**The black-lead of Borrowdale, 1500–1750: an object history of a mutable material**

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**Abstract.** The black-lead mines of Borrowdale are located in the centre of the English Lake District. They are the source of some of the purest graphite in the world. The Furness Abbey Coucher Book suggests that the riches of these mines have been known for more than 600 years. From the 1560s, graphite mined in Borrowdale was transported across Europe, where it was used in the creation of a variety of transformative objects. Traders were supplying artists in Italy with Borrowdale graphite before the end of the sixteenth century and, in the process, helped to influence the emergence of a new form of portraiture known as plumbago drawing. But the commercial use of graphite was hardly restricted to the arts. Following the ban on the exportation of Bavarian graphite in 1613, Borrowdale's black-lead became increasingly essential for sustaining the English armament industry. Thanks to its molecular properties, graphite was widely considered the best material for facing moulds for cannon and musket balls as well as for cleaning firearms and lubricating rollers, screws and rigging. Nor was this all. By the turn of the eighteenth century, Borrowdale graphite was also being used medicinally to treat disorders ranging from gallstones to bladder infections. This chapter considers each of these early modern applications of graphite in order to reveal how this mutable and mobile material was essential to the manufacture and circulation of a wide range of objects. In doing so, the chapter delves into an often-unappreciated aspect of the Lake District's early modern history and, thereby, suggests how an object-oriented approach to the Lake District's past can help us place the region within a broader, European context.

Seathwaite, in Borrowdale, in the English Lake District, ranks among Britain's rainiest places. If you are going walking there, you would do well to pack an anorak. But rain or shine, the valley is well worth visiting. It is an especially ideal spot for exploring the Lake District's industrial history. That history is often overlooked. In many instances, it is neglected in favour of the Lake District's other associations, not least its historic links with English art and literature.[1] At Seathwaite, however, the region's industrial history comes to the fore, and it does so in a way that helps us to see the Lake District in a different light. Rather than just seeing the region as a meaningful part of English or even British history, at Seathwaite we can begin to see the Lake District's connections with the entangled, material histories of early modern Europe.

[INSERT FIG. 1 HERE.]
Figure 1. Seathwaite, from Seatoller Fell
Source: Image © The author

You would be hard pressed not to notice how Seathwaite has been shaped by human hands. There is the historic farmstead, for starters, with its wide cobbled yard and its rows of barns and cottages. The earliest of these buildings probably dates to the 1660s, but the fields and intakes around the farm are much older (Figure 1).[2] These features affirm that people have been working the land in Seathwaite since at least the thirteenth century.[3] Equally striking though, is the run of spoil heaps that stretch up the side of Seatoller Fell, on the valley's north-west side (Figure 2). From a distance, these heaps look like the work of some giant mole, but they are manmade. Like the ruined shelters found around them, they are actually part of one of the most interesting chapters in the Lake District's mining history. They mark the old workings of Borrowdale's black-lead mines.

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[1] On this point, see J. D. Marshall and Michael Davies-Shiel, *The Industrial Archaeology of the Lake Counties* (Newton Abbot: David & Charles, 1969), and more recently, Ian Whyte, 'Whose Lake District? Contested Landscapes and Changing Sense of Place', *North West Geography*, 2.2 (2002), 1–11, and John K. Walton, 'Landscape and Society: The Industrial Revolution and Beyond', in *The Making of a Cultural Landscape: The English Lake District as Tourist Destination, 1750–2010*, ed. by John K. Walton and Jason Wood (Farnham: Ashgate, 2013), pp. 69–86.

[2] Peter Schofield, *Borrowdale, Cumbria: Historic Landscape Survey*, 2 vols (Lancaster: Oxford Archaeology North, 2017), vol. 2, pp. 225–28.

[3] Chris Wood, et al., 'Evidence for Medieval Clearance in the Seathwaite Valley, Cumbria', *Transactions of the Cumberland and Westmorland Antiquarian and Archaeological Society*, ser. 3, 11 (2011), 53–68.

[INSERT FIG. 2 HERE.]

Figure 2. The spoil heaps of the black-lead mines

Source: Image © The author

The black-lead of Borrowdale is not actually lead. It is graphite. But the word graphite was not introduced until the 1780s.[4] Before then, graphite was known by other names, including wadd, cawke, killow, black-lead and plumbago. The latter, which means 'lead-like stone', comes from the Latin word for lead (*plumbum*) and was in use by the first century. It appears in Pliny's *Natural History*.[5] From Pliny, the word passed into early modern mineralogy. Christoph Entzelt, Georgius Agricola and Conrad Gesner all used it in influential works in the sixteenth century.[6] Like the other natural philosophers of their era, these men associated graphite with molybdenite, antimony and galena (or lead sulphide). But graphite is not lead. Like a diamond, it is a kind of crystallised carbon. Unlike diamonds though, in graphite the carbon atoms are arranged in weekly bonded layers. Consequently, graphite is soft and slippery to the touch, and like lead it makes a grey streak when rubbed on paper. That is part of the reason why terms like plumbago were introduced. Black-lead, for its part, was evidently a conventional term in England by the 1580s. William Camden suggests as much.[7] Around Borrowdale, however, wadd, cawke and killow were more common.[8]

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[4] R. J. King, 'Graphite', *Geology Today*, 22.2 (2006), 71–77 (p. 72); Henry Petroski, *The Pencil: A History of Design and Circumstance* (New York: Alfred A. Knopff, 1990), p. 43.

[5] Pliny the Elder, *Naturalis historiae: libri XXXVII*, ed. by Karl Mayhoff, 6 vols (Munich and Leipzig: K. G. Sauer, 2002), vol. 5, pp. 411–12 (xxxvii.18).

[6] Christoph Entzelt, *De re metallica, hoc est, de origine varietate, et natura corporum metallicorum, lapidum gemmarum atque aliarum* (Frankfurt: Chritain Egenolf, 1551), pp. 66–71; Georgius Agricola, *De re metallica libri xii* (Basil: Hieronymus Froben & Nicolaus Episcopius, 1556), p. 78; Conrad Gesner, *De omni rerum fossilium genere, gemmis, lapidibus, metallis, et huiusmodi* (Zurich: Jacob Gesner, 1565), fols 74r–75v. See also, Johann Beckmann, *Beytrage zur Geschichte der Erfindungen*, 5 vols (Leipzig: Paul Gotthelf Rummer, 1780–1805), vol. 5, pt 2, pp. 235–54.

[7] William Camden, *Britannia, sive florentissimorum regnorum, Angliae, Scotiae, Hiberniae, et insularum adiacentium*, 2nd edn (London: Ralph Newbery, 1587), p. 523.

[8] Beckmann, *Beytrage zur Geschichte*, p. 246; Petroski, *The Pencil*, p. 43; George C. Boon, 'An Early Tudor Coiner's Mould and the Working of Borrowdale Graphite', *Transactions of the Cumberland and Westmorland Antiquarian and Archaeological Society*, ser. 2, 76 (1976), 97–132. The origin of these three terms is obscure. Early visitors to the mines occasionally conjectured about this matter. See, for instance, William

Seathwaite's graphite mines are unusual. Though now closed, they were once the source of some of the purest graphite in the world. They were also one of the few graphite mines known in early modern Europe.[9] It is not clear when people began working them. A number of popular histories claim that Seathwaite's graphite was discovered by accident in the 1500s. It is said some shepherds found the mineral under an uprooted tree.[10] There is no specific evidence to prove that story, though. 'The recorded history' of the event is, as Molly Lefebure notes, 'patchy' and 'unreliable'.[11]

Still, local shepherds must have known about Borrowdale graphite by the early modern era. Tudor inventories refer to the substance as 'Shepe Oodde' (or 'sheep wad'), which, alongside other evidence, suggests that shepherds were using graphite to mark their flocks.[12] These inventories relate to the lands of Furness Abbey, which owned Seathwaite between the thirteenth and sixteenth centuries, and it has been proposed that graphite from the valley may have been used to prepare manuscripts at the abbey as early as the 1410s. The abbey's Coucher Book, which dates to that decade, appears to have graphite guidelines.[13]

The earliest written records of graphite mining in Seathwaite postdate Furness Abbey's dissolution. Yet there is reason to believe that some sort of digging was taking place in the valley by the turn of the sixteenth century. A graphite coiner's mould now in the collections of Tullie

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Nicholson's letter of 1710 in Joseph Nicholson and Richard Burn, *The History and Antiquities of the Counties of Westmorland and Cumberland*, 2 vols (London: W. Strahan & T. Cadell, 1777), vol. 2, pp. 81–82. More informed interpretations have since been provided by Robert Ferguson, *The Dialect of Cumberland* (London: Williams and Norgate, 1873), pp. 19, 160, and E. W. Prevost, *A Supplement to the Glossary of the Dialect of Cumberland* (London: Henry Frowde, 1905), p. 38.

[9] See, for instance, Thomas Fuller, *The History of the Worthies of England* (London: Thomas Williams, 1662), p. 215, and Beckmann, *Beytrage zur Geschichte*, pp. 245–48.

[10] Petroski, *The Pencil*, p. 45; W. G. Collingwood, *Lake District History* (Kendal: Titus Wilson & Son, 1925), p. 129; Ian Tyler, *Seathwaite Wad and the Mines of the Borrowdale Valley* (Keswick: Blue Rock Publications, 1995), p. 68.

[11] Molly Lefebure, *Cumberland Heritage* (London: Gollancz, 1970), p. 18.

[12] Boon, 'Early Tudor Coiner's Mould', p. 111; John Brownbill (ed.), *The Coucher Book of Furness Abbey*, Vol. 2, pt. 3 (Manchester: Chetham Society, 1919), p. 653. See also: Thomas Robinson, *An Essay Towards a Natural History of Westmorland and Cumberland* (London: W. Freeman, 1709), and George Smith, 'Journey to the Black Lead Mines', *Gentleman's Magazine*, 21 (1751), 51–53. The latter claims that 'before [graphite's] value was discovered, the farmers used it as those of the S[outh] countries do ruddle, to mark their sheep' (p. 53).

[13] Boon, 'Early Tudor Coiner's Mould', p. 112; Tyler, *Seathwaite Wad*, p. 68.

House Museum & Art Gallery in Carlisle provides the main case in point (Figure 3). This mould, as George C. Boon and others have explained, was discovered in the western Lake District in 1865.[14] A local worker found it in a pile of stones. When and why the mould was placed there is unknown. The identity of its creator is a mystery. But the mould was evidently made around the turn of the sixteenth century. It is clear, moreover, that it was used for counterfeiting money. The coins the mould was designed to cast (silver groats, half groats and pennies) all date to the final decade of Henry VII's reign.

Graphite's melting point is more than 3,000ºC: about three times that of copper, gold and silver.[15] Graphite is also fairly light. Its density is only about 2.25 g/cm$^3$. (Silver's, by contrast, is closer to 10.5 g/cm$^3$.) That makes graphite an ideal material for casting coins. By the same stroke though, graphite is also soft. Its hardness on Mohs scale lies only between 1 and 2.[16] In short, graphite is far less useful for die-striking, which is the way most Tudor coins were minted. Compared with authentic, hammered coins, the coins made with this mould would have likely seemed too thick. Such counterfeits, as Boon surmises, would probably have been passed off 'only at crowded markets and fairs, where money changed hands quickly'.[17]

[INSERT FIG. 3 ABOUT HERE.]
Figure 3. Plumbago coiner's mould (c. 1500)
Source: Image © Tullie House Museum & Art Gallery

For all that though, the mould is an important artefact. It is formed of two palm-sized blocks of high-quality Borrowdale graphite. Each block measures around seven by six by two centimetres and weighs about 160 grams.[18] That is just a bit larger and heavier than a standard

[14] Boon, 'Early Tudor Coiner's Mould', pp. 97–105. See also, R. S. Ferguson, 'On Certain Plumbago Moulds, Found in Netherwasdale, Cumberland', *Transactions of the Cumberland and Westmorland Antiquarian and Archaeological Society*, ser. 1, 13 (1878), 27–30; Philip Nelson, 'Plumbago Mould for the fabrication of Coins of Henry VII', *The Numismatic Chronicle and Journal of the Royal Numismatic Society*, ser. 4, 5 (1905), 205–7; and C. A. Parker, *The Gosforth District: Its Antiquities and Places of Interest*, ed. and rev. by W. G. Collingwood (Kendal: Titus Wilson & Sons, 1926), pp. 74–75

[15] King, 'Graphite', p. 76.

[16] King, 'Graphite', p. 73.

[17] Boon, 'Early Tudor Coiner's Mould', p. 99.

[18] Personal communication from Elsa Price, Curator of Human History, Tullie House Museum & Art Gallery, 18 December 2020.

deck of cards. This means the mould is portable. It could easily be concealed or carried in a pocket. The mould's shape also shows that it was formed from a single piece of graphite, which must have been at least 168cm$^3$. Such a big nodule could have been unearthed by natural processes. The graphite in Borrowdale is found in randomly sized veins and 'sops'. So, it is not impossible that a large piece of graphite might have been brought to the surface by erosion. Still, Boon concludes that the nodule in question was probably 'obtained […] by mining.'[19] A specimen of such size and quality would, he reasons, have likely lain deep underground.

This conclusion is compelling, but it has not swept all before it. Lefebure, for one, has followed G. P. Jones in pointing out that the mould might have actually been imported.[20] Knowledge of the use of graphite in casting metals was not common in England until the 1570s. Consequently, some have speculated that the person who made the mould was a foreigner, or at least someone who had spent time abroad.[21] Yet the quality of the graphite from which the mould was made and the location where it was found both favour Boon's interpretations. There were active graphite mines elsewhere in Europe at the turn of the sixteenth century, notably in Bohemia and Bavaria. The sort of superb graphite of which the mould was made was, however, only found in the Lake District. The mould has therefore generally been accepted as evidence that some sort of graphite mining was going on in Seathwaite before the Reformation.[22]

Here, as is often the case, object history carries us back farther than the written record. But that is not all. For, in addition to providing a likely *terminus ante quem* for graphite mining in Seathwaite, the coiner's mould alerts us to the fact that graphite was appreciated as a mutable and mobile commodity as early as the 1500s. Seathwaite was a remote place at that time. All the same, it was within the orbit of market towns like Keswick and Cockermouth. The valley was also connected with the Cumberland coast. Nether Wasdale, the place where the mould was found, actually lies near the medieval track from Seathwaite to the port of Ravenglass. (This was the path the monks of Furness Abbey used to access their Borrowdale estates.[23]) In sum, the mould's provenance suggests how Borrowdale graphite began to find its way into the rest of Britain and beyond. Within a century graphite from the valley was being shipped from England to the Low Countries. From there, it passed into central and southern Europe, where it was

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[19] Boon, 'Early Tudor Coiner's Mould', p. 96.

[20] Lefebure, pp. 76–78.

[21] See Ferguson, 'On Certain Plumbago Moulds', pp. 29–30.

[22] See, for instance, Tyler, *Seathwaite Wad*, p. 69.

[23] Brian Paul Hindle, *Roads and Trackways of the Lake District* (Ashbourne: Moorland Publishing, 1984), p. 119.

variously known as 'Flanders stone' and 'English antimony'.[24]

The latter term ('lapis Flandriae') was used in Zurich as early as 1565. The former ('stimmi Anglicum') appeared in print in Rome in the 1590s. In both cases, the books in question associate graphite with a curious new invention: the 'lead' pencil. Gesner, the author of the earlier work, described this invention as an instrument 'made for writing, of a certain kind of lead […] shaved into a point and inserted into a wooden handle.'[25] He even included an explanatory illustration, which is now widely considered to be the first picture of a 'lead' pencil (Figure 4).

[INSERT FIG. 4 ABOUT HERE.]

Figure 4. Illustration of a 'lead' pencil from Gesner's *De omni rerum fossilium genere*
Source: Image © Folger Shakespeare Library

Graphite had been used for making ruling lines in manuscripts in Europe and the Ottoman Empire as early as the eleventh century.[26] But the use of graphite pencils was an early modern innovation. As devices for writing and drawing, they had a number of advantages over other media. For starters, graphite pencils are harder than plummets made of lead and tin, and that means that they hold a sharpened point for longer. What is more, graphite pencils are less dusty and more durable than either chalk or charcoal. Unlike ink, marks made with graphite are easy to erase. As John Brinsley advised in 1612, even a piece of fresh bread will remove them.[27] Unlike silverpoint, moreover, graphite can mark a wide range of surfaces. It does not require gesso or other foundation compounds.

Ferrante Imperato singled out these qualities of graphite for praise in 1599. He claimed that this versatile mineral (which he called 'grafio piombino') was preferable to all other art materials.[28] This opinion was widely held. By the turn of the seventeenth century, the 'lead'

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[24] Gesner, *De omni rerum fossilium genere*, fol. 104; Andrea Cesalpino, *De metallicis, libri tres* (Rome: Aloysius Zannetti, 1596), p. 186. See also Petroski, *The Pencil*, p. 47.

[25] Gesner, *De omni rerum fossilium genere*, fol. 104: 'Stylus […] ad scribendum factus est, plumbi cuiusdam […] genere in mucronem derasi, in manubrium ligneum inserto.'

[26] Jonathan J. G. Alexander, *Medieval Illuminators and their Methods of Work* (New Haven: Yale University Press, 1992), pp. 38–40.

[27] John Brinsley, *Ludus Litterarius: Or, the Grammar Schoole* (London: Thomas Mann, 1612), pp. 46–47.

[28] Ferrante Imperato, *Dell'historia naturale* (Naples: Costantion Vitale, 1599), p. 122: 'Il grafio piombino si preferisce a tutte le materie, che preparino il disegno, alla penna e l'inchiostro: percioche facilmente, usandovi industria, si cancella: e non volendo cancellarlo si conserva. Non da impedimento al maneggio

pencil was not just well known, but also sought after. It was a desirable commercial commodity. This was, not inconsequently, the period when the mass production of art supplies in Europe began.[29] But what is especially interesting about early descriptions of the 'lead' pencil is the language used to describe its core ingredient. In many cases, the sources allude to Borrowdale graphite. Gesner's use of the term 'English antimony' in telling. So, too, is the expression 'Flanders stone', which appeared in Andrea Cesalpino's *On Metals* in 1596. Cesalpino explained this name by noting that the mineral was 'brought from Belgium'.[30] This remark has been dismissed as a mistake.[31] But notice Cesalpino's choice of words. Contrary to some translations, he does not state that graphite comes from Belgium. Rather, he writes that it was 'ex Belgia affertur', and that makes perfect sense. There were no graphite mines in the Low Countries. There were, however, long-established trading links between Flanders and the Netherlands and English ports like London and Newcastle, where black-lead was being handled by merchants by the turn of the seventeenth century.[32]

Cesalpino's account is noteworthy, and not just because of his use of the term 'Flanders stone'. Like Imperato, he draws attention to the value of graphite as a medium for the arts. He explains that painters used graphite to draw outlines ('utuntur eo pictores […] ad figuras designandas') when preparing their works.[33] In this respect, Cesalpino's commentary comes close to Camden's. In *Britannia*, we find graphite described as a 'stone' that 'painters use to draw their lins [sic] and make pictures of one colour in their first draughts.'[34] Such statements are

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della penna, il che fa il piombo per un modo, & il carbone per un altro: si tirano con questo sottilissimi lineamenti, ne si può stimar materia per inventioni da far in carta, che se le possa agguagliare: è ontuoso al tatto, & al fuoco sommaméte indurisce.'

[29] S. A. M. Adshead, *Material Culture in Europe and China, 1400–1800: The Rise of Consumerism* (Basingstoke: Macmillan Press, 1997).

[30] Cesalpino, *De metallicis*, p. 186.

[31] See, for instance, Petroski, *The Pencil*, p. 47.

[32] Boon, 'Early Tudor Coiner's Mould', p. 117; see also, F. W. Dendy and John Roberts Boyle. *Extracts from the Records of the Merchant Adventurers of Newcastle-upon-Tyne*, 2 vols (Durham: Surtees Society, 1894), vol. 1, pp. 58–59; John F. Wade, 'The Overseas Trade of Newcastle upon Tyne in the Late Middle Ages', *Northern History*, 30.1 (1994), 31–48; George Hammersley (ed.), *Daniel Hechstetter the Younger, Memorabilia and Letters, 1600–1639* (Wiesbaden: F. Steiner Verlag, 1988).

[33] Cesalpino, *De metallicis*, p. 186.

[34] Camden, *Britannia,* p. 523; translation from William Camden, *Britain, or, a Chorographicall Description of the Most Flourishing Kingdomes, England, Scotland, and Ireland, and the Ilands Adioyning*, trans by Philemon Holland (London: George Bishop and John Norton, 1610), p. 767.

important points of reference for art history. That said, early modern artists also used graphite in other ways. In fact, the increasing amount of Borrowdale graphite imported to the Low Countries helped usher in a new kind of portraiture during the seventeenth century: plumbago drawing. Such drawings were exquisitely detailed miniature portraits produced using sharpened graphite sticks. The special properties of Borrowdale graphite made it particularly useful for this sort of work. As Marjorie Wieseman has explained, the 'exceptional purity' of Borrowdale graphite meant that it 'imparted a lustrous tonal quality to drawings'.[35] As a medium, it helped bring the subject of the portrait to life.

Not all of the graphite used in this period came from Borrowdale, of course. A good deal also came from Bohemia and Bavaria, and by the mid-seventeenth century, the latter had become the most important centre for pencil making in Europe. Nuremberg-based manufacturers like Friedrich Staedtler were, as S. A. M. Adshead has pointed out, 'among the earliest international brand names'.[36] The industrial production of pencils in England, including Keswick's pencil industry, did not get underway for another 150 years.[37] But the graphite found on the Continent was not as pure as the sort found in Seathwaite. So, by the 1600s, English graphite was being exported to central Europe, too, whence, in some cases, it came back to England in the form of pencils. These arrangements were not, however, only a consequence of the quality of Borrowdale graphite. They were also a result of the creation of the Company of Mines Royal, which brought Bavarian and Tyrolean miners to the Lake District during the latter half of the sixteenth century.

The history of the Company of Mines Royal is too well known to require an extended overview here.[38] But it is worth recalling, as Eric Ash reminds us, that the Company's formation in the 1560s owed a lot to the inferiority of English knowledge about mining and metallurgy.

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[35] Marjorie E. Wieseman, 'Between Paint and Print: Plumbago Portraits in Britain and the Netherlands', *Perfect Likeness: American and European Portrait Miniatures from the Cincinnati Art Museum*, ed. by Julie Aronson and Marjorie E. Wieseman (New Haven: Yale University Press, 2006), pp. 33–47 (p. 33).

[36] Adshead, *Material Culture*, p. 194. See also Petroski, *The Pencil*, pp. 80–84.

[37] See Lefebure, *Cumberland Heritage*, pp. 91–98; Tyler, *Seathwaite Wad*, pp. 170–72; and Thomas Fletcher Smith, *Pencil People: The Story of a Lakeland Industry* (Carlisle: Bookcase, 2017).

[38] See, for example, W. G. Collingwood, *Elizabethan Keswick: Extracts from the Original Account Books, 1564–1577, of the German Miners in the Archives of Augsburg* (Kendal: Titus Wilson, 1912), CWAAS Tract Series, no. 8; M. B. Donald, *Elizabethan Copper: The History of the Company of Mines Royal, 1568–1605* (London: Pergamon Press, 1955); and Eric H. Ash, *Power, Knowledge, and Expertise in Elizabethan England* (Baltimore: Johns Hopkins University Press, 2004), pp. 19–55.

People in Britain were aware of their island's mineral wealth, but they lacked the skills and knowhow to exploit it. Foreign expertise was required, and the English found it in Bavaria and Tyrol, in the heart of 'the prolific mining districts of German-speaking central Europe'.[39]

Consequently, the Company of Mines Royal was set up as a joint-stock English and German undertaking in which Augsburg-based investors owned a just under half of the shares.[40] The English shareholders enjoyed a controlling interest, but they were still at a disadvantage. They 'knew almost nothing' about the work in which the Company's miners were engaged.[41] Needless to say, it was not long before the management of the Company's mines had been placed in the hands of Daniel Hoechstetter. Hoechstetter was an Augsburg-born mining manager and prospector who had close connections with the Company's Bavarian investors. He was the one who brought the first party with miners from the Continent to Keswick in 1564.[42] Within 18 months, these 'prospectors' were joined by around 50 more men.[43]

Elizabeth I had empowered the Company of Mines Royal to find and extract precious metals in counties across the North and South West of England, and in the Midlands and Wales. Part of the Company's remit was, therefore, to search for gold and silver. But it was mainly lead and copper that brought them to the Lake District. Some of the region's rocks contain deposits of both ores, and that is especially the case around Keswick. The Company's mines in the Newland's Valley (to the south west of Derwent Water) proved a particularly profitable investment, and Hoechstetter devoted considerable resources to opening mines in Borrowdale as well.[44] Yet the Company's account books suggest that he took little interest in Borrowdale graphite. Royal commissioners had documented the 'black-lead' mines in the valley as early as 1555.[45] It seems likely therefore that Hoechstetter would have known of them. For whatever

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[39] Ash, *Power, Knowledge, and Expertise*, p. 19.

[40] Collingwood, *Elizabethan Keswick*, p. 3.

[41] Ash, *Power, Knowledge, and Expertise*, p. 19.

[42] George Hammersley, 'Hoechstetter, Daniel (1525–1581), mining promoter', *Oxford Dictionary of National Biography*, 23 September 2004 <https://www.oxforddnb.com> [accessed 18 December 2020].

[43] Ash, *Power, Knowledge, and Expertise*, p. 34.

[44] See Collingwood, *Elizabethan Keswick*, pp. 10–12; Donald, *Elizabethan Copper*, pp. 165–70; and Ian Tyler, *Goldscope and the Mines of Derwent Fells* (Keswick: Blue Rock Publications, 2005).

[45] Boon, 'An Early Tudor Coiner's Mould', p. 107; Charlotte Kipling, 'A Salt Spring in Borrowdale', *Transactions of the Cumberland and Westmorland Antiquarian and Archaeological Society*, ser. 2, 61 (1961), 57–70 (pp. 61–62); Susan Johnson, 'Borrowdale, its Land Tenure and the Records of Lawson Manor', *Transactions of the Cumberland and Westmorland Antiquarian and Archaeological Society*, ser. 2, 81 (1981), 63–71.

reason though, it was not until the early 1600s that the Company set its sights on Seathwaite.

By that time, Hoechstetter had handed over the management of the Company's mines to his sons, Emmanuel and Daniel. It was these two men who purchased a share in the lease of the Seathwaite mines in 1607. Graphite had already been commercially extracted at Seathwaite before then, of course. It is principally from this date onwards, however, that written records survive, and these records give the lie to some claims that have been made about the Seathwaite mines. C. M. L. Bouch and G. P. Jones's characterisation of Borrowdale graphite as 'a mineral of minor economic importance' comes to mind.[46] Contrary to such assertions, the records show us that the Hoechstetter and their partners extracted around 220 tonnes of graphite between 1607 and 1631. The records also indicate that this graphite was sold to merchants in Newcastle, London and Hamburg for more than £5,700.[47] It was chiefly through these merchants that Borrowdale graphite found its way into the Low Countries and central Europe, whence it spread across the rest of the Continent.

The demand for 'lead' pencils was an important factor in this process. Fittingly, it is largely on account of its association with the pencil that graphite eventually got its modern name. (Graphite simply means 'a substance for writing'.) It would be wrong though, to suppose that graphite was only used for pencils in early modern Europe. After all, graphite was also used in manufacturing crucibles, cupels and ingot moulds. This was an equally important innovation. But the knowledge needed to make such 'furnace ware' was in short supply in England before the 1570s. That was when the Saxon metallurgist Christopher Schütz introduced the technology to the British.[48] In doing so, Schütz effectively helped establish a new industrial market for Borrowdale graphite. Once more, it took foreign expertise to unlock the full potential of Britain's mineral wealth.

In effect, Schütz showed the British how to harness the same properties that the creator of the graphite coiner's mould had exploited some seventy years earlier. Instead of casting silver though, Schütz revealed how graphite could be used to make cast iron objects, such as cannon and musket balls. The use of graphite in manufacturing such munitions helped produce round shot that was more spherical, and which could thus be fired farther and with greater accuracy.

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[46] C. M. L. Bouch and G. P. Jones (with R. W. Brunskill), *A Short Economic and Social History of the Lake Counties, 1500–1800* (Manchester: Manchester University Press, 1961), p. 257.

[47] Henry Bankes, 'History of the Black Lead Mine at Seatoller', 1771 (copied c. 1890), Cumbria Archive Service: Carlisle, DX DX294/11; see also, Tyler, *Seathwaite Wad*, p. 75.

[48] R. C. D. Baldwin, 'Schütz, Christopher (1521-1592)', *Oxford Dictionary of National Biography*, 23 September 2004 <https://www.oxforddnb.com> [accessed 18 December 2020].

This made graphite important for the developing arms industry both in England and in other parts of Europe. As Patrick Brugh has observed, during the seventeenth century 'advancements in […] firearms manufacturing' moved at pace with 'the steady rise in the popularity and prevalence of cannons, shoulder arms and pistols.'[49] The significance of Borrowdale graphite in this context should not be overlooked. After Bavaria banned the export of its crucible-grade graphite in 1613, Seathwaite's mines became vital to supplying England's arsenal.[50]

Nor was this all, though. By the seventeenth century, graphite was also recognised as a useful substance for coating, cleaning and preserving metal objects, including everything from firearms to fireirons. Like lampblack it helped prevent rusting. Thanks to its weak carbon bonds, moreover, graphite was widely used as a lubricant for rollers, screws and rigging as well. Some sources even suggest that graphite was used in glazing ceramics and dying felt.[51] Most surprising of all though, was the medicinal use of graphite. According to Thomas Robinson, the Rector of Ousby, in Cumberland from 1672 to 1719, local people mixed powdered graphite with 'white Wine, or Ale' as a remedy for a range of 'Distempers'.[52] This concoction, he affirms, 'operates by *Urine*, *Sweat*, and *Vomiting*', and is 'a present *Remedy* for the *Cholick*'.[53] What is more, 'it easeth the Pain of *Gravel*, *Stone*, and *Strangury*', and 'for theses and the like Uses,' he concludes, 'it's much bought up by *Apothecaries* and *Physicians*.'[54] Samuel Dale sounded similar notes in his *Pharmacology* of 1692. According to Dale, the mineral was useful for treating scrofula and tumours and for balancing the humours.[55]

In sum, before the end of the seventeenth century Borrowdale graphite had an array of applications. It contributed to advances in the arts as well as in medicine and manufacturing. This versatility made graphite a valuable commodity, but that value brought its own burdens. As is often the case, it caused fears of scarcity and drove up costs. Thomas Fuller, for one, expressed his anxiety in 1662 that the demand for graphite 'causeth it daily to grow dearer, being

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[49] Patrick Brugh, *Gunpowder, Masculinity, and Warfare in German Texts, 1400–1700* (Rochester: University of Rochester Press, 2019), p. 66.

[50] Boon, 'An Early Tudor Coiner's Mould', p. 118; Johnson, 'Borrowdale', p. 64.

[51] Fuller, *Worthies of England*, p. 215; Robinson, *An Essay*, p. 75; and Beckmann, *Beytrage zur Geschichte*, pp. 247–48.

[52] Robinson, *An Essay*, p. 75

[53] Robinson, *An Essay*, p. 75

[54] Robinson, *An Essay*, p. 75

[55] Samuel Dale, *Pharmacologia, seu manuductio ad materiam medicam* (London: Samuel Smith & Benjamin Walford, 1692), p. 650.

so much transported beyond the seas.'[56] True to Fuller's word, by 1671 the highest quality graphite mined at Seathwaite was commanding as much as £100 per ton.[57] Ninety years later, the price had increased to more than £1,300 per ton.

Even by the standards of the period, Seathwaite was still relatively remote. Consequently, it was not an easy place to police. It comes as little surprise, then, that the mines were prone to being plundered in spite of steps taken to protect them. By the mid-seventeenth century, the mines were only opened every six or seven years.[58] Ultimately though, it proved impossible to prevent depredations. Raids on the mines became commonplace, but it was not until after a violent attack in 1751 that Parliament took decisive action. That year, Henry Pelham's Government passed an Act that made the theft of Borrowdale graphite a felony. If convicted, those caught stealing from the mines could be punished by public whipping and a year's hard labour or by up to seven years' transportation.[59] It is clear though, that the Act did not stop graphite being stolen and sold illegally. George Smith, a local schoolmaster, visited Seathwaite shortly after the attack in 1751, and he reported that Keswick's 'poorer inhabitants [still] subsisted chiefly by stealing, or clandestinely buying from those who steal, the black-lead' and selling it in secrecy.[60]

Like Smith's account though, the later history of Borrowdale graphite lies beyond the chronological scope of this collection. Still, taking note of this illicit activity in the 1750s sends us back to the coiner's mould made some 250 years early. That mould, too, is evidence of the black-lead mine's links to the black market. But beyond noting this connection, the material surveyed in this chapter also enables us to appreciate the peculiar status of graphite as a mutable and mobile material. As we have seen, Borrowdale graphite was essential to the manufacture and circulation of a wide range of objects both within and beyond Britain. In some cases, such as with the 'lead' pencil, these objects proved transformative. In other cases, as with casting iron, they stimulated significant advancements. In every case though, tracing the early history of Borrowdale graphite has helped to shine a light on its place within the rapidly transforming commercial markets of early modern Europe.

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[56] Fuller, *Worthies of England*, p. 215.

[57] Bankes, 'History of the Black Lead Mine'; see also, Boon, 'An Early Tudor Coiner's Mould', pp. 122–23.

[58] Bankes, 'History of the Black Lead Mine'.

[59] Public Act, 25 George II, c. 10: 'An Act for the more effectual securing Mines of Black Lead from Theft and Robbery', Parliamentary Archives: HL/PO/PU/1/1751/25G2n18.

[60] Smith, 'Journey to the Black Lead Mines', p. 52.

What is more, tracing this history has also highlighted an often-unappreciated aspect of the history of the Lake District. Today, the Lake District is conventionally valued for its associations with English culture. As this chapter has suggested, however, those associations are but one part (and a provincial one at that) of a much broader history: a history that includes the economic and industrial development of early modern Europe as well as much more besides. Indeed, it is salient to reflect on how the presence of central European miners in the Lake District during the sixteenth and seventeenth centuries helped to shape the landscape that came to be widely celebrated for its 'natural' beauty during the Hanoverian age. What is more, it is striking to consider that some of the people who came to sketch the region's landscapes during the 1700s may have been using German-manufactured pencils made with graphite drawn from the ground they were drawing. Whether those people were aware of that fact is not, to my knowledge, generally known. But the connection clearly did register in the minds of some. Notably, William Gilpin, whose books on picturesque beauty did much to promote the Lake District to artists, paid a visit to 'the celebrate black-lead mines' in 1772. Though usually averse to industrial sites, he confessed he 'could not help feeling a friendly attachment to this place, which every lover of the pencil must feel, as deriving from this mineral one of the best instruments of his art.'[61]

[61] William Gilpin, *Observations, Relative Chiefly to Picturesque Beauty, Made in the Year 1772*, 2 vols (London: R. Blamire, 1786), vol. 1, p. 205.

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