BJHS **41**(1): 19–41, March 2008. doi:10.1017/S0007087407000349 First published online 25 September 2007

In search of the 'true prospect': making and knowing the Giant's Causeway as a field site in the seventeenth century

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Abstract. The phenomenon of the Giant's Causeway in the north of Ireland has attracted much attention over five centuries. This essay recounts the formative years between 1688 and 1708 of the Giant's Causeway as a field site and 'philosophical landscape' in the light of recent research on the historical geographies of scientific knowledge. This research has provided new perspectives on field science, emphasizing the spatial character of the field and its discursive formation in different spaces. A view of the field as a self-contained unit in which science is practised is rendered problematic. Instead, it is seen as part of a network of intersecting locales within which scientists and science circulate. This essay draws upon this work, exploring and mapping the spaces and techniques used by late seventeenth-century natural philosophers in London and Dublin to generate observational and conceptual knowledge of the Giant's Causeway. In doing so, the paper contributes to an understanding of the spaces of natural philosophy in the seventeenth century, of the knowledge networks within which the virtuosi operated and of the earth science field site.

> And truly whoever takes a Pleasure or Satisfaction in making Inquiries after Natural Productions, and examining the various Works of the Creation, cannot but be very desirous if he has once heard of this *Fossil*, to be as fully informed of it as 'tis possible, being 'tis so remarkably singular and curious of its Kind.
>
> Thomas Molyneux, 1698[1]

> It is a pleasing, as well as an interesting pursuit, to observe the gradual advancement of mankind in any particular object of enquiry; to trace the wild shoot of infant philosophy from the natural soil, in which it has grown rank and uncultivated, to the garden of science, where it blooms in all the improved beauty and vigour which the hand of art and industry can add to it. In this point of view, a little history of the opinions which have prevailed concerning the curious combination of pillars in this neighbourhood, called the Giants Causeway, may perhaps afford you some amusement; and if it do not bring with it much solid information concerning the

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1 T. Molyneux, 'A letter from Dr. Thomas Molyneux, to Dr. Martin Lister, Fellow of the Colledge of Physicians, and of the Royal Society, in London: Containing some additional observations on the Giants Causway in Ireland', *Philosophical Transactions* (1698), **20**, 209–23, 210.

> operations of nature, yet it may be pleasant enough to see the various attempts which men have made to explain them.
>
> William Hamilton, 1790[2]

During five centuries, the scientific study of the Giant's Causeway and its columnar basalts in the north of Ireland has generated a considerable body of literature,[3] and has contributed much to knowledge of basalt and its origins. However, the Giant's Causeway's cultural and scientific history has been poorly treated and where considered at all has been frequently consigned to footnotes and brief introductions in the volumes of geological writing on the topic.[4] It was and remains an important field site both for the active production of knowledge about the earth and also for the display of such knowledge in textbooks and through pedagogical field trips. While the site is now viewed by geologists as a remnant of an ancient volcanic landscape, its distinctive columnar jointing seen as the shrinkage fractures of a chilled basaltic lava flow, this was not always the case. The Giant's Causeway has been interpreted in different ways and employed in a variety of sometimes mutually exclusive scientific discourses. Indeed, its cultural and scientific heritage, coupled with its exemplary natural features of ancient vulcanism, was one of the reasons for its registration in 1986 as a World Heritage Site.[5] This essay recounts the formative years of the Giant's Causeway as a field site and 'philosophical landscape' over two decades from 1688 to 1708. During this period a range of interpretative schemes were proposed, each raising particular questions about the origin and character of the Causeway. Was it the purposive work of humans or giants? Alternatively, was it a naturally occurring 'fossil' (by which was meant a distinct mineral object of either organic or inorganic origin, rather than fossil in the modern sense[6])? Debates about the nature of the Giant's Causeway provide the empirical focus for this essay.

The intention, however, is not only to relate an episode in the early history of what would later be known as earth science, but also to map the historical geography of the Giant's Causeway as a field site and to explore the complexity of practices and spaces which natural philosophers used to develop their understanding of it. I draw upon

2 W. Hamilton, *Letters Concerning the Northern Coast of the County of Antrim*, Dublin, 1790, part II, 5–6.

3 For recent accounts of the geology of the area see H. E. Wilson and P. I. Manning, *Geology of the Causeway Coast: Memoir for One-Inch Geological Sheet 7*, 2 vols., Belfast, 1978; P. Lyle, *A Geological Excursion Guide to the Causeway Coast*, Belfast, 1996; W. I. Mitchell (ed.) *The Geology of Northern Ireland*, 2nd edn, Belfast, 2004.

4 Short historical synopses of earth science at the Giant's Causeway are found in Wilson and Manning, op. cit. (3); and S. I. Tomkeieff, 'The basalt lavas of the Giant's Causeway district of Northern Ireland', *Bulletin volcanologique* (1940), **4**, 89–143, with plates. See also R. M. Young, 'Early notices and engraved views of the Giant's Causeway', *Ulster Journal of Archæology* (1896), **3**, 40–9; M. Anglesea and J. Preston, '"A philosophical landscape": Susanna Drury and the Giant's Causeway', *Art History* (1980), **3**, 252–73, with plates; S. Rousham, *The Story of the Causeway Stones*, The National Trust, 1987.

5 ICOMOS, *World Heritage List no. 369. Nomination: Giant's Causeway and Causeway Coast*, Paris, 1986; IUCN, *Nomination to the World Heritage List*, IUCN, 1986.

6 M. J. S. Rudwick, 'Minerals, strata and fossils', in *Cultures of Natural History* (ed. N. Jardine, J. A. Secord and E. C. Spary), Cambridge, 1996, 266–86.

recent work on the historical geographies of knowledge,[7] which has shown how the process of finding out about and knowing the world is facilitated and conditioned by the many spaces in which such knowledge is produced and disseminated. It has also demonstrated the important epistemological role that site and situation play in the production of natural knowledge. I also draw on new considerations and theorizations about field sites and fieldwork,[8] which have shown the multiplicity of embodied spatial practices that constitute such venues, not only *in situ* but in other places as well. As Jan Golinski has pertinently observed, 'Practitioners of the fieldwork sciences may be seen to be involved in constructing representations of their world, manipulating spatial relations so as to render the wider world accountable within scientific practices that are nevertheless, in substantial respects, local.'[9] From such a viewpoint the perspective of the field as a self-contained unit in which science is practised is rendered problematic. Instead, it is seen as part of a network of intersecting locales within which scientists and science circulate in pursuit of natural knowledge.[10] This is the attitude used here to view the study of the Giant's Causeway in the late seventeenth century. In so doing, the beginnings of a more general change among virtuosi in their attitude to fieldwork is brought to light.

Making the field site

In 1688 Sir Robert Redding, natural philosopher and member of the Royal Society,[11] heard of a wonderful rock formation in County Antrim, which he subsequently

7 A. Ophir, S. Shapin and S. Schaffer (eds.), 'The place of knowledge: the spatial setting and its relation to the production of knowledge', special edn of *Science in Context* (1991), **4**; C. Smith and J. Agar (eds.) *Making Space for Science: Territorial Themes in the Shaping of Knowledge*, Basingstoke, 1998; D. N. Livingstone, 'The spaces of knowledge: contributions towards a historical geography of science', *Environment and Planning D: Society and Space* (1995), **13**, 5–34; *idem*, *Science, Space and Hermeneutics* (Hettner Lecture, 2001), Heidelberg, 2002; *idem*, *Putting Science in its Place: Geographies of Scientific Knowledge*, Chicago, 2003; S. Naylor, 'Introduction: historical geographies of science – places, contexts, cartographies', *BJHS* (2005), **38**, 1–12; S. Shapin, 'Placing the view from nowhere: historical and sociological problems in the location of science', *Transactions of the Institute of British Geographers* (1998), **23**, 5–12; T. J. Barnes, 'Placing ideas: genius loci, heterotopia and geography's quantitative revolution', *Progress in Human Geography* (2004), **28**, 1–31.

8 J. R. Camerini, 'Wallace in the field', *Osiris* (1996), **11**, 44–65; J. D. Dewsbury and S. Naylor, 'Practising geographical knowledge: fields, bodies and dissemination', *Area* (2002), **34**, 253–60; F. Driver, 'Editorial: fieldwork in geography', *Transactions of the Institute of British Geographers* (2000), **25**, 267–8; B. Hevly, 'The heroic science of glacier motion', *Osiris* (1996), **11**, 66–86; R. E. Kohler, 'Place and practice in field biology', *History of Science* (2002), **40**, 189–210; H. Kuklick and R. E. Kohler, 'Science in the field', *Osiris* (1996), **11**, 1–14; H. Lorimer and N. Spedding, 'Locating field science: a geographical family expedition to Glen Roy, Scotland', *BJHS* (2005), **38**, 13–33; M. J. S. Rudwick, 'Geological travel and theoretical innovation: the role of "liminal" spaces', *Social Studies of Science* (1996), **26**, 143–59; C. W. J. Withers and D. A. Finnegan, 'Natural history societies, fieldwork and local knowledge in nineteenth-century Scotland: towards a historical geography of civic science', *Cultural Geographies* (2003), **10**, 334–53.

9 J. Golinski, *Making Natural Knowledge: Constructivism and the History of Science*, Cambridge, 1998, 98.

10 See B. Latour, *Pandora's Hope: Essays on the Reality of Science Studies*, London, 1999.

11 He had also been a member of the Dublin Philosophical Society, but this society had a rather shaky life and was not in existence at this point. It met formally from 1683 to 1687, from 1693 to 1697 and briefly

reported to the Royal Society. At the society's meeting on 23 January 1689 two letters were read from Sir Robert. The first concerned freshwater pearl fishing,[12] while the second informed the society about 'ye Giants Causey'. A summary of this letter, the earliest known account of the Giant's Causeway, survives in the society's minutes:

> There was read Sr. Robert Reddings Description of ye Giants Causey within 2 miles of Dunluce, to the north thereof, in the County of Antrim in Ireland: where there are a vast quantity of Hexagonall Pillars of stone about 8 Inches side, which stand pitch't perpendicularly as in a Pavement runing down obliquely into the Sea. These Columns are so regularly ranged and fitted one to the other that it seems rather the work of art than nature, and they are made up of pieces of about 8 Inches deep, the Convexity of the bottom parts entering into a Cavity in the Top of [the] next under it made to receive it.[13]

Although much of the seventeenth-century mythology that surrounded the Giant's Causeway has been lost, it is apparent that the local people interpreted it very differently from natural philosophers, whose accounts briefly and dismissively referenced the local tales of giants and demons as formative forces. The site's Irish name, *Clochán na bhFomharaigh*, translates as 'the stepping stones of the Fomorii', the evil, misshapen and violent gods of Irish myth.[14] It may be that Redding's appellation 'Giants Causey' was an English approximation of the original Irish. It is against these early, localized, forms of knowing the Giant's Causeway that the enquiries by Redding and those who followed him should be understood. Having caught the collective eye of natural philosophers in Dublin and London, the Giant's Causeway would no longer be just a place of folklore but also a site for philosophy. It became incorporated into much wider knowledge networks and discourses. Under the aegis of natural philosophy the columns would be observed, investigated, experimented upon, discussed, written about, drawn, collected and given new meanings in the coming decade. Although it seems likely that it was the local tales of gigantic architecture that led to Redding's interest, the old folklore surrounding the Giant's Causeway was seen as scarcely worth recording by the newly arrived, rational, enquirers into Nature.

Kohler has argued that field science is a 'practice of place',[15] an activity in which the deliberate demarcation of a geographical area for scientific study is a fundamental element. It is the very particularity of the site that gives it value as an object of study. The 'vast quantity of Hexagonall Pillars of stone … regularly ranged and fitted one to

around 1708. Many of its members were also Fellows of the Royal Society. See K. T. Hoppen, *The Common Scientist in the Seventeenth Century: A Study of the Dublin Philosophical Society 1683–1708*, London, 1970.

12 This letter was later published. See R. Redding, 'A Letter from Sir Robert Redding, late Fellow of the R.S. concerning Pearl-Fishing in the North of Ireland', *Philosophical Transactions* (1693), **17**, 659–64.

13 Royal Society, Journal Book Copy, vol. 7 (1686–90), minutes of the meeting of 23 January 1689, 161–2. A comparison of his account with Sir Richard Bulkeley's later account, based upon second-hand accounts, suggests that Redding had actually seen what he reported. From his report on freshwater pearl fishing, Redding is known to have travelled around the north of Ireland in August 1688. It is plausible to assume that he not only heard about the Giant's Causeway but also paid it a visit out of his interest in rocks and minerals (see Robert Redding to Martin Lister, 28 September 1684, Royal Society, Letter Book Copy, vol. 10, a list of rock and mineral specimens from Ireland that Redding had sent to the Society).

14 P. B. Ellis, *A Dictionary of Irish Mythology*, London, 1987.

15 Kohler, op. cit. (8), 192; see also D. N. Livingstone, 'Making space for science', *Erdkunde* (2000), **54**, 285–96.

the other' gave to the Giant's Causeway philosophical value for the members of the Royal Society, who were fascinated with natural oddities. Redding's letter demarcated the Giant's Causeway as an object for study, carving it out from its surrounding landscape and associated mythologies. It was reconceptualized as an object and place of philosophical discourse and brought into the discursive space of the Royal Society. Bringing the Giant's Causeway into circulation among virtuosi in this way was an important aspect of its constitution as a field site, since the field could not exist outside, or independently of, other spaces. As Felix Driver has observed, 'The field … is not just "there"; it is produced and re-produced through both physical movement across a landscape and other sorts of cultural work in a variety of sites.'[16]

In March 1689 Redding died. If he had ever had any intention or desire to collect more information about the Causeway it remained unfulfilled. Furthermore, the momentous events of the Williamite war in Ireland from 1689 to 1691 disrupted any philosophizing about the 'Giants Causey' and it was not until the summer of 1692 that another visit to the site was made. This visit was reported to Sir Richard Bulkeley, who sent a letter about the formation to the Royal Society in April 1693, rekindling interest in the Giant's Causeway among natural philosophers.[17] By the end of that decade four further accounts and two engraved pictures of it had been published in the *Philosophical Transactions*.[18] These visits and reports helped to highlight, then fix, the Giant's Causeway as a philosophical landscape.

Knowing nature at a distance: eyewitnesses and proxy fieldworkers

Richard Bulkeley's and Thomas Molyneux's papers on the Giant's Causeway were written at a distance from the field site, not from personal on-site observations. They were produced on the basis of eyewitness reports and other proxies for the field such as specimens and drawings, an indication that among seventeenth-century virtuosi, travelling into the field in order to experience something at first hand was not a necessary part of knowledge-making. It was felt that one could wander through and understand the universe better in a museum or library.[19] This attitude complicated the virtuosi's study of nature. The remainder of this essay teases out the complexities of their relationship with the field. Instead of seeing for themselves, natural philosophers

16 Driver, op. cit. (8), 267.

17 R. B[ulkeley]., 'Part of a Letter from Sir R.B. S.R.S. to Dr. Lister, concerning the Giants Causway in the County of Antrim in Ireland', *Philosophical Transactions* (1693), **17**, 708–10.

18 C. Cole, 'A draught of the Gyants Causway which lyes near Pengorehead in the County of Antrim', *Philosophical Transactions* (1694), **18**; S. Foley, 'An account of the Giants Causway in the North of Ireland', *Philosophical Transactions* (1694), **18**, 170–2; *idem*, 'Answers to Sir Richard Bulkeley's queries relating to the Giant's Causway, wrote down when we were upon the Causway', *Philosophical Transactions* (1694), **18**, 173–5; T. Molyneux, 'Some notes upon the foregoing account of the Giants Causway, serving to further illustrate the same', *Philosophical Transactions* (1694), **18**, 175–82; E. Sandys, 'A true prospect of the Giants Cawsway near Pengore-head in the County of Antrim', *Philosophical Transactions* (1697), **19**; Molyneux, op. cit. (1).

19 M. J. S. Rudwick, *Bursting the Limits of Time: The Reconstruction of Geohistory in the Age of Revolution*, Chicago, 2005.

frequently relied on others for the collection of data, which they would then warrant on the basis of their knowledge of the informant's social standing and trustworthiness. It was believed that gentlemen would have nothing to gain by wilfully propagating inaccurate reports, so would not do so. This raised profound issues of trust in, and the reliability of, reporters.[20] This section considers the role of eyewitnesses and proxy fieldworkers in shaping seventeenth-century comprehension of the Giant's Causeway.

While Bulkeley and Thomas Molyneux knew their informants, their readers may not, so needed to be assured of these reports' veracity. Bulkeley was careful to give his eyewitness's credentials before relating their information. He informed readers that he was 'a person that was *rei compos*, perhaps *peritus*, a Scholar (a Master of Arts in *Cambridge*) and a Traveller, who went on purpose the last Summer with the present Bishop of *Derry* to see it.'[21] Bulkeley's witness 'was in possession of facts' and 'perhaps an expert', and being a traveller was obviously a gentleman, able to afford the time and expense travel entailed. His accompaniment by the Anglican Bishop of Derry, William King, would have enhanced the credibility of Bulkeley's claims. Deeply sceptical, however, of the Royal Society's project in advancing knowledge and their publication of trivial or *outré* things as facts in the *Philosophical Transactions*,[22] King would later suggest that the compiler of the *Transactions*, Sir Hans Sloane, was less concerned with verifying accounts than with their sensationalism. In King's anonymously published *The Transactioneer*, a parody of the *Transactions*, the 'Transactioneer' (a caricature of Sloane) revealed, 'I rely so much upon the sincerity of my Correspondents that I cannot tell how to disbelieve [them] … I am not inclined to destrust [*sic*] Mankind.'[23] When asked, 'pray what Reasons can be given to justifie the sincerity of your Correspondents', the Transactioneer replied, 'Reason! Psha! I don't trouble my self to enquire after the Reason of every thing that's told me; if I should, I should have Work enough to find Reasons for every thing that's Communicated in the Transactions.'[24] These accusations of laxity in the editorial standards of the *Philosophical Transactions* incensed the Royal Society. However, problems of verifiability and credibility would always manifest themselves in a field report about something new, distant and previously unseen, making 'trust in [the reporter's] moral integrity and trust in his perceptual accuracy'[25] of vital importance. Thomas Molyneux, introduced as a '*Fellow of the Colledge of* Physicians, *and of the* Royal Society',[26] noted that his information was garnered from 'my very honoured Friend, Dr. *St. George Ash*, now Lord Bishop of

20 S. Shapin, *A Social History of Truth: Science and Civility in Seventeenth-Century England*, Chicago, 1994.

21 B[ulkeley]., op. cit. (17), 708.

22 R. D. Lund, '"More Strange than True": Sir Hans Sloane, King's *Transactioneer*, and the deformation of English prose', *Studies in Eighteenth-Century Culture* (1985), **14**, 213–30.

23 W. King, *The Transactioneer with Some of his Philosophical Fancies: In Two Dialogues*, Los Angeles, 1988 (first published 1700), 54–5.

24 King, op. cit. (23), 55.

25 D. Outram, 'On being Perseus: new knowledge, dislocation, and Enlightenment exploration', in *Geography and Enlightenment* (ed. D. N. Livingstone and C. W. J. Withers), Chicago, 1999, 281–94, 283.

26 Molyneux, op. cit. (1), 209.

Clogher', and from 'A Gentleman of my Acquaintance in those Parts'.[27] The latter was asked to dig into the ground at the bottom of a pillar, to see how far down it went, and reported that he dug

> till he could well go no farther; and it continued still of the same Make and Figure, Jointed as it was above, for the Depth of Eight Foot together, and could he then conveniently have gone on with his Design, and followed it deeper, he tells me he had no Reason to doubt but he might still have traced it much farther into the Earth.[28]

Molyneux's personal knowledge of his informants permitted him to report on their findings with confidence, while his, Foley's and Bulkeley's reputations enabled those reading their reports to believe them, even if King's charges were well-founded. As Shapin has argued, for the virtuosi to know about nature in the seventeenth century they had to know about people: they could not have *thing*-knowledge without *people*-knowledge. Unlike the laboratory, where philosophers worked in close proximity with their laborants, the philosophers' knowledge about the field was made at a distance from the place of data acquisition, the field site itself, a distance bridged by eyewitnesses in whom trust was required if their reports were to be believed.[29] It was through people-knowledge that witnesses became the surrogate eyes of Bulkeley and the other savants in Dublin and London and extended their gaze into a remote part of Ireland.

After the publication of his letter on the Giant's Causeway in 1693, Bulkeley sent a questionnaire to Samuel Foley in which he solicited observations of what he deemed relevant, in order to clear up ambiguities in previous descriptions. Questionnaires were a common method used by virtuosi to generate knowledge at a distance, ensuring commonality of observation and making reports of phenomena less haphazard.[30] They were intended to discipline or calibrate witnesses and their senses, and can be thought of as a means to turn eyewitnesses into remote sensing instruments. Bulkeley's questions, nine in total, published along with Foley's answers, asked of such matters as

> Q. 1. Whether any of the Pillars are Hexagons, or whether there be any Squares, or whether they be all Pentagons only?
> Q. 3. Whether the Natural tops of these Pillars have any gravings upon them, or striate lines, or are naturally smooth?
> Q. 7. What may be supposed to be the number of those Pillars? (To which Foley replied, 'We guess they cannot be so few as One Hundred Thousand'.)[31]

Foley was careful to authenticate his observations and give them an immediacy that Bulkeley's account had lacked, noting that his answers were actually written down 'when we were upon the Causway'.[32] The visit also led Foley to write his own account of the Giant's Causeway, presented to the Royal Society at a meeting on 27 June 1694.

27 Molyneux, op. cit. (1), 214, 218.
28 Molyneux, op. cit. (1), 218.
29 See Shapin, op. cit. (20).
30 C. W. J. Withers, 'Reporting, mapping, trusting: making geographical knowledge in the late seventeenth century', *Isis* (1999), **90**, 497–521.
31 Foley, 'Answers', op. cit. (18), 173–4.
32 Foley, 'Answers', op. cit. (18), 173.

The minutes recorded that 'the subject being very Curious, and also very accurately handled [Foley's letter] was ordered to be Inserted in the Transactions'.[33]

Sighting the Giant's Causeway: pictures and specimens

Reliance on eyewitness accounts and fieldwork by proxy was not the only means by which natural philosophers in Dublin and London could know about the Giant's Causeway. They also used pictures and specimens to generate important observational data about the Giant's Causeway at a distance from the field. These proxies provided a means for reproducing the field site in other places. They effectively enabled virtuosi to verify the eyewitness accounts of the phenomenon by being eyewitnesses themselves. Pictures were an important instrument for seeing at a distance;[34] like a telescope, pictures brought geographically distant objects closer into the very libraries and drawing rooms of natural philosophers, where things could be discussed in comfort. In the form of ink and paper, large immobile objects could be successfully transported to and reproduced in other places. Through the medium of the picture philosophers could visit and visualize the field. Such a strategy for remote fieldwork was soon deployed at the Giant's Causeway, since reproducing it in paper-space provided a technique for mobilizing the formation and rendering it visible in other places. Specimens functioned in the same way, although they were not in themselves reproducible.

The first drawing of the Giant's Causeway was made by Christopher Cole from Coleraine, a town about ten miles away.[35] There is no evidence to suggest that Cole's picture of the Giant's Causeway was commissioned. Cole may have suggested to Foley that he could draw it for him. Owen Lloyd of the Dublin Philosophical Society noted to Richard Waller at the Royal Society that

> I expected to have sent Dr Foleys account of the stones of the Gyants Causey, with these, it seems his friend who promised him a draught of one of these has been indisposed and that is the reason the Dr has deferred it.[36]

However, Cole visited the Causeway on 29 March 1694 and sent his picture to Dublin the next day where it was engraved by Edwin Sandys. After further delays it was sent to London for publication in the *Philosophical Transactions*.[37] This engraving (Figure 1) accompanied Foley's and Thomas Molyneux's 1694 papers on the Causeway in the

33 Foley, 'Account', op. cit. (18); Royal Society, Journal Book Copy, vol. 8 (1690–96), minutes of the meeting of 27 June 1694, 247.

34 Rudwick, op. cit. (19).

35 Cole had previously sent a drawing to the Royal Society in 1690, *A Demonstration of a Strange Appearance in the Air over Coleraine on Whitmunday 1690 Between Two & Three in the Aftern*[n]. Royal Society, Southwell Papers 1611–1700, MS 248, So.23.

36 Owen Lloyd to Richard Waller, 31 October 1693 (Royal Society, EL/L5/126).

37 Christopher Cole to Owen Lloyd, 30 March 1694, in K. T. Hoppen (ed.) *The Papers of the Dublin Philosophical Society* (microfiche archive; henceforth DPS papers), 377; Owen Lloyd to Richard Waller, 31 March 1694 (DPS papers, 378); Owen Lloyd to Richard Waller, 13 June 1694 (Royal Society, EL/L5/128).

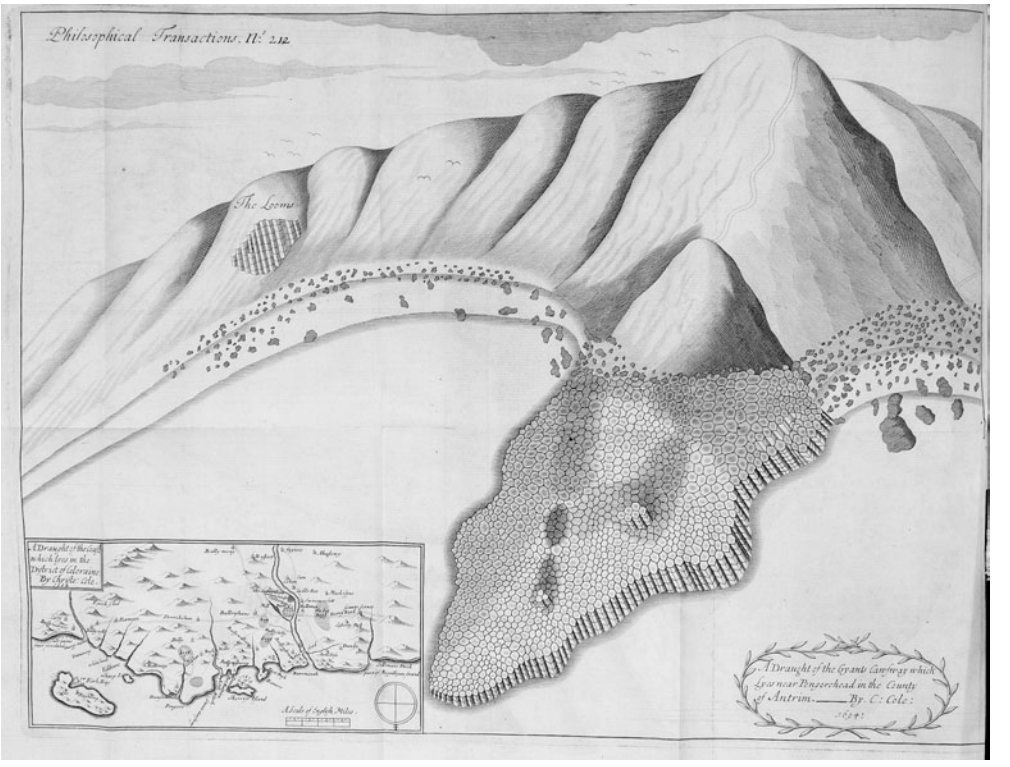

Figure 1. Christopher Cole, 'A Draught of the Gyants Cawsway which Lyes near Pengorehead in the County of Antrim', *Philosophical Transactions* (1694), **18**. © The Royal Society.

Philosophical Transactions. Foley claimed it would 'make the whole much more Intelligible'.[38]

Brian Ford has noted that scientific illustrations are both didactic and a record of the state of contemporary knowledge.[39] However, they are today often treated by historians of science as picturesque images of little epistemic significance.[40] As Foley acknowledged, Cole's drawing was intended to inform natural philosophers about the Giant's Causeway and to deepen their understanding of it. So its pedagogical purpose should not be undervalued. Many of the picture's viewers would never have seen such a landscape before either in reality or on paper. Only one other image of columnar basalt had been published before, in Conrad Gesner's *De omni rerum fossilium genere* in 1565, which showed a cluster of polygonal basalt columns dislocated from their landscape

38 Foley, 'Answers', op. cit. (18), 175.

39 B. J. Ford, *Images of Science: A History of Scientific Illustration*, London, 1992.

40 M. J. S. Rudwick, 'The emergence of a visual language for geological science 1760–1840', *History of Science* (1976), **14**, 149–95; D. Topper, 'Towards an epistemology of scientific illustration', in *Picturing Knowledge: Historical and Philosophical Problems Concerning the Use of Art in Science* (ed. B. S. Baigrie), Toronto, 1996, 215–49.

context, some of which had pointed, crystal-like ends.[41] That Cole's Causeway image was valued as a means to knowledge in this period can be seen from its inclusion in the *Philosophical Transactions* and from the Dublin Philosophical Society's subsequent attempts to commission a second, improved, one. However, as a record of contemporary knowledge Cole's drawing is perhaps of more value now than it was then. It illustrates the geological features of the Causeway and surrounding coast that had caught the eye of late seventeenth-century visitors: the Giant's Causeway itself, the polygonal nature of its component stones, its relation to the cliffs, the 'Looms' (the Giant's Organ) and the loose blocks of basalt rubble that lay on the shore. This selective recording of particular features accounts for the drawing's abstract appearance.

Cole's chosen perspective is noteworthy: there was no possible single viewpoint from which he could have obtained the perspective used, which gives the viewer a bird's-eye view of the formation. Closer inspection of the drawing suggests that Cole used a double perspective, drawing the Giant's Causeway landscape from two viewpoints, not one. One of these viewpoints was from the top of Aird Snout, the headland behind the Causeway, which was used to draw the surface of the Grand Causeway. This is apparent in the drawing from the close correspondence of the outline shape of Cole's Causeway with the landform when seen from Aird Snout and from the progressively smaller polygons towards the end of the Causeway, a perspectival impossibility if the picture's bird's-eye viewpoint is assumed. The second viewpoint was towards the seaward end of the Causeway, Cole presumably having inverted the drawing made from the summit of Aird Snout and then sketched in the surrounding slopes. It is possible that other viewpoints were used to draw the Looms and three-dimensional rendering of the west side of the Causeway. Foley's comments on Cole's drawing suggest that this was indeed the technique used to produce the view, and they also demonstrate that the artist was struggling to find a pictorial language in which to depict the formation:

> I have annext two Figures, drawn by Mr. *Cole*, Collector in those Parts; one of the Causway, the other of the adjoining Sea-Coast … He tells me, he has not drawn the Causway as a Prospect, nor as a Survey or Platform, which he thought would not answer his Design, and that he has no other name for it but a Draught, which he took after this sort: He supposed the Hills and Causway, &c. Epitomized to the same height and bigness the Draught shews them, and this he fancied the most Intelligible way to express it.[42]

This is not surprising; no one had previously attempted visually to represent the Giant's Causeway and there were no established visual conventions for geological formations, such as the maps and sections now taken for granted by geologists. Although the concept of landscape painting had been established in Britain in the early seventeenth century,[43] there was as yet no firm visual vocabulary in which to express an actual, philosophical landscape such as the Giant's Causeway, since idealized or 'classical' landscapes were preferred to realistic depiction. Thus Cole had to make a decision as to

41 W. B. Ashworth, *Vulcan's Forge and Fingal's Cave: Volcanoes, Basalt, and the Discovery of Geological Time*, Kansas City, 2004.

42 Foley, 'Answers', op. cit. (18), 175.

43 L. Herrmann, *British Landscape Painting of the Eighteenth Century*, London, 1973.

whether he should draw it as a map ('a Survey or Platform') or a topographical landscape ('a Prospect'), or somehow combine these two representational modes. He chose the latter, combining multiple viewpoints and ignoring certain features to produce his 'Draught'. Perhaps the picture evolved as he drew it, out of a frustration that he could not convey what was required using one viewpoint. A map could not show the depth of the columns. Lacking a convention for representing elevation, this would obscure the Causeway's relation to the surrounding cliffs. Conversely, there was no single viewpoint from which the formation and its surroundings could be comprehended in their entirety as a landscape picture or prospect. Looking at it from the shore to the east or west would not show the polygonal cross sections of the columns, while viewing it from Aird Snout would give no impression of the depth of the columns. Thus the result was a mix of the semi-oblique aerial view (a common cartographic technique from the sixteenth century[44]) with a topographical representation of the landscape.

Considered as a rhetorical device, rather than precise reproduction, Cole's drawing becomes of greater significance. Labelling it as 'a crude aerial view'[45] obscures its importance. It could persuade a distant audience of the significance of the Giant's Causeway as a field and, importantly for those who had not visited, it allowed them to 'see' the formation. A small map of the north Antrim coast was inset into the engraving, although it was drawn originally on a separate sheet. This served to locate the phenomenon in relation to known places and so inscribed it in space, helping to *site* the *unsighted*, while the large drawing of the stones *sighted* the *site*.[46] Furthermore, Cole's map and landscape painting complemented each other: the map facilitated access to the field, while the painting facilitated contemplation and comprehension of the site.[47]

Natural philosophers had to accept that Cole's drawing was an accurate depiction of the Causeway for it to have any significance in their discourses. Samuel Foley noted that Cole was a local collector,[48] and he and Bulkeley endorsed his picture. Bulkeley wrote to Martin Lister: 'for a more perfect understanding of it I must refer you to the two draughts [Cole's drawing and map] which are sent to the Royal Society'.[49] However, in a rather sycophantic letter to Owen Lloyd of the Dublin Philosophical Society, Cole had confessed, 'It's true I am unknown', but hoped that

> that character which distinguishes the society will admit of an illusion to judge of me as well as of minerals, waters, animals, and I hope every gentleman that has promised or wished me favour will influence what he can do for me with conveniency, which shall always be acknowledged with the precisest gratitude I can imagine.[50]

Cole aspired to the status of a natural philosopher and sought to integrate himself with learned society in Dublin. In the light of his letter to Lloyd his Causeway drawing can be

44 P. D. A. Harvey, *The History of Topographical Maps: Symbols, Pictures and Surveys*, London, 1980.
45 Anglesea and Preston, op. cit. (4), 255.
46 Withers, op. cit. (30).
47 See E. S. Casey, *Representing Place: Landscape Painting and Maps*, London, 2002.
48 Foley, 'Answers', op. cit. (18).
49 Richard Bulkeley to Martin Lister, *c.* June/July 1694 (DPS papers, 381).
50 Cole to Lloyd, op. cit. (37).

further seen as a rhetorical device, intended to persuade the members of the Dublin Philosophical Society of his worth to them in their work. He requested that the members of the Dublin Philosophical Society send him 'printed enquiries' and desired that they

> spare not to command me or to write to me. When I can lay hold of anything that will be pleasing or serviceable to [the] society you shall hear from me. I beg of your assistance to forward and increase my interest.[51]

However, his attempts were unsuccessful and he never achieved inclusion in the Dublin Philosophical Society. Nevertheless, his depiction of the Giant's Causeway was published in the *Philosophical Transactions*. The importance attributed to Cole's drawing by Foley and other natural philosophers, coupled with its expensive engraving and reproduction,[52] attest to the epistemic value accorded it in this period.

Despite its initially acknowledged accuracy, shortcomings in Cole's drawing were soon realized. Thomas Molyneux later commented that it was an unreliable guide to the appearance of the Giant's Causeway, 'as being done by the Hand of one who was no extraordinary Artist',[53] while Cole himself had admitted that 'the art of man cannot do it like the original'.[54] Consequently, Edwin Sandys, 'an excellent artist' and 'a good Master in Designing and Drawing of Prospects', was commissioned by the Dublin Philosophical Society in 1696 to draw the Giant's Causeway and carefully instructed to 'take the genuine and accurate Figure of the whole Rock, with the natural Posture of the Hills and Country about it for some distance' while 'upon the Place'.[55]

Sandys returned bearing *A True Prospect of the Giants Cawsway* (Figure 2). Where Cole had wrestled with the concept of drawing a philosophical landscape, Sandys opted for a more conventional topographical landscape, choosing a single viewpoint on the Stookan to the west of the Causeway. Labelling on the picture referred the viewer to a key that clarified various points and guided the viewer around the virtual field site. Sandys's painting was a more complete rendering of the Giant's Causeway and its context in comparison with Cole's: new features were shown in the cliffs, such as the Chimneys and a hint of stratification in the farthest headland, and an outcrop of horizontally inclined columns on Aird Snout. He also included two inset vignettes that gave detailed insights into certain aspects of the formation, a different solution to the problem of representing the Giant's Causeway landscape completely. Together with the

51 Cole to Lloyd, op. cit. (37). Hoppen, op. cit. (37), notes that the 'printed enquiries' to which Cole refers suggest that the Dublin Philosophical Society was redistributing William Molyneux's 1682 *Queries for a Natural History of Ireland*.

52 Rudwick, op. cit. (40).

53 Molyneux, op. cit. (1), 211.

54 Cole to Lloyd, op. cit. (37).

55 Richard Bulkeley to Martin Lister, 13 April 1697 (DPS papers, 389); Molyneux, op. cit. (1), 211. Bulkeley noted that Sandys's drawing cost the Dublin Philosophical Society £13, and was 'very curious and instructive'.

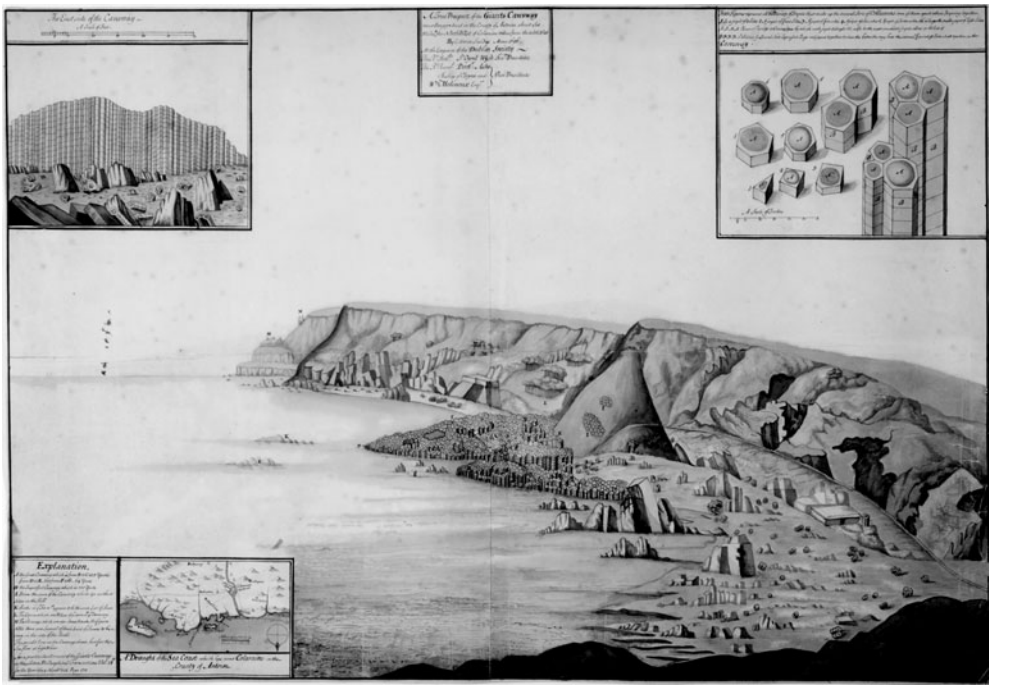

Figure 2. Edwin Sandys, *A True Prospect of the Giants Cawsway near Pengore head in the County of Antrim*, original ink and watercolour (1696). Photograph reproduced with the kind permission of the Trustees of the National Museums Northern Ireland.

main picture, these vignettes helped to distinguish between what the Causeway looked like and what it consisted of. The vignette of polygon types was felt by Thomas Molyneux to be

> one of its most instructive *Schemes*, as being the chief and most essential part of it all … from whence … you will easily frame to your self a just *Idea* of the most singular and remarkable Properties of this Stone of the *Giants Causway*.[56]

He reproduced it in his 1698 paper, revising his description of the polygonal shapes found in the Causeway stones accordingly. Interestingly, the engraved version published in the *Philosophical Transactions* in 1697 depicted several people in the lower right-hand corner. Among the fishermen, cattle and sheep, a pair of fieldworkers were drawn, engaged in viewing the Giant's Causeway, their tricorn hats and skirted coats suggesting that they were from the upper echelons of society. Populating the field space with these fieldworkers conceptually shifted the picture from one of a geological scene to one of a geological site.

56 Molyneux, op. cit. (1), 212.

https://doi.org/10.1017/S0007087407000349 Published online by Cambridge University Press

Sandys's drawing of the Giant's Causeway also had its shortcomings, which led the Reverend William Hamilton to comment scornfully a century later,

> In this *true* prospect, the painter has very much indulged his own imagination at the expence of his employers, insomuch that several tall pillars, in the steep banks of this fanciful scene, appear loaded with luxuriant branches, skirting the wild and rocky bay of Port Noffer with the gay exhibition of stately forest trees. In the background he discovered a parcel of rude and useless materials which his magic pencil soon transformed into comfortable dwelling-houses; and for chimneys he has happily introduced some detached pillars of basaltes, which, from their peculiar situation, and the name given to them by the peasants of the country, naturally excited the attention of this extraordinary artist.[57]

A closer look at Sandys's drawing shows that the artist knew that these columns were not 'stately forest trees' but formed of the same kind of rock as the Giant's Causeway. The label for the Organ, 'L', reads, 'The Orgins which are Pillars of ye same with ye Causway.' The supposed 'trees' were not a deliberate glamorization of the landscape surrounding the Causeway, but rather show that the artist was struggling to depict these geological formations. It can be suggested that Sandys was trying to draw the rubbly entablature that caps the basaltic columns but was limited by his technical ability and the artistic tradition in which he worked, which had not yet developed a way of visually representing such rock.[58] Nevertheless, Cole's and Sandys's utilization of various visual techniques enabled the reproduction of the Giant's Causeway in different sites, serving as Latourian 'immutable mobiles' of the field.[59] They allowed it to be moved into other places such as Dublin and London, making it much more visible and thus more accessible to discourse in different locations. Engraving and publishing the drawings in the *Philosophical Transactions* increased their circulation even more. In a sense these images, and the specimens, became the Giant's Causeway, since many natural philosophers would see nothing else.

From the earliest period of research specimens of the Giant's Causeway were collected and circulated, forming another part of natural philosophy's remote knowledge base. While taken from natural things, specimens are artificial and constructed to meet particular needs.[60] The first recorded collection of pieces of the Causeway for philosophical purposes was made by Samuel Foley, who took back to Dublin two column segments, which he and his colleagues called 'joints'. There he measured them and studied their geometry, 'which … Nature likewise observes in the formation of Crystals'.[61] There too Thomas Molyneux saw these specimens, and so was able to add to his accounts more details about the Causeway stones. He reported that the rock from the Giant's Causeway appeared to have the same properties as that of a touchstone, a small tablet of stone used for basic analysis of metal alloys.[62] While images enabled the

57 Hamilton, op. cit. (2), part II, 14–15.

58 See Rudwick, op. cit. (40).

59 B. Latour, *Science in Action: How to Follow Scientists and Engineers through Society*, Cambridge, MA, 1987, 227.

60 A. Larsen, 'Equipment for the field', in *Cultures of Natural History* (ed. N. Jardine, J. A. Secord and E. C. Spary), Cambridge, 1996, 358–77.

61 Foley, 'Answers', op. cit. (18), 174.

62 Molyneux, op. cit. (18).

appearance of the Giant's Causeway to be transmitted across space, specimens could additionally transmit other attributes: texture, colour, hardness, density and even scent could be sensed remotely through them. Reading Georgius Agricola's *De Natura Fossilium*, Thomas Molyneux had discovered a reference to 'a sort of Marble' found in Germany, the description of which seemed 'to bear in several Respects, a great Analogy or Agreement with this Stone of the *Giants Causway*'.[63] This stone emitted a distinctive smell when struck, as did the Causeway specimens: 'I'm assured of from frequent Experiments, that the Marble of the *Giants Causway*, like these *Stony Beams*, when forcibly struck with another Stone or a Bar of Iron, sends forth a strong offensive Scent like Burnt Horn.'[64]

The Royal Society soon desired their own specimens of the Causeway, and, at their meeting on 20 October 1697, 'The Society ordered a Letter to be wrote into Ireland praying a piece or joint of the Giants Causeway.'[65] To this request William Molyneux replied,

> I shall … soon transmitt to you an Intire Joynt of the Giants Causway, by the first ship that goes from hence to you by sea to London … I have two of the Hexagonal Joynts in my Garden here in Dublin; and one of them shall be at your service.[66]

This piece of the Giant's Causeway was carefully wrapped in canvas and dispatched to the Royal Society in late 1697. Suspecting that not everybody who handled the specimen would recognize its philosophical value, William Molyneux wrote advising them that it was on its way and warning them to 'lay wait for it at your Custom House, London, or else such a rude trifle as that may be mislaid or lost'.[67] The specimen was successfully received by the Royal Society in December 1697 and provoked some discussion at a meeting on the 22nd of that month. One Mr Wilson noted 'that the joint of the Giant's Causeway was of the Ordinary blew Irish Stone capable of Polish, there being another kind not capable of it'.[68] Further specimens were collected and by 1698 Thomas Molyneux possessed pairs of Causeway stones with three to eight sides. These specimens enabled him, while in Dublin, to compare pieces of the Causeway with pieces of columnar basalt from other parts of the Antrim coast, and he found that they were

63 Molyneux, op. cit. (1), 222.

64 Molyneux, op. cit. (1), 222.

65 Royal Society, Journal Book Copy, vol. 9 (1696–1702), minutes of the meeting of 20 October 1697, 66.

66 William Molyneux to Hans Sloane, 4 November 1697 (Royal Society, EL/M1/99).

67 William Molyneux to Hans Sloane, 13 November 1697 (DPS papers, 392).

68 Royal Society, Journal Book Copy, vol. 9 (1696–1702), minutes of the meeting of 22 December 1697, 77. The comment recorded in the minutes immediately after Mr Wilson's is intriguing: 'Dr Hooke said that Glass plates were long since made Con Cave for Watches by the help of fire melting down plates on a fire Stone Concave.' Such a comment might have been provoked by the concavo-convex surfaces of the Causeway stone just seen. If so, perhaps Hooke was proposing that the shape of the Causeway stones was the result of the action of heat. However, the comment is ambiguous and may also relate to a discussion on glass that evening. The minutes of the same meeting also record that a letter from a Mr Gray was read, 'giving some Experiments about making Concave Speculums easy'. The discussion about lenses could have equally been stimulated by the Causeway specimen. The minutes of this meeting are somewhat confused and may not be in chronological order, as the presentation of the Causeway specimen and Sandys's drawing are recorded after Mr Wilson's comment on the specimen.

the same type of rock.[69] Like Cole's and Sandys's illustrations, these specimens were also immutable mobiles of the Giant's Causeway and allowed the field site to be seen and reproduced in other places.

The Giant's Causeway in sites of accumulation

Thomas Molyneux made the first move towards a conceptual knowledge of the Giant's Causeway by proposing a classification of its constituent rock. He did not do so in the field, however, but in Dublin. All of the data on the Giant's Causeway – eyewitness accounts, illustrations, observations and specimens – were gathered into what Bruno Latour has termed a centre of accumulation. The Dublin Philosophical Society was an example. There data in the form of 'immutable and combinable mobiles' could be gathered from all over the world, juxtaposed and analysed, allowing scholars to roam through nature without leaving the building or the city.[70] As John Evelyn commented, in such a space the philosopher could 'name himself *Cosmopolitan*, or Habitant of the *Universe*'.[71] Using the evidence derived from the field site, contained in the eyewitness reports and in Cole's drawing, Thomas Molyneux initially set about disproving the contention that the Giant's Causeway was the 'Workman-ship of Art and Mens Hands',[72] as local mythologies held. He pointed to the facts of its situation, near to 'precipitous Hills, not Accessible by Man without great difficulty';[73] the fact that it lost itself in the water and had no apparent use; the lack of any substance cementing the columns together, and of any tool marks; and the occurrence of 'other parcels of the like Stone, which lye still in their Native Beds, as they were first produced in the adjoining Mountain'.[74] Taken together, he thought that these observations were conclusive proof against the Causeway's ascription to giants.

Once he had proved what the Giant's Causeway was not, he discussed items to which it bore certain resemblances in an attempt to discover what it actually was, for

> nothing puts this point more out of Dispute, than to make a little Enquiry into other Works of Nature of the like kind; where though perhaps we may find nothing altogether the same, yet we may observe some of her Productions, that at least bear such an *Analogy*, or Resemblance to the Composition and Figure Remarkable in these Stones, that we shall conclude These as well as They must certainly be the Architecture of the Regular Hand of Nature.[75]

He compared the various descriptions of it with similar natural things which were in some ways analogous to it: 'the several *figured Stones* already described by [other] Authors',[76] namely *Entrochos* and *Astroites* (both types of fossil crinoid), a touchstone, and *Basaltes* or basalt. For this he drew upon Boetius's *Gemmarum et lapidium*

69 Molyneux, op. cit. (1).
70 Latour, op. cit. (59), 227.
71 Quoted in A. Johns, *The Nature of the Book: Print and Knowledge in the Making*, Chicago, 1998, 488.
72 Molyneux, op. cit. (18), 176.
73 Molyneux, op. cit. (18), 176.
74 Molyneux, op. cit. (18), 177.
75 Molyneux, op. cit. (18), 177.
76 Molyneux, op. cit. (18), 177.

historia, and a paper by Martin Lister in the *Philosophical Transactions* which contained a plate illustrating various fossils. He also noted similarities of the Causeway's columns with reeds and bamboos, because their 'joynted stems … seem to bear somewhat of Analogy or Resemblance to the *Geniculated Mineral*, or *Rock-Plants* we are speaking of'.[77] This approach to determining what the Giant's Causeway might be was similar to that advocated by Nicolaus Steno, who had argued in 1669 that if

> a solid substance is in every way like another solid substance, not only as regards the conditions of surface, but also as regards the inner arrangement of parts and particles, it will also be like it as regards the manner and place of production.[78]

For Thomas Molyneux this was a valid method for elucidating the secrets of nature:

> This affinity between Plants and Fossils, will not seem altogether imaginary to any one that Judiciously considers, how the various Classes of Beings in the Creation, even from the perfectest to the most imperfect are link'd together, and as it were related by slow descents and Gradations from one to t'other … Thus, the *Monky* has something of the *Man*, and *Quadrupede*; the *Batt*, of the *Bird* and *Beast*; the *Amphibious*, of the *Beast* and *Fish*; the *Hirundo Marina*, or *Flying Fish*, of the *Bird* and *Fish*; the *Mollusci*, and *Zoophyta*, of the *Fish* and *Plant*; and so of the rest.[79]

However, from the account and picture of some columnar basalt in Saxony published in Conrad Gesner's *De omni rerum fossilium genere* of 1565,[80] Thomas Molyneux concluded that the rock of the Giant's Causeway was a species or form of *Lapis Basaltes*, which he classified as

> *Lapis Basaltes* vel *Basanos maximus Hibernicus, angulis minimum quinque plurimum septem constans; crebris articulis sibi invicem affabrè conjunctis, sed facilè separabilibus, geniculatus*.[81]

Such was the overview of nature that a site of accumulation afforded Thomas Molyneux that he was able to classify the Giant's Causeway without having seen the actual Causeway for himself. Writing from such a position gave him more epistemic power than an eyewitness had when writing from the field. Surrounded by immutable and combinable mobiles in Dublin, he was able to compare descriptions of the Giant's Causeway with descriptions of similar natural things from other places, an achievement which could not be performed in the field by surrogate fieldworkers. His space gave him access to different data, and thus enabled his classification. In Dublin he could see new things from afar. Field proxies, such as texts, illustrations and specimens, allowed him in some respects to be an eyewitness of many fields. Molyneux had a sense of having seen the Giant's Causeway through such proxies. This is revealed by his contention that

77 Molyneux, op. cit. (18), 180.

78 Quoted in R. Laudan, *From Mineralogy to Geology: The Foundations of a Science 1650–1830*, London, 1987, 39.

79 Molyneux, op. cit. (18), 180.

80 See Ashworth, op. cit. (41).

81 Molyneux, op. cit. (18), 181. Translated this reads, 'The greatest Irish stone is basalt or touchstone, standing with at least five corners and at the most seven; full of knots, it has numerous joints which are alternately and skilfully interlinked, but easily separable.'

an anonymous critic who had had the temerity to dispute his claim that its rock was basalt had not seen the Giant's Causeway – neither, in fact, had Molyneux.[82]

Explaining the origin of the Giant's Causeway caused Thomas Molyneux some difficulty. He was equivocal about the value of proposing theories to account for it. He certainly scorned local beliefs in '*Giants*, *Fairies*, *Dæmons*, and such like Imaginary Causes' as the originators of the Causeway.[83] However, while he observed that its regularity 'must certainly be the Architecture of the Regular Hand of Nature',[84] and declared that 'the *Giants Causway* of *Ireland* may very well be esteemed one of the greatest *Wonders*, Nature, or the first Cause of all things has produced',[85] he urged caution when seeking for explanations of its formation:

> By what means these Stony Joints, so Ponderous and Bulky, and so distinct and discontinued Bodies from one another, should arrive at first to this great Height, and reach the Summits of these tall Colums where they now are placed, seems a Problem of that difficulty, that some perhaps for its Solution may be apt to think they were co-æval with the first Creation, and ranged then in the same Order they now stand by the great *Fiat* that produced the World. But it were easy to give another Conjecture of this odd Appearance, were I not better pleased to observe and set down the History of Nature as it truly is, than to amuse my self and others by making vain and uncertain Guesses at the hidden Causes of its *Phænomena*.[86]

Despite the greater epistemic value afforded to sites of accumulation compared with the field, by 1698 Thomas Molyneux, along with other natural philosophers such as Edward Lhuyd and John Woodward,[87] was on the verge of newer ways of thinking about the field which would eventually give it more prominence in natural philosophy and later in the earth sciences. Thomas Molyneux acknowledged limitations in the view provided by the various proxies of the Giant's Causeway that he had used to construct his classification. He commented, revealingly, that he had deferred writing to the Royal Society in the hope that he would have been able to get to see it,

> more to my own as well as your Satisfaction; for being an Eye-witness of this rare and surprising Piece of Nature's inanimate Workmanship, I might by a more diligent Search and Ocular Inquiry, correct some Mistakes and Oversights I find committed by those that have already described it; and add to their Observations such farther Remarks, as might render the Image and Notions we have of the *Giants Causway*, still more Compleat and Circumstantial.[88]

82 Molyneux, op. cit. (1). The greater scope of vision inherent in such a space can be further seen in the discussions between Thomas Molyneux and Edward Lhuyd. Lhuyd had discovered a basalt formation in Wales, and sent an account of it, accompanied by a drawing, to Thomas Molyneux, who advised him to compare a specimen of the Welsh basalt with a specimen of Causeway basalt in the Repository at Gresham College. See Thomas Molyneux to Edward Lhuyd, 4 May 1699 (DPS papers, 402).

83 Molyneux, op. cit. (18), 176.

84 Molyneux, op. cit. (18), 177. This comment reflects the prevalent conception of nature as art and God as the artisan; cf. L. Daston, 'Nature by design', in *Picturing Science, Producing Art* (ed. C. A. Jones and P. Galison), London, 1998, 232–53.

85 Molyneux, op. cit. (1), 210.

86 Molyneux, op. cit. (1), 219.

87 Davies has observed that Woodward 'was evidently the first fully to appreciate the vital importance of field-work in geological studies', this around the 1690s. G. L. Davies, *The Earth in Decay: A History of British Geomorphology 1578–1878*, London, n.d., 75.

88 Molyneux, op. cit. (1), 209.

Such thinking affords greater epistemic value to the field site than to a centre of accumulation. Thomas Molyneux's desire to see the Giant's Causeway for himself in order more fully to understand it is comparable with his brother William's empiricist belief that sensory experience was the basis of knowledge. William Molyneux famously answered his eponymous philosophical problem negatively: would a blind man, having learned by touch to distinguish between a cube and a sphere and then regaining his vision, be able to distinguish between these forms by sight without first handling them?[89] Even so, in their search for an understanding of earth processes, direct personal experience of the field remained the exception rather than the rule for natural philosophers until the last decades of the eighteenth century.[90] This led Sir John Strange to lament in 1775 that

> I shall think myself very happy if they [his observations on columnar basalt] afford any satisfaction; and more particularly so, should they be found conducive to the advancement of so interesting a province of Science as that of Physical Geography, which being grounded upon facts, that require observation, seems hitherto to have suffered for the want of it.[91]

Not everybody agreed with Thomas Molyneux's classification of the Giant's Causeway. In February 1696 the *Miscellaneous Letters*, a short-lived journal of literature reviews and other philosophical contributions, published an anonymous letter which briefly discussed the formation.[92] Its author had in an earlier letter to the same journal promised an article on his observations about the Causeway,[93] but having subsequently discovered the contributions about it in the *Philosophical Transactions* of 1694, 'to which I can add but little',[94] he refocused his latest communication. However, he made a point of observing that he believed Thomas Molyneux had been mistaken in his classification of the Giant's Causeway as *Lapis Basaltes*:

> I must take notice that the *Ingenious Gentleman* [Thomas Molyneux], who wrote the Notes upon it, might (at least in my poor Opinion) have rather referr'd this admirable *Fossil* to the *Entrochi*, than to the *Lapis Basaltes*, or *Basanos*; for the Internodia or Joints, do not seem to agree with the latter. It cannot have been the Vertebrates or Joints of any Water or Land Animal left there by a Flood, for the Magnitude of the Articulations, and the Situation of the Thing evince the contrary at first sight.[95]

89 J. G. Simms, *William Molyneux of Dublin*, Dublin, 1982.

90 Davies, op. cit. (87); R. Rappaport, 'The earth sciences', in *The Cambridge History of Science, Volume 4: Eighteenth-Century Science* (ed. R. Porter), Cambridge, 2003, 417–35; Rudwick, op. cit. (19).

91 J. Strange, 'An account of two giants causeways, or groups of prismatic basaltine columns, and other curious vulcanic concretions, in the Venetian State in Italy; with some remarks on the characters of these and other similar bodies, and on the physical geography of the countries in which they are found', *Philosophical Transactions* (1775), **65**, 5–47.

92 Anonymous, 'A letter from Dublin to the author of the miscellaneous letters, giving an account of some petrifactions, with animadversions thereupon', *Miscellaneous Letters* (1696), **2**, 49–57. This issue is incorrectly numbered.

93 See S.G.A., 'An account of, and reflections upon the two essays sent from Oxford to a nobleman in London, concerning some errors about the creation, general flood, and the peopling of the world; as also of fables, romances, and the state of learning', *Miscellaneous Letters* (1695), **1**, 561–6.

94 Anonymous, op. cit. (92), 49.

95 Anonymous, op. cit. (92), 49–50.

Importantly, the anonymous author believed that the columns of the Giant's Causeway ('this admirable *Fossil*') were of organic origin, some sort of vitrified plant. This differed from Thomas Molyneux's definition of it as *Lapis Basaltes*, a mineral of inorganic origin. Nevertheless, despite this difference of opinion on the classification of the Causeway stones, he confirmed that the Giant's Causeway was indeed 'an *Original Fossil* of a Stupendous Figure and Dimensions, and prove[d] the Art, Power, and Variety of Nature in her Subterraneous Workmanship, especially in her forming of figur'd Stones'.[96] However, Thomas Molyneux would hear nothing of this alternative (organic) classification, and wrote angrily in the *Philosophical Transactions*,

> I cannot but think that Gentleman extreamly out, whoever he is, for he conceals his Name, and perhaps would have done well had he his Opinion too, that publish'd a Paper, *Number* 23. *Page* 46. in the *Monthly Miscellaneous Letters*, where he says, the Stone of the *Giants Causway* (which I am confident he had never seen) *might rather be referr'd to the Entrochi than to the Lapis Basaltes or Basanos*.[97]

The 1696 'letter from Dublin … giving an Account of some Petrifactions, with Animadversions thereupon' was indeed anonymous. This conferred upon its author a position of power which a credited letter could not.[98] It posed a threat to Thomas Molyneux's analysis of the Giant's Causeway data, since Molyneux could not use the intellectual status and experience of his opponent to discount this alternative classification. That Molyneux felt intellectually threatened can be seen from his publication of a second paper on the Giant's Causeway in 1698 and the *ad hominem* paragraph in it. This paper added little to existing knowledge, but merely reinforced and reiterated his earlier classification. The only new data it contained concerned the number of sides found on the columns: in 1694 he had numbered the sides from four to seven, and he now corrected this to between three and eight. This evidently worked: Thomas Molyneux's classification of the rock of the Giant's Causeway as (inorganic) basalt endured.

Who was Molyneux's anonymous disputant? It seems likely that the writer to the *Miscellaneous Letters* was St George Ashe. The earlier letter to which he referred was signed 'S.G.A.' and dated Dublin College, 18 December 1695[99] – Ashe had been Provost of Trinity College since 1693. This is intriguing, for Ashe and Molyneux would have known each other well, since they were both members of the Dublin Philosophical Society. Furthermore, Molyneux had cited Ashe as one of his sources of first-hand observations on the Giant's Causeway in his 1698 account. Perhaps Molyneux's comment ('which I am confident he had never seen') was an attempt to deflect any suspicions that it was Ashe who was querying his classification. This would have discredited Molyneux's claims based on data supplied by Ashe. While it may have been that Molyneux simply did not know his disputer, this seems very unlikely. Given his and Ashe's proximity they would surely have talked about such things and consultation of

96 Anonymous, op. cit. (92), 50.

97 Molyneux, op. cit. (1), 221.

98 See J. A. Secord, *Victorian Sensation: The Extraordinary Publication, Reception, and Secret Authorship of* Vestiges of the Natural History of Creation, Chicago, 2000.

99 S.G.A., op. cit. (93).

the earlier letter would have supplied Molyneux with Ashe's initials. If indeed the anonymous disputer was Ashe, his disagreement with Molyneux over what the Causeway was is interesting and suggestive.

Conclusion

On 14 August 1708 Samuel Molyneux, son of William Molyneux and nephew of Thomas Molyneux, visited the Giant's Causeway during a tour of the north of Ireland.[100] The day before, he and his entourage had travelled from Shane's Castle, County Antrim, and

> arrived in 4 or 5 hours thro' a miserable, wild, Barbarous, boggy countrey, to as bad a Lodging in a poor Village called Maghereoghill … Having Passed the Night but ill, we were Soon on our journey … to the Gyant's Causey.[101]

His accommodation that night was no better: 'Having taken a sufficient view of the Gyant's Causey' he rode to Coleraine, where he stayed in a 'drunken, Stinking Kennel' of an inn.[102] For a man accustomed to a comfortable town house in Dublin, life in the field, gathering data for a proposed natural history of Ireland,[103] was not a pleasant experience.

However, grubby villages and dirty inns were not the only spaces through which Samuel Molyneux had travelled on his way to the Giant's Causeway. His view of it was surely influenced by the geography of his childhood and the particular institutional and discursive spaces that he had passed through as a teenager (he was eighteen years old when he visited). In the garden of his Dublin home his father William had deposited specimens of its columns. The young Samuel had doubtless played upon them and marvelled at their shape. His uncle Thomas was the leading authority on the Causeway and he would likely have listened to his father and uncle conversing about it, and after his father's death in 1698 discussed it with his uncle, whose writings on it he had certainly read. He would also have seen the pictures and specimens of it that the Dublin Philosophical Society had commissioned and collected. But not only did these people and objects direct his attention to the Giant's Causeway, they also mediated his visit to it. He recorded that he brought with him to the Causeway copies of his uncle's 1698 paper and Sandys's painting, 'and compared them both on the place as strictly as I could', concluding,

> The Draught is pretty well as to the Causey itself, but not so Exact in the face of the Hill and the Organs or Loomes as it should be; and indeed it does not repressent ye Causey itself to run

100 For Samuel Molyneux's diary of his tour in the north of Ireland, see S. Molyneux, 'Journey to ye North, August 7th, 1708', in *Historical Notices of Old Belfast and its Vicinity* (ed. R. M. Young), Belfast, 1896, 152–60; note that Young mistakenly attributes this account to Thomas Molyneux.

101 Molyneux, op. cit. (100), 157.

102 Molyneux, op. cit. (100), 157, 158.

103 Although Samuel Molyneux did redistribute copies of his father's questionnaire on Irish natural history, he also made the effort to go and see natural phenomena for himself, further evidence of the beginning of a shift away from collating data obtained through eyewitness reports; see Hoppen, op. cit. (11), and *idem*, op. cit. (37).

> from the Hill as it so does. I think it would be as necessary and usefull to have a plan of it as well as prospect as for the acco't [Thomas Molyneux's] on't in *Dr. Lister's Letter*.[104]

Of note is the importance attached by Samuel Molyneux to imagery for understanding the earth. Indeed, it was of greater significance to him than the field site itself, as his only recorded observations about the Giant's Causeway were related to how well Sandys's prospect had reflected the reality. Cole's and Sandys's drawings are undervalued by modern historians of geology and their brave and groundbreaking attempts meaningfully to picture a philosophical landscape have been poorly treated or ignored.[105] Given the early period in which these drawings were produced, the lack of a stylistic tradition for such landscapes and the importance accorded to them by contemporary philosophers this is surprising.

In order to publicize his new knowledge of the Giant's Causeway, Samuel Molyneux needed to pass through another set of places. Whether or not he in fact did so cannot be ascertained, although since he was actively trying to re-establish the Dublin Philosophical Society (moribund since 1697) it seems likely that he gave the few philosophers he had rallied to its standard some account of his trip to the north. While he left a manuscript record of his journey this was not published until 1896. He never wrote his proposed natural history of Ireland.[106] His visit marks the end of an era, bringing to a close this story of the historical geography of the first years of the Giant's Causeway as a subject of the 'scientific' gaze. It would be over thirty years before new studies of the Giant's Causeway were published.

Knowledge of the Giant's Causeway in the late seventeenth century was an activity distributed across different sites. To begin with, there was the landscape of the Giant's Causeway, constituted as space of natural philosophy by virtue of the intriguing regularity of its stones. However, the Giant's Causeway was not a simple Euclidean space, but a place constituted in multiple venues and through various social practices. There was a marked disjunction between the field site and the sites of knowledge production. Understanding of the Giant's Causeway was developed in places remote from it. Through proxies such as pictures and specimens, even observations could be made at a distance from the field. The field was necessary as the source of the data, but more important spaces in the late seventeenth century for developing conceptual knowledge about the Giant's Causeway were the centres of accumulation. The geographical distance between the field and the philosopher was overcome by mobilizing the field through proxies, eyewitness reports, drawings and specimens, which provided the possibility of reproducing and understanding it in other places. This raised issues of

104 Molyneux, op. cit. (100), 157.

105 Klonk is more concerned with 'inaccuracy' and 'errors' in these images than with their intellectual importance and conceptual significance. C. Klonk, 'Science, art, and the representation of the natural world', in *The Cambridge History of Science, Volume 4: Eighteenth-Century Science* (ed. R. Porter), Cambridge, 2003, 584–617. Porter's history of geology mentions them only in passing and wrongly attributes Sandys's drawing to William Molyneux. R. Porter, *The Making of Geology: Earth Science in Britain 1660–1815*, Cambridge, 1977. Rudwick, op. cit. (40), while admittedly dealing with later geological illustration, still does not mention its predecessors from the pens of Cole and Sandys.

106 Hoppen, op. cit. (11).

trust, so the data sources had to be credible. When these proxies for the Giant's Causeway were combined with others containing information relating to different sites in a centre of accumulation, Thomas Molyneux's field of vision was extended to encompass other places and similar formations. By virtue of the epistemic space that he occupied, he was enabled to classify the rock of the Giant's Causeway as *Lapis Basaltes*. Looking upon the field site from the Dublin Philosophical Society, he could see new things that could not be seen by fieldworkers. Nevertheless, by 1698 Thomas Molyneux had doubts about the accuracy of the various proxies for the Giant's Causeway and about the epistemic validity of relying on second-hand data rather than making personal observations.

As natural philosophers sought a 'true prospect' of the Giant's Causeway in the seventeenth century, many intellectual spaces had to be traversed. These spaces, linked by personal contact, letters and publications, drawings and specimens, concepts of trust and social status, were not neutral containers for natural philosophy but had an important epistemic role in the development of understanding about the Giant's Causeway. Even at this early period, the field site was already problematized as a self-contained area of study. As a place of philosophical interest the Giant's Causeway, like any field, was constituted in other venues by a variety of embodied spatial practices, and became part of a network of cross-cutting locals and locales in which natural knowledge was sought.