PREFACE

"We study the past,
Because it is a guide to the present,
And a promise for the future.
The struggle for a better world is strengthened,
By the hopes, ambitions and deeds,
Of those who were before us.
As we look backward,
Our attention is directed forward."

--- A.B. Wilder.

While working as Chemist, in the Museum and Picture Gallery, Baroda, the author, had opportunities to deal with several metal antiquities, commonly described as 'bronzes'. But a Chemist knows, that a good many of them, are not made of an alloy, which is scientifically known as bronze, which is composed of copper and tin. Since very few of these Indian metal figures, have been chemically analysed, it is extremely difficult to distinguish a gilt copper object, from one made of gilt bronze, merely by sight. Without scientific examination, it is hardly possible, to differentiate between a corroded brass object, and a corroded copper object. Many Indian metal figures, have been assigned an early date, simply because of their antique appearance; but further scientific examination, may not justify any such conclusion. In these days of fakes and forgeries; and skilful imitations; even the critical stylistic study of such figures, is wrought with
a good deal of uncertainty. Modern techniques of imitation of motifs, styles, artificial patination and inscriptions have deceived even art historians and Indologists, who are finding it more and more difficult, to determine the correct dates of metal figures, on the basis of a study of 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 to ascertain their metallic composition, techniques of manufacture, impurity patterns including trace elements, nature of formation of natural patina, and their differences, from those created artificially.

This study, led to the conclusion, that besides stylistic investigations, it was quite essential, to find out, the internal characteristics of metal antiquities, based on advanced chemical, metallographical and spectrographical analysis. In particular, it has been his special endeavour, to make available, as much technical information as possible, concerning the composition, manufacturing methods and sources of raw materials etc., as would facilitate, proper understanding, not only of the scientific and technical principles underlying the working and shaping of various metal objects found in Gujarat, but also of the life, culture and craftsmanship, of this historic land, in those ancient times.
In this investigation, the author received a great deal of encouragement, from his friends and colleagues; but he is particularly grateful to Mr. V. L. Devkar, Director of the Department of Museums, Gujarat State, Baroda, who unreservedly, extended all possible help, as and when required. Thanks are also due to Dr. M. N. Rajaguru of the Deccan College, Poona, Dr. R. N. Mehta of the Department of Archaeology and Ancient Indian Culture, M.S. University of Baroda, Mr. M. A. Dhaky of Department of Archaeology, Gujarat State, and Dr. U. P. Shah, Deputy Director of the Oriental Institute, M.S. University of Baroda, for their encouragement, and support, in undertaking such a research. A final decision to compile a scientific Thesis on the subject, was taken at the instance of Prof. Dr. H. D. Sankalia, without whose guidance, the work would never have been completed. The author is, therefore, deeply indebted to him, for its successful completion.

And finally, the author acknowledge with grateful thanks, the help extended to him, in collecting ore samples from the various sites of Rajasthan and Ambamata in Gujarat; and in solving several problems reported in this work, by the authorities of the N.M.D.C. Khetri (Rajasthan); the Department of Geology, M.S. University of Baroda; the N.M. Laboratory, Jamshedpur, and the Geological Survey of India.