LABORATORY INSTRUCTIONS FOR FIRE ASSAYS OF GOLD, SILVER, AND LEAD: MINING 107 A-B

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649246755

Laboratory Instructions for Fire Assays of Gold, Silver, and Lead: Mining 107 a-b by Walter S. Morley

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

www.triestepublishing.com

WALTER S. MORLEY

LABORATORY INSTRUCTIONS FOR FIRE ASSAYS OF GOLD, SILVER, AND LEAD: MINING 107 A-B

Trieste

UNIVERSITY OF CALIFORNIA
DEPARTMENT OF MINING AND METALLURGY
ASSAYING LABORATORY

S. B. CHRISTY
Dean

LABORATORY INSTRUCTIONS FOR FIRE ASSAYS OF GOLD, SILVER, AND LEAD

MINING 107 *a-b*

BY
WALTER S. MORLEY
Assistant Professor of Metallurgy

UNIVERSITY OF CALIFORNIA PRESS
BERKELEY
1913

PREFACE

These instruction sheets have been prepared in this form to take the place of mimeograph copies which were formerly used by students electing the course in fire assaying at the University of California. These notes are concise directions for the carrying out of certain laboratory work, and in no wise cover the ground of the lectures which supplement the instruction in the laboratory.

The purpose of the course is not to teach merely practical fire assaying, but also to familiarize the student with metallurgical principles which underlie smelting operations on the large scale; and in the lectures as much emphasis is placed on the underlying metallurgical principles as on the practical details of fire assaying.

The laboratory work is divided into twenty-five assignments, thirteen of which are intended to cover the work of the first half-year, and the remaining twelve, the work of the second half-year. In addition to the twelve assignments of the second half-year, there will be given, as time permits, assignments relating to the fire assays of mercury, tin, cobalt, and antimony, and the determination of carbon, sulphur, and ash in coal and coke.

TABLE OF CONTENTS

CHAPTER I

Preliminary Work

	PAGE
1. Weighing	8
2. Practice in Cupellation	10
3. Parting Gold and Silver	13
4. Fire Assay of Lead Bullion	14

CHAPTER II

Scorification Assays

5. Scorification in General	15
6. Scorification of Silver Ores	17
7. Quartz-Gold Ores containing less than one-half Pyrite	19
8. Quartz-Gold Ores containing more than one-half Pyrite	20
9. Scorification Assay of Samples High in Copper	21
10. Scorification Assay of Ores and Products Fusible with Difficulty.	21
11. General Practice	22

CHAPTER III

Crucible Assays

12. Determination of Gold and Silver in Litharge: of the Reducing Powers of Charcoal, Argol, and Flour, and Assay of Fluxes	23
13. Quartz Ores	25
14. Nitre Assay for Ores containing Moderate Amounts of Pyrite	27
15. Nitre Assay for Ores containing Large Amounts of Pyrite	29
16. Roasting Method for Ores containing Large Amounts of Pyrite	30
17. Assay of Sulphide Ores by "Nail Method"	31
18. Assay of Tailings	33

CHAPTER IV

Bullion Assays

19. Assay of Gold Bullion	35
20. Fire Assay of Silver Bullion	39

CHAPTER V

Miscellaneous Work

21. Furnace Repairs. Making Cupels	40
22. Melting, Refining, and Sampling of Gold and Silver Bullion	41
23. Comparison of Methods for Assay of Copper-bearing Materials	42
24. Practice in Sampling, Panning, and Amalgamating	43
25. Fire Assay of Lead Ores	45

THE NOTE-BOOK

Systematic, neat and accurate note-taking is of just as much, if not more, importance to the student of fire assaying than the actual details of the work itself. Careful note-taking involves close observation and concentration. A mere numerical result, without a statement of the conditions governing the experiment, is not wanted. With a particular numerical result should be given all the essential facts concerning the experiment, as determined by observation, reading and thought.

System and neatness are essential characteristics of a good engineer, especially a mining engineer, whose duties often take him into places where hardship, dirt, and disorder are the rule.

You should take your note-book not only into the lecture room, but into the furnace room as well. Write down your observations while they are fresh in your memory. Keep your note-book clean, your writing legible, and your drawings neat.

Properly taken carbon copies are expected, and they should be handed in not later than one week after the experiment has been performed.

REGULATIONS COVERING WORK IN THE ASSAYING LABORATORY

Before commencing work, each student should be supplied with the folowing articles:

1. Copy of Fulton's *Manual of Fire Assaying.*
2. Capsule-box containing six porcelain capsules, three unglazed capsules, three Kennedy parting-flasks, three test tubes, needle and magnifier.
3. Laboratory folder with centimeter-ruled paper, arranged for carbon copy.
4. HHH lead pencil.
5. Set of Becker (or equivalent) weights from 1 gram to $\frac{1}{10}$ milligram.
6. Pair of bone-tipped pincers.
7. Pair of steel pincers.
8. Pair of bead pliers.
9. Blow-pipe.
10. Laboratory suit.

Each student should report promptly for work at the appointed hour, and should stay the full laboratory period, unless excused.

All fires should be drawn by 4:15 o'clock.

All apparatus should be left in its proper place and in order.

CHAPTER I

Preliminary Work

ASSIGNMENT 1

WEIGHING

In this assignment you are expected to become thoroughly familiar with the construction, adjustment, use, and care of an assay balance. Read carefully all the references given at the end of this assignment.

An assay balance is similar to a chemical balance, except that the moving parts are made lighter, and instead of limiting the sensibility to .10 mg. it is made to weigh accurately to .01 mg. With the balance you use this is done entirely by the method of deflections. Later on you will be given a balance with a rider.

Calculate the sensibility of the balance assigned to use, as follows: After a couple of oscillations take readings, first on one side and then on the other—for example:

Pans Empty

Left	Right
—2.9	2.6
—2.5	2.2
—2.0	1.8
—1.6	
4) 9.0	3) 6.6
—2.25	2.2

—2.25
2.20
2) .05
—.03 Resting point, left

Repeat the readings until uniform results are obtained. If the resting points do not agree, increase the number of readings on a side. After a little practice, two readings on one side and one on the other will suffice.

In this assignment record all readings in your notes. After you have become skillful in reading, recording will not be necessary. In taking readings do not let the needle vibrate more than a total of five divisions.

Now place your ½ mg. weight on the left pan, allow needle to swing as before, and determine the new resting-point—for example:

½ MG. WEIGHT ON LEFT PAN

Left		Right
3.1		7.3
3.3		7.0
3.6		
3) 10.0		2) 14.3
3.33		7.15

	7.15	
	3.33	
	2) 10.48	
	5.24	2nd resting point, right
—	.03	1st resting point, left
	5.27	Difference

The difference between the two resting points is the number of divisions on the ivory index through which ½ mg. has caused the needle to be deflected.

The sensibility of a balance may be defined as the deflection caused by 1 mg.; or, expressed in another way, the sensibility is the weight in hundredths of a milligram which will cause the needle to be deflected one division on the index.

In the above example, the sensibility is 10.54 divisions, or .095 mg.

As you can readily read to tenths of a division, the balance will be sensible to .01 mg. Were the beam perfectly rigid, this sensibility would hold for much greater loads than are usually weighed on an assay balance; but for a load of even ½ grm. there is a perceptible change. To test this, place a load of 1 gram on each pan of the balance and determine the sensibility as you did when the load was zero. Compare results.

You are now ready to weigh by the deflection method. Obtain a number of pieces of gold or silver weighing from 1 to 10 mg. Weigh each separately and then all together. Add up the separate weights and compare with the total weight. Repeat until your results are consistent.