

## BOOK REVIEW

**Minerals and Metals in Ancient India**, Vol. I : Archaeological Evidence, by Arun Kumar Biswas, pp. xxix+524, pls. 50 (colour and halftone) Vol. II : Literary Evidence, by Arun Kumar Biswas and Sulekha Biswas, pp. xvii+259, pls. 25 (colour excluding only 16-17). published by D.K. Printworld (P) Ltd., New Delhi, 1996. Rs. 3500.

This over 800-page beautifully produced set of two volumes is the outcome of a project on the subject financially supported by the National Commission for the History of Science of the Indian National Science Academy, New Delhi, from September 1987 to March 1991 and accomplished with the assistance of Ms. Nayanbala and Ms. Sulekha Biswas, spouse of Prof. Biswas, who figures as the co-author of Vol. II. This happens to be the first authentic comprehensive work on the theme of such a vital importance for a proper appreciation of varied facets of early Indian history. The period covered ranges from the earliest known times to around 1200 AD, and by 'India' is meant pre-partition India covering Pakistan and Bangladesh and in some cases adjoining countries like Sri Lanka and Nepal, too. It takes into account the latest archaeological findings which help remove certain erroneous prevailing notions which still continue to figure in general writings.

Vol. I begins with an account of minerals and metals in pre-Harappan cultures and naturally offers to recent findings of archaeological work in Pakistan. The earliest evidence comes from extensive excavations at Mehargarh (or Mehrgarh) at the foot of the Bolan pass in Baluchistan (Pakistan) which have altered our existing notions completely. Levels of Period Ia-c dating from 7th-6th millennium BC have

afforded, *inter alia*, a cylindrical shaped copper bead and those of Period III dating from 1st half of 4th millennium BC the earliest used green cylindrical jasper drills and micro-drills for *lapis lazuli* as well as several crucibles for melting copper which should suffice to show that the copper-related techniques were indigenously developed by the Indians and there could be no question of their diffusion from Iran as earlier believed by archaeologists. It is noteworthy in this connection that a few of the crucibles still have traces of metal adhering to them. Evidences required for these probably came from the Khetri mines as well as from some Central Asian sources. There is likewise clear evidence of gold-silver alloy at the Harappan sites which most probably obtained the bullion from Kolar gold mines. The Harappans perfected the technique of producing bronze from copper by alloying it with tin or arsenic which have the hardening effect. There was organised metallurgy at Lothal, the port city of the Harappan culture, and the people there had attained expertise in metallurgical engineering. They developed, so says the extant evidence, the brass-making technique by adding zinc to copper; it was also practised at Rajpura-Dariba and Atranjikhera slightly later and culminated centuries thereafter in the unique fourth century BC brass artefacts at Taxila (ancient Takshasila) prior to the advent of the Greeks. The zinc-making technology

appears to have travelled west from India during sixth-fifth centuries BC. Called *Oreichalkos*, it was an expensive alloy and treated as an exotic metal in Greece. Zinc was not present in early Greek bronzes, and Etruscan bronze of the fifth century BC contained only 11% Zinc. Although S.R. Rao, the excavator, felt that copper at Lothal was obtained from Oman in Asia Minor only because it was free from even a trace of arsenic, it is likely that the metal was obtained from nearer Madhan-Kudhan mines in Rajasthan which contains arsenic in trace only, the percentage figure being in the fourth place of decimal. There is nothing to support the current notion that the 'Aryans' were responsible for the introduction of copper, iron or associated Painted Grey Ware culture in North India. On the other hand we now know that the mature Harappan culture was followed by its degenerate form called late Harappan or post-harappan and the latter by iron or PGW one. The excavated evidence at Atranjikhera (Etawah district, Uttar Pradesh) and Hallur in Karnataka and perhaps Ahar in Rajasthan, which have yielded a large volume of iron implements, leaves no doubt whatsoever that the iron technology was indigenously developed in more than one Indian nuclear region around or by thirteenth-twelfth centuries BC. In West Bengal and Bihar also Iron age culture which coincided with what is known as Black and Red Ware culture flourished almost simultaneously or only slightly later. There is no doubt left by the extant evidence now that the techniques of manufacturing carburised iron, laminated iron sheets, wootz steel, forge-welding of wrought iron,

etc. were developed and perfected by Indians and it was from India that an unknown technician carried this technique to Britain in the eighteenth century. Diamonds are well-known to have been mined and diamond-working to have been perfected in India and so also pearl-industry. This is recognised even by European and other foreign visitors to India.

The above is only sampling of the large number of new and somewhat startling-looking conclusions which are well-supported by the evidences cited by the author. It is just not possible to record all the conclusions arrived at by Prof. Biswas in the space provided by a review of this nature. These are based on archaeological evidence and the averments of foreign travellers of India who have cared to leave records of what they saw and experienced. The concluding chapter caption.

\* "Future of the Past" gives an idea of the scientific analysis on archaeo-materials being conducted in India and abroad and makes a plea for vigorous work in this direction including its replication.

Thus far about the contents of Vol. 1. The second companion volume is devoted to a study and analysis of the literary evidence bearing on minerals and metals in ancient India which is authored jointly by the Biswas couple. It culls together the shreds of data scattered in the *Rgveda*, other Vedic and post-Vedic literature, Pāṇini's *Aṣṭādhyāyī*, the *Kauṭilīya Arthaśāstra*, the *Rāmāyana* and the *Mahābhārata*, literature on gemmology (*Ratnaśāstra*), the texts

on *Rasasāstra*. and finally the *Rasaratnasamuccaya* of Śrī Vāgbhaṭa composed in early fourteenth century AD but reflecting earlier traditions in mining and metallurgy as well as body-tissues. The material in this volume is compiled in great detail though it has not been brought into relationship with the archaeological evidence which would have been desirable and useful. The two volumes are thus complement to each other: one familiarising the reader with the archaeological evidence and the other with corresponding literary data.

The contents, extremely rich and valuable indeed deserved a better organisation. It would have been better to have a topical arrangement of chapters instead of excavationwise which would have enabled the readers to familiarise themselves with the progress in a given field in a chronological perspective and would have also eliminated the unnecessary verbatim reproduction of excavation reports and repetitions which have unnecessarily inflated the bulk. Then there is much material unrelated to the theme of the work in chapters 15 and 16 dealing with trade. References to sites and excavations which have no bearing on the theme proper as in case of Arkamedu, otherwise an important site, could and should have been avoided. Chapter 8 dealing with Chalcolithic cultures in Peninsular India includes, *inter alia*, an account of Kayatha near Ujjain, Malwa culture at sites like Navdatoli, Eran Nagda and Prakash, Jorwe culture sites like the typesite Jorwe itself, Nevasa, Nasik, Chandoli, Inamgaon and Daimabad which

can by no stretch of imagination be included in the commonly accepted definition of 'Peninsular India' Then, there are references to Madras, Mysore and Hyderabad states which have long ceased to exist after the linguistic reorganisation of states, and it would have been helpful to the readers to have mention of modern reformed states like Tamilnadu, Karnataka and Andhra Pradesh by enabling them to locate places correctly. It is observed at p. 252 and elsewhere that the archaeological excavations at the *Mahābhārata* site of Hastināpura show that there was very little material prosperity in pre-1200 BC settlement and that even the PGW era at the site commencing 1100 BC does not reveal widespread urban settlement. We are further told that the original core of the *Mahābhārata* story evolved in an agro-rural setting and was later in the phase represented by what is known in archaeological terminology as Northern Black Polished Ware (NBPW) expanded in an altogether urban setting of the historical period beginning about the sixth century BC, a fact also suggested by epic references to the city of Ahicchairā were few, if any, remains earlier than third century BC have been encountered. It is a well-known historical phenomenon that an event occurs first and while describing the event the concerned author adds the elements of his own time and clime. It is nobody's case that the *Mahābhārata* events took place exactly in the manner as described in the extant text of the *Mahābhārata* which has received several accretions as admitted even by the tradition recorded in the epic itself. At p. 285 we come across mention of some coins formed of a copper-blank thickly covered with

silver before receiving the impression of the punches. As we have pointed out elsewhere ("Presidential Address", *Coinage, Trade and Economy*, Nasik, 1991, pp. xi-xx and at several other places), such coins with of a copper core and a silver wash, thick or thin, are actually ancient numismatic forgeries a large number whereof has been reported in practically all the series of silver or gold coins which were in great demand and brought high returns without any substantial investment. At p. 289 we are told that the discovery of monsoon winds by Hippalus took place prior to 14 AD. This epoch-making event which made deep sea voyage possible resulting into substantial saving of time besides safety from pirates is commonly placed by historians around 45 AD on the basis of a statement of Pliny. But it is supposed that Hippalus was not the real discoverer and it was most probably known much earlier to the Arab middlemen in Indo-Roman trade or their Indian agents and was in full use before the death of emperor Augustus in 14AD. In consequence of its supposed discovery by Hippalus the south-western monsoon wind itself was known after him. Putting linguistics to a good use for the history of metallurgy is a plus point of the work, but we are at a loss to know the basis for the statement that *Pannā* in Sanskrit means *Beryl*, (p.304). At p. 419 we are told that Ch. 57 of the *Brhatsamhitā* of Varāhamihira captioned *Vajralepa-lakṣaṇa* as its last chapter, a statement which is apparently a slip as it is followed by nearly half a century of chapters.

literary evidence. But it is mostly confined, as admitted by the authors themselves to Sanskrit sources. However, it would have been advisable to utilise the rich data in Prakrit (including Pāli) texts as well as travel accounts of Greek, Roman and Chinese visitors whose narratives are extent. Even as regards Sanskritic sources, only a few well-known texts have been consulted. And there also except only Ch. 7 dealing with the gemmology (*Ratnaśāstra*) the treatment is not topical but text-wise : as observed in connection with Vol. I, a thematic arrangement would have been preferable and more convenient from the peruser's point of view. Then, original Sanskrit citations are also found to be defective in many a case, and at several places where one expects an *anusvāra*, a final *m* is employed.

However, these and other points of omission and commission, which the authors will hopefully take care of while revising the work for a future edition which must be required shortly in view of the great thematic value of the topic, do not adversely affect its enormous usefulness. We highly appreciate this pioneering work and are happy to recommend it to the inquisitive readers who are bound to enhance their knowledge of the topics covered in the two volumes. Every library specialising in historical, mineralogical and metallurgical literature would do well to have it. We take this opportunity to congratulate the authors for accomplishing this gigantic task so very creditably and the publishers, D.K. Printworld, for bringing it out so very beautifully.