

a continuity of the civilization from the pre-Harappan to the post-Harappan era (there was no invasion from outside), and that both copper technology and iron technology were indigenous developments and not the result of any diffusion from other civilizations. He has asserted that he has been very objective in making these assessments and no chauvinistic sentiment has clouded his judgement.

One of the amazing achievements of ancient Indian metallurgy is the carbothermic reduction of roasted zinc blende (sphalerite) to distil zinc vapour and recover the condensed metal. A collaborative project among M/s Hindustan Zinc Ltd, the Department of Archaeology, Baroda University (K. T. M. Hegde) and the British Museum Research Laboratory (P. T. Craddock and colleagues) involving archaeological excavations in the Zawar region of Rajasthan, brought to light extensive debris of the ancient zinc smelting furnaces and retorts. Through techniques of ¹⁴C dating, the activity has been placed in the first millennium BC. The primacy of India's contribution to zinc smelting is now well accepted. It was not till 1730 AD that a similar technology for zinc extraction was successfully attempted in the Western world (in England). Biswas, who had carried out investigations on the characterization of Zawar zinc retort residues, has dwelt at length on the scientific basis of the Indian process, in his chapter on 'Antiquity of zinc and brass in ancient India' (chapter 18).

Volume 2 is a search for and survey of references to minerals, metals, processes and related concepts in Vedic and Sanskrit literature up to fourteenth century AD. It is an eloquent illustration of the versatility of the Sanskrit language to develop an extensive vocabulary to distinguish various minerals and metals in relation to their appearance and properties, to develop scientific concepts, and to deal with the subtleties of materials technology. At the same time, the Biswas team has made the observation that the references to minerals and metals in the Sanskrit literature are surprisingly scanty and scattered, the exceptions being the cases of Panini's *Asthādhyāyī*, Kautilya's *Arthasāstra* and the *Rasasastra* texts.

As interesting examples of etymology, for cat's eye or beryl Panini uses

the description *Vaidūrya* (derived from the city of Vidura where the gem was cut). While *ayas* was used as a general name for metal, *Kālāyasa* or black metal referred to iron and *lohitāyasa* or red metal referred to copper. *Padārtha* (which literally meant the meaning of a word) was also adopted to mean a material or substance.

Arthasāstra is an important sourcebook on the economic importance attached to materials and metals in ancient India. While there has been some controversy on the date of the *Arthasāstra* – placing it between 4th century BC and third century AD – Biswas accepts the traditional view that it was the work of Kautilya (also known as Chānakya or Vishnugupta), in the time of Chandragupta Maurya whose reign commenced around 321 BC. Apart from giving details on metal processing, the *Arthasāstra* also defines the duties and responsibilities of the director of mines (*Ākarādhyaksha*) and the director of metals (*Lohādhyaksha*).

Volume 2 devotes a long chapter to gemmology literature (a millennium of *Ratnasāstra*) and a short chapter to non-gem minerals and metals in ancient Indian texts. Alchemy was pursued for a long time in India, perhaps even from the Ayurvedic period, but more prominently between fourth century AD till as late as the 14th century AD – but with greater emphasis on the use of minerals and herbs in health and medicine. Literature on Indian alchemy is voluminous, in the form of the *Rasasāstra* texts and is discussed in chapter 8 in this volume.

Rasaratnasamuccaya (compiled during the 14th century AD) has been described by the authors as 'a pinnacle in the Indian Iatro-chemistry'. It is interesting for the detailed descriptions related to mineral and metal processing. Extensive extracts referring to zinc extraction, brass and lead, and different kinds of iron are included in chapter 9, but the text is in Sanskrit, and the authors have not considered it necessary to provide English translations.

There is a closing chapter titled 'The future of the past' in volume 1, and a resume in Volume 2, where the authors have summarized the major conclusions from their work, and made suggestions for future work. Maps showing the sites of archaeological excavation, the chronological presentations of historical

information, the large number of tables giving the chemical analysis and other significant details of ancient objects, and the beautiful colour plates of jewellery, seals, implements, icons, metal work, stone sculpture, etc. all add great value to the presentation.

It is undisputed that Indian civilization – in the ancient and medieval periods – had touched great heights in the aesthetic application of minerals and metals, and in metallurgical accomplishments of a high order and pioneering quality. The authors have raised the familiar question why such a vibrant civilization did not maintain its leadership in the subsequent eras and did not proceed to develop modern science and large-scale technologies. (There are many aspects to this question as explained by B. M. Udgaonkar in his comprehensive article 'Scientific traditions and other traditions', *Curr. Sci.*, 1995, 69, 197–206.) The authors place particular emphasis on the stratification that had crept into society, where specific skills (like working with different metals: iron, zinc or gold) remained confined to particular castes and tribes, the intellectual class largely stayed aloof, and there was no effective cross-communication and discussion of experience.

The Biswas couple have produced a very impressive and valuable compendium of information, that should serve as a consolidated sourcebook for future historians and research workers.

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Parasitic Infections of Domestic Animals: A Diagnostic Manual, Johannes Kaufmann. Birkhauser Verlag, Basel, P.B.No. 133, CH-4010. SFr 68. 1996. 423 pp. Price: DM 78.

Several textbooks on parasitology and parasitic infections of domestic animals are available. These mainly focus on the parasites grouped according to zoological classification; give detailed descriptions of morphology and life-cycle; and small notes on pathology, symptoms and control. Some of the books contain

separate host-wise chapters on postmortem diagnosis and control, again under zoological grouping. Methods of diagnosis wherever mentioned are insufficiently described to be of much value to the field laboratory staff.

A few manuals extant on the subject contain accounts of diagnostic techniques and requirements for biological products of the listed diseases. Some manuals produced by commercial houses contain excellent coloured photographs of the parasites and lesions, but do not provide sufficient information on diagnosis and control.

All these are of limited practical help to field veterinarians and staff of field laboratories, in the diagnosis of the parasites involved. Kaufmann has addressed the problem of reaching rapid and precise diagnosis of parasites involved.

Kaufmann is eminently suited to undertake this stupendous task as he has the experience of dealing with the subject both in the laboratory (he heads the Diagnostic Section of the Institute of Parasitology at University of Berne, Switzerland) and in the field as he worked in a field laboratory in Gambia in late 1980s. Besides the material collected by him then and used in the book, he has incorporated in it a lot of information gleaned from about 300 institutions and universities. He is the principal author and has tapped the expertise of some 74 scientists based in Africa and Europe who collaborated as contributors or advisers, in producing the book. The result is a unique, beautiful, practical and self-contained manual for rapid diagnosis and control of parasitic infections of domestic animals and poultry.

Though the book was primarily meant for use in Africa, it is of equal relevance elsewhere for rapid diagnosis of economically important parasitic infections occurring worldwide. A few gaps in the information of local importance can be easily filled in. The book is unique as it deals with the parasites host-wise, system-wise and organ-wise as a veterinarian encounters them in the field. As he collects material from sick animals, or performs postmortem examinations, the book keeps pace with him by providing information as to which parasite(s) to expect, and in establishing rapid specific diagnosis.

The first chapter is on METHODS

for identification of parasites by direct and indirect techniques. The former includes up-to-date methods for examination of faeces, blood, skin scrapings and tissues. Detailed descriptions of these methods have been given, viz. counting of ova and oocysts and their identification, recovery of lungworm larvae, culture and recovery of third stage larvae of nematodes and their identification, haematology including quick staining methods, viz. Diff-Quick®, QBC®, dark ground/phase contrast buffy coat, and skin scrapings.

As most parasites produce antibodies in blood these are detected by indirect immunological techniques – indirect fluorescent antibody test (IFAT) enzyme-linked immunosorbent assay (ELISA), immunoblotting (Western blot) and complement fixation test (CFT) adequate descriptions of which have been provided. These are specific antigen-antibody reactions. Within the limitations, the tests are useful in diagnosis of parasitic infections.

The above-noted techniques meet routine diagnostic requirements of field workers. But for epidemiological studies, molecular biological techniques for detection and identification of parasites using nucleic acid probes come in handy. The last section of the chapter describes the techniques based on DNA probes and PCR (polymerase chain reaction) or both: DNA-random amplification of polymorphic (RAPD)-PCR. These techniques being extremely sensitive and highly specific are finding increasing use in diagnostic parasitology.

The next six chapters describe parasites of cattle, sheep, horses and donkeys, dromedaries, swine and poultry, respectively. Each chapter is divided into 5 sections representing stages in which parasites may occur: in gut and faeces, blood and circulatory system, urinogenital system, internal organs, and on body surface, respectively. Under each stage, the parasites are described under protozoa, helminths and arthropods. Information on the parasites is presented under sub-heads: location, hosts, species description (morphology and life-cycle), geographic distribution, symptoms, significance, diagnosis, therapy and prophylaxis.

Rickettsiaceae (*Ehrlichia* spp., *Anaplasma* spp., *Cowdria ruminantium*, *Eperythrozoon* spp., and others) – a group of parasite-like pathogens often

seen in blood or tissue smears are also described for differential diagnosis.

The book is parasitology made-easy for field workers. It is a unique and 'well-conceived manual, intelligently and copiously illustrated'. It has some 300 colour and 400 black and white illustrations of parasites, their developmental stages, lesions, affected animals showing cardinal symptom(s), schematic diagnosis of life-cycles, keys, etc. The text is precise and concise. All this facilitates rapid diagnosis of parasitic infections of domestic animals under field conditions.

The book has been 'very reasonably' priced due to generous financial aid from three Swiss institutions (Ciba, Swiss Development Corporation and University of Berne). This brings the book within reach of veterinarians, meat inspectors, and teachers and students of veterinary parasitology who need it most.

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The State of Food and Agriculture. Food and Agriculture Organization of the United Nations, Rome, Italy. 1995. 301 pages.

The 1995 State of Food and Agriculture Report of FAO has chosen agricultural trade as its special feature. The other sections are common to the different reports and provide an overview of the current agricultural situation in the world. The data provided by FAO constitute the most authentic information available to agricultural researchers and policy makers. The data are dealt with both from a global and a regional perspective. Of particular interest is the detailed analysis of the food security challenges facing India.

In the section dealing with India, emphasis has been placed on the 1990 economic crisis arising from the large foreign debt and repayment liability. The steps taken by Government since then have been summarized in a meaningful manner. However, the following developments after the introduction of