

Man, Metals and Magic: The Ancient History of Metallurgy

Arab Alchemy

Chapter V

It is not only from a metallurgical viewpoint that the world was unproductive and chaotic during the period that followed the Romans' downfall. In the West, most manufacturing processes, mining – and also what, for want of a better word we may call culture – fell to their lowest condition. The only exception seems to have been iron making, which still prospered. The Middle East was in a more or less continual state of war, and while in modern times it is an unhappy fact that war affords a stimulus to invention and an incentive to greater effort, in the 5th and 6th centuries A.D. this was certainly not so. China, the eastern counterpart of the Roman Empire, after a period of suppression became reunited in the Sung and Tang dynasties. It is quite possible that she was metallurgically ahead of the rest of the world, but the state of affairs there is uncertain, and had no real repercussions elsewhere.

Through this vast continent of history, we are fortunately traveling only on the main metallurgical roads, and the next important system of them that we meet is that marked by the Arab conquests. By 725 A.D. the Arab empire stretched from China in the east to Spain in the west. It stretched so far and so perilously that it could not be long lived. But the Arabs, despite their political shortcomings, brought about the rebirth of Greek science and philosophy, which had so long lain dormant. Through their alchemical researches they made discoveries that laid the foundations of chemistry and contributed to many other branches of science.

There is, or was, more to alchemy than the popularly supposed search for the Philosopher's Stone – that curer of ills and transmuter of metals. Alchemy implied a postulate of the unity of matter, upon which an entire philosophy could be, and was, built.

Aristotle, about 350 B.C. had propounded the theory of the Four Elements – Earth, Air, Fire and Water – material elements derived from the two pairs of abstract opposites Hot and Cold, and Wet and Dry. The theory was not entirely new in 350 B.C. for the postulate was really a crystallization of much earlier beliefs and hypotheses. Clearly, the idea of linking opposites was supported experimentally in, for instance, the transition of cold wet water to hot dry steam. Thus, if we are believers in the theory of the Four Elements, should it not be possible to convert any one material into any other? And surely, too, this being the case, there should be one primary element from which all others are derived.

From such arguments, in the early centuries A.D. there developed the belief that there existed an agent, which could effect the transmutation of one element into another, and this was named the Philosopher's Stone. Since it could "perfect" base metals into noble ones, it should also (as the Elixir of Life) be capable of righting bodily imperfections by curing all illnesses and conferring long life.

The Arabs – and in subsequent years many scientific philosophers – occupied themselves with such suppositions, straining analogy to the limit, while less scrupulous people ignored the rainbow philosophy and worked only for the promised pot of gold. If their original assumptions were wrong, although not unreasonable ones to make, the work that the Arab alchemists accomplished made a real contribution to scientific knowledge, and an understanding of metals and their compounds.

Clearly the fault of their reasoning lay primarily in equating change of state with change of inherent structure. The original Four Element theory alluded to changes of property, or quality, such as the change from solid to liquid. However, alchemists thought that the internal constitution of materials could be altered. (We now know that it can, of course, but we should not confuse the issue by dealing with the conclusions of modern science). One has rather less patience with the

17th century alchemists than with their Arab “ancestors” for one feels that they should have learned better by their time. Indeed, Robert Boyle, in 1661, published his skepticism about the doctrine of the Four Elements and introduced the concept of an element much as we now understand it. But this was not orthodox for 100 years or so after his time.

To return to our chronological survey – the Arabs introduced the sulphur-mercury theory, which was directly derived from the Aristotelian theory of the Four Elements. Alchemical terms were delightfully vague and open to wide interpretation. Just as Fire was associated with combustion, so, in an abstruse way, was sulphur. Similarly, the element Water, associated with fluidity, could be identified with mercury, which was further representative of fusibility and metallicity.

Thus in the 8th century, an Arabian alchemist, Abu-Musa-Jabir-ibn-Haiyan (probably Geber, which we shall call him) propounded the theory that all metals were derived from mercury and sulphur and that, in perfection, gold would be produced by their marriage. This production presumably was supposed to happen in the earth, but as a result of “accidents” of impurity and so on, other minerals were unavoidably formed as well. Sulphur and mercury were associated with masculinity and femininity, respectively. Further, the seven known metals were linked with the heavenly bodies. Geber did many useful researches and produced arsenic and antimony from their respective sulphides. Of course, they were not recognized as metals in the same way that iron and copper were. Apart from the fact that the characteristics of metals were not sufficiently well known to allow it, such thinking would have been very inconvenient. After all, there would not be enough planets.

Other Arab philosophers in their common search made similar contributions, not only to a knowledge of metals and their compounds, but also to medicine, astronomy, optics and mathematics. Needless to say, their work over 700 years, which was to be followed by alchemical researches in other parts of the world until recent times, did not produce the Philosopher’s Stone.

Fiction though the Stone may have been, the search for it was certainly real, and the alchemists’ work had many valuable results and interesting effects. The results cannot be easily itemized and no attempt will be made to do so for in addition to the contradictory profusion of alchemical works, many factors make an exact account difficult to produce. Frequently, the alchemist wrote under an assumed name and the actual writer is no longer known. Sometimes manuscripts that alchemists reported to have discovered, and which they ascribed to greater personalities than themselves, were in fact, their own work. Additionally, and perhaps most confusing of all, is the mystical jargon in which they wrote, principally in order to confuse any less learned aspirants, and to frighten them away. We should not, of course, be too shocked at this habit, for it is still practiced, though perhaps more subtly. In alchemical writings it was carried to such extremes that it is difficult to differentiate between the factual and the allegorical. While we cannot categorize the findings of the alchemists, we can describe the broad effect of their work.

Firstly, we are indebted to the Arabs for a new beginning in natural philosophy. Their alchemical researches led them far and wide into the fields of medicine, mathematics and astronomy, in which notable discoveries were made, and new concepts introduced. This rebirth of philosophical thought led to a logical, or quasi-logical, method of approach.

Secondly, the Arabs were more than thinkers. They *did* things, introducing experimental techniques and inventing laboratory apparatus. Geber described, presumably in the 8th century, the construction of furnaces, and also the uses of the Vase of Hermes (a sealed vessel in which many alchemical operations were carried out). It was known, too, as the Philosopher’s Egg, for it was egg-shaped to symbolize fertility.

Another Arab, Rhasis, was given money to build apparatus for his researches, so that he could demonstrate the transmutation of metals to the Prince of Khorossan. (Rhasis is said to have written a book on his method of producing the Philosopher’s Stone, which he presented to the Prince. When the experiments failed, the Prince threw the book at Rhasis, and the blow proved fatal – which, perhaps, shows that while a little knowledge is a dangerous thing, a whole bookful may be catastrophic). In all the alchemical texts and illustrations of the period, it is clear that apparatus, although of a simple kind, was in use. This represents a most important step in the progress of scientific method. Just as Greek learning took many years to spread, so too, the results of alchemical researches were not reaped directly. They were gleaned rather than harvested. Perhaps it is because of this difficulty of pinning down any important single result of

alchemical inquiry that the subject is so often dismissed as unimportant. But it did at any rate provide the vital link between Greek philosophy and the science of the 17th and 18th centuries.

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