

BOOK REVIEWS

Swarnakamal Bhowmik. *Ancient Metallic Art and Technology of Gujarat*, with a Foreword by Navalbhai, Nemichand Shah, Minister of Education, Government of Gujarat, 1980. Published by the Museum and Picture Gallery, Baroda, 207 pages, 3 maps, 10 graphs, 95 plates with 127 figures. Rs. 80-00

The work *Ancient Metallic Art and Technology of Gujarat* by Dr. Swarnakamal Bhowmik, Director of Picture Gallery and Museum, Baroda is a welcome addition to the technical literature in the field of art objects. By training and predilection Dr. Swarnakamal is basically a scientist, with a bias for Chemistry and by nature is an investigator and analyser of scientific phenomena. He has the right attitude of not being influenced, guided or overawed by the views already expressed by established scholars in respect of the art objects handled by him, especially in regard to their dates. As though to offer a justification for the book he writes in the Preface, "Modern techniques of imitation of motifs, styles, patination and inscriptions have deceived even eminent art historians and indologists, who are finding it difficult to determine the correct dates of metal figures on the basis of a study on their external characteristics alone. Such problems concerning metal antiquities engaged the mind of the author for many years. In order to find suitable solutions and discover a better method for determining their genuineness, he examined a large number of such specimens. Considerable investigations have been carried out for ascertaining styles, motifs, spirit of age, metallic composition, techniques of manufacture, impurity patterns, including trace elements, nature of formation of natural patina and their differences from those created artificially". The above statement gives broadly the background of the book.

The book is based on the analyses, both chemical and spectroscopic of 50 objects of copper, bronze and brass of which forty-four objects are from Gujarat and fifteen samples of copper ore, of which five are from Khetri, one from Kolihan, one from Singhana in Rajasthan and seven are from Ambaji in Gujarat.

The author deals generally with the history of metallurgical analysis of copper-bronze-brass objects of India made in the past and apart from incorporating the results of his own investigations into objects from the Gujarat area, he has included the analysis of some objects from Kausambi by Rawat, some objects from Nalanda by B. B. Lal, of the Indian objects in the British Museum, London (of which three are from South India and one from Kashmir), three objects from the Victoria and Albert Museum (mentioned as South Kensington Museum, London), one bronze image from the Cleveland Museum of Art, U.S.A., and seventy-two Indian metallic objects analysed by Otto Werner of Berlin.

He has described the time-honoured *cire perdue* method (*madhuchisṭhavidhāna*) of metal casting both solid and hollow and has mentioned the *śilpaśāstras* (texts on arts and crafts), which include specific portions on the technique of metal casting: namely, *Viṣṇu-dharmottara* (fifth-seventh centuries A.D.), *Manasāra* (Gupta period) *Mānasollāsa or Adhilāstārtha-Cintāmaṇi* (twelfth century) and *Śilparatna* (sixteenth century), respectively.

The author has described what constitutes bronze and has distinguished the objects on the basis of their composition as copper, bronze (an alloy of copper and tin) lead-bronze (with an appreciable admixture of lead in addition to tin, zinc-bronze with an appreciable admixture of zinc in addition to tin) and brass as being an alloy of copper and zinc.

As regards the materials analysed, he divides the Gujarat materials into three groups on the basis of regional distribution, namely Northern Gujarat, North Eastern Gujarat and Central Gujarat, respectively and one common group of the post-medieval period. He has also assessed the available data with regard to the material from Northern and Southern India, respectively, for purposes of comparison with regard to technology and stylistic affinities.

The studies have shown a chronological pattern of the use of metals, starting with copper, developing into bronze, with the deliberate admixture of tin and also occasionally of lead or zinc, in addition to tin, and finally into brass with the admixture of zinc.

The analytical data as provided in the descriptions, charts, and graphs are extremely interesting. The pictures of spectrography (only 11 have been published) have their own tale to tell with regard to the choice of the metals and the deliberate admixture of other metals, including trace elements, besides the basic component of copper.

As regards the techniques of manufacture employed in the past, he has indicated, on the basis of his analysis, if the objects were given a heat treatment or not, annealed at suitable temperatures or worked when hot or cold, as the case may be.

He has however arrived at rather unorthodox views with regard to the dates of some objects in spite of palpably different indications given by either the style of the objects or the palaeography of the inscriptions engraved on them. This he has done on the basis of the analytical pattern of chronology on the basis of metallurgical developments. One would wish that the dates suggested by Dr. Swarnakamal Bhowmik for some of the Gujarat objects were found acceptable by all art historians. He has indeed courageously expressed the view of a pioneer and if his views have to find a larger acceptability in general, the methods adopted by him should be applied specifically to dated specimens over a much larger area throughout the country, for the technological

and stylistic traits appear to have been a common heritage, may be in differential degrees, in all parts of India and there is evidence of intermixture of styles from divergent areas at a contemporary date. He has, however, convincingly proved that a brass sculpture dated 1706 v.s. (1649 A.D.) was a fake manufactured in the nineteenth century. This is a significant breakthrough in the determination of the dates of art objects scientifically.

The analytical method adopted by Dr. Swaranakamal is indeed to be commended. He has first of all analysed the specimens himself, and has observed a pattern of techno-chronological evolution on the basis of the observation and analysis of the results based on the composition of the finished objects.

He has also analysed some ores from different areas, and has endeavoured to trace the source from which the ores were used for the manufacture of the finished objects. The resultant picture is very interesting and consistently convincing, and would throw a flood of light on the routes followed by the producers of metallic objects in search of raw materials. The exploration of the sites lying on the routes are likely to yield interesting results with regard to the other facets of the cultural life of the past.

In spite of the necessarily limited scope of the volume, the pattern of scientific study has been set and must be followed up on the larger canvas of the entire sub-continent for a comprehensive study of all connected problems. Dr. Swarnakamal has earned the right to such a study by his pioneering work, especially as he has given evidence of his capacity to work hard in an hitherto ill-trodden field.

The book, however, suffers from some obvious draw-backs, such as plentiful printer's devils, inconsistency of spellings or of diacritical marks, unnecessary use of capital letters for common nouns, occasional lack of capital letters at the beginning of proper nouns, and plentiful wrong founts, not to speak of misprints. But these cannot impair the value of this significant contribution by a pioneer, who deserves to be congratulated upon the publication of his researches in a systematic manner.

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Studies on Christiaan Huygens, Ed. H. M. Bos, M. J. S. Ruduick, H. A. M. Snelders and R. P. W. Visser. Swets and Zeitlinger, 1980, VI+322 pp. guilders 65.00.

The present volume *Studies on Christiaan Huygens* contains the text of invited papers given at the Amsterdam Symposium commemorating the 350th anniversary of the birth of Christiaan Huygens. Huygens was one of the great scientists of the seven-

teenth century. He was born on April 14th, 1629. He invented the pendulum clock (1656) and discovered the ring of Saturn (1655/1656). He was already famous by 1660. An important feature of the life of Huygens is the international character of his activities. He visited London and became a member of the newly founded Royal Society and was invited to organise the Academie des Sciences in Paris which was founded in 1666. He stayed in Paris for extended periods till 1681, which was interrupted twice by long stays in Holland—both times for reasons of health. In 1694 Huygens became ill once more and died on 8th June 1695. A chronology is given from p.19 to 26 listing the main events of Christiaan Huygens' scientific career.

The question which this book tries to understand is 'who was the person Christiaan Huygens, hidden behind these external events of his life and career?'

Several interesting chapters try to answer this. Thus the chapter 'Huygens' and Concept of Matter' provides insights into Huygens physical concepts of matter, ether, light, 'Iceland crystal', calcite and double refraction of light etc. The chapter "Huygens and Mathematics" brings out his skill for the applicability of mathematics to the natural sciences. Then follows the chapter "Huygens and the astronomers". It is rightly said that Huygens' astronomical gift to the world was that magnificent ring system surrounding Saturn which still fills every observer with wonder. Huygens entered astronomy via the route of optical studies and his contribution in astronomical telescopes of introducing a measuring device or micrometer in focal plane of the objective and an eyepiece, now called as Huygens Eyepiece, are well known. We have a chapter on "Huygens and Mechanics" which is followed by a chapter on "Huygens' Kinetical Theory of Light". This latter contribution called 'Huygens' Principle is read by every student of optics to understand wave propagation and rectilinear propagation of light. A couple of pages from the original manuscript of *Tarit de la Lumiere* which are reproduced bring the reader in contact with history and are most welcome. The next two chapters on "Huygens instrument makers" and the "Measurement of time and of longitude at sea" show that his mechanics and mathematical physics are rooted firmly in the physical world.

The chapter on "Christiaan Huygens on Consonance and Division of the Octave" shows that Huygens was not only a mathematician, physicist, astronomer, inventor but also a competent musician.

Though the monumental edition of his 'Oeuvres Completes' has brought out all published works and correspondence of Huygens, yet this book brings out several facets of Huygens and his work in a very interesting compilation in a readable way.