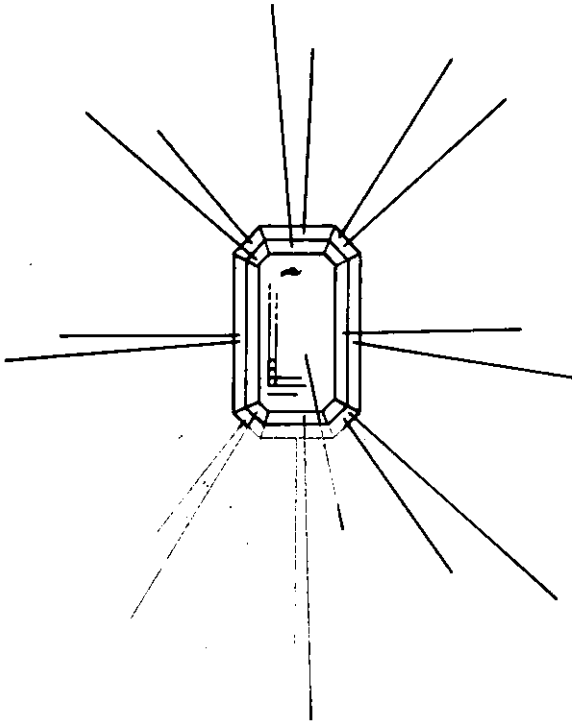


A GUIDE TO THE
COLLECTION OF GEMSTONES
IN THE
GEOLOGICAL MUSEUM



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DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

A GUIDE TO THE
COLLECTION OF GEMSTONES
IN THE
GEOLOGICAL MUSEUM
(MUSEUM OF PRACTICAL GEOLOGY)

By

W. F. P. McLINTOCK, D.Sc.

THIRD EDITION

Revised by

P. A. SABINE, B.Sc., A.R.C.S.



LONDON: H.M. STATIONERY OFFICE
1951

PREFACE TO FIRST EDITION

THE Museum of Practical Geology has acquired at various times by purchase, donation, and bequest, not only specimens of all the more important minerals used for purposes of personal adornment, but also specimens illustrating methods of cutting and polishing the natural stones so as to enhance their beauty. Following the general practice of this Museum, examples of these gemstones as found in nature, and as prepared for the jeweller, together with a few specimens of the jewellers' art, have been brought together and, for many years, have formed one of our most useful and attractive exhibits.

The gemstones to which this Guide refers, form a part of a general collection illustrating the uses of the so-called non-metallic minerals. They have not been arranged in special cases, but the references in the Guide will enable any of them to be easily found. For the benefit of students and the public, brief accounts of the general properties, of the methods employed in cutting and identification, and of the imitation, treatment, and artificial formation of gemstones have been given.

Great interest has been aroused of late years in the artificial preparation of such minerals as ruby, sapphire, and spinel. Some examples of these artificial gems will be found in the cases, side by side with the natural products, and not the least interesting part of the Guide is that which refers to these artificial stones and to the processes by which they have been obtained.

The Guide has been written by Mr. McLintock, under the supervision of Mr. Howe, who has acted as Editor.

J. J. H. TEALL,

Director.

Museum of Practical Geology,
29 March, 1912.

PREFACE TO THIRD EDITION

SINCE the publication of the second edition of this Guide a quarter of a century ago, the transfer of the Museum from Jermyn Street to South Kensington in 1935 presented the opportunity to display the gemstones in a more fitting manner than before.

Along with those massive minerals which are used for ornamental purposes the gem minerals are arranged in a series of exhibits in the Main Hall of the Museum and this edition of the Guide describes them as they are now displayed. Descriptions of the principal additions to the collection have been introduced and some of the old diagrams have been replaced by new drawings of a more suitable character.

The Guide has been revised by Mr. Sabine under the supervision of Dr. Phemister who has acted as Editor.

W. F. P. McLINTOCK,

Director.

Geological Museum,
South Kensington,
LONDON, S.W.7.
31 October, 1950.

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INTRODUCTION

THE minerals in the Geological Museum are arranged for the most part according to their commercial applications and, in consequence, the ores, that is, minerals used for the extraction of metals, are separated from the so-called non-metallic minerals which, in general, are not applied to such a purpose. This arrangement has, of course, no scientific basis and fails to bring out the relationships between the various species, but it possesses the advantage of showing in a compact and readily accessible way those minerals which concern commercial and mining men.

The term non-metallic is somewhat misleading, as nearly all the minerals to which it is applied contain a metal or metals. These, however, are usually the light metals, e.g. aluminium, calcium, magnesium, potassium, sodium, as distinguished from the heavy metals of commerce, such as copper, tin, silver, gold, lead, etc.

Amongst the non-metallic minerals gemstones occupy an important place from the point of view of commercial and general interest. Accordingly, they have been brought together to occupy the cases in the centre of the ground floor of the Museum. Usually gemstones show no natural relationships with one another, the only feature which unites them into a class being their suitability for purposes of adornment. This suitability depends mainly on *beauty* and *durability*. Many stones possessing these qualities in a high degree have, however, little or no value at the present time, for there is a wide distinction between a stone naturally fitted for the purposes of the jeweller, and one for which there is a demand.

From the commercial point of view the really precious stones are *diamond*, *ruby*, *sapphire*, *emerald*, and *opal*. (The *pearl*, although among the most valuable gems at the present time, is excluded, as it can hardly be termed a mineral.) The demand for these is fairly constant and the value of good specimens is always high. The fashion of the moment dictates the value of the other minerals which legitimately claim a place amongst gemstones. At one time it may be *tourmaline*, at another, *peridot*, at another, *cat's-eye*, or *aquamarine*, or *topaz*, or *zircon*, which is in vogue; the favoured gem consequently rises in value until some new whim relegates it to comparative obscurity. To such stones 'semi-precious' is sometimes applied, although the use of this term is to be deprecated, as it frequently casts a stigma upon beautiful and rare stones.

The element of *rarity* plays, perhaps, the most important part in determining the value of a gemstone and outweighs, by what often seems a disproportionate amount, considerations of beauty and of durability. In this respect it must be noted that, although a particular mineral may be fairly abundant, yet pieces suitable for cutting are usually rare. A striking example is afforded by the *emerald* which is one of the costliest stones at the present time. Crystals of emerald are not uncommon, but those possessing the correct colour combined with transparency and freedom from flaws are exceedingly rare and cut specimens of such perfect stones command very high prices.

A curious and instructive instance of the influence exerted by rarity on the value of a precious stone is afforded by the ruby. As will be described later (p. 24) this stone is manufactured in clear, transparent finely-coloured masses which, when cut and polished, yield very effective gems. Such *synthetic rubies*, as they

are called, are identical for all practical purposes with the natural stone, from which they can be distinguished only by very special examination, yet the difference in value between the two is enormous. The artificial stone can be purchased for a few shillings per carat, whilst a Burmese stone of similar colour and transparency would fetch, because of its rarity, £80 per carat or more, the price per carat depending partly upon the weight.

The diamond, superior to all other stones in hardness, lustre and 'fire,' is popularly supposed to stand first in value, yet on account of the comparative abundance of good specimens, its value is often less than that of the emerald and the ruby. To put the matter briefly we may say that the possession of beauty and durability entitle a mineral to rank as a precious stone, whilst rarity, combined with these two characteristics, settles its position in the series.

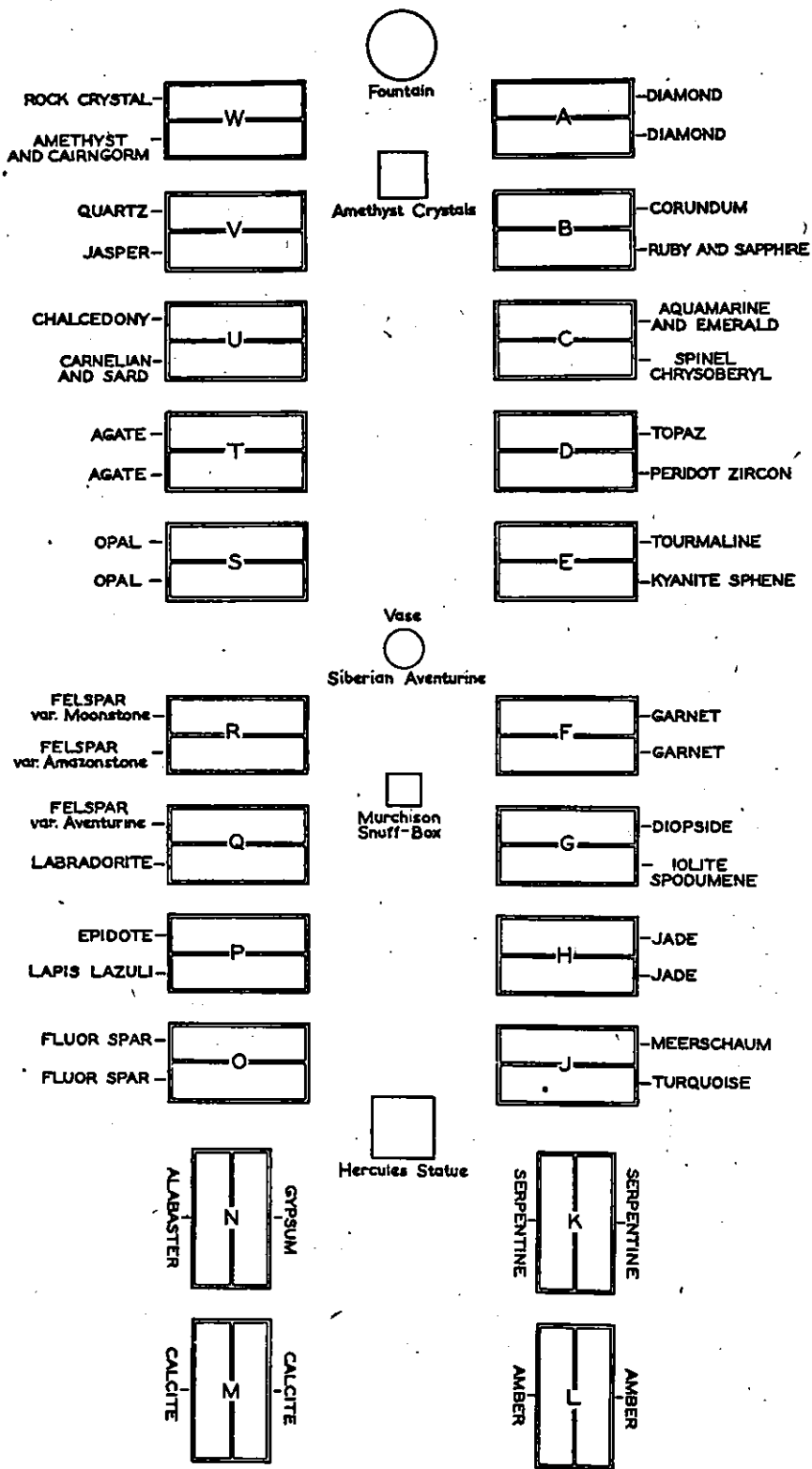
Various classifications of precious stones have been adopted from time to time, but all are more or less unsatisfactory. In Chapter IV of this guide-book the stones are considered in the order in which they occur in the cases (see frontispiece), starting with diamond. Chapter I deals with the properties of precious stones with special reference to their identification; in Chapter II the principal styles of cutting are touched upon; whilst Chapter III deals with the imitation, artificial treatment and formation of precious stones. Throughout the descriptions, the unit of weight used is the *metric carat* of one-fifth (.2) gramme. Approximately 28 grammes equal one ounce avoirdupois.

In order to facilitate the determination of cut specimens, the principal stones have been tabulated according to colour and other physical properties, and the tables will be found at the end of the book.

The literature relating to gemstones is wide and scattered, but most of the important information has been collected in Professor Schlossmacher's edition of Professor Max Bauer's *Edelsteinkunde*, 3rd edit., 1932, and this work has been largely consulted in the preparation of this Guide. This book is in German, but an admirable English translation of the first edition (1904) was made by Dr. L. J. Spencer, lately Keeper of Minerals in the British Museum (Natural History). Other books dealing with the subject are:—

- Anderson, B. W. 1947. *Gem Testing*. 4th edit.
- Kraus, E. H. and C. B. Slawson. 1939. *Gems and Gem Materials*. 3rd edit.
- McCallien, W. J. 1937. *Scottish Gem Stones*.
- Smith, G. F. H. 1949. *Gemstones*. 10th edit.
- Spencer, L. J. 1946. *A Key to Precious Stones*. 2nd edit.
- Sutton, J. R. 1928. *Diamond: A descriptive treatise*.
- Webster, R. 1947. *Practical Gemmology*. 2nd edit.
- Webster, R. 1947. *The Gemmologists' Compendium*. 2nd edit.
- Williams, A. F. 1923. *The Genesis of the Diamond*. 2 vols.
- Williamson, G. C. 1932. *The Book of Amber*.

Apart from these separate volumes many interesting and important papers are published in the monthly magazine *The Gemmologist* and in the quarterly *Journal of Gemmology and Proceedings of the Gemmological Association of Great Britain*.



PLAN OF ARRANGEMENT OF THE GEMSTONE CASES

APPENDIX

In order that the determination of the more important precious stones may be facilitated, a few tables have been inserted here. The stones have been classified according to colour and have then been arranged in order of specific gravity; other physical constants have been tabulated as it is necessary that some of these should be determined before a definite conclusion is arrived at as to the identity of a specimen. Only the transparent stones have been tabulated as it is with these that difficulty usually arises. The translucent and opaque stones, with one or two exceptions, can be readily determined, sometimes by mere inspection. Where there is a range of values of refractive indices this has been shown in the tables; the figures given do not, therefore, necessarily represent the maximum and minimum values for any particular stone.

TABLE I
COLOURLESS STONES

Stone	Specific Gravity	Hardness	Refraction	Refractive Indices
Zircon	4.69	$7\frac{1}{2}$	double	1.99-1.92
Corundum	4.0	9	double	1.77-1.76
Synthetic spinel	3.63	8	single	1.73
Topaz	3.56	8	double	1.62-1.61
Diamond	3.52	10	single	2.42
Tourmaline	3.04	$7\frac{1}{2}$	double	1.64-1.62
Danburite	3.0	7	double	1.64-1.63
Phenakite	2.96	$7\frac{3}{4}$	double	1.68-1.66
Beryllonite	2.84	6	double	1.56-1.55
Beryl	2.71-2.68	$7\frac{3}{4}$	double	1.58-1.57
Rock-crystal	2.65	7	double	1.55-1.54
Hambergite	2.35	$7\frac{1}{2}$	double	1.63-1.55

APPENDIX

TABLE II

RED AND PINK STONES

Stone	Specific Gravity	Hardness	Refraction	Refractive Indices	Dichroism
Zircon ...	4.69	7½	double	1.97-1.92	not observable
Almandine ...	4.3-3.9	7½	single	1.81-1.75	absent
Spessartine ...	4.20-4.12	7½	single	1.80	absent
Ruby ...	4.0	9	double	1.77-1.76	distinct
Pyrope ...	3.8-3.7	7½	single	1.75-1.74	absent
Spinel ...	3.65-3.58	8	single	1.72	absent
Topaz ...	3.53-3.50	8	double	1.64-1.63	distinct
Kunzite ...	3.18	7-6½	double	1.68-1.66	strong
Tourmaline ...	3.05	7½	double	1.64-1.62	strong
Morganite ...	2.90-2.70	7½	double	1.59-1.58	weak
Scapolite ...	2.67	6-5	double	1.57-1.55	distinct
Fire Opal ...	2.0	6	single	1.45	absent

TABLE III

YELLOW AND BROWN STONES

Stone	Specific Gravity	Hardness	Refraction	Refractive Indices	Dichroism
Cassiterite ...	6.9	6½	double	2.09-1.99	distinct
Zircon ...	4.7-4.4	7½	double	1.97-1.92	not observable
Spessartine ...	4.20-4.12	7½	single	1.80	absent
Corundum ...	4.0	9	double	1.77-1.76	weak
Chrysoberyl ...	3.74-3.64	8½	double	1.76-1.75	weak
Hessonite ...	3.65-3.63	7	single	1.74	absent
Topaz ...	3.54-3.50	8	double	1.64-1.63	distinct
Diamond ...	3.52	10	single	2.42	none
Epidote ...	3.5-3.35	6½	double	1.77-1.73	strong
Sphene ...	3.53-3.45	5½	double	2.06-1.91	distinct
Idocrase ...	3.4-3.3	6½	double	1.72	weak
Axinite ...	3.29-3.27	7-6½	double	1.69-1.68	strong
Apatite ...	3.22-3.17	5	double	1.64-1.63	weak
Spodumene ...	3.20-3.15	7-6½	double	1.68-1.66	weak
Andalusite ...	3.18-3.12	7½	double	1.64-1.63	strong
Fluorspar ...	3.18-3.02	4	single	1.43	absent
Tourmaline ...	3.11-3.05	7½	double	1.64-1.62	strong
Beryl ...	2.71-2.68	7½	double	1.58-1.57	weak
Scapolite ...	2.70-2.68	6-5	double	1.57-1.55	weak
Quartz ...	2.65	7	double	1.55-1.54	distinct*
Orthoclase ...	2.56	6	double	1.53-1.52	absent

* Only very weak dichroism in heat-treated stones.

APPENDIX

TABLE IV

GREEN STONES

Stone	Specific Gravity	Hardness	Refraction	Refractive Indices	Dichroism
Zircon ...	4.69-3.94	7½-6	double	1.97-1.78	not observable
Corundum ...	4.0	9	double	1.77-1.76	distinct
Demantoid ...	3.86-3.81	6½	single	1.90	absent
Alexandrite ...	3.74-1.64	8½	double	1.76-1.75	strong
Epidote ...	3.50-3.35	6½	double	1.77-1.73	strong
Idocrase ...	3.4-3.3	6½	double	1.72-1.71	weak
Olivine ...	3.44-3.35	7-6½	double	1.70-1.66	weak
Diopside ...	3.31-3.27	6-5	double	1.70-1.67	very weak
Hiddenite ...	3.20-3.15	7-6½	double	1.68-1.66	distinct
Andalusite ...	3.18-3.12	7½	double	1.64-1.63	strong
Fluorspar ...	3.18-3.02	4	single	1.43	absent
Tourmaline ...	3.11-3.05	7½-7	double	1.64-1.62	strong
Euclase ...	3.10-3.05	7½	double	1.67-1.65	distinct
Emerald ...	2.77-2.68	8-7½	double	1.58-1.57	distinct
Aquamarine ...	2.71-2.68	8-7½	double	1.58-1.57	distinct

TABLE V

BLUE STONES

Stone	Specific Gravity	Hardness	Refraction	Refractive Indices	Dichroism
Zircon ...	4.69	7½	double	1.97-1.92	strong
Sapphire ...	4.0	9	double	1.77-1.76	strong
Kyanite ...	3.68-3.60	7-5	double	1.73-1.72	distinct
Benitoite ...	3.68-3.64	6½	double	1.80-1.76	strong
Spinel* ...	3.65-3.58	8	single	1.72	absent
Topaz ...	3.57-3.56	8	double	1.63-1.62	weak
Apatite ...	3.22-3.17	5	double	1.64-1.63	distinct
Tourmaline ...	3.11-3.05	7½-7	double	1.64-1.62	strong
Aquamarine ...	2.71-2.68	7½	double	1.58-1.57	weak
Cordierite ...	2.65-2.58	7½-7	double	1.55-1.54	strong

* Gahnspinel: Specific gravity 3.98, refractive index 1.747.

APPENDIX

TABLE VI

PURPLE AND VIOLET STONES

Stone	Specific Gravity	Hardness	Refraction	Refractive Indices	Dichroism
Almandine ...	4.3-3.9	7½	single	1.81-1.75	absent
Corundum ...	4.0	9	double	1.77-1.76	distinct
Spinel ...	3.65-3.58	8	single	1.72	absent
Kunzite ...	3.18	7-6½	double	1.68-1.66	strong
Fluorspar ...	3.18-3.02	4	single	1.43	absent
Amethyst ...	2.65	7	double	1.55-1.54	distinct

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