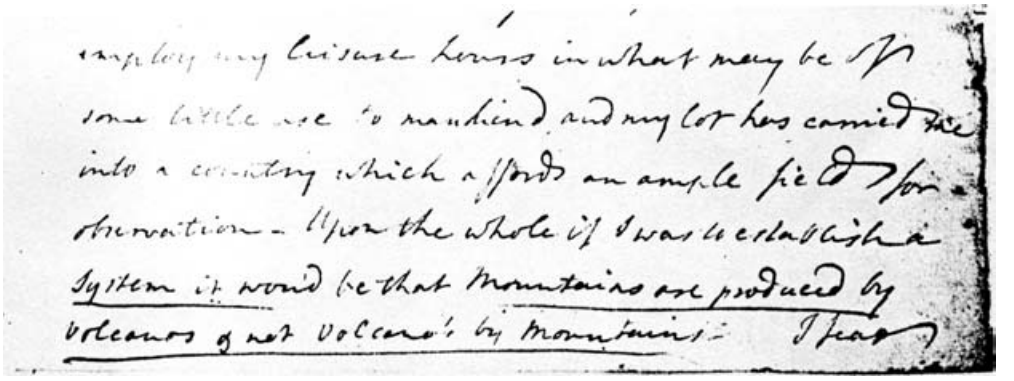


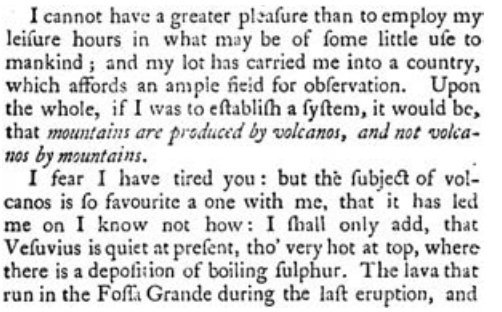
Figure 3. Part of a letter handwritten by Hamilton to Maty, 4 October 1768, RS.L&P.V.71 f. 5. ©The Royal Society. The last sentence reads, 'Upon the whole if I was to establish a system it wou'd be that Mountains are produced by volcanos & not volcano's by mountains'. Hamilton frequently used underlining and on his messy page it has limited impact. Compare with Figure 4.

page breaks.[65] By contrast, as journal articles Hamilton's reports appear in regular typescript, surrounded by wide margins on small quarto pages. They were published quarterly and bound into annual volumes in which a standardized system of spelling, punctuation and presentation created consistency across diverse contributions. This shared physicality had several consequences. By implying that all accounts received the same systematic treatment, it emphasized formal procedures for unbiased review. Direct comparison was easier between published articles than between reports in their various original forms, so it encouraged readers to cross-reference and critique. By presenting a huge variety of observations in a similar format, *Philosophical Transactions* contextualized Hamilton's volcanic research as one small part of the society's broader endeavour. Visual uniformity also set deviations from standard script into striking relief, enabling the Committee of Papers to emphasize words that had previously been less obvious (see Figures 3 and 4).

Headings guided readers as to how each article should be approached.[66] In Hamilton's case, they prefaced each contribution with a short statement categorizing its type ('A letter', 'an account') and subject matter ('… containing some further particulars on Mount Vesuvius …'; '… of a journey to Mount Etna …' and so on). In line with contemporary practice, letter titles in *Philosophical Transactions* also included author and recipient designations. These located our author as a diplomat, resident in the region he described ('… from the Honourable William Hamilton, His Majesty's Envoy Extraordinary at Naples') and his correspondents as society office

65 Such modifications followed a long tradition. Henry Oldenburg, founder of *Philosophical Transactions*, extensively revised his material; see S. Shapin, 'O Henry', *Isis* (1987), 78, 417–24, 420. For another example of editing correspondence for publication see P. Fara, *Sympathetic Attractions: Magnetic Practices, Beliefs, and Symbolism in Eighteenth-Century England*, Princeton, 1996, 252, fn 62.

66 For more on titles and social signalling see A. G. Gross, J. E. Harmon and M. Reidy, *Communicating Science: The Scientific Article from the Seventeenth Century to the Present*, Oxford, 2002, 83–4.



I cannot have a greater pleaſure than to employ my leiſure hours in what may be of ſome little uſe to mankind; and my lot has carried me into a country, which affords an ample field for obſervation. Upon the whole, if I was to eſtabliſh a ſyſtem, it would be, that *mountains are produced by volcanos, and not volcanos by mountains.*

I fear I have tired you: but the ſubject of volcanos is ſo favourite a one with me, that it has led me on I know not how: I ſhall only add, that Veſuvius is quiet at preſent, tho' very hot at top, where there is a depoſition of boiling ſulphur. The lava that run in the Foſſa Grande during the laſt eruption, and

Figure 4. The passage in Figure 3 as it appeared in *Philosophical Transactions* (1769), **59**, 21. ©The Royal Society. Here deviation from regular print is effective for laying emphasis on this crucial sentence. Italics in *Philosophical Transactions* were unusual, appearing only once in this article.

holders ('… to the Earl of Morton, President of the Royal Society'; '… to Matthew Maty, M. D. Sec. R. S.' and so on). These prominent attributions constructed reputations for authors and recipients alike. Subheadings giving the date upon which each letter was read aloud further advertised the society's communicative routine.

The published articles also retained strong vestiges of their previous form. *Philosophical Transactions* distributed knowledge in detached pieces, an endeavour aptly presented by sequential letters. Several titles identify the previous appearance of Hamilton's work, and his epistolary starts and finishes are printed in full – 'Sir, … Your most obedient/humble servant, William Hamilton'. Statistical study shows that articles in this format were common and displayed a distinctive style. As letters, these epistolary articles were unusual for the extent to which, between the opening and closing passages, personal and social concerns faded behind observational detail and measurement.[67] This trend exactly fits the distinctions already described, between Hamilton's letters to individual friends and those for the Royal Society. A review of his work in its printed context can thus illuminate the relationship between his writing and contemporary publishing conventions.

Widely circulating articles encouraged communication between contributors and promoted natural philosophy as a group endeavour.[68] But the logic of interactive discourse was easily lost when journals recorded only half a conversation. After studying some of Hamilton's letters and rock samples, Dr Morris, FRS in London, produced a series of specific questions concerning the thickness, structure and location of volcanic strata, which Maty relayed. Hamilton responded, 'As far as I am able I readily undertake to answer Dr Morris's queries, my answers are here inclosed', framing this letter as an attempt to deal directly with Morris's concerns. When it appeared in *Philosophical Transactions*, however, all references to Morris were omitted. Instead, the report is

67 During the eighteenth century nearly one in three introductions to English scientific articles looked like a letter. Gross, Harmon and Reidy, op. cit. (66), 69–71.

68 Daston and Park, op. cit. (55), 241. See Samuel More's published response to Hamilton, *PT* (1781), **71**, 50–2.

portrayed as a spontaneous dispatch entitled 'A letter … containing some farther particulars on Mount Vesuvius and other Volcanos in the neighbourhood'.[69]

Just as Hamilton structured his letters to suit spoken delivery, he also adapted his work over time to fit journal publication. Successive reports moved towards the standard printed layout until, by 1779, Hamilton's letter to the Royal Society actually looked like an article. Numbered pages of regular script use a comprehensive footnoting system to separate quotations from the main text. Hamilton's own editorial decisions apparently met with the full approval of the Committee of Papers which published this letter almost without change.[70] Narrowing the stylistic gap between the letters sent to society members, the monologues heard at their meetings and the articles published in their journal both eased and encouraged the movement of observations between these formats.

Hamilton's articles, like his letters, integrated words with images and objects. But the norms of journal production and the challenge of translating pictures and specimens strengthened the relative importance of text. In the case of pictures, black-and-white mezzotint plates replaced vibrantly coloured paintings. The processes of transformation are hard to discern because only two original images remain in the society archives and these bear no editorial scars. Direct comparison between printed and painted images shows a dramatically reduced sense of atmosphere, subtlety and depth, as well as some alterations to the reference system. Within each volume of the journal, a single artist contributed to the impression of consistent Royal Society procedures discussed above.[71] However, even viewed solely through articles, Hamilton's pictorial descriptions remained unusual. That five engravings accompanied eight articles showed an uncommonly strong visual focus.[72] The close relationship between his panoramic eruption scenes and landscape art (see Figure 5) was unique amongst *Philosophical Transactions*' typical images of instruments and specimens. By providing the considerable resources necessary to produce such plates, the Committee of Papers acknowledged that pictures were important for Hamilton's project. But the journal failed to retain the visual impact of the original reports.

Publication also diminished the descriptive role of objects. Hamilton's letters made close reference to samples that 'I have put into bottles myself … and have sent … in a box directed to your lordship'.[73] Spoken at Royal Society meetings, these words derived meaning from the physical presence of the objects concerned. But printed in *Philosophical Transactions* they referred to collections in a London museum that were inaccessible and effectively irrelevant to most readers. The Committee of Papers

69 Maty to Hamilton, 5 July 1768, BL.Add.MS.40 714, f.47; Hamilton to Maty, 4 October 1768, RS.L&P, V.71; *PT* (1769), **59**, 18–22.

70 See Hamilton to Banks, 1 October 1779, RS.L&P, VII.130, f.18. Footnoted text is at the bottom of the page, under the heading '(Notes)'. For the same text as it later appeared, see *PT* (1780), **70**, 74–5. Apart from the division of one paragraph into two, no editorial changes were made between letter and published article.

71 There was less consistency between volumes due to the employment of engravers with different styles of depiction. Compare *PT* (1768), **58**,13–14 (anonymous engraver) with *PT* (1780), **70**, 84 (Basire).

72 Typically, four in ten scientific articles in the eighteenth century included tables or illustrations, of which only one-third were 'likenesses'. Gross, Harmon and Reidy, op. cit. (66), 104.

73 *PT* (1767), **57**, 199.

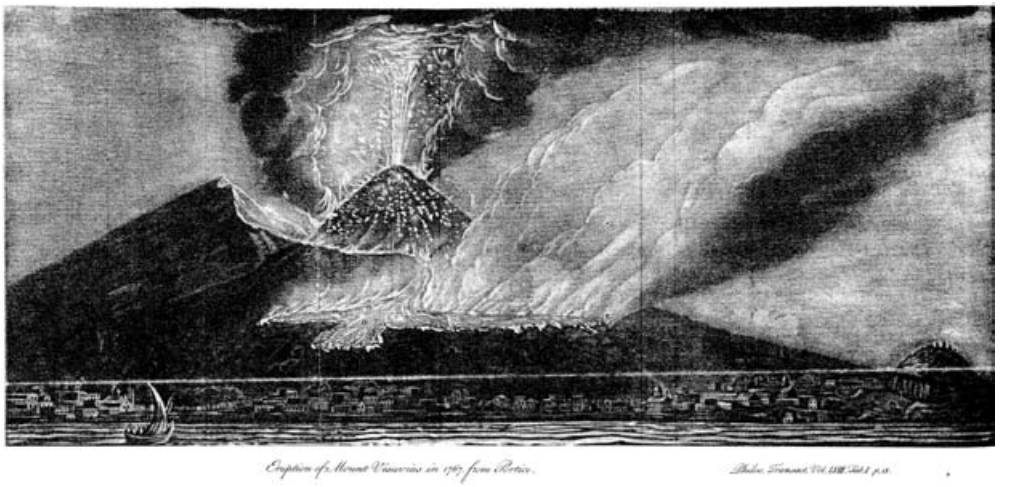


Figure 5. 'Eruption of Mount Vesuvius in 1767, from Portici', *Philosophical Transactions* (1768), **58**, facing 13 (17.3 × 39 cm). ©The Royal Society. This foldout engraving followed one of Hamilton's articles, with a page identifying each numbered and lettered feature. The original painting sent to the Royal Society has been lost.

did not attempt to translate the objects for publication, and so erased them in all but reference from Hamilton's descriptive apparatus. Journal readers therefore received a curtailed witnessing experience and the significance of the objects themselves faded. The specimens Hamilton had painstakingly collated and transported were soon divided and relocated, unlabelled, such that none can now be identified.[74] Three of his five pictures have also been lost, despite the enormous archival care taken over his written manuscripts. By reducing the role of images and objects to frame text as the primary mode of description, the Committee of Papers expressed a value hierarchy that closely mirrored the fate of Hamilton's original work.

Turning now from the immediate material consequences of the publication of *Philosophical Transactions*, we consider its effects upon the circulation of Hamilton's work. All Fellows of the Royal Society, 418 at home and 140 abroad in 1776, received a copy paid for by annual subscription. The society's bookseller, Peter Elmsey, sold many copies to a less traceable audience.[75] Through direct purchase or loan from libraries and private collections, *Philosophical Transactions* took Royal Society business to entirely new constituencies, including foreign residents, artisans, aspiring FRS candidates and women. His observations were also re-consumed by people who had heard them at meetings or read them first-hand, proving that his articles and letters were each valued in distinct ways. The articles notably circulated back to Hamilton himself, who used them to guide his future labours. The Royal Society's mechanisms of report evaluation and reproduction simultaneously added a measure of authority

74 Moore, op. cit. (9), 186.
75 Royal Society archives, *List of Fellows of the Royal Society*, 1775–1824. Weld, op. cit. (32), i, 522.

to his observations and rendered them more socially and physically mobile than ever before.

Philosophical Transactions began a relentless proliferation of printed material which distributed Hamilton's work even more widely. The *Annual Register* quickly presented his articles to a huge audience with no necessary interest in natural history, as matters of current affairs alongside state papers and poetry.[76] Meanwhile, Thomas Cadell, bookseller in the Strand, won the author's approval to compile a small, cheap edition of letters 'for the Convenience of such [lovers of natural history] as may have an opportunity of visiting the curious Spots described in them'.[77] When the *Gentleman's Magazine* reviewed a reprint of one article, it discussed Hamilton's journey and companions in greater depth than it did the eruption. Hutton, Shaw and Pearson later re-wrote the letters in the third person and cut the epistolary start and finish of the letters to condense 135 years of *Philosophical Transactions* into eighteen volumes.[78]

For Rees's *Cyclopaedia* these articles informed the entry under 'Volcano'. The 'usual symptoms of an approaching eruption' were described using Hamilton's words, by omitting the particular towns, mountains and people originally mentioned. Mixing the content of several letters, Hamilton's explanations for these phenomena were then related.[79] By contrast, when Lobley used the articles it was for a compendium of every Vesuvian eruption on record. While making extensive use of dates, measurements, temperatures, heights and descriptions, the travel narratives and theories were largely omitted.[80] Hamilton's increasingly well-known descriptions were soon found in an array of travel guides, diaries and reference texts, inexpensive to buy and widely available to borrow from burgeoning networks of lending libraries across the country.[81]

It was impossible to retain authenticity in this web of reproduction.[82] As descriptions were printed, reprinted, abridged, extracted and compiled, repeated editorial cycles removed them ever further from their original form. Quotation marks were rarely

76 For reprints of six Hamilton articles see *Annual Register* (1767), 201–3; (1769), 66–71; (1770), 68–70; (1771), 71–80; (1772), 62–83; (1780), 72–91.

77 'The Editor to the public', in William Hamilton, *Observations on Mount Vesuvius, Mount Etna and Other Volcanos* (ed. T. Cadell), London, 1772.

78 See C. Hutton, G. Shaw and R. Pearson, *The Philosophical Transactions of the Royal Society of London from their Commencement in 1665 to the Year 1800 Abridged*, 18 vols., London, 1809, viii, 1–7, 92; xii, 592–3; xiv, 276–8, 613–24.

79 'Volcano', in Abraham Rees, *Cyclopaedia, or an Universal Dictionary of Arts and Sciences by E Chambers*, London, 1783.

80 J. L. Lobley, *Mout Vesuvius: A Descriptive, Historical, and Geological Account of the Volcano*, London, 1868, 16–19.

81 For examples of Hamilton's work in contemporary travel literature see H. Swinburne, *Travels in the Two Sicilies in the years 1777, 1778, 1779 and 1780*, 2nd edn, 4 vols., London, 1790, i, 84–7; P. Brydone, *A Tour through Sicily and Malta in a Series of Letters to William Beckford, Esq.*, London, 1773, 22–4; J. Moore, *A View of Society and Manners in Italy: With Anecdotes Relating to Some Eminent Characters*, London, 1781, 173. For the wide availability of these texts see Porter, op. cit. (61), 408–10, 426.

82 See A. Johns, 'Print and public science', in *The Cambridge History of Science, Volume 4: Eighteenth-Century Science* (ed. R. Porter), Cambridge, 2003, 542–9.

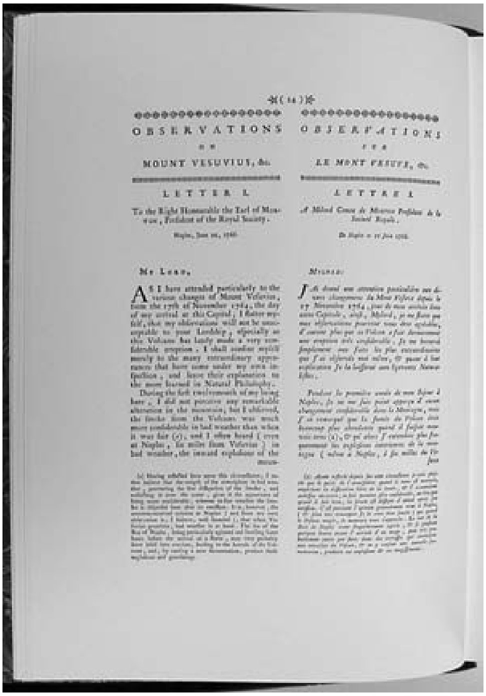
Figure 6. 'View of MOUNT VESUVIUS in Naples with the eruption of Smoke, Fire, Lava &c', (18.7 × 28.7 cm). Private collection, reproduced by permission. Although this isolated print has no date or record of origin, it probably dates from the nineteenth century. The distinctive lava flow suggests Hamilton's work was the original source of its image; see Figure 5. The labelled features have been removed, while the decorative border, change of caption and enlarged flames enhance the drama of the scene.

used, even around blocks of text copied verbatim from published articles. Copied pictures often went unaccredited. A comparison of Figures 5 and 6 in this paper shows that one image from *Philosophical Transactions* found its way into the ephemeral, anonymous world of the print shop.[83] In their most pervasive forms, Hamilton's observations were also at their least stable.

Enriching description

By including parcels and pictures, Hamilton's contacts with the Royal Society had pushed the boundaries of correspondence as a medium. But when an adequate description delivered nothing less than the experience of being a direct witness, the limitations of letter-writing could frustrate even an accomplished correspondent. In 1773 he embarked upon *Campi Phlegraei: Observations on the Volcanos of the*

83 For another engraving of this image see 'View of the GREAT ERUPTION of VESUVIUS 1767 from Portici' (8.3 × 14.6 cm) in Hamilton, op. cit. (77), facing 42.


OBSERVATIONS ON MOUNT VESUVIUS, &c.

LETTER I.

OBSERVATIONS SUR LE MONT VESUVE, &c.

LETTRE I.

Figure 7. The opening text of William Hamilton, *Campi Phlegraei: Observations on the Volcanos of the Two Sicilies*, Naples, 1776, 14 (32.5 × 46 cm). Reproduced by permission of the Whipple Library, University of Cambridge. The paper and print of this edition are of the highest quality. On each spacious page two columns provide English and French text in parallel.

Two Sicilies,[84] a magnificent folio edition of letters accompanied by a volume of fifty-four hand-coloured plates. Against a background in which his observations were propagating through cheap, crude commercial networks, the look and feel of each new bilingual page instantly signified quality and expense (see Figure 7). Despite textual similarities with previous embodiments of his observations, the pictures and physical impact of *Campi Phlegraei* offered an entirely new encounter. It intrigued beholders, inviting practices of scrutiny and attention that echoed Hamilton's own. Using widely read and recycled journal articles, Hamilton created a luxury object, which was as rare and beautiful as the phenomena it described. Here we explore the techniques employed to deliver an enhanced witnessing experience.

Campi Phlegraei was radically different from, yet heavily influenced by, the previous movements of Hamilton's observations. According to the subtitle its contents were 'As they have been communicated to the Royal Society of London by Sir William Hamilton, K.B.F.R.S., His Britannic Majesty's Envoy Extraordinary, and Plenipotentiary at the Court of Naples'. In fact the new pictures gave a far more

84 Neapolitan printer identified as Paolo De Simone in C. Knight, 'Sir William Hamilton's *Campi Phlegraei* and the artistic contribution of Peter Fabris', in *Oxford, China and Italy: Writings in Honour of Sir Harold Acton on his 80th Birthday* (ed. E. Chaney and N. Ritchie), London, 1984, 195.

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elaborate and extensive visual description than had his letters. Even the texts were not as they had been communicated *to* the Society, but *by* the Society, consisting of five articles almost exactly as published in *Philosophical Transactions*. Despite a new Introduction and some changes to footnotes and titles, *Campi Phlegraei* retained many journal features, including the omission of certain passages from Hamilton's original letters. The repetition of these changes acknowledged the Royal Society's editorial authority and encouraged readers to credit this independent publication with the status of a learned journal.

However, encountering Hamilton's work in *Campi Phlegraei* was different from reading it as isolated letters or articles. Here all the curious phenomena that Hamilton had described were concentrated into one volume with exhilarating effect. Reading temporally distributed letters, one immediately after another, compounded the foreshortening already present within each text such that the region appeared continually volcanically active. Cross-referencing footnotes lent his project coherence, helping the collected letters give readers the perception of an enduring relationship with Hamilton. Rather than documenting isolated encounters with nature, his letters now chronicled the parallel development of author and landscape. Thus, like the epistolary novels of the time, *Campi Phlegraei* exploited serial correspondence to deliver intimacy and narrative power.[85]

Although the Royal Society preferred English, French dominated the learned world in the eighteenth century, including the court in Naples.[86] So Hamilton's inclusion of a French translation contributed both an international readership and a desirable air of cosmopolitanism. But it also added complexity, acknowledged by an apology for 'the little errors of the press which have been unavoidable owing to the Printers ignorance of the two languages in which this book is printed'.[87] As Hamilton complained to his nephew, 'I have been obliged to be the translator, corrector, inspector &c., &c.' and despite his efforts, frequent typographical errors remain.[88] In a new letter addressed to Pringle, Hamilton wrote a polemical introduction which dedicated *Campi Phlegraei* to the Royal Society.[89] Justifying this latest project, Hamilton emphasized his acts of unremitting attention: 'No one, I may venture to affirm, has ever follow'd up their remarks on one subject with greater assiduity, and constancy, than I have in the course of above 10 years residency at Naples.' Although his letters were scrupulously prepared, he remained 'still sensible of the great difficulty of conveying a true idea of the curious country I have described, by words alone'. So rather than accept this limitation, he argued that the 'Drawings that accompany this edition of my letters will shew at one glance more than volumes could possibly describe'.[90]

85 M. McKeon, 'Prose and fiction in Great Britain', in *The Cambridge History of Literary Criticism: The Eighteenth Century* (ed. H. B. Nisbet and C. Rawson), Cambridge, 1997, 260.

86 Daston, op. cit. (16), 376; P. Thornton and H. Dorey, *A Miscellany of Objects from Sir John Soane's Museum*, London, 1992, 17.

87 'Advertisement', W. Hamilton, *Campi Phlegraei*, Naples, 1776 (subsequently *CP*), 100.

88 Hamilton to Greville, 1776 in Morrison, op. cit. (17), i, 48.

89 For dedication see *CP*, 6.

90 *CP*, 12, 5, 12.

Figure 8. 'View of the great eruption of VESUVIUS from the mole of Naples in the night of the 20.th of Oct.r 1767', William Hamilton, *Campi Phlegraei*, Naples, 1776, Plate 6 (image size: 22 × 40 cm). Reproduced by permission of the Whipple Library, University of Cambridge. The colour, size, foreground features and detailed references of this image create a more powerful viewing experience than previous engravings of the same scene. Compare with Figures 5 and 6. For a colour reproduction see I. Jenkins and K. Sloan (eds.), *Vases and Volcanoes: Sir William Hamilton and his Collection*, London, 1996, 66.

Furthering his established position as an art patron, Hamilton employed Peter Fabris, a little-known painter working in Naples, to make drawings of the places his letters had described. These were then engraved and reproduced, and the prints hand-painted in gouache by local artists. To affirm their validity as a source of knowledge, Hamilton stressed his role as attentive supervisor: 'Fabris completed this collection under my eye, and by my direction, with the utmost fidelity'.[91] Each image therefore embodied the skilled labour of artists, engravers and colourists and of Hamilton's management of these workers.

Editing and financing his own book granted Hamilton new freedom to develop the descriptive power of images. Printed in *Philosophical Transactions*, his pictures had been constrained in size, colour and number by Royal Society conventions. But by lavishing personal time and money, he now helped create plates similar to the paintings that had originally accompanied his letters. Hamilton had endorsed the authority of the Committee of Papers to edit his words by repeating its textual changes. But in reversing their pictorial alterations, he openly challenged its treatment of his images. The new plates radically changed the impact of individual scenes (compare Figures 8 and 5 in this paper) and also introduced the narrative opportunity of sequential pictures.[92] Encouraged by marginalia indicating where specific pictures were relevant, readers could view the separate volumes of plates and letters in parallel. Thus integrated, *Campi Phlegraei*'s literary and visual technologies contributed simultaneously to achieving a more complete witnessing experience.

91 *CP*, 5.

92 See K. Wood, 'The figure in the landscape in Sir William Hamilton's *Campi Phlegraei*', M.Phil. essay 2, University of Cambridge, 2002, 14.

Already an authority on the subtle language of landscape art, Hamilton was able to develop themes from his texts using images. Whereas the pictures in *Philosophical Transactions* had depicted only distant eruptions, *Campi Phlegraei*'s plates had more varied subject matter. Many placed foreground human figures in specific, visible relationships with the landscape, dramatizing the practices embodied by the book. People positioned on the mountainside stressed direct interaction with nature, while those absorbed in concentrated thought demonstrated focused attention. Likewise, plates depicting the artist at work documented how the pictures themselves had been produced. Using colour, lighting and pose, these plates also distinguished visually the rational behaviour of curious aristocrats from the captivated fear and wonder of awe-struck peasants.[93]

Hamilton's letters had originally made major reference to specimens, while publication in *Philosophical Transactions* had all but erased the role of reference objects. In *Campi Phlegraei* he again attempted to reverse this change, addressing an issue that the Committee of Papers had deliberately avoided – the challenge of publishing rocks. His final plates depicted examples of volcanic matter in remarkable detail, using *trompe l'oeil* techniques that invited beholders to inspect the images just as they would specimens in a collector's cabinet. In this format Hamilton's rock specimens became more mobile and accessible than they had been previously.

Campi Phlegraei derived economic, as well as aesthetic, value from its luxury format and plates. Without a subscription list Hamilton used his own money to cover the huge costs of production at significant personal risk.[94] An advertisement on one of the final pages reads,

> The price of the two volumes of this work, half bound and with the 54 plates illuminated is sixty Neapolitan Ducats, and they are to be had only of Mr Peter Fabris, Painter at Naples, who will punctually obey such orders as the Public may be pleased to favour him with.[95]

In practice neither the price nor the distribution of Hamilton's finished work remained within his control, as booksellers purchased and resold *Campi Phlegraei* across Europe. Limited supply led to high prices in the Paris sales, while the London bookseller Cadell advertised copies at £12 12s.[96] To put this price into context, in a catalogue from 1791 the most expensive natural history book was *A Complete Translation of Count de Buffon's Natural History* in nine volumes with three hundred copper plates, costing £4 1s. Even *The History of England* in eight volumes, printed on 'Royal Paper … with

93 For interesting examples see *CP* Plates 22, 38 and 41. For discussion of these issues see Wood, op. cit. (92), 2–9.

94 By March 1776 costs totalled over £1,300 while diplomatic allowances were around £3,000 a year. On luxury books and subscription lists see J. Brewer, *The Pleasures of the Imagination: English Culture in the Eighteenth Century*, London, 1997, 164. On costs of *CP* see Morrison, op. cit. (17), i, 48; also in Knight, op. cit. (84), 195. On allowances see Moore, op. cit. (9), 170.

95 *CP*, 100. A 'half-bound' book had spine and outer corners of leather while the rest of the cover used cloth or paper. See J. Carter, *ABC for Book Collectors*, 7th edn, London, 1994, 115.

96 On the Parisian market see G. Soulavie, *Oeuvres complettes de M. le Chevalier Hamilton*, Paris, 1781, p. x. On London prices see *Monthly Review* (1777), **56**, 381, and *Critical Review* (1777), **43**, 465. The *Supplement* was available from Cadell in 1782 priced £2 12s. 6d.; see *Monthly Review* (1782), **66**, 476.

fine impressions of the Plates', cost only £8 18s. 6d.[97] So in terms of monetary value, *Campi Phlegraei* was in a league of its own.

Contemporary critics were active and influential interpreters of literature, who shaped the context in which many people read. The *Monthly Review* and *Critical Review* circulated widely in Britain and abroad, aiming to provide prompt coverage of all new publications. Listing the seller and price with each article, they assisted the sales of books reviewed. But through unauthorized extraction and descriptions necessarily coloured by opinion, they also made books partially accessible to secondary readers.[98] The small-scale production, high demand and exorbitant cost of *Campi Phlegraei* meant that reviews in these journals were the closest most readers would ever come to the original. *Monthly Review* devoted several pages to *Campi Phlegraei*, treating it as a testament to dedicated activity: 'In this age of observation … there are few philosophers who have examined Nature with such profound attention … It does not appear that this excellent Naturalist has refused his attention even to the minutest circumstances'.[99] But the *Critical Review* took a different line: the work's 'principal merit lies in the great beauty and perfection of the plates; and in this respect it deserves the attention of all conoscenti and encouragers of polite arts and genuine taste'.[100] These two interpretations neatly demonstrate *Campi Phlegraei*'s appeal as an object of both superior knowledge and exquisite beauty. Recognizing this duality is our key to understanding the initial distribution and subsequent circulation of this extraordinary work.

Collecting curiosities

This monumental publication was of such size and value that it rendered Hamilton's acts of attention and description less physically and socially mobile than they had previously been. In fact, as a reaction against the unchecked proliferation of his articles through the periodical press, the publication was designed to immobilize his observations by setting them into a limited, definitive edition to be treasured and retained for posterity. Of all the embodiments of Hamilton's work, *Campi Phlegraei* offered readers their most immediate and accessible witnessing experience. Yet it has often been more highly valued as an object of curiosity than as a witnessing tool. Positioning *Campi Phlegraei* within specific collections reveals the consequences of material embodiment for the movement of Hamilton's knowledge. This section uses case studies to explore how particular copies have circulated and been consumed.

In an exchange network reminiscent of letters that were 'sent as a gift', books could symbolize personal association and intimacy. Hamilton gave away at least three presentation copies of *Campi Phlegraei* and *Supplement* with specially prepared

97 T. Cadell and A. Strahan, *The Following Valuable Books are Printed for A. Strahan and T. Cadell, in the Strand*, London, 1791, 3.

98 J. Basker, 'Criticism and the rise of periodical literature', in *The Cambridge History of Literary Criticism: The Eighteenth Century* (ed. H. B. Nisbet and C. Rawson), Cambridge, 1997, 327–32.

99 *Monthly Review* (1777), **56**, 380.

100 *Critical Review* (1777), **43**, 467.

plates in richer colours. Received by the Royal Society, Joseph Banks and King George III, they moved into contrasting spaces. At the Royal Society it was routine practice that Fellows should donate one copy of any published scientific work to the society's ever-expanding library. Here Hamilton's gifts entered a controlled space where gentlemen engaged in certain types of learned activity. Open for three hours twice a week, Fellows and guests on approval could consult and, with leave from the council, borrow from its contents.[101] A logic of almost boundless collection informed its extensive coverage of publications from around the world and of old and rare books. Despite already holding Hamilton's original manuscript letters, his articles in *Philosophical Transactions* and several other versions of his work, the society still found space for this illustrated edition.[102]

Banks received his copy of *Campi Phlegraei* as a personal friend. Having taken a small volume of Hamilton's collected works on a voyage to Iceland in 1772, this regular correspondent was already familiar with Hamilton's observations.[103] But Banks's library at Soho Square was, like his herbarium, an invaluable resource for the many associates to whom he gave free access and offered loans on a generous basis. Unlike the Royal Society, the audience for this copy included women, young scholars and those without specific interest in nature. A social place for meetings and informal gatherings, Banks's library was a showcase where his possessions, including Hamilton's gifts, were available for friends to browse, admire and discuss.[104]

In the Royal Library, *Campi Phlegraei* occupied a more private space. Hamilton's gift to King George III marked respect for his monarch and employer and reflected an intimacy developed during time spent together as children. In this, the golden age of bookbinding, George III's private bindery at Buckingham Palace gave his books an elaborate, coordinated appearance. Of all the copies described here, that of the king is most impressive: three volumes bound in heavy red leather, with gold-tooled spines, gilt page edges and embossed royal insignia. Such craftsmanship positioned *Campi Phlegraei* as an object of external beauty, exuding taste and magnificence even from his bookshelf.[105] Giving *Campi Phlegraei* in these cases was an act of deference or goodwill, but it could also be one of patronage and munificence. To one scientific society Hamilton's gift seemed so generous that it deserved pride of place.[106] He donated another copy to the Public Library of Catania, Sicily, in the hope that 'it might awaken some ones curiosity to attend a little to the motions of the Sublime

101 Lyons, op. cit. (32), 150–1, 99.

102 For acknowledgment of *CP* and *Supplement* see *PT* (1777), **67**, 859; *PT* (1782), **72**, 443.

103 H. B. Carter, *Sir Joseph Banks (1743–1820): A Guide to Biographical and Bibliographical Sources*, Winchester, 1987, 235.

104 A large portion of this collection is now held in the British Library, including *CP* and *Supplement*, bound together, shelfmark 459.f.12. For the library as a resource see H. B. Carter, *Sir Joseph Banks 1743–1820*, London, 1988, 173, 225.

105 On Hamilton's relationship with George III see Fothergill, op. cit. (15), 24. On the Royal bindery see E. Potter, 'To St Paul's Churchyard to treat with a book binder', in *Property of a Gentleman: The Formation, Organisation and Dispersal of the Private Library 1620–1920* (ed. R. Myers and M. Harris), Winchester, 1991, 25–7, 36. This copy is now held in the British Library, shelfmark 33.h.5–7.

106 See letter from the Gesellschaft naturforschender Freunde zu Berlin, in Dawson, op. cit. (36), 47.

Volcano in its neighbourhood'.[107] In this geographical context he wanted his work not to be treated as a narrow observational record, but as an inspiration for others to experience the landscape for themselves.

For the accomplished gentleman, a discerning appreciation and extensive possession of books was an acknowledged mark of taste, learning and refinement. With growing emphasis on bibliographical rarity, the curious allure of personal collections came to be valued above other traits.[108] Horace Walpole had little interest in natural history, despite being a long-standing FRS. Yet in 1776 he requested from Hamilton a subscription to *Campi Phlegraei*. Walpole was a connoisseur, passionate about fine antiquities, paintings and books. Like Hamilton and Banks he was a Fellow of the Society of Antiquities and the Society of Dilettanti, clubs which united cultured gentlemen of independent fortunes interested in collecting. Aided by Hamilton's social network, *Campi Phlegraei*'s Italian origins, learned credentials, delicate art and evident expense brought it desirability amongst this elite.[109]

Hamilton's work also fitted into the much broader collection of the seventh Viscount Fitzwilliam of Merrion. With an enthusiastic interest in curiosities of every sort and price, *Campi Phlegraei* appealed to his eclectic acquisitional habits. Coins, vases, medals, manuscripts, paintings, drawings and prints were all found in his museum, which put man's and nature's objects on display in celebration of rich diversity. Through the contents of his library, Fitzwilliam extended this ethos to things he did not own. Books on history, art, antiquities and natural history all enabled him to admire distant artefacts, just as he would those in his museum.[110]

Young men who undertook the Grand Tour frequently returned with rarities of art and nature that formed the basis of future collections. Thus when Sir John Soane travelled to Naples in 1779 he obtained and carefully preserved 'a piece of cinder from Vesuvius'. Soane eventually assembled ten thousand books and a vast array of pictures, sculptures and fragments of architecture which evidenced the classical principles of design. In 1813 he rebuilt his London home as a museum to educate and inspire 'Amateurs and Students in Painting Architecture and Sculpture'. His dining room and library formed a single entertainment space, where the Pomeian Red walls and numerous vases and busts deliberately evoked an ancient era. In these surroundings, *Campi Phlegraei* enabled Soane to revisit Vesuvius and observe again a region he had once enjoyed. The extensive classical references connecting volcanic activity

107 Hamilton to Banks, July 1781, BL.Add.MS.34 048, f.12.

108 Whitaker, op. cit. (45), 75–6; R. Myers and M. Harris, 'Introduction', in *Property of a Gentleman: The Formation, Organisation and Dispersal of the Private Library 1620–1920* (ed. R. Myers and M. Harris), Winchester, 1991, p. vii; J. Raven, 'From promotion to proscription: arrangements for reading and eighteenth-century libraries' in *The Practice and Representation of Reading in England* (ed. J. Raven, H. Small and N. Tadmor), Cambridge, 1996, 187.

109 Elected FRS in 1747; *DNB*. On request for *CP* see Morrison, op. cit. (17), i, 46; also in Fothergill, op. cit. (15), 146. Walpole actually seems never to have received his copy; see A. T. Hazen, *A Catalogue of Horace Walpole's Library*, London, 1969, No. 2865. On other societies see Jenkins and Sloan, op. cit. (12), 178; Brewer, op. cit. (94), 256.

110 This copy is now held in the Fitzwilliam Museum, Cambridge. On the logic of comprehensive collection see K. Pomian, *Collectors and Curiosities: Paris and Venice, 1500–1800*, Cambridge, 1990, 233–4.

with human history also helped him to share Hamilton's own antiquarian interest in nature. Twenty years after publication, Soane's copy, with *Supplement*, cost him £20, probably from one of a growing number of second-hand dealers profiting from rare books.[111] As the collecting habits of connoisseurs increased the market value of Hamilton's work, they pushed it further into the exclusive domain of the wealthy. Fifty years after it was issued, when Charles Lyell turned his attentions to the district of Naples, he did so through the large, thick pages of *Campi Phlegraei*. It was this 'great work', rather than any of Hamilton's letters or other publications, to which he referred for a reliable account of the eruptions of Vesuvius.[112] In terms of both testimonial and aesthetic value, the luxury edition quickly eclipsed all other embodiments of Hamilton's observations.

Ultimately, the desirability of its magnificent images led to the destruction of *Campi Phlegraei* as a whole. Single plates fetched high prices, so many sets were dismembered and sold as separate prints.[113] Complete copies are now rarely found outside the preserved museums and libraries of celebrated gentlemen such as those described here, while the fascinating paths and fates of others have vanished from view.

Conclusion

Hamilton's curiosity about volcanic phenomena led him to the dual practices of observation: attention and description. The letters he wrote embodied these acts, enabling certain beholders to participate in his experiences as nature's witness. As these letters were received, interpreted, edited and redistributed by active readers, his acts of attention and description were translated between distinct visual, oral and printed forms. This physical restructuring was crucial to way in which Hamilton's observations circulated.

To ignore the practical activity of recipients in favour of the intellectual achievement of technologies of persuasion is to mistakenly separate the form of knowledge from its content. Witnessing was an active process, both for a direct observer who attended and described and for those who beheld an eyewitness's embodied experiences. Readers did not passively receive the testimony of recorded events, as is often implied by literature on witnessing. Rather they spent time participating in the process of attending to nature. Just as Hamilton had noted and studied a strangely formed rock, so his distant readers were able to note and study it also. Even virtual witnesses had to physically manipulate and mentally engage with their curious environments.

The beholders of each embodied observation discussed in this paper had their experiences of nature mediated by that of others, not just by Hamilton but by every other active reader who relived and communicated his attentions. By selecting,

111 On collection and the Grand Tour see Whitaker, op. cit. (45), 75. On Soane see *Sir John Soane's Museum: A Short Description*, Nottingham, 1996, and Thornton and Dorey, op. cit. (86), 17. His copy is still held in Sir John Soane's Museum, London. On second-hand dealers see Raven, op. cit. (108), 187.

112 Charles Lyell, *Principles of Geology*, 11th edn, London, 1872 (first published 1830–3), Figures 68 and 69, 611.

113 Knight, op. cit. (84), 196.

speaking, discussing, editing, printing, extracting, reviewing and translating observational experiences, readers shaped how distant scenes were witnessed in future and by whom. Hamilton's experiences of volcanic phenomena moved far and wide, in ways that cannot be explained by framing his work as a tool for witness replication alone. Objects were made, moved and used for a multitude of aesthetic, commercial and practical reasons. By studying these transactions in relation to their specific environments, I have shown why this author's intentions cannot be simply discerned from the preserved evidence ascribed to him. This conclusion must strengthen the case against scouring revered texts such as *Campi Phlegraei* for the origins and first practitioners of modern science.