

*De Natura Fossilium*. This is the most important work of Agricola, excepting *De Re Metallica*. It has always been printed in combination with other works, and first appeared at Basel, 1546. This edition was considerably revised by the author, the amended edition being that of 1558, which we have used in giving references. The work comprises ten "books" of a total of 217 folio pages. It is the first attempt at systematic mineralogy, the minerals 1 being classified into (1) "earths" (clay, ochre, etc.), (2) "stones properly so-called" (gems, semi-precious and unusual stones, as distinguished from rocks), (3) "solidified juices" (salt, vitriol, alum, etc.), (4) metals, and (5) "compounds" (homogeneous "mixtures" of simple substances, thus forming such minerals as galena, pyrite, etc.). In this classification Agricola endeavoured to find some fundamental basis, and therefore adopted solubility, fusibility, odour, taste, etc., but any true classification without the atomic theory was, of course, impossible. However, he makes a very creditable performance out of their properties and obvious characteristics. All of the external characteristics which we use to-day in discrimination, such as colour, hardness, lustre, etc., are enumerated, the origin of these being attributed to the proportions of the Peripatetic elements and their binary properties. Dana, in his great work 2, among some fourscore minerals which he identifies as having been described by Agricola and his predecessors, accredits a score to Agricola himself. It is our belief, however, that although in a few cases Agricola has been wrongly credited, there are still more of which priority in description might be assigned to him. While a greater number than fourscore of so-called species are given by Agricola and his predecessors, many of these are, in our modern system, but varieties; for instance, some eight or ten of the ancient species consist of one form or another of silica.

Book I. is devoted to mineral characteristics colour, brilliance, taste, shape, hardness, etc., and to the classification of minerals; Book II., "earths" clay, Lemnian earth, chalk, ochre, etc.; Book III., "solidified juices" salt, *nitrum* (soda and potash), saltpetre, alum, vitriol, chrysocolla, *caeruleum* (part azurite), orpiment, realgar, and sulphur; Book IV., camphor, bitumen, coal, bituminous shales, amber; Book V., lodestone, bloodstone, gypsum, talc, asbestos, mica, calamine, various fossils, geodes, emery, touchstones, pumice, fluorspar, and quartz; Book VI., gems and precious stones; Book VII., "rocks" marble, serpentine, onyx, alabaster, limestone, etc.; Book VIII., metals gold, silver, quicksilver, copper, lead, tin, antimony, bismuth, iron, and alloys, such as electrum, brass, etc.; Book IX., various furnace operations, such as making brass, gilding, tinning, and products such as slags, furnace accretions, *pompholyx* (zinc oxide), copper flowers, litharge,

hearth-lead, verdigris, white-lead, red-lead, etc.; Book X. "compounds," embracing the description of a number of recognisable silver, copper, lead, quicksilver, iron, tin, antimony, and zinc minerals, many of which we set out more fully in Note 8, page 108.

*De Ortu et Causis Subterraneorum.* This work also has always been published in company with others. The first edition was printed at Basel,

1546; the second at Basel, 1558, which, being the edition revised and added to by the author, has been used by us for reference. There are five "books," and in the main they contain Agricola's philosophical views on geologic phenomena. The largest portion of the actual text is occupied with refutations of the ancient philosophers, the alchemists, and the astrologers; and these portions, while they exhibit his ability in observation and in dialectics, make but dull reading. Those sections of the book which contain his own views, however, are of the utmost importance in the history of science, and we reproduce extensively the material relating to ore deposits in the footnotes on pages 43 to 52. Briefly, Book I. is devoted to discussion of the origin and distribution of ground waters and juices. The latter part of this book and a portion of Book II. are devoted to the origin of subterranean heat, which he assumes is in the main due to burning bitumen a genus which with him embraced coal and also, in a minor degree, to friction of internal winds and to burning sulphur. The remainder of Book II. is mainly devoted to the discussion of subterranean "air", "vapour", and "exhalations", and he conceives that volcanic eruptions and earthquakes are due to their agency, and in these hypotheses he comes fairly close to the modern theory of eruptions from explosions of steam. "Vapour arises when the internal heat of the earth or some hidden fire burns earth which is moistened with vapour. When heat or subterranean fire meets with a great force of vapour which cold has contracted and encompassed in every direction, then the vapour, finding no outlet, tries to break through whatever is nearest to it, in order to give place to the insistent and urgent cold. Heat and cold cannot abide together in one place, but expel and drive each other out of it by turns".

As he was, we believe, the first to recognise the fundamental agencies of mountain sculpture, we consider it is of sufficient interest to warrant a reproduction of his views on this subject: "Hills and mountains are produced by two forces, one of which is the power of water, and the other the strength of the wind. There are three forces which loosen and demolish the mountains, for in this case, to the power of the water and the strength of the wind we must add the fire in the interior of the earth. Now we can plainly see that a great abundance of water produces mountains, for the torrents first of all wash out the soft earth, next carry away the harder earth, and then roll down the rocks, and thus in a few years they excavate the plains or slopes to a considerable depth; this may be noticed in mountainous regions even by unskilled observers. By such excavation to a great depth through many ages, there rises an immense eminence on each side. When an eminence has thus arisen, the earth rolls down, loosened by

constant rain and split away by frost, and the rocks, unless they are exceedingly firm, since their seams are similarly softened by the damp, roll down into the excavations below. This continues until the steep eminence is changed into a slope. Each side of the excavation is said to be a mountain, just as the bottom is called a valley. Moreover, streams, and to a far greater extent rivers, effect the same results by their rushing and washing; for this reason they are frequently seen flowing either between very high mountains

which they have created, or close by the shore which borders them. . . . Nor did the hollow places which now contain the seas all formerly exist, nor yet the mountains which check and break their advance, but in many parts there was a level plain, until the force of winds let loose upon it a tumultuous sea and a scathing tide. By a similar process the impact of water entirely overthrows and flattens out hills and mountains. But these changes of local conditions, numerous and important as they are, are not noticed by the common people to be taking place at the very moment when they are happening, because, through their antiquity, the time, place, and manner in which they began is far prior to human memory. The wind produces hills and mountains in two ways: either when set loose and free from bonds, it violently moves and agitates the sand; or else when, after having been driven into the hidden recesses of the earth by cold, as into a prison, it struggles with a great effort to burst out. For hills and mountains are created in hot countries, whether they are situated by the sea coasts or in districts remote from the sea, by the force of winds; these no longer held in check by the valleys, but set free, heap up the sand and dust, which they gather from all sides, to one spot, and a mass arises and grows together. If time and space allow, it grows together and hardens, but if it be not allowed (and in truth this is more often the case), the same force again scatters the sand far and wide. . . . Then, on the other hand, an earthquake either rends and tears away part of a mountain, or engulfs and devours the whole mountain in some fearful chasm. In this way it is recorded the Cybotus was destroyed, and it is believed that within the memory of man an island under the rule of Denmark disappeared. Historians tell us that Taygetus suffered a loss in this way, and that Therasia was swallowed up with the island of Thera. Thus it is clear that water and the powerful winds produce mountains, and also scatter and destroy them. Fire only consumes them, and does not produce at all, for part of the mountains usually the inner part takes fire."

The major portion of Book III. is devoted to the origin of ore channels, which we reproduce at some length on page 47. In the latter part of Book III., and in Books IV. and V., he discusses the principal divisions of the mineral kingdom given in *De Natura Fossilium*, and the origin of their characteristics. It involves a large amount of what now appears fruitless tilting at the Peripatetics and the alchemists; but nevertheless, embracing, as Agricola did, the fundamental Aristotelian elements, he must needs find in these same elements and their subordinate binary combinations cause for every variation in external character.

*Bermannus*. This, Agricola's first work in relation to mining, was apparently first published at Basel, 1530. The work is in the form of a dialogue between "Bermannus," who is described as a miner, mineralogist, and "a student of mathematics and poetry," and "Nicolaus Ancon" and "Johannes Neavius," both scholars and physicians. Ancon is supposed to be of philosophical turn of mind and a student of Moorish literature, Naevius to be particularly learned in the writings of Dioscorides, Pliny, Galen, etc. "Berman-

nus" was probably an adaptation by Agricola of the name of his friend Lorenz Berman, a prominent miner. The book is in the main devoted to a correlation of the minerals mentioned by the Ancients with those found in the Saxon mines. This phase is interesting as indicating the natural trend of Agricola's scholastic mind when he first comes into contact with the sciences to which he devoted himself. The book opens with a letter of commendation from Erasmus, of Rotterdam, and with the usual dedication and preface by the author. The three conversationalists are supposed to take walks among the mines and to discuss, incidentally, matters which come to their attention; therefore the book has no systematic or logical arrangement. There are occasional statements bearing on the history, management, titles, and methods used in the mines, and on mining lore generally. The mineralogical part, while of importance from the point of view of giving the first description of several minerals, is immensely improved upon in *De Natura Fossilium*, published 15 years later. It is of interest to find here the first appearance of the names of many minerals which we have since adopted from the German into our own nomenclature. Of importance is the first description of bismuth, although, as pointed out on page 433, the metal had been mentioned before. In the revised collection of collateral works published in 1558, the author makes many important changes and adds some new material, but some of the later editions were made from the unrevised older texts.

*Rerum Metallícarum Interpretatío.* This list of German equivalents for Latin mineralogical terms was prepared by Agricola himself, and first appears in the 1546 collection of *De Ortu et Causis, De Natura Fossilium, etc.*, being repeated in all subsequent publications of these works. It consists of some 500 Latin mineralogical and metallurgical terms, many of which are of Agricola's own coinage. It is of great help in translation and of great value in the study of mineralogic nomenclature.

*De Mensuris et Ponderibus.* This work is devoted to a discussion of the Greek and Roman weights and measures, with some correlation to those used in Saxony. It is a careful work still much referred to by students of these subjects. The first edition was published at Paris in 1533, and in the 1550 edition at Basel appears, for the first time, *De Precio Metallorum et Monetis*.

*De Veteribus et Novis Metallis.* This short work comprises 31 folio pages, and first appears in the 1546 collection of collateral works. It consists mainly of historical and geographical references to the occurrence of metals and mines, culled from the Greek and Latin classics, together with some

information as to the history of the mines in Central Europe. The latter is the only original material, and unfortunately is not very extensive. We have incorporated some of this information in the footnotes.

*De Animantibus Subterraneis*. This short work was first printed in Basel, 1549, and consists of one chapter of 23 folio pages. Practically the whole is devoted to the discussion of various animals who at least a portion of their time live underground, such as hibernating, cave-dwelling, and burrowing animals, together with cave-dwelling birds, lizards, crocodiles, serpents, etc. There are only a few lines of remote geological interest as to migration

of animals imposed by geologic phenomena, such as earthquakes, floods, etc. This book also discloses an occasional vein of credulity not to be expected from the author's other works, in that he apparently believes Aristotle's story of the flies which were born and lived only in the smelting furnace; and further, the last paragraph in the book is devoted to underground gnomes. This we reproduce in the footnote on page 217.

*De Natura eorum quae Effluunt ex Terra.* This work of four books, comprising 83 folio pages, first appears in the 1546 collection. As the title indicates, the discussion is upon the substances which flow from the earth, such as water, bitumen, gases, etc. Altogether it is of microscopic value and wholly uninteresting. The major part refers to colour, taste, temperature, medicinal uses of water, descriptions of rivers, lakes, swamps, and aqueducts.

## BIBLIOGRAPHICAL NOTES.

For the following we have mainly to thank Miss Kathleen Schlesinger, who has been employed many months in following up every clue, and although the results display very considerable literary activity on the part of the author, they do not by any means indicate Miss Schlesinger's labours. Agricola's works were many of them published at various times in combination, and therefore to set out the title and the publication of each work separately would involve much repetition of titles, and we consequently give the titles of the various volumes arranged according to dates. For instance, *De Natura Fossilium*, *De Ortu et Causis*, *De Veteribus et Novis Metallis*, *De Natura eorum quae Effluunt ex Terra*, and *Interpretatio* have always been published together, and the Latin and Italian editions of these works always include *Bermannus* as well. Moreover, the Latin *De Re Metallica* of 1657 includes all of these works.

We mark with an asterisk the titles to editions which we have been able to authenticate by various means from actual books. Those unmarked are editions which we are satisfied do exist, but the titles of which are possibly incomplete, as they are taken from library catalogues, etc. Other editions to which we find reference and of which we are not certain are noted separately in the discussion later on. 3

\*1530 (8vo).

*Georgii Agricolae Medici, Bermannus sive de re Metallica.*

(Froben's mark).

*Basileae in aedibus Frobenianis Anno. MDXXX.*

Bound with this edition is (p. 131–135), at least occasionally, *Rerum metallicarum appellationes juxta vernaculam Germanorum linguam, auctori Plateano.*

*Basileae in officina Frobeniana, Anno. MDXXX.*

\*1533 (8vo):

*Georgii Agricolae Medici libri quinque de Mensuris et Ponderibus: in quibus pleraque à Budaeo et Portio parum animadversa diligenter excutiuntur. Opus nunc primum in lucem aeditum.*

(Wechel's Mark).

*Parisiis. Excudebat Christianus Wechelus, in vico Iacobaeo, sub scuto Basileiensi, Anno MDXXXIII.*

261 pages and index of 5 pages.

\*1533 (4to):

*Georgii Agricolae Medici Libri quinque. De Mensuris et Ponderibus: In quibus pleraque à Budaeo et Portio parum animadversa diligenter excutiuntur.*

(Froben's Mark).

*Basileae ex Officina Frobeniana Anno MDXXXIII. Cum gratia et privilegio Caesareo ad sex annos.*

1534 (4to):

*Georgii Agricolae. Epistola ad Plateanum, cui sunt adiecta aliquot loca castigata in libris de mensuris et ponderibus nuper editis.*

Froben, Basel, 1534.

\*1535 (8vo):

*Georgii Agricolae Medici libri V. de Mensuris et Ponderibus: in quibus pleraque à Budaeo et Portio parum animadversa diligenter excutiuntur.*

(Printer's Mark).

At the end of Index: *Venitüs per Joan Anto. de Nicolinis de Sabio, sumptu vero et requisitione Dnni Melchionis Sessae. Anno. Dnni MDXXXV. Mense Julii. 116 folios.*

On back of title page is given: *Liber primus de mensuris Romanis, Secundus de mensuris Graecis, Tertius de rerum quas metimur pondere, Quartus de ponderibus Romanis, Quintus de ponderibus Graecis.*

\*1541 (8vo):

*Georgii Agricolae Medici Bermannus sive de re metallica.*

*Parisiis. Apud Hieronymum Gormontiú. In Vico Jacobeo sub signotrium coronarum. 1541.*

\*1546 (8vo):

*Georgii Agricolae medici Bermannus, sive de metallica ab accurata autoris recognitione et emendatione nunc primum editus cum nomenclatura rerum metallicarum.*

*Eorum Lipsiae In officina Valentini Papae Anno. MDXLVI.*

\*1546 (folio):

*Georgii Agricolae De ortu et causis subterraneorum Lib. V. De natura eorum quae effluunt ex terra Lib. IIII. De natura fossilium Lib. X. De veteribus et novis metallis, Lib. II. Bermannus sive De re Metallica dialogus. Interpretatio Germanica vocum rei metallica addito Indice faecundissimo.*

*Apud Hieron Frobenium et Nicolaum Episcopium Basileae, MDXLVI. Cum privilegio Imp. Maiestatis ad quinquennium.*

\*1549 (8vo):

*Georgii Agricolae de animantibus subterraneis Liber.*

Froben, Basel, MDXLIX.

\*1550 (8vo):

*Di Georgio Agricola De la generatione de le cose, che sotto la terra sono, e de le cause de' loro effetti e natura, Lib. V. De La Natura di quelle cose, che de la terra scorrono Lib. IIII. De La Natura de le cose Fossili, e che sotto la terra si Cavano Lib. X. De Le Minere antiche e moderne Lib. II. Il Bermanno, ò de le cose Metalliche Dialogo, Recato tutto hora dal Latino in Buona Lingua volgare.*

(Vignette of Sybilla surrounded by the words) *Qv Al Piv Fermo E Il Mio Foglio È Il Mio Presaggio.*

*Col Privilegio del Sommo Pontefice Papa Giulio III. Et del Illustriss. Senato Veneto per anni. XX.*

(Colophon). *In Vinegia per Michele Tramezzino, MDL.*

\*1550 (folio):

*Georgii Agricolae. De Mensuris et ponderibus Rom. atque Graec. lib. V. De externis*

*mensuris et ponderibus Lib. II. Ad ea quae Andreas Alciatus denuo disputavit De Mensuris et Ponderibus brevis defensio Lib. I. De Mensuris quibus intervalla metimur Lib. I. De restituendis ponderibus atque mensuris. Lib. I. De precio metallorum et monetis. Lib. III.*

*Basileae. Froben. MDL. Cum privilegio Imp. Maiestatis ad quinquennium. 4*

\*1556 (folio):

*Georgii Agricolae De Re Metallica Libri XII. quibus Officia, Instrumenta, Machinae, ac omnia denique ad Metallicam spectantia, non modo luculentissime describuntur, sed et per effigies, suis locis insertas, adjunctis Latinis, Germanicisque appellationibus ita ob oculos ponuntur, ut clarius tradi non possint Eiusdem De Animantibus Subterraneis Liber, ab Autore recognitus: cum Indicibus diversis, quicquid in opere tractatum est, pulchre demonstrantibus.*

(Froben' s Mark).

*Basileae MDLVI. Cum Privilegio Imperatoris in annos V. et Galliarum Regis ad Sexennium.*

Folio 538 pages and preface, glossary and index amounting to 86 pages. This is the first edition of *De Re Metallica*. We reproduce this title–page on page XIX.

\*1557 (folio):

*Vom Bergwerck xii Bücher darinn alle Empter, Instrument, Gezeuge, unnd Alles zu disem Handel gehörig, mitt schönen figuren vorbildet, und Klärlich beschriben seindt erstlich in Lateinischer Sprach durch den Hochgelerten und weittberümpften Herrn Georgium Agricolam, Doctorn und. Bürgermeistern der Churfürstlichen statt Kempnitz, jezundt aber verteüschet durch den Achtparen, unnd Hochgelerten Herrn Philippum Bechium, Philosophen, Artzer und in der Loblichen Universitet zu Basel Professorn.*

*Gedruckt zu Basel durch Jeronymus Froben Und Niclausen Bischoff im 1557 Jar mitt Keiserlicher Freyheit.*

\*1558 (folio):

*Georgii Agricolae De ortu et causis subterraneorum Lib. V. De natura eorum quae effluunt ex terra Lib. IV. De natura fossilium Lib. X. De veteribus et novis metallis Lib. II. Bermannus, sive De Re Metallica Dialogus Liber. Interpretatio Germanica vocum rei metallica, addito duplici Indice, altero rerum, altero locorum Omnia ab ipso authore, cum haud poenitenda accessione, recens recognita.*

*Froben, et Episcop. Basileae MDLVIII. Cum Imp. Maiestatis renovato privilegio ad quinquennium.*

270 pages and index. As the title states, this is a revised edition by the author, and as the changes are very considerable it should be the one used. The Italian translation and the 1612 Wittenberg edition, mentioned below, are taken from the 1546 edition, and are, therefore, very imperfect.

\*1561 (folio):

Second edition of *De Re Metallica* including *De Animantibus Subterraneis*, with same title as the first edition except the addition, after the body of the title, of the words *Atque omnibus nunc iterum ad archetypum diligenter restitutis et castigatis* and the year MDLXI. 502 pages and 72 pages of glossary and index.

\*1563 (folio):

*Opera di Giorgio Agricola de L' arte de Metalli Partita in XII. libri, ne quali si descrivano tutte le sorti, e qualità de gli uffizii, de gli strumenti, delle macchine, e di tutte l' altre cose attenenti a cotal arte, non pure con parole chiare ma eziandio si mettano a luoghi loro le figure di dette*

*cose, ritratte al naturale, con l'aggiunta de nomi di quelle, cotanto chiari, e spediti, che meglio non si puo desiderare, o havere.*

*Aggiugnesi il libro del medesimo autore, che tratta de gl'Animali di sottoterra da lui stesso corretto et riveduto. Tradotti in lingua Toscana da M. Michelangelo Florio Fiorentino.*

*Con l'Indice di tutte le cose piu notabili alla fine (Froben' s mark) in Basilea per Hieronimo Frobenio et Nicolao Episcopio, MDLXIII.*

542 pages with 6 pages of index.

\*1580 (folio):

*Bergwerck Buch: Darinn nicht Allain alle Empte Instrument Gezeug und alles so zu diesem Handel gehörig mit figuren vorgebildet und klärlich beschriben, etc. Durch den Hochgelehrten . . . Herrn Georgium Agricolam der Artzney Doctorn und Burgermeister der Churfürstlichen Statt Kemnitz erstlich mit grossem fleysss mühe und arbeit in Latein beschriben und in zwölf Bücher abgetheilt: Nachmals aber durch den Achtbarn und auch Hochgelehrten Philippum Bechium Philosophen Artzt und in der Löblichen Universitet zu Basel Professorn mit sonderm fleysss Teutscher Nation zu gut verteutscht und an Tag geben. Allen Berckherrn Gewercken Berckmeistern Geschwornen Schichtmeistern Steigern Berckheuwern Wäschern und Schmelzern nicht allein nützlich und dienstlich sondern auch zu wisseem hochnotwendig.*

*Mit Römischer Keys. May Freyheit nicht nachzutrucken.*

*Getruckt in der Keyserlichen Reichsstatt, Franckfort am Mayn, etc. Im Jahr MDLXXX.*

\*1612 (12mo):

*Georgii Agricolae De ortu et causis subterraneorum Lib. V. De natura eorum quae effluunt ex terra, Lib. IV. De natura fossilium Lib. X. De veteribus et novis metallis Lib. II. Bermannus, sive de re metallica Dialogus. Interpretatio Germanica vocum rei metallicae.*

*Addito Indice faecundissimo, Plurimos jam annos à Germanis, et externarum quoque nationum doctissimis viris, valde desiderati et expetiti.*

*Nunc vero in rei metallicae studiosorum gratiam recensiti, in certa capita distributi, capitum argumentis, et nonnullis scholiis marginalibus illustrati à Johanne Sigfrido Philos: et Medicinae Doctore et in illustri Julia Professore ordinario.*

*Accesserunt De metallicis rebus et nominibus observationes variae et eruditae, ex schedis Georgii Fabricii, quibus ea potissimum explicantur, quae Georgius Agricola praeteriit.*

*Wittebergae Sumptibus Zachariae Schüreri Bibliopolae Typis Andreae Rüdingeri, 1612.*

There are 970 pages in the work of Agricola proper, the notes of Fabricius comprising a further 44 pages, and the index 112 pages.

\*1614 (8vo):

*Georgii Agricolae De Animantibus Subterraneis Liber Hactenus à multis desideratus, nunc vero in gratiam studiosorum seorsim editus, in certa capita divisus, capitum argumentis et nonnullis marginalibus exornatus à Johanne Sigfrido, Phil. & Med. Doctore, etc.*

*Wittebergae, Typis Meisnerianis: Impensis Zachariae. Schureri Bibliop. Anno. MDCXIV.*

\*1621 (folio):

*Georgii Agricolae Kempuicensis Medici ac Philosophi Clariss. De Re Metallica Libri XII Quibus Officia, Instrumenta, Machinae, ac omnia denique ad metallicam spectantia, non modo Luculentissimè describuntur; sed et per effigies, suis locis insertas adjunctis Latinis. Germanicisque; appellationibus, ita ob oculos ponuntur, ut clarius tradi non possiut.*

*Ejusdem De Animantibus Subterrancis Liber, ab Autore recognitus cum Indicibus diversis quicquid in Opere tractatum est, pulchrè demonstrantibus.*

(Vignette of man at assay furnace).

*Basilae Helvet. Sumptibus itemque typis chalcographicis Ludovici Regis Anno MDCXXI.*

502 pages and 58 pages glossary and indices.

\*1621 (folio):

*Bergwerck Buch Darinnen nicht allein alle Empter Instrument Gezeug und alles so zu disem Handel gehörig mit Figuren vorgchildet und klärlich beschrieben: . . . Durch den Hochgelehrten und weitberühmten Herrn Georgium Agricolam, der Artzney Doctorn und Burgermeister der Churfürstlichen Statt Kemnitz Erstlich mit grossem fleiss mühe und arbeit in Latein beschrieben und in zwölf Bücher abgetheilt: Nachmals aber durch den Achtbarn und auch Hochgelehrten Philippum Bechium. Philosophen, Artzt, und in der loblichen Universitet zu Basel Professorn mit sonderm fleiss Teutscher Nation zu gut verteutsch und an Tag geben und nun zum andern mal getruckt.*

*Allen Bergherrn Gewercken Bergmeistern Geschwornen Schichtmeistern Steigern Berghäwern Wäschern unnd Schmelzern nicht allein nutzlich und dienstlich sondern auch zu wissen hochnohtwendig.*

(Vignette of man at assay furnace).

*Getruckt zu Basel inverlegung Ludwig Königs Im Jahr, MDCXXI.*

491 pages 5 pages glossary no index.

\*1657 (folio):

*Georgii Agricolae Kempnicensis Medici ac Philosophi Clariss. De Re Metallica Libri*

*XII. Quibus Officia, instrumenta, machinae, ac omnia denique ad metallicam spectantia, non modo luculentissimè describuntur: sed et per effigies, suis locis insertas, adjunctis Latinis, Germanicisque appellationibus, ita ob oculos ponuntur, ut clarius tradi non possint. Quibus accesserunt hac ultima editione, Tractatus ejusdem argumenti, ab eodem conscripti, sequentes.*

*De Animantibus Subterraneis Lib. I., De Ortu et Causis Subterraneorum Lib. V., De Natura eorum quae effluunt ex Terra Lib. IV., De Natura Fossilium Lib. X., De Veteribus et Novis Metallis Lib. II., Bermannus sive de Re Metallica, Dialogus Lib. I.*

*Cum Indicibus diversis, quicquid in Opere tractatum est, pulchrè demonstrantibus.*

(Vignette of assayer and furnace).

*Basileae Sumptibus et Typis Emanuelis König. Anno MDCLVII.*

Folio, 708 pages and 90 pages of glossary and indices. This is a very serviceable edition of all of Agricola's important works, and so far as we have noticed there are but few typographical errors.

\*1778 (8vo):

*Gespräch vom Bergwesen, wegen seiner Fürtrefflichkeit aus dem Lateinischen in das Deutsche übersetzt, mit nützl. Anmerkungen erläutert. u. mit einem ganz neuen Zusatze von Zlüglicher Anstellung des Bergbaues u. von der Zugutemachung der Erze auf den Hüttenwerken versehen von Johann Gottlieb Stör.*

*Rotenburg a. d. Fulda, Hermstädt 1778. 180 pages.*

\*1806 (8vo):

*Georg Agricola's Bermannus eine Einleitung in die metallurgischen Schriften desselben, übersetzt und mit Exkursionen herausgegeben von Friedrich August Schmid. Haushalts- und Befahrungs-Protokollist im Churf. vereinigten Bergamte zu St. Annaberg.*

*Freyberg 1806. Bey Craz und Gerlach.*

\*1807-12 (8vo):

*Georg Agrikola's Mineralogische Schriften übersetzt und mit erläuternden Anmerkungen. Begleitet von Ernst Lehmann Bergamts-Assessor, Berg-Gegen- und Receszsreiber in Dem*

*Königl. Sächs. Bergamte Voigtsberg der jenaischen Societät für die gesammte Mineralogie Ehrenmitglieder.*

*Freyberg, 1807–12. Bey Craz und Gerlach.*

This German translation consists of four parts: the first being *De Ortu et Causis*, the second *De Natura eorum quae effluunt ex terra*, and the third in two volumes *De Natura Fossilium*, the fourth *De Veteribus et Novis Metallis*; with glossary and index to the four parts.

We give the following notes on other possible prints, as a great many references to the above works occur in various quarters, of date other than the above. Unless otherwise convinced it is our belief that most of these refer to the prints given above, and are due to error in giving titles or dates. It is always possible that such prints do exist and have escaped our search.

*De Re Metallica*. Leupold, Richter, Schmid, van der Linden, Mercklinus and Eloy give an 8vo edition of *De Re Metallica* without illustrations, Schweinfurt, 1607. We have found no trace of this print. Leupold, van der Linden, Richter, Schmid and Eloy mention an 8vo edition, Wittenberg, 1614. It is our belief that this refers to the 1612 Wittenberg edition of the selected works, which contains a somewhat similar title referring in reality to *Bermannus*, which was and is still continually confused with *De Re Metallica*. Ferguson mentions a German edition, Schweinfurt, 8vo, 1687. We can find no trace of this; it may refer to the 1607 Schweinfurt edition mentioned above.

*De Natura Fossilium*. Leupold and Gatter refer to a folio edition of 1550. This was probably an error for either the 1546 or the 1558 editions. Watt refers to an edition of 1561 combined with *De Medicatis Fonlibus*. We find no trace of such edition, nor even that the latter work was ever actually printed. He also refers to an edition of 1614 and one of 1621, this probably being an error for the 1612 edition of the subsidiary works and the *De Re Metallica* of 1621. Leupold also refers to an edition of 1622, this probably being an error for 1612.

*De Ortu et Causis*. Albinus, Hofmann, Jacobi, Schmid, Richter, and Reuss mention an edition of 1544. This we believe to be an error in giving the date of the dedication instead of that of the publication (1546). Albinus and Ferguson give an edition of 1555, which date is, we believe, an error for 1558. Ferguson gives an edition of the Italian translation as 1559; we believe this should be 1550. Draud gives an edition of 1621; probably this should be 1612.

*Bermannus*. Albinus, Schmid, Reuss, Richter, and Weinart give the first edition as 1528. We have been unable to learn of any actual copy of that date, and it is our belief that the date is taken from the dedication instead of from the publication, and should be 1530. Leupold, Schmid, and Reuss give an edition by Froben in 1549; we have been unable to confirm this. Leupold also gives an edition of 1550 (folio), and Jöcher gives an edition of Geneva 1561 (folio); we have also been unable to find this, and believe the latter to be a confusion with the *De Re Metallica* of 1561, as it is unlikely that *Bermannus* would be published by itself in folio. The catalogue of the library at Siena (Vol. III., p. 78) gives *Il Bermanno, Vinegia*, 1550, 8vo. We have found no trace of this edition elsewhere.

*De Mensuris et Ponderibus*. Albinus and Schmid mention an edition of 1539, and one of 1550. The Biographie Universelle, Paris, gives one of 1553, and Leupold one of 1714, all of which we have been unable to find. An epitome of this work was published at various times, sometimes in connection with editions of Vitruvius; so far as we are aware on the following dates, 1552, 1585, 1586, 1829. There also appear extracts in relation to liquid measures in works entitled *Vocabula rei numariae ponderum et mensurarum*, etc. Paul Eber

and Caspar Peucer, *Lipsiae*, 1549, and in same Wittenberg, 1552.

*De Veteribus et Novis Metallis*. Watt gives an edition, Basel, 1530, and Paris, 1541; we believe this is incorrect and refers to *Bermannus*. Reuss mentions a folio print of Basel, 1550. We consider this very unlikely.

*De Natura eorum quae Effluunt ex Terra*. Albinus, Hofmann, Schmid, Jacobi, Richter, Reuss, and Weinart give an edition of 1545. We believe this is again the dedication instead of the publication date (1546).

*De Animantibus Subterraneis*. Van der Linden gives an edition at Schweinfurt, 8vo, 1607. Although we have been unable to find a copy, this slightly confirms the possibility of an octavo edition of *De Re Metallica* of this date, as they were usually published together. Leupold gives assurance that he handled an octavo edition of Wittenberg, 1612, *cum notis Johann Sigfridi*. We think he confused this with *Bermannus sive de re metallica* of that date and place. Schmid, Richter, and Draud all refer to an edition similarly annotated, Leipzig, 1613, 8vo. We have no trace of it otherwise.

#### UNPUBLISHED WORKS ON SUBJECTS RELATED TO MINING.

Agricola apparently projected a complete series of works covering the whole range of subjects relating to minerals: geology, mineralogy, mining, metallurgy, history of metals, their uses, laws, etc. In a letter 5 from Fabricius to Meurer (March, 1553), the former states that Agricola intended writing about 30 books (chapters) in addition to those already published, and to the twelve books *De Re Metallica* which he was about to publish. Apparently a number of these works were either unfinished or unpublished at Agricola's death, for his friend George Fabricius seems to have made some effort to secure their publication, but did not succeed, through lack of sympathy on the part of Agricola's family. Hofmann 6 states on this matter: "His intentions were frustrated mainly through the lack of support with which he was met by the heirs of the Mineralogist. These, as he complains to a Councillor of the Electorate, Christopher von Carlovitz, in 1556, and to Paul Eber in another letter, adopted a grudging and ungracious tone with regard to his proposal to collect all Agricola's works left behind, and they only consented to communicate to him as much as they were obliged

by express command of the Prince. At the Prince's command they showed him a little, but he supposed that there was much more that they had suppressed or not preserved. The attempt to purchase some of the works the Elector had given Fabricius money for the purpose (30 nummos unciales) proved unavailing, owing to the disagreeableness of Agricola's heirs. It is no doubt due to these regrettable circumstances that all the works of the industrious scholar did not come down to us." The "disagreeableness" was probably due to the refusal of the Protestant townsfolk to allow the burial of Agricola in the Cathedral at Chemnitz. So far as we know the following are the unpublished or lost works.

*De Jure et Legibus Metallicis.* This work on mining law is mentioned at the end of Book IV. of *De Re Metallica*, and it is referred to by others apparently from that source. We have been unable to find any evidence that it was ever published.

*De Varia temperie sive Constitutione Aeris.* In a letter 7 to Johann Naevius, Agricola refers to having a work in hand of this title.

*De Metallis et Machinis.* Hofmann 8 states that a work of this title by Agricola, dated Basel 1543, was sold to someone in America by a Frankfort-on-Main bookseller in 1896. This is apparently the only reference to it that we know of, and it is possibly a confusion of titles or a "separate" of some chapters from *De Re Metallica*.

*De Ortu Metallorum Defensio ad Jacobum Scheckium.* Referred to by Fabricius in a letter 9 to Meurer. If published was probably only a tract.

*De Terrae Motu.* In a letter 10 from Agricola to Meurer (Jan. 1, 1544) is some reference which might indicate that he was formulating a work on earthquakes under this title, or perhaps may be only incidental to the portions of *De Ortu et Causis* dealing with this subject.

*Commentariorum in quibus utriusque linguae scriptorum locos difficiles de rebus subterraneis explicat, Libri VI.* Agricola apparently partially completed a work under some such title as this, which was to embrace chapters entitled *De Methodis* and *De Demonstratione*. The main object seems to have been a commentary on the terms and passages in the classics relating to mining, mineralogy, etc. It is mentioned in the Preface of *De Veteribus et Novis Metallis*, and in a letter 11 from one of Froben's firm to Agricola in 1548, where it is suggested that Agricola should defer sending his new commentaries until the following spring. The work is mentioned by Albinus 12, and in a letter from Georg Fabricius to Meurer on the 2nd Jan. 1548, 13 in another from G. Fabricius, to his brother Andreas on Oct. 28, 1555, 14 and in a third from Fabricius to Melanchthon on December 8th, 1555 15, in which regret is expressed that the work was not completed by Agricola.