

A TEXTBOOK OF FIRE ASSAYING

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A textbook of fire assaying by Edward E. Bugbee

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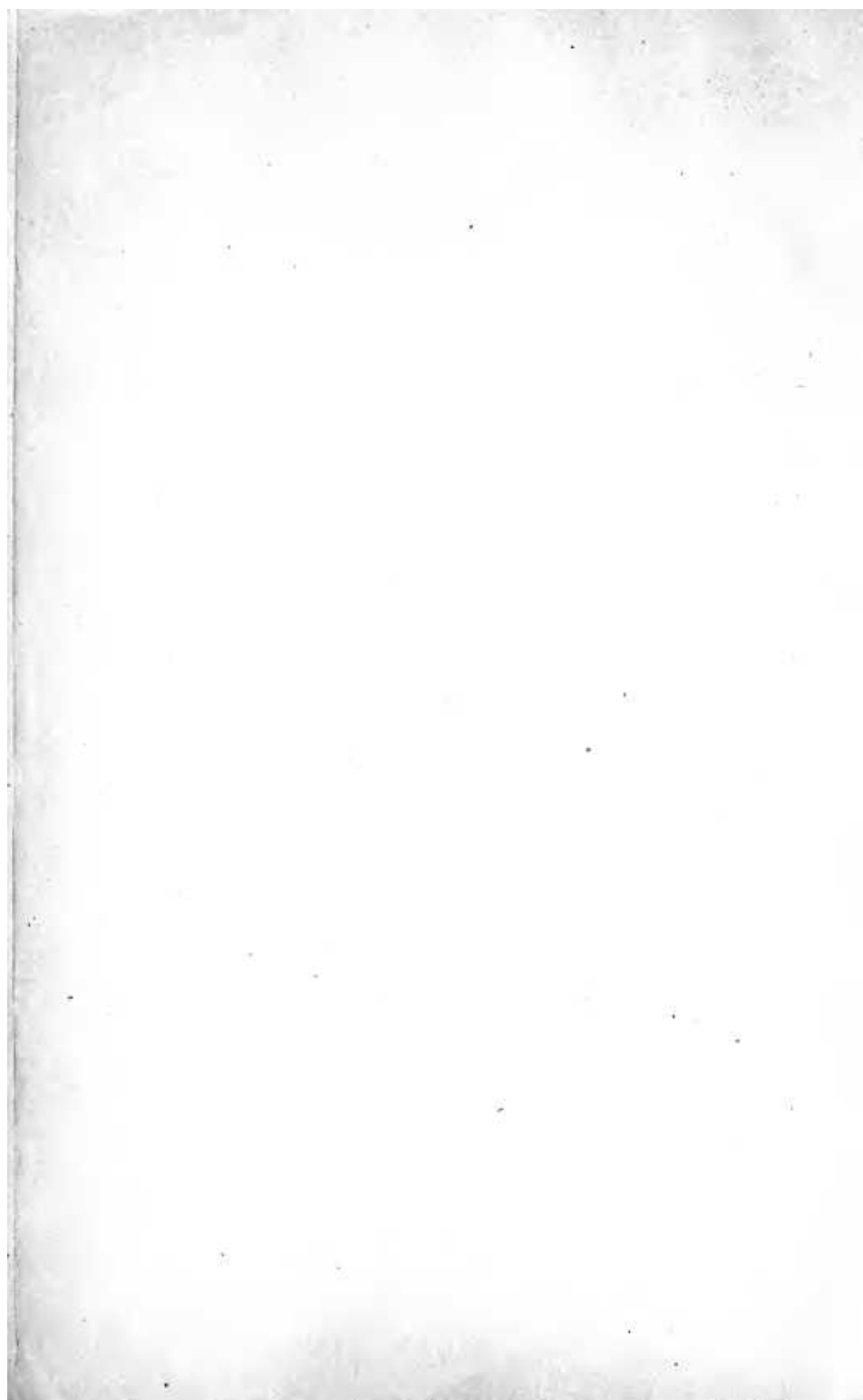
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BY

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PREFACE

This book is the outgrowth of a set of mimeograph notes prepared in 1911 and intended for use in the course in fire assaying at the Massachusetts Institute of Technology. The mimeograph notes were succeeded by a book of 150 pages published by the author in 1915. The present volume has been revised and enlarged and is offered as a small contribution toward the scientific explanation of the ancient art of fire assaying. It contains some hitherto unpublished results of research, as well as considerable new data derived from a careful search of all the available literature, none of which have previously appeared in book form.

Although intended primarily as a college textbook, it is not entirely elementary in character and it is hoped that it will be found sufficiently complete and fundamental to be of service to the more mature student of the science. Every effort has been made to avoid the old "cook-book" method of presentation so common in books of this kind and to give the underlying scientific reasons for the many phenomena which occur, as well as the rationale of each process and detail of manipulation.

The object of instruction in fire assaying should not be merely the training of students to obtain results of a certain degree of precision by blindly following some set procedure, as is unfortunately too often the case. On the contrary, their attention should be focussed on the physical and chemical principles which govern the various operations. If they truly understand the reasons for the use of each of the reagents and for the various details of technique, they will not have to hunt over the pages of a receipt book when confronted by an ore of unfamiliar constitution, but will be able to make up their own assay charges and outline their own details of manipulation.

The author believes that a course in fire assaying is the logical place to introduce the study of metallurgy. The study of general metallurgy, which is abstract and uninteresting by itself, is made concrete and intensely interesting if the various processes of fire assaying are used to illustrate its principles. Most of the

principles of metallurgy are utilized in one stage or another of the fire assay and if taught in this connection, the student's interest is awakened, the principles are understood and the study of this branch of metallurgy becomes a pleasure and not a burden. With this end in view, emphasis has been laid on those metallurgical principles which are of importance in fire assaying, for example, the thermochemistry of the metals and of their oxide and sulphide compounds, the nature and physical constants of slags, the characteristics of refractories and fuels, the principles of ore sampling, the behavior of metallic alloys on cooling and the chemical reactions of oxidation and reduction.

In the short time allowed for instruction in fire assaying in the crowded curricula of our technical schools, the time factor is an important consideration. With large classes and a limited number of laboratory instructors, the author's experience leads him to the conclusion that it is inadvisable to rely too much on verbal instruction in the classroom and laboratory, particularly during the first few weeks when so much that is entirely new has to be mastered before any real progress can be made. Explicit directions are given, therefore, for the first analyses; thus saving the student's time and conserving his efforts by making it possible for him to attack the subject intelligently and without any unnecessary delay. As the work progresses, less stress is laid upon detailed procedure and the student is placed more upon his own resources and encouraged to work out his own assay charges from his knowledge of fundamental principles, aided by a study of typical examples.

The order of arrangement of laboratory work is the logical one beginning with cupellation, first in the qualitative and then in the quantitative way. The assay of lead bullion leads naturally to parting for the determination of the gold, after which either scorification or crucible assaying may be undertaken.

When available, the source of what may be termed "new information" has been acknowledged, but this has not always been possible and the author trusts he may be pardoned for any serious omissions in this particular. Although it is hoped that in the present book all of the errors which occurred in the author's edition have been eliminated, some new ones may have crept in and the author will esteem it a favor to have these called to his attention. He would also be pleased to receive any suggestions and

criticisms which might be embodied in a subsequent edition, if such should be required.

To the many friends who have supplied material or helped in other ways the writer wishes to express his gratitude. The officials of the Anaconda Copper Mining Company and of the United States Smelting, Refining and Mining Company have been especially helpful in this way. The author is particularly indebted to Mr. Rufus C. Reed for many helpful suggestions and for reading the type script. He wishes also to express his appreciation of the courtesy of the Allis-Chalmers Mfg. Co., the Braun Corporation, the Denver Fire Clay Co., the Thompson Balance Co., and the United States Bureau of Mines for furnishing photographs and electrotypes.

