

## Agricola's *De re metallica*, 1556. Part I

In 1556, the final work of the town doctor of Chemnitz, a town in Saxony, was published posthumously in Basel in an edition lavishly illustrated with more than 200 excellent woodcuts. The book, Agricola's *De re metallica*,<sup>1</sup> is the first full account, since the few sketchy classical descriptions, of techniques of mining and for the separation and purification of metals. The book remained the standard reference for more than two centuries. It also contained the first real description of the industrial diseases of miners – diseases which continue to claim victims in modern times – and of ways of reducing exposure to them.

### THE AUTHOR

Georg Bauer (or Pauer) was born at Glauchau in Saxony in 1494. But he was known to his contemporaries and is known to history as Georgius Agricola.

Many authors of the time, academic authors in particular, Latinised their names in their published works. In many cases, the name in the vernacular was simply altered to a pseudo-Latin form; for example, Jean Fernel, the great French physician, becomes Ioannes Fernelius. But if the birth name in the vernacular represented an object or an occupation, this might be translated into Latin or, less frequently, into Greek to produce the academic pseudonym. Thus Jacques Dubois ('of the wood' in French), one of Vesalius's teachers in Paris, becomes Iacobus Sylvius; Joseph Duschenne (or du Chesne, 'of the oak') a protestant iatrochemical physician to Henri IV of France, becomes Quercetanus. These three examples are familiar under both their vulgar and their academic names. In contrast, Philipp Schwartzerd is almost forgotten but, as Philipp Melancthon, a Greek translation of his name, he lives on as Luther's famous theologian friend. Jan Herbst (whose name means 'autumn' in German), turned into Ioannes Oporinus when he became a professor of Greek in Basel. He had been an assistant to Paracelsus and to the printer Johann Froben (Frobenius, whose son Hieronymus Froben printed most of Agricola's books), before becoming a printer himself. His *nom de plume* results from a double metamorphosis, first translating the German *herbst*, autumn, into Greek then Latinising the result as Oporinus – the name under which he published both editions of Vesalius's great *Fabrica*.

Our present author's name, Bauer means 'peasant' or 'farmer' in German; it translates directly into the Latin noun for farmer, Agricola. I give these details about the Latin pseudonyms of 16th century academics not only



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*De re metallica libri XII*  
Basel, 1556

because our present author was a contemporary of some of them, but because he was one of their number. Agricola was not just a doctor who happened to work in a mining district; he was a serious and very well-regarded academic. He was no mere mechanic in an age which did not value vulgar manual occupations or crafts such as mining and, indeed, surgery, very highly. He was known to, and probably by, the great humanist Erasmus of Rotterdam when the latter was working as a literary advisor and editor in the printing establishment of the younger (Hieronymus) Froben in Basel (see Bloch<sup>2</sup>). Certainly Erasmus and he shared friends; one of them, Plateanus, wrote a preface for Agricola's first book on mining, *Bermannus sive de re metallica* (published in 1530) and recommended it to Erasmus<sup>3</sup> who was sufficiently impressed, not only to recommend it to

Hieronymus Froben to publish – as he duly did – but to grace it with an additional prefatory letter to two young men who had been his protégés.<sup>4</sup> These were the two sons, Andreas and Christophe, of the man to whom Plateanus addressed his preface, Heinrich von K nneritz, the superintendent of mines in Joachimsthal where Agricola was working at the time. Andreas had become acquainted with Agricola in Bologna in the 1520s. So Agricola had additional connections with Erasmus – who already knew of him in 1525 if not before – through the von K nneritz family. Erasmus's elegant and slightly whimsical open letter is written very much for a sophisticated literary audience and couched in a style very remote from the elegant simplicity he professes to admire in Agricola's book. It is very much a recommendation from someone conscious of his own elevated position, a blessing *ex cathedra*. Nevertheless, there is no reason to suppose that Erasmus's expressed admiration of the book was other than genuine. And there could hardly have been a better passport to academic acceptance in the 16th century humanist world than an endorsement by Erasmus. In the end, all was very well and Froben went on to publish almost all of Agricola's later works culminating 25 years later with the posthumous, lavishly illustrated, *De re metallica* for which the publisher must have laid out a fortune for its fine wood blocks.

### AGRICOLA THE SCHOLAR

Agricola was much more than a medical practitioner in a small mining town who developed his interest in mining and metallurgy into a specialism of which he became the

master in his own time and whose works were still the primary authority more than two centuries later. How did this come about?

The introduction to the Hoover translation provides an account of Agricola's life of which some further details are given in Prescher.<sup>5</sup> In very brief summary, Agricola was born in 1494, graduated in Arts from the University of Leipzig when he was about 23, then taught Greek and Latin, first as a master then as principal of a school at Zwickau. About this time he published a short Latin grammar. In 1522 he became a lecturer at Leipzig where he lodged with the professor of medicine, Heinrich Stromer von Auerbach.<sup>5</sup> In Leipzig he studied under the humanist professor Petrus Mosellanus (Peter Schade). Mosellanus had inherited the mantle of the teaching of Greek from Richard Croke, who had brought it to Leipzig in 1513.<sup>6</sup> Mosellanus was a scholar and promoter both of Greek scholarship and the teaching of Greek, who opened the disputation between the leading theologian Johann Eck, (defending the Catholic status quo) and Karlstadt and Luther in Leipzig in the summer of 1519. Eck succeeded in pushing Luther into a much more extreme position than he had maintained previously, one which now defined him as an enemy of the whole western Church.<sup>7</sup> Mosellanus was a friend of Melanchthon and a correspondent of Erasmus. Indeed, he wrote to Erasmus in January 1519 about the forthcoming theological battle. So we see that Agricola was close to the group of Greek scholars led by Erasmus – perhaps, indeed, already a member of it – and in close contact with those around the promoters of the new 'reformed' theology at that critical time when schism in the church was moving towards inevitability. It is worth remarking that Agricola remained a Catholic even after the region in which he worked had become Protestant.

In 1523 he went to Italy to pursue further study, including that of medicine, and remained there for about three years. It seems he was in Bologna in October 1523, where he was influenced by the teaching of the anatomist Berengario da Carpi, and that he had graduated in medicine by the time of his arrival in Venice in the autumn of 1524.<sup>8</sup> What attracted the humanist scholar to medical study we do not know, but his medical education did not last long; perhaps it did not need to. At a time when the professional education of physicians was based exclusively on study of ancient texts, Agricola had a head start; he was already an accomplished Greek scholar – a rarity – as well as the competent Latinist that any physician had to be. Not much seems to be known of the details of Agricola's seemingly brief medical education except that he studied in more than one Italian university. By 1526 he had returned to Saxony and in 1527 was appointed town physician at Joachimsthal, a mining settlement in Bohemia – now Jáchymov in the Czech Republic – from whose pitchblende the Curies isolated radium in the early 20th century. And he had by no means deserted his humanism. While in Italy, Agricola was one of those who worked on the preparation

of the first Greek edition of Galen's medical works. In a letter to Erasmus in 1525, Cassembroot – a native of Bruges and later its burgomeister – says that George Agricola 'one of the greatest admirers of your name sends his greetings. He has been in charge of editing Galen for Asula [*apud Azulam*];'<sup>9</sup> (see also Perilli<sup>10</sup>). 'Asula' was Andreas de Torresani de Asula (Andrea Torresani di Asolo), now director of the great printing house of the late Aldus Manutius. He was Aldus's father-in-law and partner and it was Andrea Torresani di Asolo who finally published the first Greek edition of Galen's medical works in 1525, publication of which had been Aldus's cherished ambition for more than 20 years. Agricola is mentioned in a prefatory letter to the fifth volume of this edition, by di Asolo to Giambattista Opizzoni the director of a consortium of scholars who worked on Galen's texts. Di Asolo says '....and George Agricola is worthy of not a little praise, for, in editing Galen, he spared himself no labour or industry...' According to Perilli<sup>10</sup> the consortium consisted of John Clement, Edward Wotton, William Rose and Thomas Lupset, English followers of Thomas Linacre, the famous Oxford Humanist, and 'the Saxon scholar and scientist Georg Agricola'. This is a good deal more modest than Cassembroot's claim that Agricola was in charge of editing the forthcoming Greek edition of Galen (*praefectus castigando Galeno*)<sup>3</sup> but it certainly shows he was one of an expert international team of its editors; he must have been a more than competent Greek scholar. The Aldine Greek editions, which made a good many of Galen's works widely available for the first time in post-classical Europe, were a major trigger for the explosion of interest in Galen's teachings; this then led to the sudden burst of feverish translation of them first into Latin then into vernaculars. The centre of this activity was Paris and, over the next decades, it produced the establishment of a new Galenism of which Paris became first the centre, then the stronghold and finally the besieged citadel, defended by a resolute *Faculté de Médecine* against all change. By his work on the Aldine Greek editions, Agricola played a small but not insignificant part in this revolution in medical theory.

In 1529, Plateanus, in his letter recommending Agricola's first book on mining to Erasmus, speaks of him as 'a man beloved by you', praises his scholarship in glowing terms and speaks of the debt 'not only of doctors for several works on Hippocrates and Galen edited in Venice some years ago' but of a greater debt to come when 'he has released his books on metals and published others – not of the common sort – which he now has in hand'<sup>13</sup> [my translations]. The first fruit of this scholarship on metals was the *Bermannus* of 1530. Hannaway<sup>6</sup> proposes that the *Bermannus* arose from 'Agricola's desire as a humanist apothecary-physician to recover the knowledge and use of the mineral species of medicaments described in the ancient authorities, especially Galen, Dioscorides, Pliny, and Theophrastus'. It seems very credible indeed that this was the stimulus – ultimately a humanist interest in words and their relation to the knowledge of physical materials – that

started Agricola's profound studies of mining and metallurgy. Agricola, then, was no mere village doctor who happened to take an interest in the industries practised in his community and the diseases related to them; his humanist scholarship which had made him a member of the most revered scholarly circle in Europe was an essential part of the character of a man of whom his contemporaries expected much.

## THE HOOVER TRANSLATION

We need to consider not one but two books: Agricola's *De re metallica* and its Hoover translation<sup>11</sup> – itself a remarkable piece of work which was first published by The Mining Magazine on behalf of the translators in 1912. These translators were the future US President Herbert Clark Hoover, who was a mining engineer by profession, and his wife Lou Henry, a geologist and Latinist. Lou had seen a copy of *De re metallica* in London in 1905 and, for the next five years, she and her husband worked on translating it. Having been a distinguished and very successful mining engineer, Hoover played a large part in humanitarian relief after the First World War – notably in Belgium in 1916. In 1921 he accepted a post in President Harding's administration and, in 1928, was nominated by the Republican party as its presidential candidate. He served as President from 1929–1933 during the worst years of the great depression. For more details about the Hoovers and the circumstances of their translation of *De re metallica* see Dibner.<sup>12</sup>

The translators say in their introduction that they believe the lack of any previous successful translation of Agricola's book was principally because he had had to invent Latin words for technical terms in mining and metallurgy since the classical language had never had such words. This is true of course. But, much more relevantly, mediæval and renaissance writers did not forge such words because they had no need of them; they did not write about the details of mining or metal-working crafts. There was effectively no learned literature of technology and so no Latin vocabulary for it. Obviously there were vernacular oral vocabularies used within the crafts but even these were rarely used in writing; they would have hardly been spread beyond the craft communities and would have been unlikely to have much presence in literary vocabularies even in the vernaculars.

The problem for the translators, they say, was that the exact meanings – and occasionally even the general sense – of Agricola's technical words were often obscure. Similar difficulties arising from the lack of any, or of any consistent, Latin or vernacular technical vocabulary are not uncommon in other fields but are usually a matter of disentangling exact detail rather than general meaning. Nevertheless, sometimes the exact meaning is essential to understanding the text and the problems of understanding it are then very far from trivial. In *De re metallica*, however, the

woodcuts and their legends are a great help in understanding what Agricola means by the often rather general terms in his text; it is very strange that the Hoovers do not mention this in their discussion of the difficulties of translation.

Hoover's training, accomplishment and experience in mining engineering, and his detailed technical knowledge of the physical contexts of its descriptions and operations, put him in a uniquely favourable position to be able to extract exact meanings from the obscure terms in Agricola's text and often to replace them by modern technical words. Equally, and more importantly, they enabled him to add a set of detailed, and often very illuminating, footnotes clarifying many points and providing additional information. Add to this the appendices containing a detailed annotated bibliography, an account of earlier writings on similar subjects and one on the difficulties of interpreting Agricola's weights and measures, and it becomes apparent that the Hoover translation is much more than a translation of a text, it is a considerable *tour de force*.

In the next part of this article I shall consider the contents of *De re metallica* and the Hoover translation.

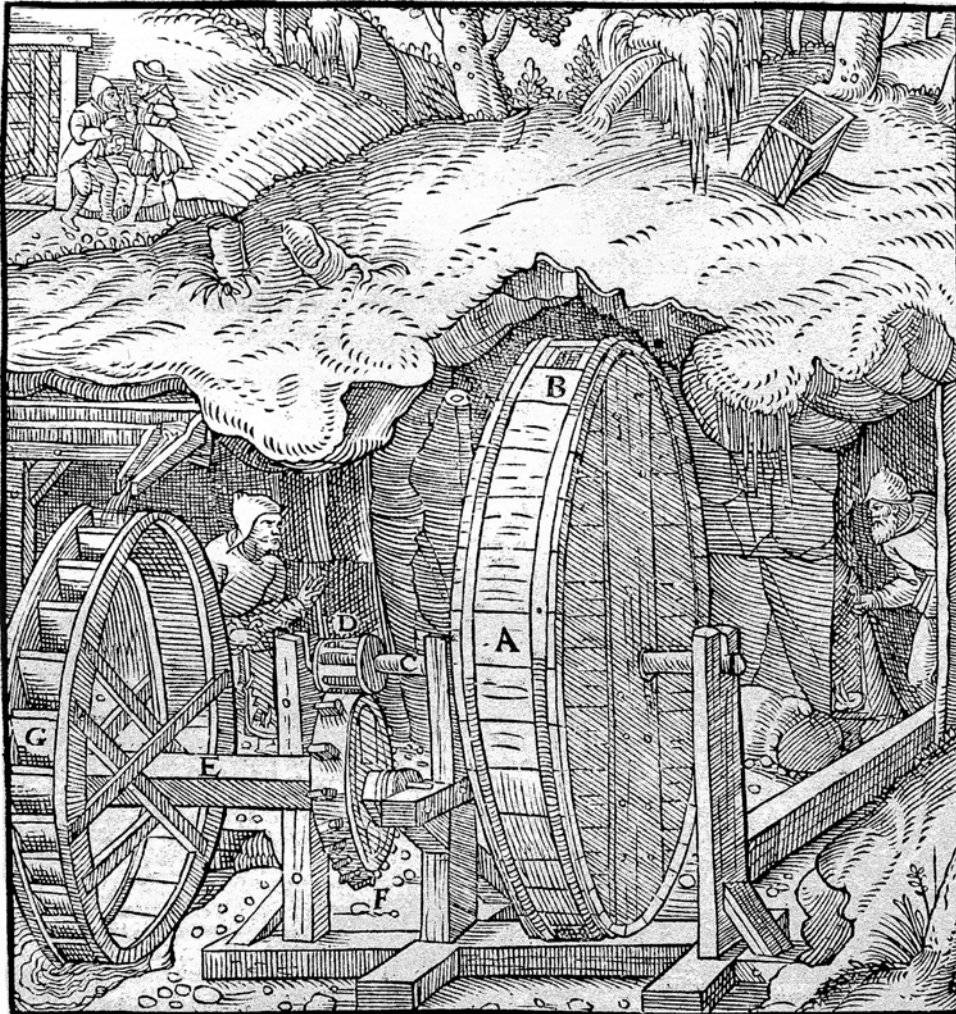
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*Tympanum cauum A. Eius foramen spiritale B. Axis cui flabella sunt C. Eius tympanum quod ex fufis constat D. Axis inferior E. Eius tympanum dentatum F. Rota G.*



A water-driven ventilation engine for mines from Agricola's *De re metallica* of 1556, see pages 180–2. One of several types of ventilating machines described and illustrated by Agricola. These were variously hand-driven, driven by a wind-mill, by a water-wheel or by a horse-treadmill.

A: hollow drum; B: entrance hole for air; C: shaft carrying fan blades; D: drum made up of segments [lantern pinion]; E: lower shaft; G: waterwheel.

The hollow drum contains a fan with blades that extend out close to the casing. The unlabelled open box shown projecting above ground is perhaps an inlet air duct for the machine below the surface. The unlabelled horizontal box running from the drum past the miner on the right is the duct leading the air blown from the fan into the shaft or adit beyond the miner.