INSTRUCTIONS FOR THE DISCRIMINATION OF MINERALS BY SIMPLE CHEMICAL EXPERIMENTS

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Trieste

THE

DISCRIMINATION OF MINERALS

BY

CHEMICAL TESTS.

INSTRUCTIONS

FOR THE

DISCRIMINATION OF MINERALS

BY

SIMPLE CHEMICAL EXPERIMENTS.

BY

FRANZ ritter VON KOBELL,

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TRANSLATED FROM THE GERMAN,

BY ROBERT CORBET CAMPBELL.

GLASGOW:

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AND THOMAS TEGG, LONDON.

MDCCCXLI.

ADVERTISEMENT.

THE object and use of this work are so fully explained in the Author's "INTRODUCTION," that it is needless for the Editor to expatiate either on the merits of the subject, or the manner in which it is treated. He believes that the work will prove no unwelcome addition to British scientific literature, and he indulges in the hope that the translation will be found to do justice to the original.

The greater part of the work was prepared for publication by the late ROBERT CORBET CAMPBELL, a zealous and talented young chemist of this city. When nearly ready for the press, its progress was stopped by a severe illness which attacked the Translator, and which, after a few weeks continuance, terminated fatally, to the regret of the numerous friends whom MR. CAMPBELL'S scientific acquirements and amiable character had attached to him.

The manuscript left unfinished by the Translator, has been carefully compared with the original, and such corrections and additions have been made, as were necessary to render the work complete. The text is almost a literal translation of Professor VON KOBELL'S text, except as regards the alteration of the chemical symbols, explained at page xi of the "Introduction." Where any thing is added, it is placed within brackets [ ]. The only additions that require particular notice, are those which exhibit the new method of *expressing the* CLEAVAGE *of minerals by symbols*, described in J. J. GRIFFIN'S recently published "*System of Crystallography.*"

The "Introduction" is a paraphrase of the Prefaces prefixed to the Second and Third Editions of the German work. It comprises the whole matter of those two documents, re-arranged and condensed, deprived of a few unimportant sentences, and altered by one or two explanatory interpolations. It is hoped that these corrections will meet the approval both of the author and the public.

That part of MR. GRIFFIN'S "*System of Crystallography*," which contains the "Application of Crystallography to Mineralogy," will be found to form, in conjunction with the present work, a useful Manual of Practical Mineralogy.

EDITOR OF THE SCIENTIFIC MISCELLANY.

GLASGOW, 20*th February*, 1841.

INTRODUCTION.

THE object of the following work is to facilitate the DISCRIMINATION OF MINERALS. For this purpose, simple and easy experiments, performed with Chemical Tests or the Blowpipe, are employed to develope certain properties, which serve to separate the minerals into a number of groups, each containing but a few dissimilar species. A second set of chemical experiments is then employed, conjointly with the more striking physical characters of the minerals, to distinguish the individual species belonging to each group from one another.

The examination of a mineral, conducted on this plan, furnishes the observer with a pretty trustworthy indication of the name of the specimen submitted to trial. He is thus enabled to refer to a System of Mineralogy, and, on comparing the characters of his specimen with those registered in the book, he either finds a confirmation of the correctness of his results, or is supplied with such additional information, as leads him, by short steps, to the true solution of his problem.

Of the advantages which attend this method of procedure, I have been furnished with satisfactory experience, in the course of several years, during which it has been employed by the students of Mineralogy in this University. The method will also be found useful to persons who, though not devoted to the study of Mineralogy, have yet frequent occasion to ascertain the names of minerals which accident or business places before them: I allude to chemists, miners, technologists, and naturalists; to whom, I hope, this little production will not prove unwelcome.

It is naturally taken for granted, that the reader is acquainted with the use of the blowpipe, and with the mode of performing the simpler kinds of analytical operations; such as solution, filtration, and precipitation. Details on these points must be sought for in works which treat expressly on Manipulation. In regard to the blowpipe, we have, in the admirable work published by BERZELIUS, every kind of information which the analyst can require.*

* [See also CHEMICAL RECREATIONS, by J. J. GRIFFIN, Eighth Edition, Part First, containing the subjects of *Chemical Manipulation*, and *Analysis by the Blowpipe*, 12mo, Glasgow, 1838. This work contains an account of the apparatus employed in Chemical Analysis, and of the precautions necessary to be taken to ensure success in using it.]

The principal classification in the following work, is founded on one of the most striking and obvious of the external characters of minerals, namely, the possession of a *metallic* or *non-metallic lustre*. In doubtful cases, I have placed in the former class, only such minerals as are also perfectly opaque; which arrangement appears to obviate every difficulty that might possibly arise during the examination of minerals that possess an adamantine or pseudo-metallic mother-of-pearl lustre. However, it requires but a couple of blowpipe experiments, and a trial of solubility in muriatic acid, to enable one in such cases to determine the name or place of a mineral without reference to its lustre at all. Thus, if you compare with one another the characters of the subordinate groups, you will find that a mineral belonging to one group, is not easily referable to another. Take *Lievrite* as an example of a case in which you doubt whether the substance has a metallic or a non-metallic lustre. You examine its properties experimentally, and find that it fuses to a magnetic bead without fuming, that it gives no sulphuret with soda, and that it gelatinises with muriatic acid. These characters, without further examination, show that the mineral does not come under any of the sections in Class 1, and that it agrees entirely with the characters of Class 2, Section B 5. *c*.). Nevertheless, as *Lievrite* possesses a pseudo-metallic greasy lustre, and is opaque, it is also placed in the system among the minerals with metallic lustre, in Class 1, where, under A 6, there is a reference to *Lievrite* at its right place.

The examination of the *fusibility of minerals* must not only be tried upon charcoal, but also in the platinum tongs, and when the minerals are difficult of fusion, very thin pointed splinters are to be taken for trial. If a small round block of a mineral is submitted to the blowpipe flame, it may appear to be entirely infusible; when, if a fine splinter were taken and heated in the same flame, it would be pronounced fusible.

As experience has shown me that beginners easily mistake degrees of fusibility in minerals, I have been induced to propose, for their guidance, the following

SCALE OF FUSIBILITY BEFORE THE BLOWPIPE.

1. Sulphuret of Antimony.
2. Natrolite.
3. Almandine. (Thoneisengranat.)
4. Strahlstein.
5. Adularia.
6. Diallage. (Bronzite.)

All minerals which are distinctly fusible, fall within the first five degrees of this scale. Those whose degree of fusibility brings them between 5 and 6 of the scale, may be considered infusible, either when the pieces submitted to trial are not sufficiently slender, or when the

Assayer is not perfectly master of the blowpipe. One great advantage of this scale of fusibility is, that it facilitates the highly useful practice of *comparative experiment*. Two persons operating on the same mineral may sometimes differ as to its degree of fusibility; but when a person tries the fusibility of an unknown mineral against another mineral whose fusibility is well ascertained, he has the advantage of a fixed point of comparison, which acts as a check upon erroneous experiments, that might otherwise lead to false conclusions. The minerals selected for this scale belong to those which can be procured without much difficulty. The analyst should be provided with a quantity of each, split into pieces of different sizes and shapes, from which to select such as closely agree in form with the pieces of the unknown minerals that are to be submitted to comparative experiment. This preliminary comparison of the form of two assays that are to be submitted to comparative fusion, is the more necessary, since, at the best, the determination of the degree of fusibility of a mineral, can only be considered as approximate to exactness.*

As I have endeavoured, throughout this work, to render the correct discrimination of a mineral as independent as possible of all errors of observation, I have guarded against any mistaking of fusible for infusible minerals, by placing such as are of difficult fusibility in both classes, so that a mistaken judgment on that point cannot lead to the overlooking of the puzzling substance. The experimenter is, however, particularly requested to observe, that, in the examination of every mineral, he must commence by a comparison of its characters with those of the classes and orders which occur at the beginning of the book, and so proceed regularly on, without skipping any, till he comes to the one of which he is in search. This procedure cannot safely be altered or reversed; for many minerals which belong to an early group also manifest the characters of a subsequent group; whereas the minerals of the later groups do not show the characters of the groups that precede them.

In order to observe whether or not a mineral colours the blowpipe flame, it is necessary to produce a small and very clear blue flame,† because a large ragged yellow flame overpowers some of the more delicate tinges of colour.

The DEGREE OF HARDNESS of the minerals, is denoted according to the scale of MOHS, which contains the following degrees:—

* [Messrs. R. GRIFFIN & Co., Glasgow, supply a small cabinet containing a collection of the minerals which form VON KOBELL'S DEGREES OF FUSIBILITY, at the price of 5s.]

† [On the subject of "*Coloured Blowpipe Flames*," consult GRIFFIN'S *Chemical Recreations*, Part First, page 148.]

MOHS'S SCALE OF HARDNESS.*

1. Talc.	6. Adularia.
2. Gypsum.	7. Rock Crystal.
3. Calc Spar.	8. Topas.
4. Fluor Spar.	9. Corundum.
5. Apatite.	10. Diamond.

To determine the presence of water in a mineral, it is proper to take a small crystal, or a compact piece, of the size of half a pea, and to heat it before the blowpipe, or over a spirit lamp, in a small glass tube closed at one end, or in a narrow glass tube, ¼ inch wide, open at both ends, and held in the flame horizontally. In the latter case, the water gathers in drops in the cold part of the tube, on both sides of the assay.

When solution in an acid is to be effected, the assay is pulverised extremely fine in an agate mortar, water is added and ground with the mineral, and the fine powder is gradually decanted off with the water. The action of a diluted acid is first tried, and if without success, then a concentrated acid is employed. The best vessel to use is a small flask, or else a glass tube, one inch wide and seven inches long, which can be heated over a spirit lamp.

The general remark may not be useless here, that all minerals which are as hard as quartz, with the exception of chrysolite, some garnets, and a few other minerals, are not decomposable by muriatic acid, without previous fusion with an alkali.

Instead of entering into further details respecting the following work, I shall give an example or two to show the way to use it.

First Example. Aluminite.

This mineral has a non-metallic lustre. It is infusible. Hence it belongs to Class 2, Order C. The characters of the first Section of this Order, C 1, depend upon the colour which the mineral assumes, when heated before the blowpipe with solution of cobalt. On making this trial, the mineral is found to belong to Section C 1. This Section contains two divisions, *a.*) and *b.*), depending upon the presence or absence of water in the mineral. You make the necessary experiment, by heating the assay in a glass tube, and find that it gives much water: it therefore belongs to division *a.*) You now refer, from the table of *Classification*, to page 36 of the text, where the minerals of C 1 *a.*) are described. The first group of this division contains *Alum-stone* and *Aluminite*, and the distinctive character given for them is, that, with soda on charcoal, they give sulphurets, which is not the case with the

* [Messrs. R. Griffin & Co., Glasgow, supply small cabinets containing the minerals constituting MOHS'S DEGREES OF HARDNESS, (Diamond excepted), with a proper file for making the trials, at the price of 16s.

Instructions for examining the degrees of hardness of minerals, with suitable precautions, are given in Griffin's "*System of Crystallography*," Part Second, page 96.]