

## Lead in history and history in lead

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### Lead and Lead Poisoning in Antiquity.

By Jerome O. Nriagu.

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AMONG the technological arts discovered by our ancestors, none has played a larger role in shaping our civilization than metallurgy; and because the common minerals of lead melt at low temperatures, lead was the first metal to be refined. Lead may also have given rise to our oldest chemical industry, the production of white lead (ceruse), and is responsible for our oldest occupational disease.

The oldest lead object found by archaeologists is a string of beads worn in Anatolia some 8,000 years ago, and its use in jewellery suggests that this was a time when lead was still new and rare. Because of lead's malleability, corrosion resistance and other desirable qualities, human ingenuity devised many other uses for the metal and it attained great commercial importance in the classical world. The lead mines of Cartagena in southern Spain were exploited by Carthage before the area was conquered by Rome, and were worked by 40,000 miners who left a legacy of more than  $10^7$  tons of slag. In antiquity, lead was employed in coinage, glass, medicines, warfare (as sling bullets and in molten form during sieges), ship building, cosmetics (various oxides as eye shadows and so on), glazes for pottery, pigments, masonry (as mortar) and, of course, in "plumbing".

These are just a few of the myriad facts which Dr Nriagu has collected in his book, along with poetic and literary references to lead, arcane lead lore and the role of lead in alchemical theory. As a geologist and geochemist, the author is on familiar ground when dealing with the lead resources of the ancient world, including China and India, and with the contemporary methods of prospecting, mining and production. But he covers virtually all aspects of the metal's ancient history and has assembled an impressive bibliography from diverse disciplines which will be of great value.

The presentation of this encyclopaedic work is unfortunately not commensurate with its scope, however. The problem of organizing so much information into a readable text has not always been solved successfully: too many facts and quotations are offered without the necessary background or critical comment, and an unusually sloppy proof-reading job has left

an abundance of annoying misspellings.

No aspect of the history of lead discussed by Dr Nriagu is likely to provoke as much interest and controversy as the prevalence of chronic lead disease in antiquity and his suggestion that it played an important part in the decline of the Roman Empire. This thesis was first advanced by Gilfillan in 1965 and has, ever since, irritated historians and classicists who are familiar with the complexities of that event. Gilfillan's historical model nevertheless has great popular appeal, and questions about it are raised in almost every discussion of the history of lead poisoning.

There exists, indeed, a great deal of literary, experimental and, lately, an increasing amount of archaeological evidence that many Romans were exposed to dangerous levels of lead. The most

societies and  $30\text{--}50\ \mu\text{gd}^{-1}$  for the modern American.

Dr Nriagu raises the question why, in a society in which occupational plumbism, particularly among miners, was rampant, the connection between lead ingestion and disease remained undiscovered. Quite apart from the fact that miners were generally slaves or prisoners of war, beyond humanitarian concern or the care of physicians, the notion of a specific cause for a chronic disease, which we take for granted, was quite foreign to Graeco-Roman medicine. Galen and other contemporary physicians saw disease, including lead colic, as the result of an imbalance of the humours, and this view prevailed until some 1,500 years later when Paracelsus and his followers insisted that disease had specific chemical causes. The aetiology of the colic epidemics which were caused by the consumption of leaded wines and which persisted for many centuries was, in fact, not identified until 1696 (see *Med. Hist.* 26, 279; 1982).

But while a strong case can be made for widespread lead disease in the Roman Empire and excessive drinking at the courts of some emperors, does it justify Gilfillan's hypothesis?

Dr Nriagu considers that the gluttony and other excesses of the Julio-Claudian and Flavian emperors were lead-related, although this is difficult to reconcile with the loss of appetite and constipation which are among the prominent symptoms of chronic plumbism. And did not the Empire attain its greatest wealth, power and extent under Trajan and other sober and effective emperors, who succeeded these sodden miscreants? It has on the other hand been suggested that gradual

depopulation contributed to the failure of the Western Empire to defend itself against the invasions of the fifth century, and lead-induced infecundity may indeed have played a part in this. But the disappearance of the patriarchal families in the first century can and has been explained otherwise, and may indeed have strengthened the state by introducing new blood into the most enduring political system which the West has evolved.

In the final analysis the evidence which has been marshalled in support of Gilfillan's hypothesis is, at best, anecdotal and occasionally spurious. There is little doubt that countless Roman citizens suffered and died from plumbism, but the link between that health disaster and the fall of the Roman Empire not only remains unproven but is probably unprovable. □

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Smelting lead in the sixteenth century. The illustration comes from one of the works of Georgius Agricola (1494–1555), the German mineralogist who was the first to attempt to impose scientific order on the hitherto unsystematized knowledge of miners. (Reproduced from *Gmelins Handbuch der anorganischen Chemie*, Vol.47, Pt A1; Verlag Chemie, 1973.)

important exposure resulted from the unhappy custom of preserving and sweetening wine by the addition of a syrup (*sapa*), which was prepared by simmering grape juice (must) in a lead kettle. It has been shown that *sapa* prepared according to any of several first-century recipes contained about  $1\text{gPb l}^{-1}$ , and when added to wine in the recommended proportion would produce chronic lead disease. Without *sapa*, or other preservatives such as resin which was, and is, preferred by the Greeks, the extensive wine trade of the Roman Empire would have been impossible.

Even those Romans who eschewed leaded wines ingested *sapa*, for it was a common cooking ingredient, and saturnine cosmetics and medicines were widely used. Dr Nriagu estimates that the rate of lead absorption ranged from  $15\ \mu\text{gd}^{-1}$  for slaves to  $250\ \mu\text{gd}^{-1}$  for aristocrats, compared to  $2\ \mu\text{gd}^{-1}$  in pre-technological