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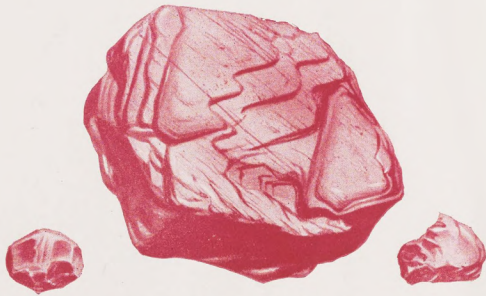
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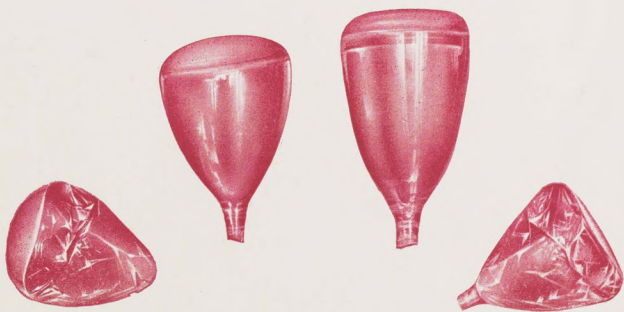
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Real Rubies in the Rough.



Manufactured Rubies in the Rough.

RUBIES

SOME PRACTICAL HINTS
ON THE
DETECTION OF ARTIFICIAL
AND IMITATION STONES

BY

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SUFFOLK HOUSE, LAURENCE POUNTNEY HILL, E.C.

WHAT IS A RUBY ?

To the mineralogist the ruby, and the many varieties of the sapphire (the beautiful blue sapphire proper, the colourless white sapphire, and so forth) are the same thing. All consist essentially of the mineral known as *corundum*, in a pure form; it is interesting to note that emery, so largely used as an abrasive, is an impure form of the same mineral.

In composition this mineral is a pure crystalline variety of the substance known to the chemist as *alumina*, which in humbler guise forms the basis of clays, and from which is derived the useful metal aluminium. The colourless white sapphire is pure crystalline alumina, and is therefore the mother of all this group of stones: from it are derived alike the ruby and the sapphire, the difference being merely one of colour, each colour being produced by minute proportions of impurity present in the material from which the stone was produced by the mysterious processes of natural crystallisation.

The value of any precious stone depends upon three things—its durability, its beauty and its rarity. As regards durability, the mineral corundum possesses properties which differentiate it from all other products of nature—it is not only exceedingly hard, but exceedingly tough and therefore proof against mechanical injury, whilst its chemical composition renders it practically indestructible.

Precious corundum, again, has a combination of optical properties, due to its peculiar form of crystallisation, which gives it exceptional beauty on cutting, for it is not only extremely brilliant but the coloured varieties have a peculiar property of appearing a different colour when viewed in different directions. This last remarkable property is particularly well developed in the ruby, and when we consider the magnificence of the intense red colour, and the extreme scarcity of fine specimens, it is easy to understand why a choice ruby is treasured above all other gems, for it is paramount in all the qualities which render stones precious.

The mines of Burma are the source of the finest rubies in the world; here the whole surface of the ground has to be dug out bodily and thousands and thousands of tons of soil washed and examined with the most minute care to obtain one fine stone. There is no such thing as finding stones by chance on the ground; one could live on the site of the mine for years and never see a ruby.

Purchasers of Rubies are strongly advised to insist on invoice definitely specifying BURMA RUBIES.

RUBIES AND THEIR IMITATIONS.

The spurious rubies offered to the unwary may be divided into three classes :—

1. Inferior stones of little value which are palmed off as rubies owing to similarity in colour.
2. "Paste," or glass made and coloured in an endeavour to imitate the precious stone.
3. Artificial corundum, which has the same composition and properties as the natural stone, and only differs from it in being made artificially and therefore valueless.

The first two classes of substitutes have been produced from time immemorial; the third is of recent origin, and its detection more particularly claims our attention, in view of the fact that large quantities are being placed on the market at the present time.

ARTIFICIAL RUBY AND ITS DETECTION.

All natural stones possess to a greater or less extent characteristic internal structures, blemishes and flaws—very minute in choice specimens, but as a rule very plentiful.

All artificial stones possess imperfections consequent upon the method of manufacture, but these are much less noticeable as a general rule and are *quite different in character*.

These differences in structure form the basis of an infallible and readily applied test for the detection of artificial ruby.

DIFFERENCES BETWEEN REAL AND ARTIFICIAL RUBIES.

STRUCTURE.	REAL STONE.	ARTIFICIAL STONE.
Bubbles ..	Irregular in shape, often elongated and frequently angular. Fig. 1.	Generally perfectly round, rarely elongated and never angular. Figs. 4, 5 & 6.
Variations of colour ..	Colour frequently varies in different parts of the stone, the bands being either parallel or irregular. Fig. 2.	Colour generally uniform but occasionally varied, the bands then being curved in outline. Fig. 5.
Striations ..	Perfectly straight or angular in outline. Fig. 2.	A series of concentric curves. Fig. 5.
Inclusions of foreign matter	Particles of various size arranged in an irregular manner. Fig. 1.	Small particles, generally arranged in curves following the lines of striation. Fig. 6.
Silk	Quite characteristic of natural ruby—due to a series of minute parallel canals arranged in three definite directions giving a silky sheen by reflected light. Fig. 3.	<i>This structure is never found in artificial stones.</i>

These differences in structure are illustrated in the plate opposite, reproduced from photo-micrographs of actual cut stones.

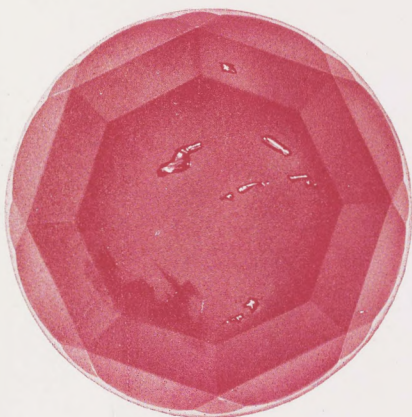


Fig. 1.

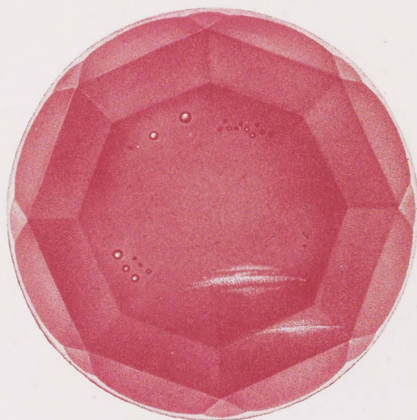


Fig. 4.

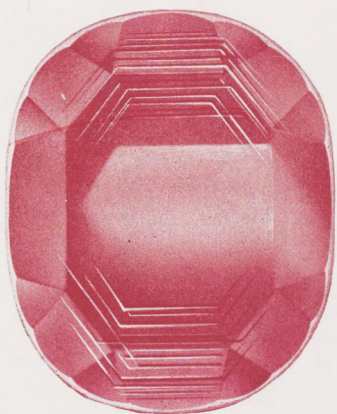


Fig. 2.

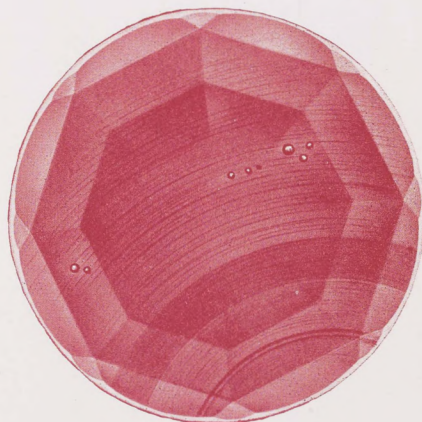


Fig. 5.



Fig. 3.

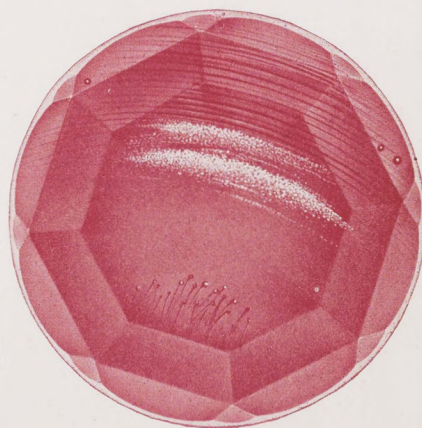


Fig. 6.



The artificial corundum, produced by fusion in the oxy-hydrogen blowpipe, is known by different names. When chips of genuine ruby are used as the raw material the stones are generally known as *Reconstructed Rubies*, whereas *Synthetic (or Scientific) Rubies* are prepared direct from alumina as the starting point. The process of manufacture is, however, exactly the same and the resulting stones are identical in character. As far as chemical composition and properties go these stones are identical with the real ruby, that is why the difference in structure forms the only reliable test.

The idea is prevalent in many quarters that to a trained eye *colour* is a sufficient guide to the genuineness of a ruby, but reliance on this test is most dangerous. It is an undoubted fact that the colour of the finest pigeon's blood ruby cannot either be imitated artificially or matched in any other stone. But as regards the ordinary qualities the test may be emphatically stated to be unreliable, especially as regards discrimination between the natural stone and the artificially-produced article.

It will be understood that the stones illustrated in the plate have been carefully selected to bring out more clearly the various points of difference. As a general rule the artificial stone is fairly clear, with only a few bubbles here and there, but real stones are frequently full of imperfections, often forming a confused mass which on examination resolves itself into patches of silk interspersed with large and small bubbles of various shape. "Silk" is the most characteristic guide to the genuineness of a ruby, as careful examination will generally reveal traces of it—perhaps only on a microscopic scale—in nearly every real stone, even those of the finest quality.

Pronounced colour banding, such as shown in Fig. 2, of course depreciates the value of a stone, and is only found in the cheaper qualities. The striations, which are well illustrated in this specimen, are not so common in the natural stone as the artificial.

The structure shown in Fig. 6 is due to a cloud of small particles of unfused alumina, suspended in the stone. It is not common to find such a mass of inclusions, but specks of such unfused matter can generally be seen in artificial stones on careful examination.

HOW TO PERFORM THE TEST.

All that is necessary is to examine the stone with a strong lens in a good light; a certain knack is however required to show up the structure clearly, which the following hints, with a little practice, will enable one to grasp.

It is of little use to hold the stone up to a strong light and look directly through it.

In order to make an examination with certainty and rapidity it is advisable to arrange a strong artificial light (gas or electric) over a table so that when sitting at the table the light is on a level with the eye.

A screen should be placed in front of the lamp so as to shield the eye from the direct light. (A sheet of cardboard fastened in front of the lamp by a wire is all that is necessary).

If a stone is now held at the edge of this screen it will be flooded with light, passing through it sideways, and every detail of its structure will be clearly visible on looking at it through an ordinary lens.

It is a great advantage, although not absolutely necessary, to have another screen covered with black cloth behind the stone.

It is also useful as a further test to examine the stone by reflected light; for this, arrange the light in the same way, but instead of looking through the stone place a piece of black paper or cloth on the table, hold the stone above this in the light and look *down* at it through the lens.

Whilst the method described above is quite sufficient for the purpose, it is a great convenience to have an apparatus permanently arranged for making the examination with rapidity and comfort.

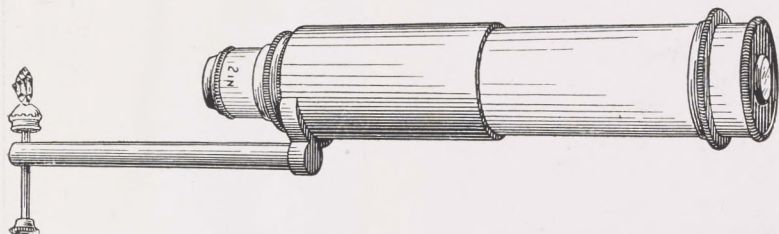
The JEWELLER'S MICROSCOPE has been designed with this object; it consists of a compound lens mounted in a tube, with a sliding collar carrying a holder for the stone.

By this means the stone can be fixed in focus and rotated at will so as to pass the light through it at different angles—this is especially useful for small stones mounted in a solid setting, which are rather difficult to examine by the method described above.

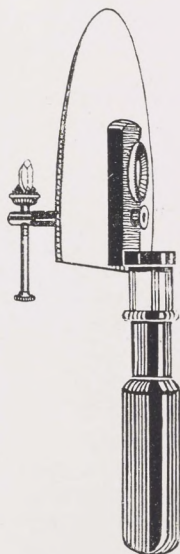
Mounted stones are a little more difficult to examine, as the setting interferes with the passage of the light, but a little practice enables one to find a position in which it will be illuminated.

If the stone is in an open setting it should be held with the back facet towards the light and examination is greatly assisted by placing a drop of oil on the culet (preferably a drop of methylene iodide).

THE JEWELLER'S MICROSCOPE.



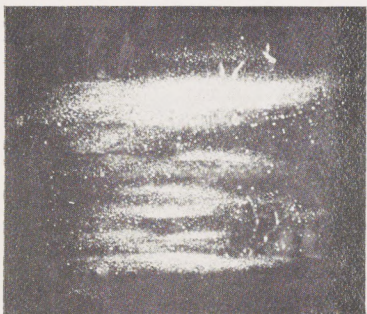
*High-power pattern with
compound lens.*



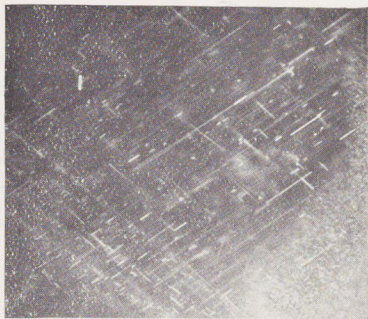
*Low-power pattern with
simple lens.*

*Several patterns of this apparatus are supplied by
Mr. J. H. STEWARD, 457, West Strand, London, W.C.
at prices ranging from 12s. 6d.*

SOME EXCEPTIONAL CASES.



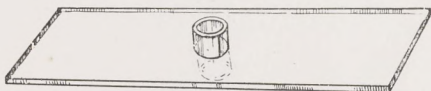
Cloud of minute bubbles in artificial ruby.



Silk in real ruby (magnified 50 times).

It is only very occasionally that examination in this way leaves any room for doubt. Now and then, however, one comes across stones, such as that illustrated above, the structure of which bears a superficial resemblance to that of real stones when seen by the naked eye.

More particularly one sometimes finds artificial stones which are remarkably free from bubbles, or in which the bubbles are arranged round the girdle, and in consequence rather difficult to see. In such cases the test can be made more stringent by immersing the stone in a highly refracting liquid, such as methylene iodide, which has the effect of doing away with the confusion caused by the light reflected from the facets. For this purpose we drop the stone into a little glass tube filled with the liquid, and examine it with the lens as before, when the most minute trace of structure can be seen.



With the aid of the jeweller's microscope the test can be made more stringent still—for this purpose the microscope is mounted on a stand, and the stone placed in a little cell, such as shown in the diagram, which is filled with the highly refracting liquid and placed on the stage.

The rough artificial stones are sometimes broken up and placed in a rotating drum with sand or emery powder. Rough fragments, resembling natural pebbles, are thus produced, which are put amongst parcels of genuine uncut stones. Although it is a point of interest more to the dealer than the jeweller, it may be noted that this fraud will be revealed in a moment by examining such a fragment immersed in a highly refracting liquid as described above.

SPURIOUS NATURAL STONES.

There are several species of precious stone, less valuable than the ruby, which approximate to it somewhat closely as far as *colour* is concerned, notably :—

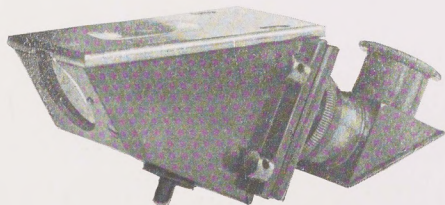
The Red Spinel, or Balas Ruby.

The Pyrope Garnet, or Cape Ruby.

The Red Tourmaline.

All precious stones possess certain definite physical properties, however, which are capable of accurate measurement, and instruments have been devised for this purpose suitable for the use of the jeweller. A very little practice in the use of these instruments renders the identification of any of these substitutes for real ruby a matter of ease. The tests can be performed very rapidly, and the result is to replace *opinion* by *scientific certainty*, as no two specimens of precious stone have exactly the same properties, and as we have already noted, the properties of the ruby are quite exceptional. The most useful tests are described below.

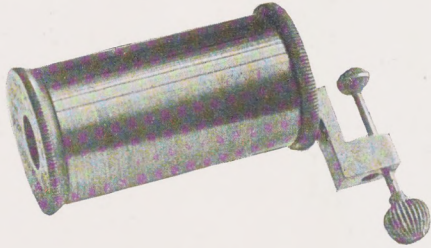
THE JEWELLER'S REFRACTOMETER.



This beautiful instrument, designed by Dr. Herbert Smith for the use of jewellers, measures the *refractive power* of the stone, or power of bending light, a property which is possessed in a very high degree by the ruby. In order to use this instrument all that has to be done is to place the stone in position on the flat surface and look through the eyepiece, when the refractive power can be read off on a scale.

The refractive power of real ruby is	1.761 to 1.770.
That of spinel is	1.726.
That of "cape ruby" is ..	1.755.
That of tourmaline is ..	1.62 to 1.64.

THE DICHROSCOPE.



This little instrument is still more simple to use—all that has to be done is to fix the stone to the holder and hold the instrument in such a position that it is well illuminated, when two images of the stone will be seen, side by side. If the stone is a real ruby these images will change colour, from pink to deep red, if the holder is rotated so as to bring the stone into different positions. Red tourmaline also shows this variation of colour, and in some cases to an even greater extent than ruby, but in the case of the spinel and garnet mentioned, the colour always remains the same, no matter how much the stone is rotated.

SPECIFIC GRAVITY TEST.

Ruby is a very heavy stone—more than four times as heavy as water, whereas the majority of other stones are somewhat lighter than this.

The relative weight of stones of the same size would be as follows:—

Ruby	..	..	..	4.03
Spinel	..	..	..	3.60
Garnet	..	..	..	3.78
Tourmaline	..	..	..	3.10

To identify substitutes for ruby by means of this property, one takes advantage of the fact that a solid will sink in a liquid lighter than itself, but float on the surface of one that is heavier. By dissolving a substance known as thallium silver nitrate in the right quantity of water, we can prepare a liquid which is exactly four times as heavy as water. If some of this is kept in a little tube, a real ruby will just sink in it, whereas the substitutes will float on the surface.

The specific gravity can be determined more accurately by means of a balance, but this requires some little skill in manipulation.

HARDNESS.

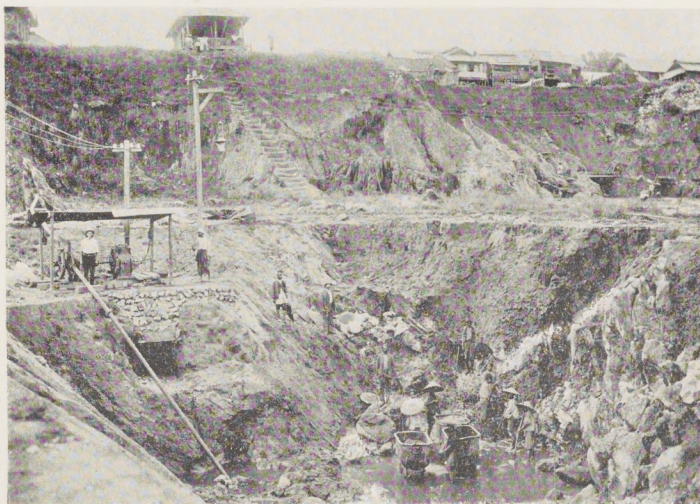
A ruby is harder than any stone except the diamond and any substitute for it can be scratched by a splinter of genuine stone. It is not as a rule necessary to resort to this old-fashioned test, however, as those already described are sufficient to place the identity of any stone beyond the possibility of error.

A WORD ABOUT PASTE.

Paste is merely an optical glass of special composition coloured in imitation of ruby; it possesses neither the beauty nor the durability of the real stone, apart from the fact that it is quite valueless, and its detection is quite a simple matter. As a rule the only test necessary is that of hardness; the great merit of the ruby is its extreme hardness, whereas the finest paste can invariably be scratched by a hardened steel point.

Numerous other tests may be mentioned :—

1. Paste is a bad conductor of heat and with a little practice can be detected in a moment by applying it to the tip of the tongue, when it feels warm as compared with a genuine stone.
2. Paste will not give the same reading on the refractometer as the natural stone.
3. Paste will never show such difference of colour with the dichroscope.
4. Paste does not show the characteristic behaviour of the ruby with the polariscope.
5. The structure of paste is different to that of the ruby, and resembles that of the artificial stone.

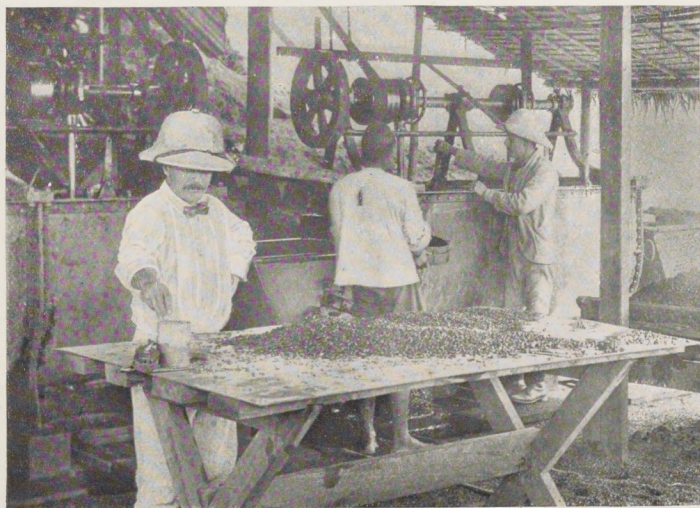


A Glimpse of the Burma Mines.

Purchasers of Rubies who are in any doubt as to their genuineness
are invited to send them for examination to—

THE BURMA RUBY MINES LTD.
SUFFOLK HOUSE,
LAURENCE POUNTNEY HILL, LONDON, E.C.

*It is advisable when purchasing Rubies to specify BURMA RUBIES
and to insist on invoice with definite statement to this effect.*



Sorters at Work.

