Bermannus – the names and the things

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The greater part of Agricola's notoriety is linked, as has been noted, to the «De re metallica», a treatise of a technical nature on the the art of mining, the outline of which took the author from his time in Joachimsthal until almost the end of his life. Within the panorama of the technical mining literature of the sixteenth century this work presents many unique features, it is written in latin, dedicated to res metallica in its broadest sense, (the administration of the mine, the diseases of the miners, prospecting, extraction and assaying methods, various stages or phases of the work and so on) and is very rich in extrordinarily descriptive illustrations. These characteristics of the work amply justify its being widely read and successful down through the centuries.

This work, however, almost obscures the rich production of writings by Agricola on multiple subjects in which he was interested, some of these were strictly geo-mineralogical but were also discussed in theoretical works. These writings provide us with a more precise image of Agricola, giving a definite outline of him with rigorous adherence to the route or path of his intellectual development.

The first work of the group of geo mineralogical writings is the «Bermannus sive de re metallica» (Froben, Basilea, 1530: all quotations used here refer to this edition) which appears as an individual edition and also as the closing article of works considered to be of minor importance. This is presented as a suggestive and varied work with which Agricola gently introduces the reader (according to Erasmus) to numerous themes concerning the res metallica, themes which would be later fully discussed only in specific works and in the following years. The *Bermannus* is often considered marginally or successively to the other works of Agricola, as is apparent, especially, in the History of Science literature from non-german cultures.

When the consideration of the *Bermannus* is strongly influenced by a knowledge of Agricola's successive writings, the *Bermannus* is then regarded as a *lighthearted and playful anticipation* of his more serious works. It thus becomes a very delicate work, not to be taken seriously in its own right, in which is lost its innovative importance or significance. This interpretation *which comes from the future* has given a distorted view of the *Bermannus* as a unitarian work which must be placed in relation to the recent past from which the dialogue is produced and expressed at the same time.

The sixteenth century, in the History of Natural Science, is presented as being a nonhomogeneous century, in which, approximately, the first half is considered as an extension of the second part of the fifteenth century and the second as the begining, without a conspicious break in continuity, of Natural Science in the seventeenth century. A significant change in the History of Natural Science may be placed therefore within the middle decade of the sixteenth century. Scientific humanism shows, through a collation of the vulgate version, the translations and the originals (or presumed as such) of old works, especially greek, rediscovered by the humanists, that the scientific literature, especially the medical and natural history works, inherited from the western latin culture, has a similar history to that of the literary and philosophical writings. The interpolations are numerous as are the multiple

alterations to the works and their contents which have taken place during the transmission from one manuscript to another. Furthermore, during this process the influence of more than one culture has been introduced among which is also included the Arabian culture.

It is well noted that the translation from one language to another is not a mechnical process, but it goes from one lexical, grammatical and syntactic universe to another, which sometimes is radically diverse. This process is influenced, frequently in a decisive way, by the ‹cultural tradition› in which it is carried out, by its own intellectual and material characteristics (environment, flora, fauna, and, within the medical-pharmacological field, specific illnesses and therapies).

The awareness of the unreliability of the translations and the vulgate versions and therefore the uncertainty of the knowledge gained from the tradition, is also accompanied however by the discovery of works from the past which remained unknown up to that time.The original works from Antiquity become a font of suggestive naturalistic knowledge. In some cases, common in the sixteenth century, humanistic culture and an interest in the surrounding nature were combined in the same person. The explaination from the old works discovered extends to include the latter type and has as a final term of the collation nature itself: the return to the *natural archetype*. The scientific assertions of the ancients are therefore scrutinized by the direct observations of the naturalistic philosopher.

From this subsequent comparison, which began to conclude in the second half of the sixteenth century and which extinguished much of the initial enthusiasm, emerges the discordance between the knowledge of the ancients and the recently acquired data and with it, for example, the inadequacy of the scientific terminology of the past. Moreover, in a relatively short time the limit of the knowledge of the ancients is ascertained, the observations of whom in the naturalistic field, except for some particular cases, have as geographical boundaries those of the Mediterrean basin.

In his attempts to resolve the differences between two sources so diverse for the knowledge of nature, i.e. the written source and direct observations, the naturalist makes a revision of his knowledge. In this way he makes new discoveries. The value of the scientific findings gained from personal observation is accentuated in this way. The emergent naturalist, knows the ancient works but distances himself from these and begins the process of a complete revision of the known works. This is the first modern scientific treatment of natural facts.

A systematic and global consideration of organic and inorganic bodies from nature became necessary: this signifies that all the natural objects should be taken into consideration together so that an effective understanding may be reached of nature itself and its behaviour, iuxta propria principia. This awareness constitutes one of the most important acquisitions of the socalled ‹scientific revolution› and it is the base of scientific collectionism. These viewpoints are amply expressed in the naturalistic literature printed in the sixteenth century. It is obvious that the interest in observing and studying nature was not born exclusively from the desire to emphasis a verification of the ancient sources through a direct comparison with the state of res naturales. The knowledge of mineralogy (in its broadest sense) together with that of botany have been for centuries strictly linked to the practise of pharmacy and to mining activities and is connected therefore or rather restricted to the world of the apothecary and the technician.

The neccesity of restoring the original links, which had been lost or recomposed in an

arbitary way, between the ancient terminology and the natural objects that they define (or defined), emerges in the sixteenth century. This happened mainly in connection with the philosophical approach to the works of antiquity. The aims of this restoration are very precise with a definite practical tendency: profitably developed in the mining activities; correct use of plants and minerals in the preparation of pharmaceuticals.

Often however, the petrographer of the sixteenth century (as for the zoologist and the botanist) saw a nature for which no corresponding one was found in the pages of the ancient works. This nature was not only different but showed a variety of organic and inorganic forms never described in the past (to those are added species successively described from recently discovered continents). A lot of problems arose from the identification, classification and systematic correlation of new forms and forms already described in the past, from the observations of which new morphological features were defined.

The interpretation of the *Bermannus* may be placed in a general context: it is shown to be one of the few printed works from the sixteenth century which allows us to grasp a precise moment in this process. The *Bermannus* is also the only work (as far as I am aware) which thanks to the freshness of its dialogue, helps us to understand in media re, the specificity of that process in relation to knowledge – past and present – on minerals.

The history of the naturalistic works elaborated since the classical age opened a division in the correspondance between the names and the things *that nature or art had made* (quas vel natura edidit vel ars invenit) (Bermannus, p. 10). There followed a serious loss to both: the names (nomina) became progressively deformed from the ancient terminology or borrowed from a non cultural language; the things (res) were little known or completely ignored. The science and the knowledge of the ancients descended into darkness and fell into oblivion. Among the best men a group of hardworking enthusiasts arrived in time before the complete disappearance of the ancient science and brought to light and to memory the bonae disciplinae e le nobiles artes.

The passionate excitement of the work of the humanists as the ones who encouraged the rebirth of bonae disciplinae and of nobiles artes was for the Agricola who wrote the Bermannus, after the return from Italy, the recognition of the significance of his efforts but also the first declaration of the direction and the aim which he intended to give to his future work. In the *Bermannus* the full acceptance of the ‹new› ancient and the modern was always accompanied by a marked refusal of the sense of impotence derived from the ignorance of the things. The two schools of medicine, the Arabian and that of the Greek-Latin tradition, are represented in the dialogue by such personnages as Ancon/Payer and Naevius/Neefe who represent the knowledge of the past, its limits and at the same time its new aspirations. On the other hand the innovative things are introduced by the character of *Bermannus*.

Bermannus numerat, metitur, canit, cursus astrorum tenet, (Bermannus, p. 16), excelled in the discipline of quadrivium. His academic culture was that of the faculty of Arts. In the opening conversation with Naevius, *Bermannus* showed that he was able to quantify the distance between places cited in his first discourse within the dialogue which was of a geographical nature. The description of the german mining district, with its mining towns, its mountains and its rivers represents a real geographical map explained through the words of *Bermannus* with the support of Naevius. This is probably in honour of the Ptolemy’s

Geographia reprinted after 1477 which was followed by the first publication of atlases and maps of Europe and the known world. It was a tribute to the modernity of the nomenclature which Ptolemy used for the relief of central Europe. It was also the recognition of the utility of an emerging discipline, cartography; one of the noble arts, the result of the attempts by the cartographers in developing adequate techniques in order to graphically represent the territory.

But the geographical description with reference coordinates given by the morphology also supported another type of information, the location of the mines of central Europe, which was emerging to compliment classical knowledge. Germany (not in the modern sense) described in antiquity, for example by Tacitus, as an infertile region as regards mining, had instead revealed an uncommon underground richness. The recognition and the exploitation of the mines was made possible by direct and original observations of the terrain and its products, the result of the accumulated experience gained from time spent completely within the world of mining. The notable and mature expertise of the miners in their field allowed the collection of data and information which, apart from the cultural tradition of knowledge, soon revealed their use in the sphere of theoretical and applicative knowledge.

In this way Agricola showed to the contractors and to von Könneritz a territory with its considerable potential for exploitation and therefore the production of the richness. He demonstrated still more to the res publica litterarum that an alternative source of natural knowledge, particularly there where the ancient science had failed, could come from the technical world and a local culture, the original and unique knowledge acquired through daily experience.

The motivation was not any different for the treatment of medical and mineralogical subjects in the *Bermannus*. Ancon and Naevius were the voices of information from the past as regards minerals: but *Bermannus* the character was speaking in reality with Agricola himself, who like every other doctor, knew the practical aspect of his profession which was technical, another of the noble arts. In Joachimsthal, this profession branched in two directions, one the doctor who cures and the other the pharmacist who prepares the medicine which he himself prescribes and also that of other colleagues.

The doctor knows that there are medicines that may be prepared with mineral substances: the ignorance which resulted from the entanglement of the knowledge of the past, perhaps was justified by Agricola, in spite of his attacks on his colleagues about this. However, he did not forgive the negligentia, that is to say the carelessness in not consulting the knowledge that was at hand. He did not forgive the ignorant and despicable doctors who exploited the good faith of uneducated men and confused their patients by pronouncing obscure names of uncertain or non-existent substances. Pudeat nos – given that Agricola was also a doctor – eas voces toties legere, toties in ore habere, et res, quas significant, non noscere (Bermannus, p. 13). For a doctor the lack of knowledge means an inability to take part in an efficient way and without risk in a therapy already tested by the ancients: therefore it is not astonishing if the doctor is often not able to heal his patients.

Agricola during the time he passed through Italy learnt how much the old traditions could offer not only in medical matters but also regarding the use of inorganic substances in the preparation of medicines. Together with many pages of comments on the pharmacology and

mineralogy of antiquity, he brought with him on his return to his own country, all the problems that came to the attention of one who, like him, presumed to inherit an *alternative medicine* from the restored works of the great doctors of the past. The official recognition of the validity of which was derived directly from its practise and from the authority of those who had used it in the past. As they themselves said the principle difficulty that they encountered was the correlation of the names with the things. In harmony with the tendencies of scientific humanism Agricola looked for answers directly from nature: Quae sana praecipua fuit causa, quam ob rem ad loca, quae metallis abundarent, contulerim (Bermannus, p 14).

Therefore to be able to recognise the minerals described by the ancients and satisfy the aims of a conscientious doctor, Agricola came to work in Joachimsthal, a recently founded mining town in the process of expansion where above all he found friends, acquaintances and colleagues already well settled in the higher levels of the community who were ready to help him on his way. Because the doctor was morally obligated to return his patient to full health, Agricola took into account the humanitarian reasons linked to specific situations. The majority of those who turned to him as a doctor and as a pharmacist were the miners of the area, poor people in need of urgent help in order to return immediately to work so as to earn their salary to live. It certainly would have been a considerable advantage to know the therapeutic properties of minerals and be able to meet the requests of the sick and the doctor's prescriptions with an inexpensive immediate medicine based on locally available components.

It is not clear when Agricola's interest in the questions raised by *Berg-medizin* was developed. These two attitudes were already fused in the *Bermannus* and besides when Agricola wrote this text he was already working in Joachimsthal for over a year. However, prior to this time the world of mining and its problems certainly was not unknown to him.

At Joachimsthal he soon realised that comparing the pages of the ancient works with the minerals was not the main route (via regia) to obtaining the answers that he was looking for. In addition to the problems in explaining the old works were the difficulties of nature itself which was particularly difficult to interpretate as it was inorganic. This inorganic nature included a wide variety of mineral bodies ignored by the ancients and the variability of their external characteristics and physical properties – consider for example the polymorphic elements such as diamond-graphite, white-black tin and so on. This does not guarantee in many cases any certainty in the recognition of minerals based on an examination of their features. Moreover, inorganic bodies are rarely represented in nature as a pure substance but rather in association with extraneous material, with other minerals or embedded within the host rock.

Dealing with the objective difficulties associated with inorganic materials – also the most recent medieval tradition did not include many studies on minerals or metals – Agricola reacted by approaching not only an isolated object which as a result of its form is a source of more ambiguity but to those who learned to recognise minerals by another method, and associate the pureness of metal obtained with that form, that colour, the external features of that local mineral type and its variants. The ease or difficulty of extraction and the labour, the grade of richness if they are able to extract it or the sum they could lose were also associated with these properties.

Agricola directed these comments therefore to those who had acquired competence from actual daily experience with the things (res). He started by frequenting the mine and descending with the miners into the galleries where the material is freshly cut. Consequently he followed the selection phases, washing, preparation for fusion, the fusion itself until the pure mineral was reduced to ingots ready for sale.

Agricola did not show any disdain towards the work in the mines, a contempt which according to some contempory historians was widespread among the ‹intellectuals› of the sixteenth century when faced with certain mechanical arts. The *Bermannus* showed that Agricola acceded to the knowledge and the expertise of the miners in order for him to also acquire these.

He re-examined them then in the light of his abilities in an Aristotelian based theoretical context and presented them – like he did in his so-called minor works – in terms of a scientific treatise with rigorous styles and concepts. Also the «De re metallica» the largest of his works was already being worked out in these years. It was, more than anything else, the symbol of the fascination the world of mining exercised over him together with its extent of men, machines, knowledge, energy and richness which was needed to convert the minerals into objects of use. The same minerals only seen until now through the pages of the ancients could not have so greatly stimulated his interest.

It cannot be denied that his choice of believing in the knowledge of the miners was, in a certain sense, forced by the nature of the objects themselves which he intended to study. At the begining of the sixteenth century, the scarce notes of descriptive mineralogy were not valid for the recognition of minerals. There didn’t exist a system of identification which specified the individual diagnostic features on which to base a classification.

Agricola therefore did not possess a systematic and descriptive reference grid with which to compare the mineral descriptions of the past – above all to eliminate or identify the uncertain ones – and on the base of which to specify newly recognised minerals. In order to acquire this knowledge himself which was essential to his aim he spent much of the time he had free from his medical and pharmaceutical commitments studying minerals and the interior of the mine and obviously contact with the miners, the workers, was inevitable even if he did not wish it. The worker (*operarius*) however, had a limited knowledge, in the sector of objects, of language (*terminology*) and of the overall work in the mine as each type of worker was expert only in his own work sector.

His real interlocutors were men like Bach and *Bermannus* and of the two chiefly *Bermannus*. The latter name was used deliberately or maybe only for assonance for giving the title to the dialogue. It is said that *Bermannus* attended the faculty of Arts and gave preference to the disciplines of quadrivium in respect to that of trivium. He therefore knew latin and as is often shown he was a cultured man who did not however, present himself as an intellectual. He was a great expert (*peritissmus*) in the art of mining. His knowledge was gained by a special type of apprenticeship, profundly diverse from that of the worker (*operarius*). *Bermannus* was the son of a Zehender (*decimanus*) and that signifies that his contact with the mining world was part of his daily life.

In contrast to the operarius who learned his trade visually, *Bermannus* was able to develop an interest in minerals which seems, from the pages of the dialogue, (little is known about his

life), that he concentrated his knowledge on systematic and descriptive subjects. Overall, like Dioscoride, he travelled and acquired knowledge that allowed him to establish comparisons between nature not between written works. *Bermannus* knew not only the world of res (things) but mining in its entirety. Probably from this merging of experience derived his ability to gather a series of problems – that today are called technical scientifical problems

– organising them within a knowledge that does not put questions and does not give answers of a scientific nature (or pre-scientific if you wish) as Agricola will do.

Bermannus was the bearer of practical considerations, he reflected on problems and solutions that could be put and resolved exclusively within the technical sphere, without even having to assume that science (in the terms in which it was outlined at that time) could have been a support or a reference. But *Bermannus*, in contrast to the operarius, extracted his knowledge not from single cases but by contrasting groups of cases (for example types of minerals). He therefore presented Agricola with data elaborated in a comparative way.

In the dialogue, *Bermannus* in spite of the fact that he attended the faculty of Arts and was therefore a cultured man in respect to the operarius, did not frankly seem interested in the problems connected with the contrast between the traditions of the past and the urgent requirements of the present. Instead an interest in these problems was characteristic of the humanists – naturalists of the first half of the sixteenth century. From *Bermannus's* point of view the opinions of the ancient doctors and naturalists on mineral bodies were not significant; in spite of the assertions of Pliny or Galen or Theophrastus – mentioned by the doctors in the dialogue, which were also known and quoted by *Bermannus* as he was well educated – his certainty was based on things which are as they exist in nature and not otherwise. In this way the limits of ancient science began to be defined.

Since the first pages of the *Bermannus* Agricola shows the awareness of finding himself at a particular moment in which the inability to recognise what is known determines the conditions which impede – or slow down – the knowledge of the new.

Agricola consequently gave to an innovator such as *Bermannus*, whose principle feature was that he himself was a new figure, the task of indicating the way by which to determine the adequacy of knowledge from the old world in relation to the reality of res naturales. But this way was already concluded in the *Bermannus* with the intuition that while a part of the scientific heritage of the classical age is found to be full of corresponding interests to the sixteenth century and in fact was the stimulus for more elaborations (as in the case of cartography and other noble techniques) the other part cannot be simply conserved in its original form.

Bermannus – who was obviously superimposed by the figure of Agricola – defined the the boundaries for the res (things) within which are enclosed the language problems connected with the sphere of the knowledge of mineralogy. The significance of his mediation is to place his intervention between the problems of the names and the physical properties of the things. He chooses the latter in his dialogue.

The *Bermannus*, appears as a symbolic work where is evident the passage from the ancient knowledge on minerals, with its burden of philological problems and new questions, to the discovery of the surrounding nature through the technical culture at the time which immediately preceded the reorganization of thought towards modern scientific elaborations.

Over the next ten years Agricola set himself the task, in minor works, of comprehending the res naturales *scientifically* (in an Aristotelian sense), in particular general problems and general contexts for specific problems and he looked for logical and empirically adequate answers.