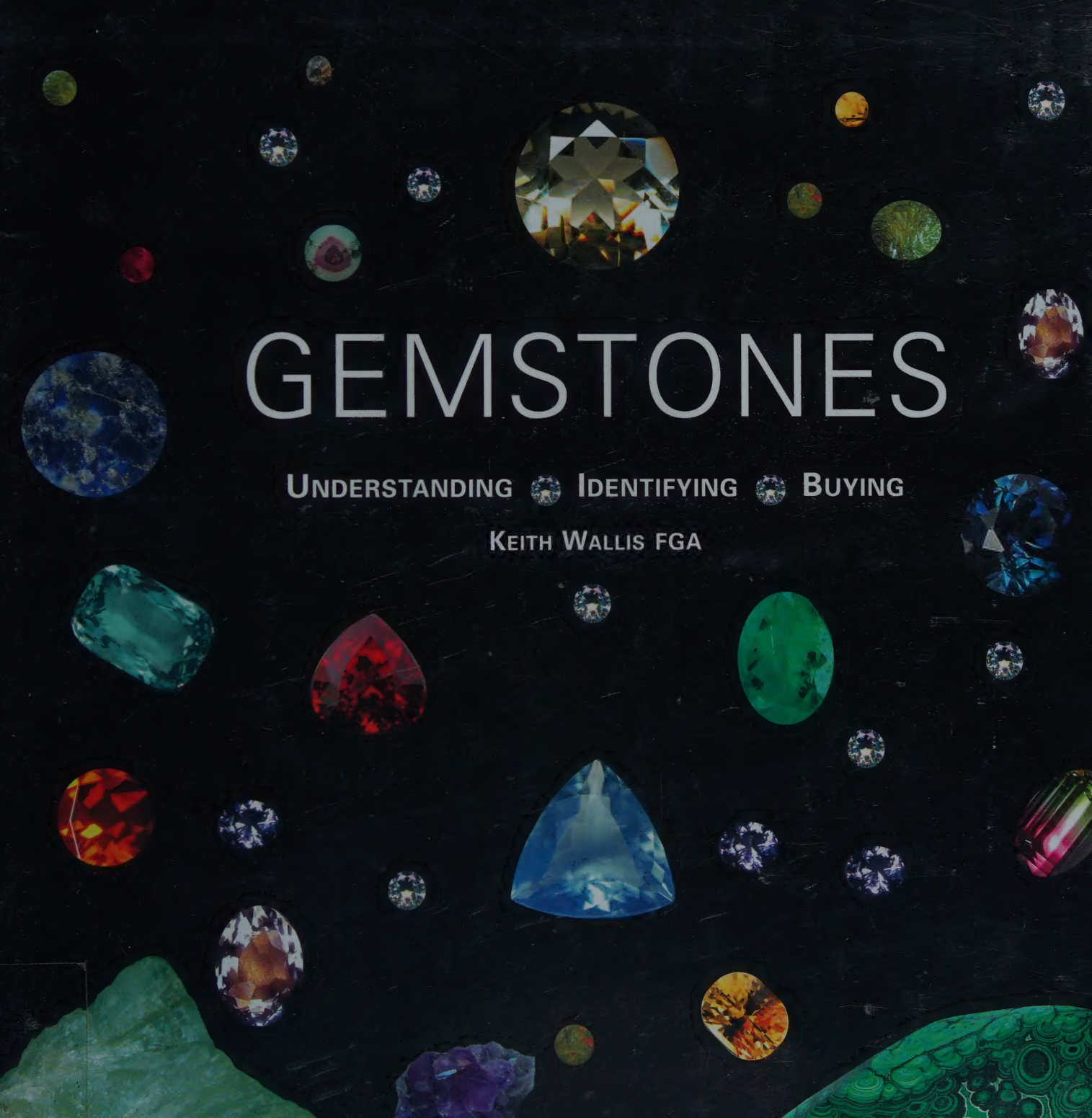

GEMSTONES

UNDERSTANDING IDENTIFYING BUYING

KEITH WALLIS FGA

GEMSTONES

UNDERSTANDING – IDENTIFYING – BUYING

To be classed as a gemstone, a crystal must possess three elements: beauty, durability and rarity. The same may be said of this new edition of *Gemstones* – sumptuously illustrated with full-colour photographs throughout and featuring up-to-date, authoritative advice, it offers a clear-cut introduction to gemmology that will prove enduringly invaluable to the enthusiast and expert alike.

From Andalusite to Zircon, this wide-ranging guide appraises more than 180 gemstones, minerals and metals used in jewellery today. Precious stones are examined in dazzling detail, while a treasure trove of organic and minor gemstones listings showcase lesser-known gems – including amblygonite, Fordite and Jeremejevite – and reveal many new varieties, such as Namibia's 'mandarin garnet'.

The properties of gemstones – colour, specific gravity, refractive index, hardness, and crystal form – are evaluated throughout, to further assist with identification. Practical advice on what to expect, and what to avoid, when buying jewellery overseas is provided in addition to a list of foreign language terminology that you might encounter. The ample appendices include tables of comparative gemstone values, with two dedicated exclusively to Tanzanite and diamond values, respectively. An illustrated guide to gem crystal forms, used in the identification of rough material, also features.

For investors, collectors and romantics alike, this comprehensive guide provides a professional insight into the world of gemstones – and the opportunity to explore and enjoy it with confidence.

This revised and extended edition includes a new 'Jewellery' section and updates on treatments, synthetics and simulants, as well as additional gemstones and varieties.

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ANTIQUE COLLECTORS' CLUB

ISBN 13: 978-1-85149-630-3

First published 2006
Reprinted 2007
Second edition 2011

British Library Cataloguing-in-Publication Data
A catalogue record for this book is available from the British Library

Frontispiece: *Greenland ruby necklace and earrings*. (Photo: TNG)
Title page: *Blue Tanzanite*. (Photo: ATG)

Printed in China
Published in England by the Antique Collectors' Club Ltd, Woodbridge, Suffolk

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Acknowledgements

The Author wishes to thank the following for their kind help and assistance:

L. Allen Brown GIA
Alan Clark FGA, DGA
Creetown Museum
Terry Davidson FGA
Gem-A
Dr Roger Harding BSc, DPhil, FGA
Alan Hodgkinson FGA, DGA
Roy Huddlestone
William Hyams
E Alan Jobbins BSc, FGA
Joyce King
Marcus McCullam
Geoffrey Munn, Wartski, London
Bonnie Pemberton GIT, GG, AJP
Peter Read CEng, MIEE, MIERE, FGA, FISTC
Michele Rowan
Memory Stather
Tim Stephenson FGA
True North Gems Inc.
Colin Winter FGA, DGA

Photographs supplied by:

Antique Collectors' Club (ACC)
Alan Hodgkinson (AH)
Alan Jobbins (AJ)
All That Glitters (ATG, ATG/LAB)
Ammon UK (AUK)
Chris Algar (CA)
Chatham Created Gems (Chatham)
Christie's Images (Christie's)
Colin Winter (CW)
David Davis (DD)
Diamond Trading Corporation (DTC)
Douglas Unwin, Creetown Museum (DU)
Gem-A (Gem-A)
John Benjamin (JB)
John Pennington (JP)
Killhope Museum (KM)
Korite – Canada (Korite)
Keith Wallis (KW)
Maggie Campbell Pederson (MCP)
Marcus McCullam (MM)
Michele Rowan (MR)
Memory Stather (MS)
Natural History Museum (NHM)
Peter Read (PR)
Huddlestone Gemmological Consultants (RH)
Sabine Betts (SB)
Sotheby's
True North Gems Inc. (TNG)
W Hamond (WH)
Geoffrey Munn, Wartski, London (WL)
Wartski, London (WL)

Please note that, unless otherwise stated, gems are shown larger than actual size.

Foreword

Gemmology, like all science, is a field that is continually expanding and evolving through new theories and discoveries. This new edition of *Gemstones* has been revised and extended to take into account the many changes that have taken place worldwide since the book was first published in 2006.

The 'Precious Stones' section pays particular attention to the latest findings on diamonds and rubies, highlighting new treatments, sources and scams to watch out for. It also includes a number of new gemstones and varieties. The updated 'Organics' section, too, includes several items not previously featured, and places this area of study firmly within the context of the current marketplace, focusing on the laws relating to sale and import.

A new 'Jewellery' section gives helpful information on the various metals used, hallmarks, a glossary of terms and tips on how to look after your jewellery. For those wishing to accumulate their own collection, the important subject of buying and investment is revised with reference to the very latest treatments, synthetics and simulants.

This new edition administers practical advice regarding the realities of fakes and fraud with an honest, no-nonsense approach while simultaneously captivating the reader with the beauty and splendour gemstones can offer, not least by the plethora of top-quality photographs splashed throughout. Warnings are juxtaposed with gentle encouragement on how to nurture a fascinating hobby or expand one's already considerable knowledge. For the enthusiastic amateur and the keen gemmologist alike, this book is invaluable.

Kate Bliss BA Hons (Oxon), MRICS, FGA

Preface to the Second Edition

Welcome once again to the fascinating, mysterious and exciting world of gemstones. In my first book, published in 2006, I introduced the reader to the basics of this world; now I am happy to have the opportunity to take things a bit further: first and foremost, the rapidly changing market makes it necessary to consider the interesting new varieties of gems that have come onto the market in the intervening years. New scams abound, ready to catch out the unwary, particularly the growing introduction of new synthetic stones and treatments.

In this edition I have broadened my approach and extent of the coverage of gemstones, encompassing additional properties and I have included a wider range of not only of the stones themselves but of a selection of decorative materials available, both inorganic and organic. The use of these materials as objects of interest and imagination, be they fossil or mineral, is discussed.

A complete new section on jewellery has been added, together with revised and expanded sections on investment, treatments, collecting and also a new chapter on hobbies. Less common metals that are also being used in contemporary jewellery, such as palladium and titanium, are covered in greater detail.

My honest advice to the globetrotter and what to avoid when buying jewellery on a holiday or business trip has been revised and updated to keep up to date with the changing times.

The wealth of high-quality photographs and illustrations help to add to the understanding and appreciation of the subject.

I must thank all those who have contributed to this new edition. A special thank you must go to Allen Brown who has provided many of the photographs and related technical information for this new edition. Of course thanks must also go to Roy Huddlestone, Marcus McCullam, Alan Hodgkinson and Alan Jobbins, who have, once again, come up trumps.

Finally, I should like to say a few words about Peter Read, a dear friend and prominent gemmologist. In 2006, our profession lost this diamond expert, who had spent many years with the Diamond Trading Company (De Beers) and was a keen designer of test instruments and gemmological software. In addition to several books and articles on gemmology, Peter also wrote three novels. A lover of ballet, in his will he established a scholarship for a student to attend the Royal Ballet School. Professionally and personally, we will all miss Peter.

An imaginative use of gem materials by Memory Stather. A perfume bottle with a base of carved rainbow obsidian, carved lemon citrine stopper, set in plique-à-jour enamel on silver. (Photo: MS)

Amethyst crystal surrounding a rock crystal core. (Photo: KW)

Introduction

Most women possess a gemstone, and, if they are lucky, several, whether in brooches, rings or necklaces. Men also occasionally sport a diamond ring or tie pin, and, these days, even a diamond stud in their ear.

But what do these stones mean to the wearer? A token of affection, an heirloom, or something that glitters and looks attractive? Perhaps it is an open display of wealth, or something to keep locked away in a bank vault as an investment. The gemstone can mean many things to the owner.

There are literally hundreds of different gemstones, but only the most important are covered in this book. Some beautiful gems are simply so rare or too fragile to be worn as jewellery that they are only bought by collectors; these are known as collectors' stones. In fact, there are new gems being discovered almost every year; if not a new species, then a different colour of a known stone.

Gold brooch in the form of an artist's palette; set with a chrysoberyl cat's eye, a ruby, pearl, sapphire, diamond, emerald and an opal. (Photo: WL)

What Constitutes a Gemstone?

If the stones you are wearing are natural, then, with a few minor exceptions, they will have been created millions of years ago. Formed in the depths of the earth under great heat and pressure, they were pushed to the surface by erupting volcanoes, often being washed out of the rocks by water into rivers where they can now be recovered. Others have to be mined, like coal, from many metres under the ground. These rough stones are then sold to local dealers, who either sell them on, via agents, to the major dealers or have them cut locally (native cut). The better stones end up in the cutting rooms of Israel, Holland, Belgium, the USA or Germany. There, the full beauty of the stone is revealed.

To be classed as a gemstone, the crystal has to fulfil three parameters: beauty, durability and rarity.

Many gems fulfil these parameters to differing degrees. Diamond, for instance, is the most durable of stones due to its great hardness, but hit one with a hammer and it will shatter, so it is not the toughest; toughness and hardness being two different things. As you are unlikely to hit your precious diamond with a hammer, this distinction is not too important. It was, however, put to dubious use by some of the early

Ruby and diamond Catherine wheel, English, c.1900. (Photo: WL)

Rough gems, clockwise from top left: emerald, sapphire, garnet, rhodonite, tourmaline and apatite. Durable and rare, but not yet beautiful. (Photo: KW)

diamond dealers: prospectors would bring in stones to sell to the dealers, who, recognising the gems as genuine, would hit one stone with a rock, thus shattering it, and demonstrating to the gullible seller that they were obviously not real diamonds as real ones were 'hard'. The dealers then bought the remaining diamonds for a pittance. Diamond is without doubt very beautiful, but are they rare? Well, with a few exceptions, not really, but we'll discuss this question later on.

Ruby is the next hardest of the gemstones and the best examples can be more rare than diamonds. Emerald, in its best quality, even more so, but it is far less durable (*see* Tables 1 and 2).

Together with sapphire, these stones constitute the so-called four 'precious stones'. Note that ruby and sapphire are actually both corundum, but of different colour.

Table 1 Scales of hardness

Stone	Mohs	Knoop
Talc	1	12.3
Gypsum	2	61
Amber	2–2.5	
Calcite	3	141
Pearl	2.5–3.5	
Fluorite and Malachite	4	181
Apatite	5	483
Turquoise, Glass and Strontium Titanate	5.5–6	
Feldspar, Opal (average)	6	621
Peridot, Demantoid Garnet and GGG	6.5–7	
Quartz (Amethyst, Citrine, Cairngorm) and Jadeite	7	788
Zircon, Tourmaline, Garnet	7.5	
Emerald	7.5–8	
Topaz, Spinel	8	1190
Chrysoberyl, Cubic Zirconia and YAG	8.5	1400
Corundum (Ruby and **Sapphire**)	9	2200
Moissanite	9.25	3000
Diamond	10	8200

*The ten stones shown in **bold** were in the original Mohs scale; the other stones have been added for interest.*

Table 2 Mohs scale of hardness: everyday materials

Everyday item	Mohs
Fingernail	2.5
Copper coin	3
Window glass	5.5
Knife blade	6
Steel file	6.5

Diamonds – beautiful even in their rough form. (Photo: AH)

All other gemstones have been classed as semi-precious. A strange differentiation, but that has been the accepted classification for many years. Consequently, such beautiful stones as tourmaline, zircon, peridot, topaz, aquamarine, alexandrite and amethyst, to name but a few, were called semi-precious. Fortunately, times have changed and most gems are now classed as 'precious'.

The Mohs scale is based on a simple test: which stone will scratch the one of a lower number? This is classed as 'destructive testing', which is generally frowned upon by gemmologists. Destructive tests may be used when checking pieces of rough mineral – but gem materials? Never! The right-hand column of Table 1 shows the Knoop scale – a more accurate scale of hardness, based on testing by indentation.

Note how much harder diamond is compared to other gems: nearly three times harder than moissanite and six times harder than cubic zirconia (two popular diamond simulants) according to the Knoop scale. A hardness of '7' on the Mohs scale is normally taken as the minimum for stones acceptable to use in jewellery. As can be seen from Table 1, certain gems, such as amber, pearl and turquoise, are softer than this and still used in jewellery, though care must be taken when wearing such gems.

Technical Terms and How Gems are Identified

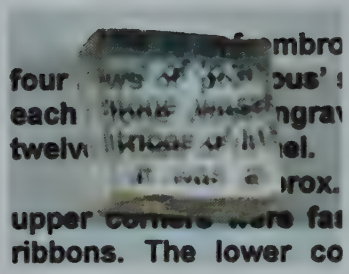
(I must stress that these are simplistic definitions but adequate for the purposes of this book.)

Let us have a quick look at how gemmologists identify gemstones with some of the instruments that are available to them.

Specific Gravity or *Density* – The specific gravity (SG) of a gemstone refers to its weight in air compared to the weight of an equal volume of water. What this means is that the higher the SG of a stone, the heavier it will weigh compared to gems of a lower SG. Consequently, a one-carat diamond (SG 3.51) is smaller in size than a one-carat tourmaline (SG 3.00) because the diamond is denser than the tourmaline. So, the higher the SG, the smaller the stone of an equivalent weight.

Some of you may recall measuring SG at school using a balance. It is still done this way in gemmology, using a similar technique but with different ways of weighing the stone. Digital scales are used in a variety of arrangements. Heavy liquids have occasionally been used, each with a different density to see if a stone floats or sinks. But, as most liquids are either noxious or poisonous, these must be used with care. The stone, of course, has to be unmounted and of an SG within the upper range of the liquids.

Refractometer. (Photo: KW)



Example of double refraction through a crystal of calcite. (Photo: KW)

Refraction and *Refractive Index* – When a ray of light passes from one medium into another it is bent. Stand a stick in a glass of water, making sure a portion of the stick is above the water level. You will see that, at the point it is immersed in the water, it appears to bend. This is refraction. The same thing occurs when light enters a gemstone.

The specific angle at which the light bends varies between different gems. This is measured and is interpreted into the refractive index (RI) for that stone. Gemstones fall into two different categories as regards refraction: the singly refractive and the doubly refractive. This depends on the crystal system to which they belong; there are seven systems, but only one, the cubic, is singly refractive; all the rest are double. Double refraction means that the stone splits the light ray into two and each ray has a different angle so the stone has two refractive indices.

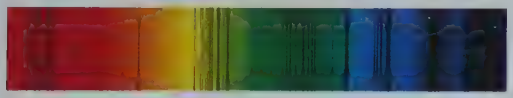
Some doubly refractive stones also have a property called dichroism. This means that, when viewed from two different directions, the stone appears a different colour or shade in each. There are many examples – ruby (yellowish-red and deep red) and blue sapphire (pale greenish-blue and deep blue) are just two.

Certain gems are pleochroic – showing three different colours or shades depending on the direction viewed.

The measurement of refractive index is done using a refractometer. This instrument is provided with a monochromatic light source, usually sodium. A small drop of contact fluid of high RI (1.79) is put on the prism in the top of the instrument before placing the gem to be tested. The refractive index of the stone is shown as a shadow on the scale by looking through the eyepiece. A double refractive gem will show two shadows and a single one.

An alternative is the use of immersion fluids, similar to the heavy liquids used for SG measurement. A stone with the same RI as the liquid will appear to 'disappear'. Again, these liquids can be pretty noxious.

The gemmologist has a battery of instruments to help identify a gemstone. Here is a brief appraisal of some of them.



Spectrum of YAG. (Photo: KW/CW)

Spectroscope – this is used to inspect the spectrum. White light is split into a rainbow of colours – red, orange, yellow, green, blue, indigo and violet. Usually remembered as 'Richard Of York Gave Battle In Vain'. This is the spectrum you see when you look through a spectroscope. However, when a suitably illuminated gem is viewed through the instrument, a series of vertical black lines may be seen. These are called Fraunhofer Lines. The number and position of these lines indicate the various elements contained in a particular gem, and can identify the stone. The spectrum covers a wavelength of 400 (violet) to 700 nm (red).

Spectroscope (stand designed by the author). (Photo: KW)

Polariscope with Conoscope. (Photo: KW)

Polariscope – this simple yet useful instrument is a rapid way of identifying whether a stone is singly or doubly refracting. It is based on crossed polarising filters, as in sunglasses, and the stone is placed in between two. By rotating the filters in sequence, the stone will show light or dark, if double refractive, or no change, if single. The polariscope is also used to show interference patterns with the use of a conoscope.

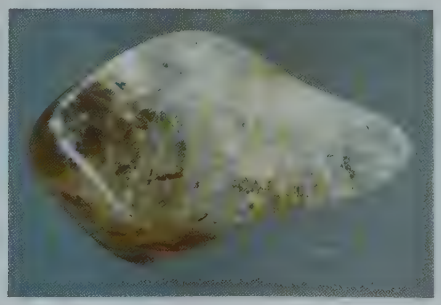
Dichroscope – another simple instrument used to show dichroism in a doubly refractive gem. It is a simple tube containing a crystal of calcite that, in itself, is highly doubly refractive. By looking through the eyepiece at an

Dichroscope (designed by the author). (Photo: KW)

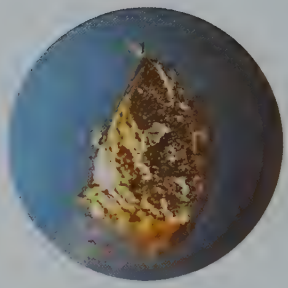
illuminated gemstone rotated at the end of the tube, two small windows will show two different colours if the stone is dichroic.

Reflectometer – an instrument used to identify a stone by the amount of reflection it exhibits. A reading is given on a meter. Popular when it introduced in the nineteen seventies, but less so today.

Microscope – an invaluable tool that allows the viewer entry into another, hidden world of gemstones. Many stones contain inclusions that help to identify not only the gem family, but also its source. Some types of inclusion are common to several gems. These are where minute cavities contain liquid together with a miniature crystal and/or a gas bubble, and are termed two- or three-phase inclusions. Others – for example, 'mares tails' in demantoid garnet, or thumbprints in amethyst – are diagnostic. Inclusions are responsible for 'star' stones, where needlelike crystals of rutile or hematite occur (see under relevant gems). Looking into some gems under the microscope may provoke surprise, as the illustrated examples show. This unassuming stone (see image) contains a strange inclusion. Quartz can contain even more unbelievable inclusions, such as this:



Quartz pebble. (Photo: KW)



Inclusion. (Photo: KW)

This rare example of rock crystal is 56 mm x 33 mm. The leading authority on inclusions was the late Edward Gubelin; his many books of photographs taken under the microscope display nature's art in a most astounding manner. (Photo: AJ)

However, even with this impressive array of instruments, and not counting the very specialised laboratory equipment required for the identification of the many treated stones today, the gemmologist's first approach is always his loupe and experience.

UV lamp. (Photo: KW)

High intensity lamp with sodium filter and visual optics filter and fibre optic (designed by the author). (Photo: KW)

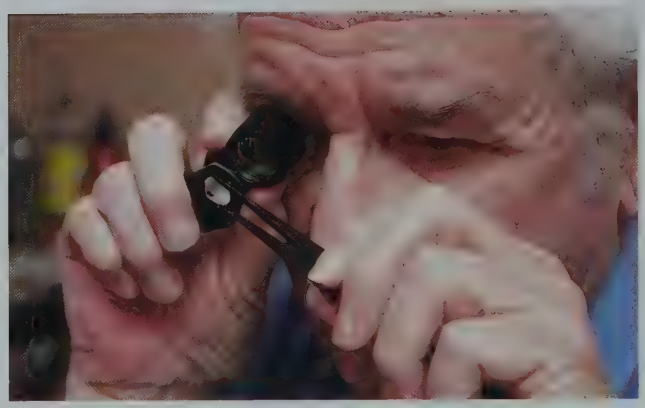
Crossed filter assembly (simple test for chromium content). (Photo: KW)

Immersion viewer. (Photo: KW)

Basic Gemmological Instruments

Loupe – A lens of ten-times (10x) magnification, the loupe is the gemmologist's most important aid in the inspection and identification of precious stones. It is the tool used to decide the clarity of a diamond. If an inclusion or other imperfection cannot be seen through the loupe, it is classed as 'flawless' or 'loupe clean'. This is a world standard for diamonds. The best type is called a triplet as, when used correctly, this gives the best possible image. Illuminating loupes are now available that light the object being viewed, and are a boon in dull conditions.

To use the loupe, first hold the stone using tongs or tweezers, preferably black. This will need a bit of practice so that a valuable stone does not flick out and get lost – this is particularly embarrassing if you happen to be in a shop at the time! Luckily, loupes are available with a slide lock to hold the gem firm; either way, it is a good idea to try it out on something of low value first. An alternative that holds the stone very firmly is the four-claw stone holder. None of these items need be very expensive; a perfectly good loupe can be bought for about £16, a pair of tongs from £12. Now, hold the loupe close to your eye and move the gem up towards it until the gem is in focus. Try to keep both eyes open; it is less tiring and an easy thing to do with a little practice. Remember to look at the gem from all directions, not just through the table, and take your time as some flaws take a bit of finding.



The author using a loupe. (Photo: JP)

A loupe. (Photo: KW)

The loupe can provide pleasure by exploring the surface of a mineralised rock under a strong light and discovering tiny crystals hiding in the crevices. Try it!

Chelsea Colour Filter – This was developed in the early 1930s at the London Chamber of Commerce's Gem Testing Laboratory together with the Chelsea College of Science and Technology. It was designed to combat the increase in the number of emerald simulants coming on to the market.

It consists of a sandwich of a couple of filters that

A Chelsea Filter. (Photo: KW)

only transmit deep red and yellow-green light. This instrument was able to distinguish the real stone from the then common glass, fakes and doublets. The true emerald (with a few rare exceptions) appears red or pinkish when viewed in strong light under the filter; the simulants show green. Unfortunately, synthetic emeralds, such as Gilson and Chatham, also show red, but this tends to be a brighter red. (Other uses for this filter are detailed under each particular stone where applicable.)

To use the filter, shine a strong artificial light on to the stone and view the illuminated stone through the filter. A Chelsea Colour Filter will cost you about £20.

The Hanneman Colour Filter Set – offers a wider range of uses. This also incorporates the Hodgkinson synthetic emerald filter and green dyed jade filter.

All the above instruments are available from Gem-A Instruments Ltd (27 Greville St., London EC1N 8TN) and other major suppliers around the world.

The author using a Chelsea Filter. (Photo: JP)

History, Myths and Legends

Diamond octahedron.
(Photo: RH)

Since cave people, men and women have been decorating themselves with whatever was to hand: paint, bone ornaments and clay beads. The use of pretty stones dates back to the Ancient Egyptians, the Ancient Greeks and the Romans. Emerald was being mined in Egypt many thousand of years ago and simulants soon followed in the form of glass. The Greeks were engraving *intaglios* from serpentine back in 600 BC and wearing them as rings to use as seals. Gemstones were certainly collected and valued, though they did not have the appearance that we are used to today as the art of faceting did not come into its own until the Middle Ages. Instead of being 'cut', stones were ground into cabochons. Often these cabochons would also be engraved using diamonds as etching tools. Diamonds were also used decoratively, but, due to the lack of the necessary skills required to make the most of their brilliance, they would have been dull compared with those of today. Later, the prized octahedral crystals were mounted into rings in their natural state.

In the Old Testament, there is a description of the Jewish High Priest's breastplate (*see* Table 3). Some of the names of the gems are rather odd, however, and not readily recognised as those that we know today.

Table 3 Breastplate of the High Priest

Made of embroidered cloth, it was set with four rows of 'precious' stones, three in each row. On each stone was engraved the name of one of the twelve tribes of Israel.

It was approximately 10 inches square; the two upper corners were fastened to the ephod by blue ribbons. The lower corners were fastened to the priest's girdle.

It was also known as 'The Breastplate of Judgement'.

The first row shall be a sardius, a topaz and a carbuncle.
The second row shall be an emerald, a sapphire and a diamond.
The third row shall be a ligure, an agate and an amethyst.
The fourth row shall be a beryl, an onyx and a jasper.
They shall be set in gold.
(Abbreviated from Exodus 28: 17-20, King James Version)

Another translation by Jerome and the Septuagint gives:
1st row – sardius (carnelian), topazius (peridot), smaragdus (green stone)
2nd row – carbuncle (ruby or garnet), sapphire (lapis lazuli), jasper
3rd row – ligurius (amber), achates (agate), amerthystus (amethyst)
4th row – chrysolitus (citrine), beryllion (beryl), onychion (onyx).

Myths and Legends

From the early days gemstones were regarded as having special powers: they were used as talismans and believed to be able to make the wearer invincible and even, in some cases, invisible. Others protected against the evil eye and magic spells. Engraved stones became highly prized and were considered as more potent in their power than plain stones.

The alchemists of the Middle Ages allocated curative properties to gemstones, vaguely similar to homeopathic medicine today. Certain stones – for instance, topaz – were attributed with the ability to cool water and consequently when powdered and added to wine were believed to reduce fevers. Green stones were thought to help poor eyesight, yellow to treat jaundice. Amethyst was supposed to ensure sobriety; because of this, Bishops of the Anglican Church have

Philip II of Spain (after Titian). (Photo: KW)

worn amethyst rings ever since the Reformation.

The diseases of the time were classified according to a system of four qualities – hot, cold, moist or dry – and the stones used to treat them had the appropriate qualities. Stones considered hot and dry would, for instance, be used to treat a case of dropsy, which was thought to stem from cold, moist sources. If the patient were rich, he might even be given a cocktail of crushed gems. Indeed, Philip II of Spain was given what was called the Most Noble Electuary of Jacinth, consisting of powdered 'jacinth' (zircon or spinel), emerald, sapphire, topaz, pearl and red coral, together with 22 other animal and vegetable ingredients. Philip died two days later.

Gemstones also played a part in astrology; birthstones in fact developed from the stones of the High Priest's breastplate, mentioned earlier. The astrological divisions were based on the dates of the equinoxes (i.e. the days that the sun crosses the equator), on approximately 21 March and 23 September. The heavens were mapped out with constellations symbolised by mythological figures and animals; those in the belt along which the sun made its daily course were collectively called the zodiac. The earliest lists allied gemstones to the signs of the zodiac. These were later related to each month of the year. The list of

Table 4 Qualities Bestowed on Gemstones

Signs of the Zodiac	Properties	Class
Aries, Leo and Sagittarius	Hot & Dry	Fire
Taurus, Virgo and Capricorn	Cold & Dry	Earth
Gemini, Libra and Aquarius	Hot & Moist	Air
Cancer, Scorpio and Pisces	Cold & Moist	Water

stones does not remain static and new stones are added from time to time; lists may also vary from dealer to dealer. Stones were also allocated to each planet and even to days of the week; many of these associations have stayed with us in our modern culture, the association of gemstones and precious metals with anniversaries, for example.

Properties Associated with Gems

Diamond – As the 'King of Gems' to the pearl's 'Queen', it is naturally endowed with every good and noble characteristic. The diamond was thought to bring victory to the wearer, giving him superior strength, fortitude and courage. Associated with thunder and lightning, it was believed that diamond could even be consumed or melted by a thunderbolt. Diamond was also believed to indicate guilt or innocence, the stone growing dim if the accused was guilty and shining brightly if he was innocent. Another curious belief was that diamonds were supposed to possess reproductive powers. This idea was also applied to other gems.

Amethyst – This gem has probably the widest range of miraculous powers of any of the precious stones. In addition to its apparently preventing drunkenness, it was also thought to induce dreams and visions. Leonardo da Vinci believed that it could dispel evil thoughts and quicken intelligence. It was imbued with the power to protect farmers' fields from storms and locusts, to bring good luck in war and hunting. It was even believed to protect against snake bites.

Table 5 Stones associated with the Signs of the Zodiac

Star Sign	Gemstone
Aries	Diamond
Taurus	Emerald or Chrysoprase
Gemini	Pearl or Moonstone
Cancer	Ruby or Carnelian
Leo	Sardonyx or Peridot
Virgo	Sapphire or Lapis Lazuli
Libra	Opal or Tourmaline
Scorpio	Topaz
Sagittarius	Turquoise or Zircon
Capricorn	Garnet
Aquarius	Amethyst
Pisces	Aquamarine or Bloodstone

Table 6 Indian Planetary Stones

Planet	Gem
Sun	Ruby
Moon	Pearl
Mars	Coral
Mercury	Emerald
Jupiter	Yellow Sapphire
Venus	Diamond
Saturn	Blue Sapphire
Rahu (Moon's north node)	Hessonite Garnet
Ketu (Moon's south node)	Cat's Eye

Navaratna jewels are made using all the Indian planetary gems together in a single jewel.

Table 7 Stones Related to the Days of the Week

Day	Gemstone
Sunday	Pearl
Monday	Emerald
Tuesday	Topaz
Wednesday	Turquoise
Thursday	Sapphire
Friday	Ruby
Saturday	Amethyst

Table 8 Anniversary Stones

Anniversary	Gem
Thirtieth	Pearl
Thirty-fifth	Coral
Fortieth	Ruby
Forty-fifth	Sapphire
Fiftieth	Gold
Fifty-fifth	Emerald
Sixtieth	Diamond

Aquamarine – This stone would be placed in a glass of water as a remedy against eye trouble, toothache, sore throat, liver problems, glandular swellings and feelings of weakness. It was thought to promote a happy marriage, but was also considered to be advantageous in avoiding discovery in the event of infidelity. When ground into flat plates, it could enhance the clarity of view and was reported to have been made into spectacles in the 14th century.

Emerald – This gem was reputed to cure blindness; Nero was said to have had a monocle made of emerald. It was believed to preserve the chastity of women, which, if violated, would cause the stone to burst into fragments.

Emerald was also supposed to blind poisonous snakes. It is a highly-prized stone for Muslims, as green is the sacred colour of the Prophet. In Asian countries, it represents hopes of immortality, courage and exalted faith.

Opal – 'Cupid's Stone of hope and love', the opal was held in the greatest esteem as it contained the red of the ruby, the blue of the sapphire, the green of emerald, the gold of topaz, and the purple of the amethyst; thus it was imbued with the properties of all these stones. Only emerald was

held in higher esteem. Many people over the centuries believed this gem to bring good luck. In the Western world, however, it gained the reputation of being unlucky in the 19th century after the publication of Sir Walter Scott's novel *Anne of Geierstein*, in which the heroine wears a cursed opal in her hair, and later dies.

Peridot – This was the favourite stone of the pirates as they believed that it would protect them against all forms of evil and, if set in gold, would save them from the terrors of the night. It was supposed to strengthen eyesight, as well as the heart and respiratory tract. It was also supposed to relieve depression and even protect against baldness.

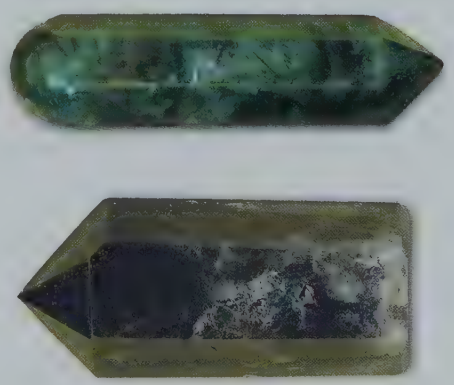
Ruby – Believed to be an antidote for poison, this gem was also attributed with prophetic powers, the stone apparently darkening to warn of impending danger. In Roman time, rubies from Greece engraved with dragons or dogs were especially prized. The gem is also extolled by Hindus as ensuring health, wealth and a joyous nature to the owner.

Sapphire – This gem symbolises truth, sincerity and faithfulness. It also was believed to have curative properties and to keep one safe from illness and protect against poison and spells. It was also associated with religious rites and ceremonies of the Christian church. Sapphire-set rings are worn by Bishops and Cardinals of the Roman Catholic Church. In the Middle Ages, sapphire was worn as a talisman to cure ophthalmic disorders; later, it was used as a test for female virtue.

Turquoise – Used since ancient times as a talisman against falling from horseback by Mongolians who attached this stone to their horses' bridles, it became a protection from all kinds of fall. Arabs also wore it as a protection against the evil eye. It was also popular with couples getting engaged, with pregnant women and for newborn babies.

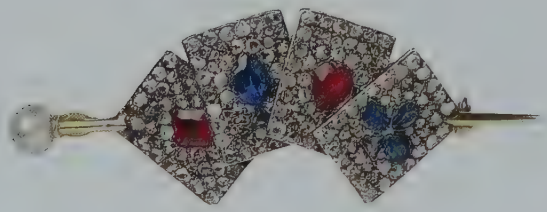
Superstition and magical powers are given to gemstones even today. Crystal pendulums are produced to be worn around the neck for a variety of purposes. These are usually quartz and sometimes referred to as 'points'. They are used in different ways: dangling the point over the abdomen of a pregnant mother, for instance, is supposed to reveal the sex of the unborn child, according to the direction in which the crystal rotates. It is also claimed that crystals can heal physical ailments by the appropriate gem being applied to the seven 'Chakra' points along the spinal column from the top of the head to the base of the spine.

All that a gemmologist can say is that quartz does have certain strange qualities. If a thin section is put under tension, radio waves are emitted; this property is used in radio transmitters to control frequency. Another surprising property of quartz is that if you take two crystals, hold one in each hand under water and hit them together, it produces a flash of light. But be careful as they may crack so only use rough material. Tourmaline also has a rare property in that if a crystal of the gem is heated, an electrical charge is developed along the crystal with opposing poles at each end.



Crystals as used in healing techniques. Labradorite point and smoky quartz point. (Photos: KW)

Precious Stones



Sapphire, diamond, ruby and pearl pin. (Photo: WL)

It is important to know some of the characteristics and colours of the different varieties and how they may be 'improved' or faked. The following reference sections (on **Precious Stones, Gemstones** and **Organic Gems**) give relevant details of the most popular gemstones and a few that are less well known. A short guidance to the identification is also given where appropriate. A couple of inexpensive instruments were detailed earlier to enable you to experiment with identification. The tips given are purely a rough indication of possible fraudulent stones that you may come across. It will certainly not turn you into a gemmologist and it is not intended that you should challenge the dealer or jeweller about his description. However, do trust your new-found knowledge, as well as your instincts: if you mistrust or are unhappy about what a dealer is telling you, then just say, "thank you very much," and walk away.

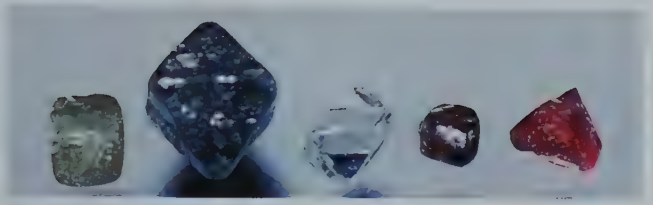
Although this book includes many helpful photographs, pictures are never as good as the real thing. An excellent idea is to visit museums where gems are on display and educate yourself on what the stones look like in reality. Of course, the quality of the museum specimens is likely to be much higher than anything you should expect to find in shops, but it does get you used; to looking at gems. There are some excellent collections to be seen; if you are in London, the Natural History Museum in Kensington has a good display.

Diamond

The diamond – the gem that apparently every woman wants, a 'girl's best friend', but what is it exactly? Formed 100-200 km under the surface of the earth from 990 million to 3.2 billion years ago, diamond is pure carbon; in fact, it is the same thing as pencil lead, just in crystal form. Diamond is the hardest natural material known to man and has many industrial uses, such as to drill for oil. It also used to cut and polish other diamonds.

About 11 to 12 tons of diamond are produced from the earth every year; only about 2 tons of this are of gem quality. To recover this quantity, 200 million tons of ore have to be shifted. The sale and distribution of only 40% of the world's production of rough diamonds is now controlled by the Diamond Trading Corporation (DTC). This reduction has been brought about by political changes and has limited the previous broad control that they had a few years ago, enabling them to oversee the supply of diamonds into the market and maintain price levels.

Their sale of rough is still through 'sights' held ten times a year in London and South Africa. 'Sight holders' are registered dealers who attend. They are offered a 'packet' of stones, a mix that is as near as possible to the holder's requirements; the packet, however, must be accepted as presented or they will lose their registration. De Beers have mines in Botswana, South Africa and Canada.



Rough diamonds. (Photo: AH)

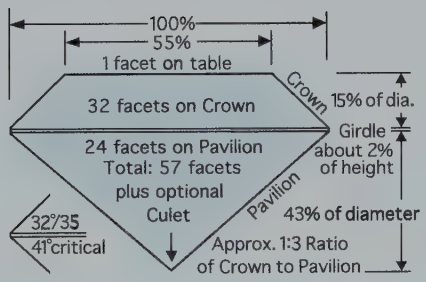
The 4 Cs: Colour, Clarity, Cut and Carat

Colour – What colour is a diamond? Blue, yellow, red, pink, brown, green, black? It can be any of these; but I expect that the one in your ring is colourless. Even 'colourless' diamonds are graded into nine different shades, the finest being exceptional white, with cape or tinted colour (a yellowish tinge) as the lowest. These differences are caused by the varying percentages of nitrogen in the stones, the best stones having the least nitrogen content. Most stones you see are 'white' or 'commercial white'. However, the colour grading system currently in use is that developed by the Gemmological Institute of America (GIA). This uses letters from D through to Z, where D is the best; the letters A-C have been reserved in case superior colours are ever discovered (*see also* Appendix 6 – Diamond Values). With the increased popularity of coloured diamonds, the GIA has introduced a colour grading system. Colour is judged by the use of a set of 'master stones' in a special light box. A grading system for all coloured gems has now been introduced by the American Gem Trade Association (AGTA).

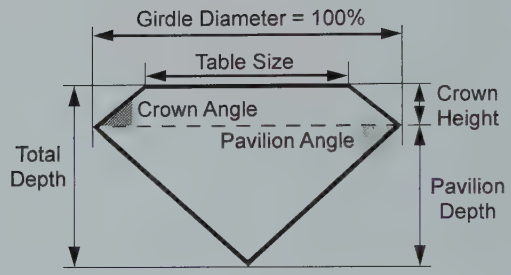
Clarity – This refers to the 'cleanness' or purity of the stone. Most gemstones contain small impurities, or inclusions; in diamond, these are usually small pieces of black carbon, though they can contain other things. Lasers can be used to burn out carbon inclusions from

Table 9 Diamond Clarity

Flawless (FL)	Shows no inclusions or blemishes under the 10x loupe
Internally flawless (IF)	Shows no inclusions and only insignificant surface blemishes under the 10x loupe
Very very slightly included (VVS)	Contains minute inclusions that are difficult for an experienced grader to see with a 10x loupe
VVS1	Contains inclusions that are extremely difficult to see
VVS2	Contains inclusions that are very difficult to see
Very slightly included (VS)	Shows minor inclusions under a 10x loupe.
VS1	Contains inclusions that are difficult to see
VS2	Contains inclusions that are somewhat difficult to see
Slightly included (SI)	Contains noticeable inclusions under 10x loupe
SI1	Contains inclusions that are easy to see
SI2	Contains inclusions are very easy to see, even with the naked eye.
Imperfect (I) (also known as 'piqued')	Contains obvious inclusions under 10x loupe, which can often be seen easily with the naked eye. They may seriously affect the stone's potential durability or are so numerous they affect the stone's transparency and brilliance.
I1	Beauty and durability are somewhat affected.
I2	Beauty and durability are seriously affected.
I3	Beauty and durability are very seriously affected.



The proportions of an ideal cut diamond brilliant.



Details of the brilliant cut. (Image: courtesy of Gem-A)

a stone to improve its appearance, though this will not necessarily improve the clarity grading and may reduce the value by 15% to 40%. A very comprehensive, if complex, grading system for all coloured stones has now been introduced by the AGTA. However, this is not for the amateur. Grading is also sub-divided into nine classifications, the top grade being pure or flawless. In fact, this means that no inclusions are visible using a ten-times magnification lens or loupe, though the stone may well have some inclusions visible under a microscope.

'Pique' means pricked, containing small inclusions usually visible to the naked eye. There have been several versions of colour and purity grading over the years and it varies from country to country, but the one issued by the GIA (and featured here as Table 9) is generally accepted at the moment.

As you can see, the distinctions between various degrees of colour and purity are open to a fair amount of expert judgement by the diamond grader and are not something that the layperson can judge for themselves. The tables are given purely as a guide to the meaning of the various terms used when describing stones.

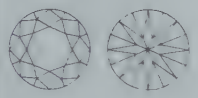
Cut – This, as it sounds, simply describes the way that the stone is cut. For a diamond to display its full beauty and sparkle, the cut has to be correct and follow certain proportions. If a diamond is faceted at the wrong angles, which does sometimes occur to minimise wastage with an awkward piece of rough, it will not give the required dispersion and will affect the fully-internal reflection necessary to allow the diamond to show its full fire. A shallow cut stone is termed a 'fish eye'. Due to the diamond's high refraction and dispersion, all light falling upon it, providing it is correctly cut, is reflected internally; no light should leak out of the back of the stone. If you look full onto the face of a correctly cut diamond, you cannot see through it. Ideal proportions differ, dependent on the refractive indices of the gem, so what is ideal for diamond is not, for instance, ideal for cubic zirconia.

Table 10 gives some of the various cuts that you will come across. These cuts apply equally well to coloured gemstones. In the USA, the quality of the cut is often referred to as the 'make'.

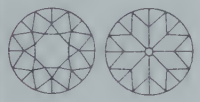
This is only a small selection of the great number of cuts that have been used in the past and new styles are still being developed. Recently, new variations of the standard brilliant cut have been marketed; one of these is the 'Eternal Cut' – designed by Gabi Tolkowsky for Asprey & Garrard, it has 81 facets compared to the standard 57.

A Japanese company claims to 'change' the colour of its diamonds by increasing the number of the facets to 86, making a deeper stone in the process. This alters

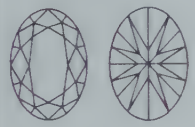
Table 10 Standard Gemstone Cuts



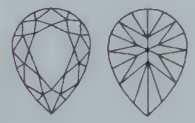
Brilliant Cut
The commonest cut for diamonds and several other gemstones. It consists of a total of 57 facets. Modern brilliants have larger table facets than earlier brilliant cuts.



Old European Cut
An early form of brilliant cut showing the small table facet. Found mostly in antique jewellery.

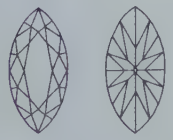


Oval Brilliant Cut
Used for many gemstones including diamond.

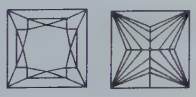


Pear Brilliant Cut
Another common cut, also known as a 'drop'.

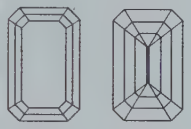
Heart Brilliant Cut
A popular cut for engagement rings and used for many gemstones.



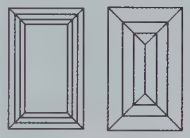
Marquise Cut
Also called 'navette' or 'boat shaped'.



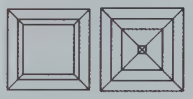
Square Brilliant Cut
Also known as 'Princess Cut'.



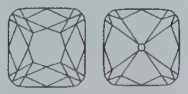
Emerald Cut
So named as it is commonly used for emeralds to show the 'garden' of the stone.



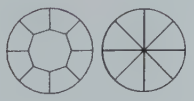
Baguette Cut
Also called 'Step Cut'.



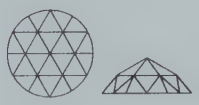
Square Cut – or Carre



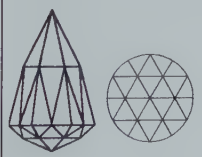
Old Mine Cut
An old style cut usually found in antique jewellery.



Eight Cut
Used for small stones where a full brilliant is impractical.



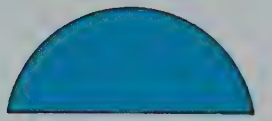
Rose Cut
A very old cut dating from before the 16th century. Mainly used for diamonds, being an economical cut. The Victorians also liked blood-red pyrope garnets cut in this style.



Briolette Cut
A variation of the rose cut in extended form.

Examples of concave-cut cubic zirconia. (Photo: CA)

Types of cabochon



Simple

Double

Hollow

Example of Jasper cut as a cabochon. (Photo: KW)

the refraction of light through the gem, accentuating a particular spectral colour.

All faceting of gemstones is carried out in a similar manner, though diamonds are so much harder that they are handled slightly differently. Large diamonds are often cleaved: a hammer and chisel are used to split the gem along natural cleavage planes within the stone. A skilled cutter can take days to decide where he will strike the stone; a wrong choice and the diamond will shatter. Once a large stone has been cleaved, it is handled in the same way as a smaller stone. First, it is sawn to a rough shape, then ground into a double cone. Then the stone is passed to the polisher, who cuts the facets onto the stone before polishing it. These last two operations are carried out on a lap – a rotating metal disc similar to a potter's wheel – impregnated with diamond powder of decreasing fineness.

In some countries, gemstones (though not diamonds) are cut using a jamb peg: a pear-shaped block of wood covered with holes in calculated positions. The 'peg' or dopstick, onto which the stone is attached with a special wax, is then inserted in the appropriate hole and the stone fed onto the rotating lap.

Concave faceting is a startling new style of cutting, but availability is limited. Four examples are shown here, but there are many variations.

Mention should also be made here of the cabochon, which, though not used for diamond, is used for many translucent minerals or those showing particular characteristics such as 'star stones'. It was fashionable at one time to cut sapphire in this manner. The cabochon is a dome – sometimes steep, sometimes shallow – the name coming from the early French for 'head'.

Table 11 Weights of Brilliant Cut Diamonds

Approx. Wt.	Diameter
0.01 ct	1.4 mm
0.05 ct	2.4 mm
0.10 ct	3.0 mm
0.25 ct	4.0 mm
0.50 ct	5.1 mm
0.75 ct	5.8 mm
1.00 ct	6.4 mm
1.50 ct	7.4 mm
2.00 ct	8.1 mm
2.50 ct	8.7 mm
3.00 ct	9.2 mm
3.50 ct	9.8 mm
4.00 ct	10.2 mm

Carat – Diamonds are weighed in carats; this is the recognised international standard. (In fact all gems are weighed in carats other than pearls, which come under a different classification and are weighed in grains.) A carat is ⅕ of a gram and is sub-divided into 100 points; there are 5 carats to a gram and 32 grams to a troy ounce.

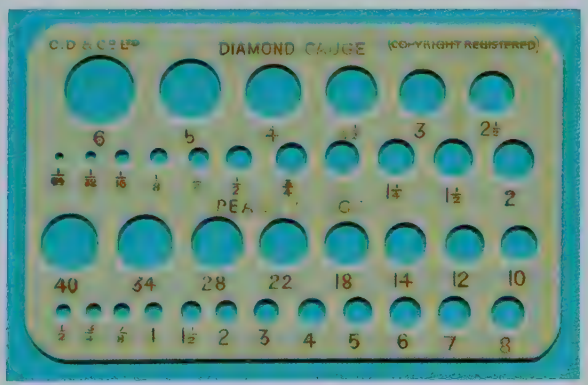
So why 'carat'? It is believed to have originated from the use of the dried seeds of the 'locust pod' tree (*Ceratonia siliqua*) by early stone dealers to weigh stones due to the seeds' weight being so consistent – approximately ⅕ of a gram. The 'metric carat' was finally standardised in various countries in the late 19th and early 20th centuries. The carat weight of stones should not be confused with the karat purity of gold, although the terms are derived from the same source. Originally also called 'carat', karat with a 'k' was introduced in the USA to avoid confusion.

An approximate guide to the weight of a round diamond can be gauged by measuring the diameter of the stone. Table 11 lists weight against diameter in

Table 12 Comparative Sizes of Gems

Gemstone	%	Overall Size
Iolite	25.85	
Quartz	24.72	L
Aquamarine	23.58	A
Emerald	23.01	R
Tourmaline	13.35	G
Kunzite	8.81	E
Moissanite	8.52	R
Peridot	5.11	
Tanzanite	4.83	
Diamond		*Reference*
Topaz	-0.57	
Spinel	-2.56	S
Hessonite	-3.69	M
Pyrope	-6.53	A
Demantoid	-9.09	L
Ruby	-13.35	L
Sapphire	-13.35	E
Zircon (Normal)	-28.98	R
YAG	-30.11	
Cubic Zirconia	-58.52	

The comparative size of popular gems compared to diamond of equivalent weight e.g. a 1 carat ruby is 13.35% smaller overall than a 1 carat diamond.



A gauge. (Photo: KW)

millimetres. It only applies to diamonds cut to near ideal proportions. It does not apply to other gems as their weight varies with their density.

An inexpensive gauge is available for measuring the size of diamonds (providing that they are ideal cut) and pearls, as illustrated.

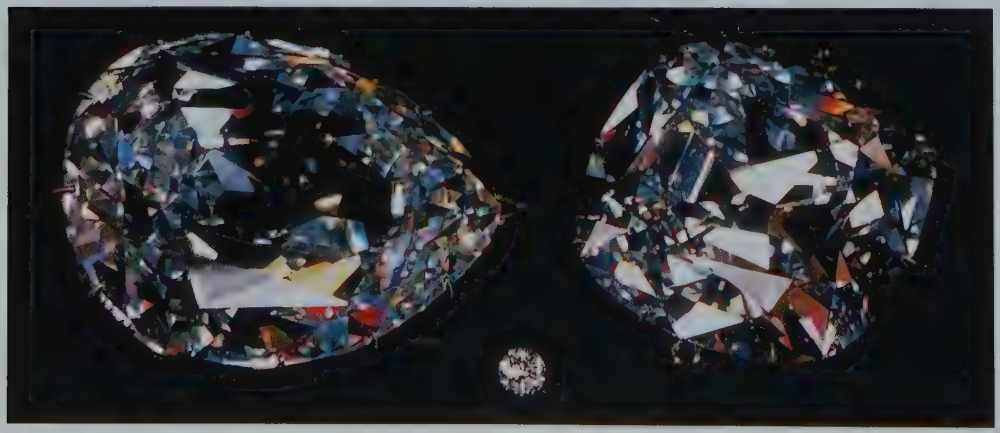
All the '4 Cs' should be taken into account when assessing a stone's value, and this can vary widely between the same size of diamonds. A one-carat stone can be worth from a couple of hundred pounds to many thousands of pounds. Some coloured diamonds, termed 'fancies' by dealers, can rate £30,000 per carat. The rarest coloured diamond is red, followed by green, blue, pink and yellow. There is not a set rate per carat, however: smaller stones rate a low price per carat, and the larger the stone, the higher the carat price.

Famous stones

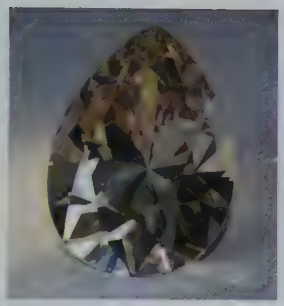
Perhaps the most famous 'fancy' is the dark blue Hope Diamond, weighing 44.5 carats, which is now on view in the Smithsonian Institution in Washington, USA. It has a reputation for being unlucky and a long history. It is believed to have been part of a large blue diamond found in India by a 17th-century merchant, Tavernier, who travelled widely and had a great interest in precious stones; it weighed 112 carats in the rough. On Tavernier's return to France, he sold it to King Louis XIV, together with some other stones. It was named 'The Blue Diamond of the Crown' and Louis had it cut to improve it, reducing its weight to 67.5 carats.

The diamond was lost during the French Revolution, but in 1830 a similar blue diamond turned up in London, this time only weighing 44.5 carats. It had obviously been recut. Henry Thomas Hope, a banker, bought it for £18,000. Hope's son lost his inherited fortune by investing badly and the gem was sold to the Sultan of Turkey for £80,000. In 1911, it was sold to an American widow who was reported to have lost her only child in an accident, her family broke up and she lost all her money before committing suicide. In 1949, it was bought by Harry Winston, the famous American dealer in New York. He exhibited it at many events world wide, before donating it in 1958 to the Smithsonian, where it now resides, worth several million dollars.

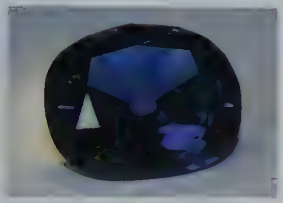
Another blue diamond is the Wittelsbach-Graff, which now weighs 31.06 carats, is internally flawless, and a deep blue (as opposed to the grey blue of the Hope). It has been on display recently, after years in private hands. Its history dates back to the 1600s, but its source is uncertain. Originally 35.56 carats, it was recut by the present owner,



The real Cullinan 1 (left) and 2 (right), shown alongside a one-carat diamond for comparison. Shown actual size. Cullinan 1: 58.9 mm (2⅜ in.) long, 45.4 mm (1¾ in.) wide, 530.2 cts. Cullinan 2: 45.4 mm (1¾ in.) maximum diameter, 40.8 mm (1⅝ in.) minimum diameter, 317.4 cts. (Photo: AJ)



CZ model of the Taylor-Burton diamond, a 'D' flawless stone, weighing 69.42 cts. This stone was famously given by Hollywood actor Richard Burton to Elizabeth Taylor in 1969. A YAG replica was made for everyday wear. Elizabeth Taylor sold the diamond in 1979 for approximately $5 m in order to raise funds to build a hospital in Botswana. Shown actual size. (Photo: RH)



CZ model of the famous Hope diamond. Shown actual size. (Photo: RH)

Laurence Graff, to improve its brilliance, clarity and grade.

There are many interesting histories associated with large diamonds and some stones can be traced back as far as the 15th century.

The largest diamond found was the Cullinan, weighing an astonishing 3,106 carats when discovered in the Premier Mine near Pretoria in South Africa in 1905. The Cullinan was cut into 9 major stones and 96 smaller brilliants. Presented to King Edward VII, the largest of the major gems was named the 'Star of Africa' (Cullinan 1; 530.20 carats), which was mounted in the sceptre of the British Crown Jewels; the next largest (Cullinan 2; 317.40 carats) was set into the Imperial State Crown. In fact, all of the nine major stones are either in the British Crown Jewels or in the personal possession of the British Royal Family. The Premier Mine continues to produce remarkable stones; as recently as 2009, one of 507.55 carats, together with three other quality diamonds ($168,58.50 and 53.30 carats), were found.

Lesotho, an independant kingdom enclaved within South Africa, produced a diamond rivalling those from the Premier Mine in 2006. It was called the 'Light of Leseng', weighed 478 carats and sold for $18.43 million.

Cullinan Diamond: a model of the rough stone as found in South Africa in 1905 with models of all the major stones cut from it. Centre left is the 'Star of Africa' with Cullinan 2 to its right. (Photo: DTC)

The famous 'Koh-i-Noor' emanated from India in the 14th century, passing through many hands before being presented to Queen Victoria in 1850. It now resides in the Queen Mother's crown. It has been recut several times; its current weight is 105.602 carats. Another diamond found in India at about the same time was the 'Great Mogul', weighing a massive 793 cts when found; its present whereabouts are unknown.

Diamonds have always been glamorous, not least that given by Richard Burton to Elizabeth Taylor. This famous 'rock' weighed 69.42 carats and was bought for $1 million. Over the past 15 years, some very large diamonds have been sold – the 'Mouawad Splendour', of 101.84 carats, sold for $12,800,000, while the 'Star of the Season', of 'D' colour and weighing an enormous 100.10 carats, sold for an equally enormous $16,548,750. (To read more, see *Famous Diamonds* by Ian Balfour, published by Antique Collectors' Club in 2008.)

Improvements

I have already mentioned, under 'clarity', how lasers can be used to remove unwanted inclusions, but this can leave a minute hole in the table that is sometimes possible to see with the 10x loupe. The vertical drillings may also be seen through the side of the stone unless they have been filled. This treatment is permanent, but does not affect the colour of the stone.

The colour can also be enhanced. This is done by the application of colour coatings to the surface as well as by irradiation and annealing.

Irradiation can produce attractive colours from indifferent stones commonly green. Brown or off-colour diamonds can sometimes be made colourless or an improved colour by heat treatment under high pressure, known as 'HPHT'. Interestingly, brown diamonds have always been frowned upon, but within recent years fashion has decreed they are now acceptable with the advent of 'champagne diamonds' notably marketed by Argyle Diamonds in Australia. A grading chart is issued, ranging from C1 to C2 light, C3 to C4 medium, C5 to C6 dark and C7 'fancy cognac'. They are, in fact, similar in colour to smoky quartz. Of course, the production levels of the various colours and shades produced – brown 80%, yellow 16%, colourless 2%, grey 3%, pink and green less than 1% – goes some way to explain this interest in brown stones.

As stated previously, the rarest diamond, in nature, is the red, with only about 50 genuine stones existing. When available on the market, they rate hundreds of thousands of pounds per carat. A process has recently been developed capable of producing a red diamond from certain 'naturals'. The girdle of the stones over half a carat are laser engraved to identify their true source. Prices are low compared to a natural red.

Surface fractures may be filled with glass-like fillers; this treatment is one to avoid – it is not permanent and can be damaged by ultra-sonic cleaning.

Any of these improvements must be declared by the vendor and noted on the sales receipt.

As most treatments apply to virtually all gemstones these are described in more detail in a later section on Buying Gemstones.

Chameleon diamonds are those that exhibit a colour change when exposed to different lighting conditions and heat. They are comparatively rare, with larger stones extremely so. Mainly of interest to collectors and gemmologists, they are usually of olive green in colour with a change to shades of yellow. Although the change due to light is fairly easy to show, temperatures of around 250 degrees Celsius. are required to demonstrate that caused by heat; generally only available in the laboratory. These properties are known as photochromism (light) and thermochromism (heat) and stones must show both to qualify as chameleon.

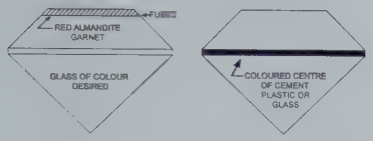
When is a Diamond not a Diamond?

Like any other precious thing, fakes, forgeries and look-alikes abound. First, it is important to understand the difference between a simulant and a synthetic. All gemstones are a chemical compound and, as such, have a chemical formula. For instance, quartz (of which citrine and amethyst are a couple of the varieties) is silicon oxide, diamond is carbon, ruby is aluminium oxide and so on. Each one contains certain impurities that cause variations in colour. A simulant is a stone that pretends to be another, but is of different chemical composition. Any stone, natural or otherwise, masquerading as another is called a simulant; common simulants are glass and plastic.

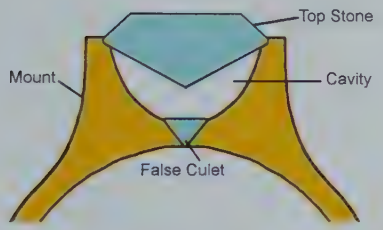
A synthetic is a stone grown in a laboratory and may be a chemical equivalent of the natural stone, or a completely new chemical compound not known in nature. Many of these man-made gems, particularly those with no equivalent in nature, are used to simulate diamond.

The names of the synthetic materials tend to be rather unattractive. This is why, for example, Yttrium aluminium garnet (YAG for short) is marketed as 'Diamonair', 'Geminair' and 'Diamone', and GGG (Gadolinium gallium

Examples of composite stones



Doublet *Triplet*



Piggy-back stone (rare)

garnet) is marketed as 'Galliant', to name but two of many. (Originally, both GGG and YAG were called 'Diamonique', but this is now the trademark name for cubic zirconia owned by QVC, the TV shopping company.)

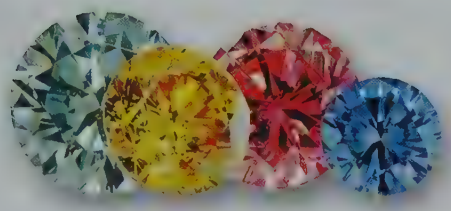
All these stones are very attractive. A few were first developed for the laser industry and found their way into the jewellery market. Their main drawback is their hardness, or lack of it. They are much, much softer than diamond and, remember, it is a diamond's hardness that gives the sharp edges to the facets, which last and last; as the song says: "Diamonds are Forever". After several years, wear on the softer synthetic stones will round off these edges.

The emergence of cubic zirconia (CZ) in the mid-seventies made an enormous and serious impact on the trade. Its characteristics are very close to that of diamond, except that it is heavier, size for size. However, the extra weight is of little consequence when set in jewellery, as most are. Many jewellers were conned by these new synthetic stones until the introduction of economically priced test instruments. CZ has now taken its place in the shops as an accepted 'jewel' and is available in a variety of colours, the yellow being a very convincing simulant of yellow diamond. Though it has been reported that CZ has a tendency to take on a grey tone after prolonged exposure to daylight.

Synthetic Moissanite is also available, although, due to its higher price and the availability of synthetic diamonds, it has lost some of its attraction. However, it is the hardest of the simulants, with an amazing dispersion. It is doubly refractive, which helps to distinguish it from diamond, and it is heavier. As it does not come in a colour better than 'J', it may appear slightly yellowish. Black Moissanite, as well as cubic zirconia, is now produced to simulate black diamond, following the fashion trend towards the wearing of black gemstones, of which there are several alternatives, e.g. tourmaline, onyx, Paris jet, obsidian.

I should make it clear that these simulants are not produced with the intention of fooling anybody, but as a relatively inexpensive alternative to the real thing, although Moissanite still retails at a high price, several times that of CZ and YAG. This price is now being challenged by the rapidly increasing production of synthetic diamonds. The danger comes when unscrupulous dealers purchase them with the direct intention of defrauding the unsuspecting

Thermal conductivity tester. (Photo: KW)



Chatham-created diamonds. (Photo: Chatham)

buyer by selling them on as genuine diamonds. Diamonds are now usually tested.

Genuine gemstones, such as rock crystal, white sapphire, white topaz and zircon, are also sometimes offered as diamonds.

Even diamond crystals have been faked. Recent cases have occurred where realistic rough diamond shapes – including octahedral – have been created from phenakite, an unusual mineral of the beryl family. The worrying factor in this case is that the fakes have, on occasion, tested positive as diamond when checked with a thermal tester. Phenakite is not the only mineral to give a diamond reading with the thermal tester; topaz may also do the same. This misreading can occur where the stone being tested is cold and has not been allowed to reach room temperature. The lesson here to all laypersons is never to buy rough diamonds if they are offered. In the past, fake crystals have also been sold made of glass. Beware!

Mounted stones can also be suspect. Always view enclosed settings where the girdle cannot be seen with caution. Diamonds as well as many other gems can be made as 'doublets'. This is where a slice of genuine stone is fused to a body of a cheaper material, such as glass or quartz, to form a table, which to cursory inspection could give the impression that the whole stone is diamond. This fools testers like reflectometers.

A rare diamond forgery is the 'piggy-back' designed to give the appearance of a large stone when, in fact, it consists of two separate pieces.

Diamonds can now be grown in the laboratory. Although experiments began in the 19th century, successful manufacture only began in the 1950s and viable commercial processes have only been achieved within the last 20 years. The main suppliers are Chatham Created Gems, who produce 500 carats of synthetic diamond rough of all colours a month. Manufactured in China under licence, each of their stones over 50 points or half a carat is engraved on the girdle to identify them.

Gemesis in the USA also produces yellow diamonds, similarly engraved. Both companies use the HPHT method of growth. Another major player is Apollo Diamonds, who use the term 'cultured' for their

Table 13 Some Names Used for Diamond Simulants

Trade Name	Synthetic Stone
Czarite	CZ
Diagem	ST
Diamante	CZ
Diamonaire	YAG
Diamond aura	CZ
Diamond Essence	CZ
Diamone	YAG
Diamonique	YAG, CZ
Diamonite	CZ
Diamonte	YAG
Fabulite	ST
Geminair	YAG
Phianite	CZ
Regulaire	YAG
Tru-Diamond	CZ

CZ = (Cubic Zirconia)
ST = (Strontium Titanate)
YAG = (Yttrium Aluminium Garnet)

Doubling of back facets in moissanite. (Photo: AH)

product. They use a process called 'Chemical Vapour Disposition' (CVD), which, they claim, produces a higher-quality stone. It is believed, however, that there are many other companies of varying size also producing synthetic diamonds. As yet, white stones are more expensive to produce than coloured ones, so less competitive with the natural gems. Consequently, most 'created' diamonds on the market are coloured. This situation will continue to grow so, if you are buying large diamonds for investment, be sure to obtain a certification from a recognised test laboratory.

At the moment, the cost of the equipment to manufacture 'laboratory diamonds' is very high but new methods are reducing these costs. It is only a matter of time before synthetic diamonds are as commonplace as synthetic rubies and emeralds. However, the effect on the diamond market is not expected to be any more severe than that that has been caused by other synthetic gems. The gemmological laboratories, such as the Gem Testing Laboratory of Great Britain, GIA and particularly De Beers, are keeping ahead of these developments and will continue to protect the trade against unscrupulous traders, producing sophisticated test instruments to identify these synthetics. De Beers have now opened 'Forevermark' diamond grading laboratories in Antwerp, Belgium and Maidenhead, UK (their long-established research labs) for the grading of selected diamonds. These may be inscribed with an icon and unique identification number and be accompanied with a detailed grading report. This will surely be of great help to serious investors to whom this type of assurance is imperative.

There are many more synthetic gems produced, whose names usually beginning with 'dia-', though this is illegal, a fact that is generally ignored. It should also be remembered that when 'diamond' is prefixed with a name, i.e. 'Saudi Diamond' or 'Bristol Diamond', these are not actually diamond, but generally quartz.

One new development in the sale of cubic zirconia is Czarite, produced by the famous crystal producers Swarovski. They claim to cut their CZ at its ideal proportions giving it maximum brilliance. A 'Starscope' is provided with the stone so that you can view the pavilion of the gem through it and see the 'star' so formed. A real diamond will not show this 'star' because it is cut to its own ideal proportion, which are different to CZ.

All this leaves a question in your mind – do you want a real diamond that took millions of year to develop in the earth and laboriously mined, or one that is churned out by machine in the factory?

Just as a parting thought on diamond – a company in the USA is offering to add some of the ashes of your dear departed into a synthetic yellow diamond made to order. The stones, made in a range of sizes, run into thousands of pounds depending on carat size.

Telling the Difference

How can the layperson distinguish a real diamond from the many simulants and synthetics? Here are a few tips:

1. Place the stone, preferably unmounted, table up on a piece of printed paper. If you can see the print through the table, it is not a diamond. This only works with a well-cut, modern, round, brilliant but not with old cut stones and fancy cuts. Beware, some less well-cut CZ and moissanite stones will pass this test.

2. Ensure that the stone is clean. Take a black felt-tip pen and draw a line across the table of the diamond. If the line breaks up, i.e. is not continuous, the stone is unlikely to be a genuine diamond. This is because diamonds have an affinity for grease, a property used for sorting them at the mines: a greased conveyor belt is used so that the diamonds stick to it and the rubbish does not. This form of sorting is now being replaced by X-ray.

3. Look at the facets through the 10x loupe; if they are rounded and not sharp or show signs of chipping, the stone is probably not genuine. This chipping occurs particularly with zircons so is a good method of identification. However, if the diamond is old, it may show signs of chipping.

4. Moissanite and zircon are doubly refractive and careful study of the stone through the kite facets will show a doubled image of the opposite facet edges. Diamond, of course, is singly refractive.

5. Cubic Zirconia is heavier, size for size, than diamond.

6. Cubic Zirconia is often identified with the use of a thermal conductivity tester. As this instrument is expensive, a simple (and cheap) way to test a diamond is to hold the stone in tongs and touch it with the tip of your tongue. Diamond will feel much colder than simulants (except Moissanite). Another way is to breathe on the face of the stone; the condensation will clear more rapidly on the diamond.

7. Looking at the depth of colour under the loupe may identify irradiated diamonds, commonly green although other colours may be seen. Irradiation is a surface enhancement, so the shallower parts of the stone, i.e near the girdle, may appear darker.

8. Check for engraved girdles on larger stones.

Alan Hodgkinson, President of the Scottish branch of Gem-A, developed a startling method of identifying diamond from any other colourless stone in the mid-seventies called 'Visual Optics'; with a little practice, it is within the grasp of a keen layperson.

You require a darkened room and a single point of light positioned at a distance from your seat; a torch or even a candle will do. Hold the crown or table facet of

Diamond. (Photo: AH)

Moissanite. (Photo: AH)

Cubic Zirconia. (Photo: AH)

Cartier brooch. Example of diamond flourescence under long-wave ultra-violet light (centre stone is not diamond). (Photos: AH)

the suspect diamond as close to your eye as possible (touching your eyelashes) and look at the light, closing your eye to a narrow slit, so that all you can see is the light coming through the stone. Slowly move your eye around the stone until you see an image. This will require a bit of practice but it is worth persevering.

The random pattern of tiny sharp images in diamond is entirely diagnostic. No other gemstone shows this. So, if this is what you see, you have a diamond. Any other pattern tells you it is not diamond. The larger blurred flakes in synthetic Moissanite give it away immediately. The singly refractive CZ is again so different to diamond that identification is simple.

In the case of diamond and synthetic moissanite, the pattern is formed by secondary reflections due to the high refraction, but the patterns seen in CZ are primary reflections from the pavilion facets due to its lower RI.

No other gem will give you the same pattern as diamond (except synthetic diamond). The technique also works with set stones, unless they have a closed back. Larger stones are easier to handle but, with practice, quite small stones may be identified using this method.

The 'Hodgkinson Technique' works with all transparent gemstones, coloured or not, but for the purposes of this book we will only consider its use with identifying diamonds.

Just one point of interest before we leave diamonds: some diamonds fluoresce under ultra-violet light (sometimes used in discos); usually blue or yellow, but not all, so don't worry if one stone in your ring fluoresces and the others don't, it doesn't matter.

Major sources for diamond are Botswana, Russia, Canada, South Africa, Brazil and Australia.

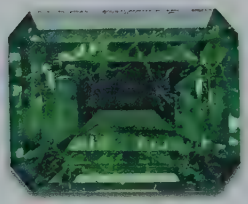
A pear-shaped, cabochon-cut Canadian emerald (2.10 cts), enlarged to show 'garden'. (Photo: TNG)

EMERALD

Emerald is a member of the Beryl family, which consists of Beryl (commonly green) itself, Aquamarine (blue), Morganite (pink), Heliodor (yellow) and Goshenite (colourless). Only green Beryl containing chromium is classed as emerald, because it is this impurity that gives the gem its beautiful colour.

Emerald is rarely free of inclusions and these are sometimes referred to as the 'garden' of the stone. Colour is all-important in emerald, inclusions are secondary. Look through the table of one with a magnifying glass and explore; it can be a wonderland. A perfect emerald can outrank a diamond in value.

Fractures are also common, which raises the



Colombian emerald showing typical 'garden'. (Photo: RH)

controversial subject of filling. Filling has been used for very many years but now commonly consists of an epoxy resin. Oils are often used to improve the appearance. Arguments have been going on in the trade as to whether filling or oiling should be declared. The general feeling is no, but agents to improve the colour must be stated.

Emeralds must be handled with care: any oil used to improve the appearance will be removed by overheating or detergents, so be careful. Diamond coating is now available to give greater resistance to wear, allegedly increasing the surface hardness to 9.6-9.8.

Ultrasonic cleaners should also be avoided, as they can cause the stone to shatter, so specify this to your jeweller should you take your jewellery in for cleaning

Brazilian emeralds, 46 pt and 44 pt. (Photo: ATG)

or repair. A reputable jeweller will already be aware of this. Even repairs to a ring where heat is required can damage any filling the stone has received and weaken it. However, sometimes it is possible to replace the filler and re-oil the stone.

The current sources of emerald are Colombia, Brazil, Russia, Australia, South Africa, India, Afganistan and Zambia plus a few minor sources. Recently, finds of gem quality have been made in Canada. A rare form of emerald, the Trapiche (tra-PEE-chee), is only found in Colombia. Its name comes from the spoked cog-wheel used to grind sugarcane, as the stone displays a spoke-like pattern, which gives a six-pointed star effect.

Large emeralds are very rare, particularly those of good colour. One of the biggest found in the early 19th century in Colombia was the 'Devonshire', which weighed in at 1383.95 carats uncut.

Fracture-filled stone. (Photo: RH)

Fakes and frauds

Because emerald is such a valuable stone, simulants abound. The value and popularity can be judged by the enormous trade in smuggled stones costing

Cartier brooch. Carved emeralds, amethysts and diamonds c.1940. (Photo: WL)

governments, such as that of Brazil, hundreds of millions of pounds a year.

Common simulants are doublets and triplets, as shown earlier; 'Soude' emeralds take their name from the French *emeraude soude* (soldered emerald) and are an early simulant, less common today. They consist of a quartz sandwich cemented together by a green gelatine layer.

Several companies produce synthetic emerald legitimately, the best known being the American company Chatham. (Gilson, which was one of the forerunners of synthetic emerald, was taken over by Chatham in the late 1990s.) Originally synthesised in

the early 20th century, it was only with the emergence of Gilson and Chatham in the 1930s that synthetic emeralds began to take their place as an accepted alternative to the natural gem in the jewellery trade.

Chemically identical to the natural stone and virtually undetectable by the layperson, synthetic emeralds sell at about a tenth of the price of the real stones. Russia and Japan also produce synthetics.

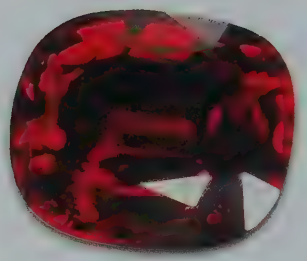
As the availability of natural emerald from the classic source of Colombia fluctuates due to mines being closed down on a regular basis caused by criminal activity, synthetics will always be there to satisfy demand for one of the most popular of gems.

The Chelsea Filter was initially developed to identify the numerous simulants from the real emerald stones, which show red under the filter due to the chromium present. However, the Gilson and Chatham synthetics also show red under the filter, but to differing degrees. Other green simulants mostly do show green under the Chelsea Filter, except demantoid garnet and zircon, which show pinkish. Chrome tourmaline, a beautiful green gem, will also show red under the filter. Yet another snag is that some emeralds contain iron and so do not show red at all under the filter. I am afraid you must rely on a gemmologist to confirm the identity.

Emeralds have always been a popular gem to synthesise and simulate so it is still possible to find early examples of these. Lechleitner synthetics consisted of a piece of faceted common beryl with a thin coating of synthetic emerald 'grown' over to give the appearance of a solid stone. This would give all the characteristics of a natural stone. These appeared in the 1960s.

Ruby

Ruby and Sapphire are chemically very similar; both are corundum, only colour differentiates them due to chromium in ruby and titanium in sapphire. The best ruby comes from Burma (Myanmar) and the best colour is



Ruby. (Photo: RH)

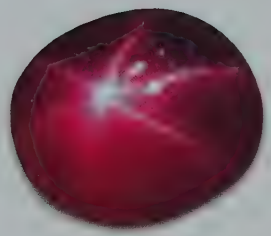
'pigeon blood', but stones of this quality are rare and very expensive. Thailand, Tanzania and Madagascar (formerly the Malagasy Republic) also produce stones but rarely of the quality of the Burmese stones. Sri Lanka, which has the greatest variety of gemstones, also provides rubies, most of which are pale, but occasionally intense reds are discovered. Pale red colours are actually classified as pink sapphire. New sources of stones are being discovered with regularity. Rubies are 'the' investment stone. Large crystals over five carats are very rare and a lot is lost in cutting, due to colour variations.

Rubies often contain inclusions called 'silk', caused by needle-like crystals of rutile. The inclusions sometimes form in such a way as to produce what is known as a 'star ruby'. These are cut *en cabochon* orientated to display the star. They are highly prized and expensive.

Of course, these can also be forged by engraving lines on the base of the cabochon and covering with a piece of reflective material or synthesised in the laboratory. Natural star stones rarely show the stars as bright and clear as the 'forgeries'.

Consequently, synthetic ruby abounds, with tons being produced every year. Chatham from the USA also produces high-quality stones that are extremely difficult to detect without laboratory help. A particularly good synthetic ruby has been produced in Mexico under the name of 'Ramaura Rubies', created by the J.O. Crystal Company. A special fluorescent dopant is added to enable identification by the gemmologist.

Rubies, diamonds, platinum and gold, c.1900. (Photo: WL)



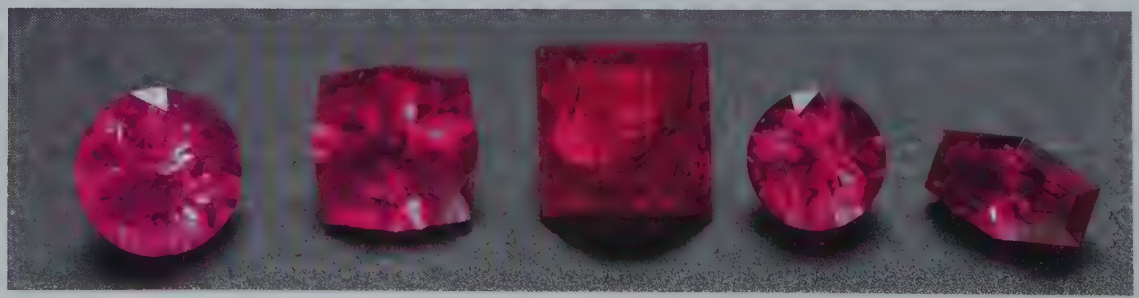
Star Ruby. (Photo: RH)

Madagascan Ruby, 1.88 ct.
(Photo: ATG/LAB)

The synthetic stones can be of such high quality that you may not mind whether you have a real ruby or not – after all, if you don't know whether the gem in your ring is real or synthetic, neither will your friends. The thing to avoid is paying the price of real for synthetic. If, however, you decide that only the real thing will do, then the only answer is to go to a reputable supplier. Inclusions and colour banding usually identify natural stones from synthetic, but of course this is the job of a qualified gemmologist. Glass filling of fractures is becoming more common, so, if a stone is being bought as an investment, then it is imperative to have it checked at a laboratory before purchase. The faking of natural rubies has been taken to a new level with synthetic ruby being purposely fractured by immersing a hot stone into very cold water and then filling these fractures with glass, therefore giving the impression that the stones are natural. The glass filling of rubies has now reached dangerous proportions, with very many in the market. They can easily deceive, being extremely difficult to identify for the layperson. Extrème care is therefore needed when purchasing – only buy from a reliable source.

Other red-coloured natural gems are sometimes confused with ruby, such as spinels and red garnets, though both of these are singly refractive and not doubly refractive as is ruby.

Ruby has been misidentified for hundreds of years. The 170-ct Black Prince's 'ruby' originally set in the helmet of King Henry V and worn at the battle of Agincourt is, in fact, a spinel; it is now set in the Imperial State Crown.



Colour range of Greenland rubies, 0.22-0.77 ct. (Photo: TNG)

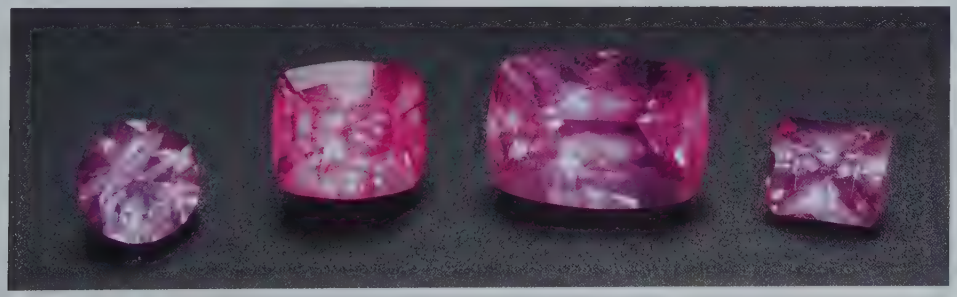
Canadian rubies. (Photo: TNG)

SAPPHIRE

Much of what has been said about ruby applies just as well to sapphire, except of course that the usually accepted colour is blue. The best colours are the rare Kashmir Blue from India and Cornflower Blue, but sapphires are also found in a range of other hues: pink, orange, yellow, green and mauve; in fact, any corundum that is not a strong red or blue is termed 'fancy sapphire'.

Sapphire is found in many places in the world: Australia (usually darker shades), Sri Lanka, Burma (Myanmar), Africa, Thailand, Canada and the USA. Strangely enough, they have also been discovered in Scotland. A colour change variety is found in Sri Lanka and East Africa.

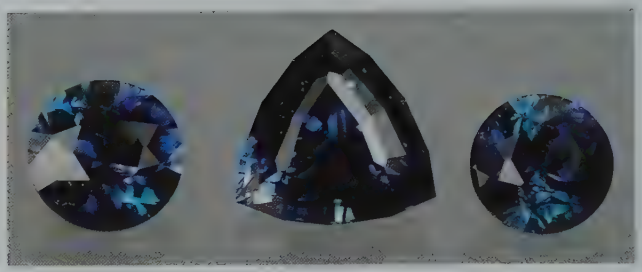
Synthetics abound; synthetic corundum is produced in a wide range of colours to simulate many gemstones.



Pink sapphires, colour range. (Photo: TNG)

Some of the many colours of sapphire. (Photo: RH)

Fancy yellow sapphires. (Photo: TNG)



Beluga sapphires. (Photo: TNG)

Chatham synthesises blue, pink, green, purple and yellow sapphire. The orange or 'padparadsha' sapphire is perhaps the most valuable gemstone when in good colour; the best have a pinkish tinge; a particularly striking stone and highly collected, it has also been synthesised by Chatham and Seiko of Japan. Yellow sapphire is also popular and difficult to identify. The majority, including the golden sapphire, are beryllium treated, so best avoided. There is also a natural colourless variety, of relatively low value, which has been used as a diamond simulant. Surprisingly, this has also been synthesised and is commonly used for watch-glasses.

Star sapphires are also produced and the remarks made about star rubies apply equally to sapphire. Colours include blue, pink, violet and brown, the near-black variety is particularly striking. As with rubies, fakes also occur of star sapphires.

To distinguish between synthetic and natural sapphire is not easy without instruments. However, it may be possible with a loupe to see the growth lines – usually curved in the synthetic stones, straight in the natural stone.

Colour zoning occurs in both natural and synthetic. Natural sapphire is strongly dichroic showing pale greenish-blue and dark blue. Chatham synthetics show violet blue and greenish-blue.

Blue synthetic spinel and cobalt glass show shades of

red to pink under the Chelsea filter, whereas sapphire shows a dirty green. Transparent blue stones that show red, orange or pink under the filter must be suspect. However, some Sri Lankan sapphires may show red due to a trace of chromium.

The darker blue Tanzanite may be mistaken for sapphire, but the strong pleochroism (three colours) should indicate the difference. Unfortunately, heat treatment of the stones can dull this effect.

Blue tourmaline and blue zircon (also heat treated) are also used as simulants. The former shows dichroism of light blue and dark blue, whereas zircon is identified by its strong 'fire'.

Sapphire in matrix. (Photo: TNG)

Ceylon sapphires, rubies and ruby beads. (Photo: WL)

The Gemstones

This section describes most of the gemstones to be found in the high street jewellers or offered on television shopping channels or over the internet. Some will only be available from specialist dealers. (A separate section deals with Minor Gemstones).

Andalusite

An attractive gemstone, the andalusite takes its name from Andalusia in Spain, where it was first discovered. It has since also been found in Sri Lanka and Brazil.

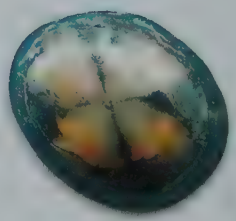
Andalusite has a hardness of 7½ on the Mohs scale, so is very suitable for a ringstone. It is extremely pleochroic: it shows different colours in different directions – yellow, green and red. If you are after something distinctive, this stone will fit the bill.

Similar shades of tourmaline are sometimes passed off as andalusite, but they lack the pleochroism.

Andalusite; note the pleochroism. (Photo: MM)

Chiastolite, an impure opaque variety of andalusite, is found in the Pyrenees. The carboniferous inclusions form a cross, hence its other name: 'Cross Stone'. It also occurs in several other locations around the world.

Andalusite has two associated gems, termed polymorphs: **Sillimanite** and **Kyanite**, which are occasionally cut and used in jewellery. Although hard, they are somewhat fragile, so the choice of mount is important.



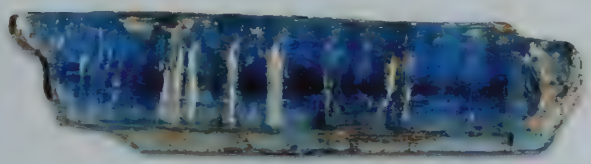
Chiastolite. (Photo: KW)

Sillimanite occurs in many countries. Rarely transparent, suitable stones for mounting are an attractive pale or violet blue.

Kyanite. (Photo: ATG/LAB)

Kyanite occurs in blade-like crystals in colours approaching the blue of sapphire. Kyanite also occurs in

a black variety. The size of cut gems is limited due to the crystal form, which has the very unusual property of having two hardnesses, 7 in one direction and 4 in the other, causing problems when faceting.



Kyanite crystal. (Photo: KW)

Anglesite

This stone's appeal is that it is one of the few gems to emanate from the UK. It is named after the island of Anglesey, off the north coast of Wales, where it was originally found in the lead mines. In the early 19th century

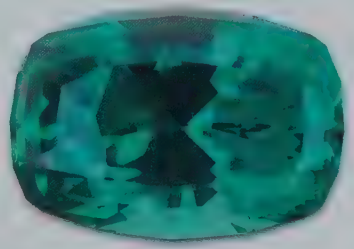
Anglesite. (Photo: AH)

it occurred in an abundance of small yellow crystals but is now no longer found. However, this stone has also been found in other parts of the UK – Cornwall, Devon, Cumbria, Derbyshire, Channel Islands, Ireland and Scotland. Further afield, it has also been discovered in Namibia, Australia, Mexico, Morocco, the USA and Switzerland.

It occurs in a variety of colours: blue, green, yellow, brown, grey and colourless. It has an amazing adamantine (diamond-like) lustre. Now for the bad news: it is very soft, only 2.5-3 on the Mohs scale. Being a lead mineral it is surprisingly heavy for its size and is brittle. Anglesite is extremely difficult to facet and is mainly cut for collectors.

Apatite

Occurs in yellow, green, blue, violet and transparent colourless varieties. With a hardness of only 5 on the Mohs scale it is vulnerable to damage unless set considerately. It can be very attractive, and has a vitreous lustre. Its name comes from the Greek



Neon blue Apatite. (Photo: ATG/LAB)

meaning 'cheat' as it is regularly confused with other stones such as topaz and tourmaline. The pale green variety from Spain is called 'Asparagus Stone'. A cat's-eye variety is also known. A popular variety, recently introduced, is neon blue apatite. The stone has also been synthesised.

It is particularly sensitive to heat and also to acids and chemicals. To improve wearability, diamond-coated stones are now available with a surface hardness of 9-9.5.

Apatite is found in several sites around the world: Burma (Myanmar), Brazil, India, Kenya, Sri Lanka, Madagascar, Mexico, Norway, South Africa and the USA.

AQUAMARINE

A member of the Beryl family, along with emerald, but of a beautiful sea blue colour. Stones are quite often greenish when found but are heat treated to reduce any green cast.

Aquamarine. (Photo: KW)

This is a very popular gem, more valuable in the larger sizes as small stones usually lack the intensity of colour. It is not subject to the included nature of emerald and quite often occurs in large water-clear crystals. It is found mainly in Brazil, Russia, Africa and the USA.

Synthetics are not particularly common, but simulants are produced in synthetic corundum, garnet-topped doublets and glass. Blue synthetic spinels also pass themselves off as aquamarine but, like sapphire, aquamarines show dirty green under the Chelsea filter not the pinkish-red of synthetic spinel. Blue topaz can also be mistaken for this gem; the only simple guide is that topaz has a very high polish and a slippery feel compared to aquamarine.

Fabergé aquamarine and diamond, c.1900. (Photo: WL)

Detail of tiara by Fouquet; aquamarine, pearl and diamond, 1908. (Photo: WL)

Axinite

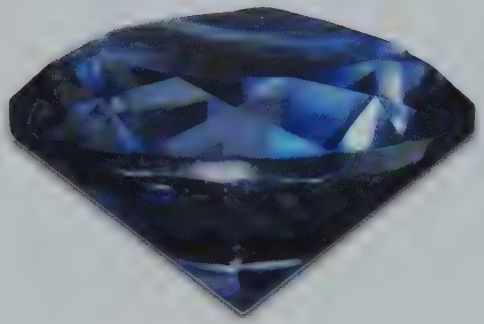
Usually found in brown, this stone also occurs in violet and yellow. It has a vitreous lustre. It is acceptably hard but brittle and fractures easily. Though rarely cut, it is available on specific websites.

Axinite has the unusual property of being pyro- and piezo-electric, which means that it attracts dust. It is also strongly pleochroic, showing three different colours depending on the direction viewed. Axinite is heat sensitive and ultra-sonic cleaning is not recommended.

Axinite may be confused with Andalusite and smoky quartz. In crystal healing circles, it is a problem-solving stone, and is associated with the name Archibald.

It has been found in Cornwall (England), France, Brazil, Mexico, Russia, Sri Lanka, Tanzania and the USA.

Axinite. (Photo: KW)



Benitoite. (Photo: NHM)

Benitoite

Discovered in America in 1907, this gem was originally thought to be sapphire due to its beautiful blue colour, but was later found to be an entirely new variety.

It has a hardness of 6½ on the Mohs scale, shows excellent fire, and is strongly dichroic (blue and colourless). Its dichroism differentiates it from sapphire, as the latter does not have a colourless ray.

Benitoite is rare as it is only found in one part of the USA. It is a very valuable and expensive gem and needs care in its handling. It is the official state stone of California.

Benitoite also occurs yellowish and colourless. It fluoresces a strong sky blue under short-wave ultraviolet light, although some crystals fluoresce dull red under long-wave. Benitoite is pleochroic blue and colourless.

Beryl

We have already discussed some of the beryllium gems, namely emerald and aquamarine, but we should also mention the lesser-known members of the same family.

Green Beryl, without the chromium that makes it emerald, is common and, because of its colour, is not particularly attractive. However, it is used in doublets and triplets to simulate emerald.

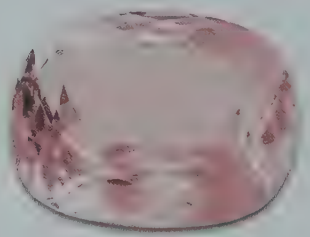
Yellow Cat's-eye Beryl. (Photo: ATG/LAB)

Yellow Beryl (Trilliant). (Photo: ATG/LAB)

Heliodor or **yellow beryls**, with shades varying from pale to rich gold, are found in the same locations as aquamarine. As with the latter it is often free of inclusions.

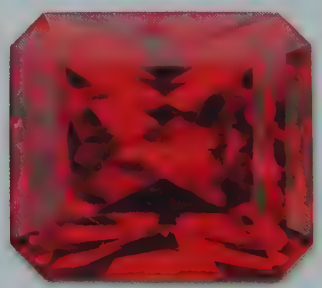
Morganite is a pink variety named after the American banker and philanthropist Henry Pierpoint Morgan. It comes in shades of rose and peach as well as pink.

Morganite is mainly translucent; cat's-eye varieties have been found. It is generally pale, though dark shades from Madagascar (formerly the Malagasy Republic) and Afghanistan may show dichroism. Its other main source is the USA. Synthetic transparent pink beryls are now grown in Russia.



Morganite. (Photo: KW)

Red Beryl or **Bixbite** in good gem quality is very rare and, as such, remains a collector's item. It is sometimes misleadingly referred to as 'red emerald'.



Red Beryl 4.66 cts. (Photo: AH)

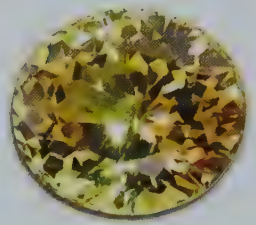
A deeper blue of beryl, darker than aquamarine, has been recently discovered in Canada. A colourless variety (Goshenite) is also found.

Charoite

Discovered in eastern Siberia near the River Chara in 1978, charoite is an opaque mineral of a very attractive violet colour with minor inclusions of other minerals. It has a hardness of 5 to 6 on the Mohs scale and takes a good polish, rendering it suitable for use in jewellery and to make carved boxes and ornaments.

Charoite vase. (Photo: AJ)

Chrysoberyl



Chrysoberyl. (Photo: ATG)

Chrysoberyl is renowned for two famous types of gemstone – cat's-eye and alexandrite.

Alexandrite is a highly prized gemstone, mainly because of its unusual feature of changing colour from grass green when viewed in daylight to rich red when seen in artificial light.

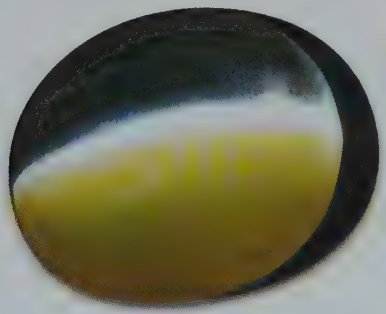
It was originally discovered in the Ural mountains in 1830. As the strongest colours are red and green, the colours of Imperialist Russia, the stone was named after Czar Alexander II, who came of age on the day it was discovered. It has subsequently been found in Sri Lanka, Burma (Myanmar), Brazil, Madagascar (Malagasy Republic) and Zambia. However, the Russian stones are still the most highly prized.

Alexandrite: seen (left) in daylight and (right) under a t ungsten lamp. (Photo: MM)

With a hardness of 7.5 on the Mohs scale it makes an excellent ring stone. It is, however, one of the more expensive gemstones, worth from about £900 per carat up.

Due to its high value, it has been the subject of simulants: both synthetic corundum and synthetic spinel

are produced in colour change copies, though neither show the strong green and red of the genuine stone. Certain doublets, consisting of rock crystal sandwiching a layer of colour gelatine, also give a colour change. These should be treated as any other doublet.



Chrysoberyl cat's-eye. (Photo: RH)

Remember, when buying alexandrite it must show a distinct colour change to be of value. The red and green of the Russian stones are rare, but good stones from Brazil show pinkish red and bluish green and are highly collected. Clarity is not as important as colour. A blue-green variety that fails to show the colour change is being offered. Chatham of the USA produces a synthetic with a good colour change.

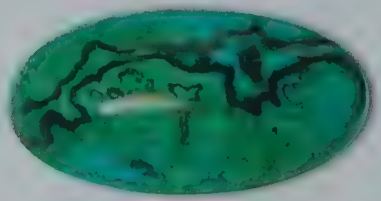
Cat's-eye is a chatoyant variety of Chrysoberyl correctly called **Cymophane**. It is usually found in shades of green or yellow; the cat's-eye effect is due to microscopic needles or canals within the crystal. These gems are cabochon cut to show the chatoyance to its full advantage, a sharp bright band across the stone. Good examples are very expensive.

Chrysoberyl also occurs as plain yellow and brown stones without cat's-eye and can be extremely attractive. Quartz cat's-eyes are sometimes sold as Chrysoberyl.

Eilat stone. (Photo: KW)

CHRYSOCOLLA

Chrysocolla is a copper mineral composed of a mix of various microscopic crystals found in a variety of colours. By itself it is too soft (H2-4) to be used, but it is found impregnating quartz or opal. In these cases the green and greenish-blue varieties, cut *en cabochon*, are very attractive. It is found in the USA, Congo, Russia, Chile and Australia. It is also occasionally found in Cornwall (England).



Chrysocolla. (Photo: MM)

Similar to chrysocolla, but an even more varied mix of copper minerals, **Eilat Stone** was supposedly found in the mines of King Solomon. It is blue to green in colour and has been compared to malachite. It is a popular souvenir for tourists. It is Israel's national stone.

Danburite. (Photo: AJ)

Danburite

Named after Danbury, Connecticut, USA where it was discovered, gem-quality danburite was actually first found in Burma (Myanmar). It has since been discovered in Madagascar (Malagasy Republic) and Mexico.

It is a very attractive, if unusual, gem in wine, yellow, pink and colourless varieties. It rates a 7 on the Mohs scale thereby qualifying as an acceptable jewellery stone. Danburite, however, does not have a very strong fire.

There are no known synthetics as yet. It is heat sensitive, so care is required when repairing jewellery set with them.

A dark orange variety has been reported from Russia but is a rarity.

Diaspore

Only recently introduced onto the market, diaspore (pronounced 'die-a-spore' or 'dee-ass-pra') is a colour-change stone similar to a medium-quality alexandrite; this mineral is also being sold under the trademarked name Zultanite. Its change from greenish-brown in daylight to pinkish bronze in tungsten light cannot compare with Russian alexandrite but still makes it an interesting gem. It has also been found in a champagne

Diaspore. (Photo: ATG/Stephen Kotlowski)

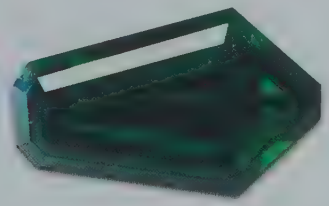
colour, similar to a pale citrine, and brown. Although known in its mineral form for some years, it was not discovered in facetable quality until 1977 in Turkey.

The major source for this gem is still Turkey, but gem-quality blue and violet Diaspore crystals have been found in Massachusetts, USA. The mineral is also found in South Africa and Norway.

Care should be taken in wearing diaspore as it has a strong cleavage and may chip if knocked.

Diopside

This is found in a variety of shades and is usually heavily included. The most collectable variety is chrome diopside from Siberia, which is a bright emerald green and sometimes called 'Siberian Emerald'. It is both beautiful and affordable, although rather soft at 5.5 to 5 on the Mohs scale. It is pleochroic (green and yellow) with a vitreous lustre. A violet colour has been found in Italy.



Chrome diopside. (Photo: MM-RH)

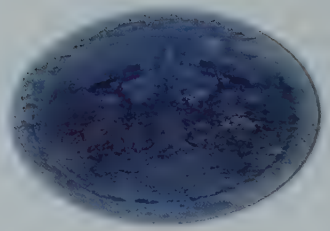
Dark green and black varieties may show a four-rayed star when cut *en cabochon*. Diopside is sensitive to heat and is rather fragile, therefore consideration must be given to mountings. It also occurs in South Africa, Burma (Myanmar), Sri Lanka, Finland and USA.

Dumortierite

Named after a French palaeontologist, Eugene Dumortier, it is sometimes called the 'blue denim stone' because of its deep blue to violet blue colouring. Rarely found as crystals, it is generally used in cabochon form in jewellery or cut into beads, eggs or spheres. It is relatively hard, averaging 7 on the Mohs scale. It may be mistaken for lapis lazuli or sodalite, though the latter contains more white areas and is less dense. Dumortierite has a fibrous nature where lapis or lazulite have not. It is used in China as a simulant of lapis lazuli.

It also occurs in a cat's eye variety and blue crystals are sometimes included in massive quartz.

It is said that when worn it gives a clear-headed approach to life and improves organising abilities.



Dumortierite. (Photo: KW)

Dumortierite is found in France, several states of America, Brazil, Siberia, India and Madagascar (Malagasy Republic).

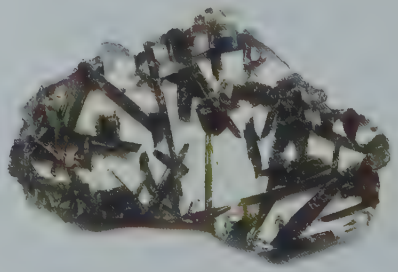
Epidote

Also known as 'Pistacite' due to its pistachio green colour, although it also occurs in brown and yellow. It is in the same family as Zoisite, a variety of which is the popular Tanzanite. A chrome-epidote known as 'tawmawite' is deep green, and named after its source in Burma (Myanmar).

It is reasonably hard and strongly pleochroic – green, brown and yellow – differentiating it from green diopside, which has only a weak dichroism.

It is sensitive to heat and acids and care must be taken when cleaning.

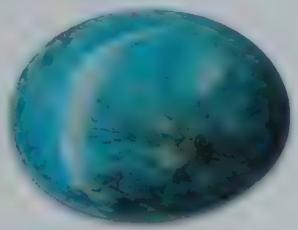
It is found widely in Europe (particularly Scandinavia), Zimbabwe, Sri Lanka and the USA.



Epidote in quartz. (Photo: MM/KW)

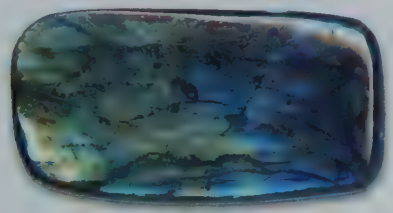
Feldspars

The feldspar group consists of about 20 members, found in abundance on Earth, though few produce gem material. The forms of interest to us are amazonite, labradorite, moonstone, orthoclase and sunstone.



Amazonite. (Photo: KW)

Amazonite is a blue-green opaque variety, mainly sourced from India and Brazil.



Labradorite from Madagascar. (Photo: KW)

Labradorite is found in Labrador, but not exclusively: Finland is a well-known locality where it is sometimes referred to as 'Spectrolite'.

It has a lovely display of interference colours of blues, greens, yellows, gold, reds and purples shining out of the grey mineral bed. There are other varieties of this stone, though they are not common.

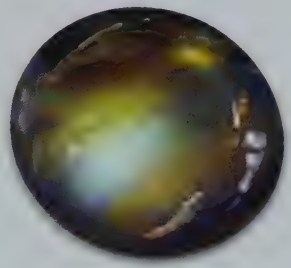
Normally opaque, transparent material has been found in the Congo and in Oregon, USA, and cut gems produced.

Moonstone is the most popular feldspar, with its beautiful adularescence, the blue schiller that drifts over an clear opalescent sea. A very romantic stone.

The effect is caused by interference of light within the stone. It is not as hard as other gemstones, about 6 on the Mohs scale, and with a relatively low density.

It is found in Sri Lanka, India, Madagascar (Malagasy Republic), Burma (Myanmar), Tanzania and the USA.

Simulants are few and should not be confused. Moonstone has identifying inclusions, sometimes called 'caterpillars'; these stress cracks are diagnostic, though not all stones have them.



Rainbow moonstone. (Photo: MM)

The best is found in Sri Lanka, where it is sometimes referred to as the 'National Stone'. Moonstone may also be found in India, Madagascar (Malagasy Republic), Burma (Myanmar), Tanzania and the USA. Rainbow moonstone, mostly from India, shows the same adularescence, but with a rainbow play of colour. Other varieties exhibit different background colours.

Simulants are few though some glass fakes are convincing except that they are singly refractive, whereas moonstone is doubly refractive.

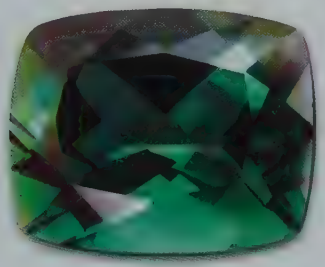
Orthoclase, also called 'Noble Orthoclase', is sometimes found as transparent golden yellow crystals with a vitreous lustre. They are rare and only cut for collectors. They are of low value.

Rough Sunstone. (Photo: ATG/LAB)

Sunstone. (Photo: ATG/LAB)

Andesine (and **Sunstone**) is similar to Labradorite. Named after the Andes, where it was first identified, Andesine mineral occurs in red, orange and green. It is the same family group as Labradorite (plagioclase).

Controversially, it has recently become clear that some red and green andesine are probably treated. Sunstone is often streaked with red but the only true natural red Andesine of gem quality is found in Oregon, USA, and is very rare.

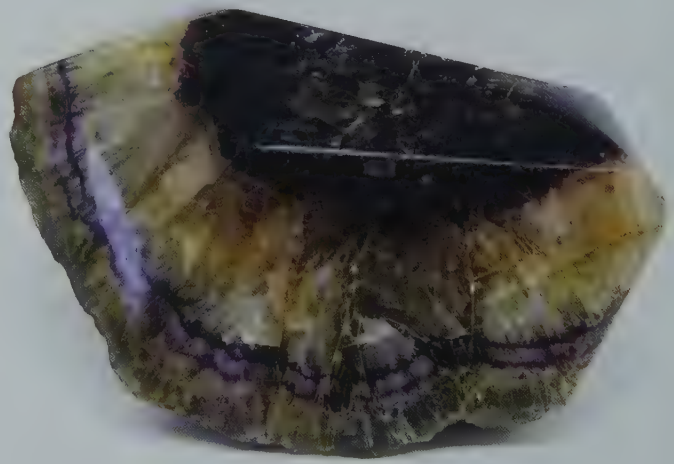


Green Andesine Feldspar. (Photo: ATG/LAB)

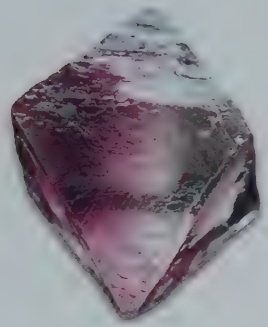
Fluorspar/Fluorite

Though fluorspar is not generally looked upon as a gemstone because of its relative softness (it rates only 4 on the Mohs scale), with care, it may be used decoratively.

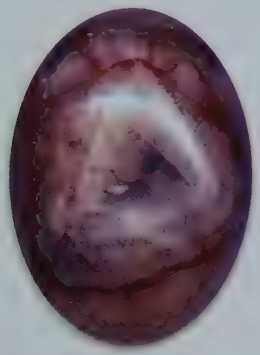
A very English mineral, it is found in Cornwall and Derbyshire. Its main claim to fame is the unique variety 'Blue John', which is found only in Derbyshire. Although supplies are now limited it was very popular in Victorian times, providing beautiful carved ornaments. Although called 'blue' it has more of a purple colour banding together with browns and yellows. The crystal structure of fluorite shows as chevron layers within a massive material. The Blue John Caverns are a popular tourist venue even today. Classic pieces of Blue John command



Blue John. (Photo: ACC)



Natural fluorspar octahedron. (Photo: RH)



Blue John. (Photo: KW)

Blue John Chalice. (Photo: AJ)

high prices and many fine examples are to be found in museums. It is notoriously difficult to work and has to be impregnated with resin before carving to stop it splitting across the strong cleavage planes.

It is possible to find excellent examples of crystals of fluorspar in Derbyshire, Durham and Cornwall.

Emerald green fluorspar is found in West Africa and has been sold as 'South African Emerald'. It is found in its other colours of yellow, pink, purple and colourless in several parts of the world.

Fluorspar has important industrial uses as flux in the production of steel and in the optical industry as specialist lenses.

A selection of gem fluorspar in facetable quality has recently been discovered in Mozambique. Green, bronze, pink and bi-coloured stones have been cut. They are very attractive, but suitable only for the collector's display cabinet, not for use in jewellery.

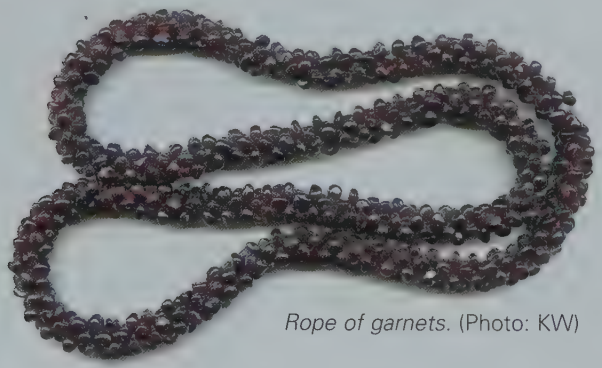
A few of the garnet family including hessonite and tsavorite. (Photo: AJ)

GARNET

Garnets consist of a complex range of varieties of similar chemical composition and come in a great range of colours. Since Victorian times the garnet normally met with was the deep red, ruby-like stone, but today there is a very wide selection of colours from which to choose.

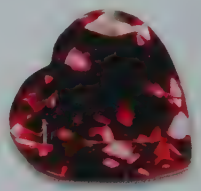
They all have certain properties in common; namely, they are all members of the cubic crystal form and therefore are all singly refractive, with a hardness between 6.6 and 7.5. The simplest way to classify the very many types is to list them in the various colour groups.

Red – sometimes called 'carbuncles' in the past when cut as recess backed cabochons. The most prominent of the red garnets is the fiery **pyrope** usually in small sizes. **Almandine** is also a red, but is available in larger stones and other colours. 'Mozambique Garnet' is a deep red and a mix of pyrope and almandine.



Rope of garnets. (Photo: KW)

Rhodolite is a more violet red. A variety called 'Raspberry Rhodolite' was discovered in 1987 in Tanzania, 'Cherry Rhodolite' is found in the same area. 'Cranberry Rhodolite', a pinkish red, has been discovered in Nigeria. Another pinkish-red garnet – known to the trade as 'Grape Garnet' – has been found in India, Tanzania, Madagascar and South America.



Rhodolite garnet. (Photo: RH)

A deep red garnet with orange flashes from Tanzania has been marketed as 'Crimson Garnet'.

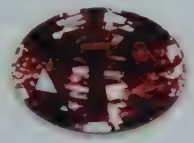
Yellowish-orange to brownish-red – **Hessonite** falls into this group and is sometimes called 'Cinnamon Stone'.

Spessartine (**spessartite**) is an orangey red. An impressive variety of the group was found in Namibia a few years ago and was christened 'Mandarin Garnet'. A similar find was subsequently made in Nigeria. This is one of the more pricey garnets.

Spessartine Garnet 796 pt. (Photo: ATG/LAB)

Some examples of **Andradite Garnet** also fit into this colour range but is better known for other colours. **Grossular Garnet** from Tanzania provides us with 'Tangerine Garnet', a bright orange.

Malayan or **Malaia Garnet** is a cross between spessatine and pyrope, giving a yellowish-brown to

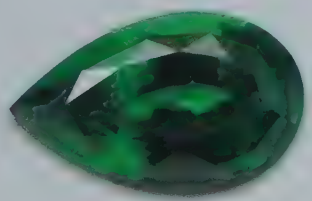


Malayan garnet. (Photo: RH)

brownish-pink hue; the more pink the tone, the more expensive the stone. Shades from Madagascar are sometimes termed 'Imperial Malaia' or 'Champagne Garnet'.

Yellow – **Topazolite** is lemon to lemon-yellow from the grossular group and has been found in Switzerland, the Italian Alps and California, USA.

Green – These will either be **Demantoid**, **Tsavorite** or **Mali Garnet**; the most famous and very expensive is Demantoid. Regularly used by Fabergé in some of his fabulous designs. This beautiful stone has a greater fire than diamond but is only 6.5 on the Mohs scale. It is a



Tsavorite garnet. (Photo: MM/RH)

variety of Andradite and has an adamantine lustre, like diamond. It is found in the Urals and Zimbabwe. The Russian stones sometimes contain a diagnostic inclusion called a 'horse-tail'.

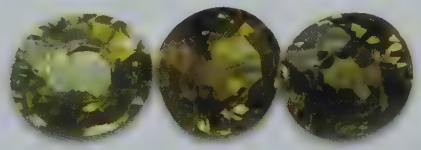
Tsavorite, a beautiful green, is less expensive than Demantoid and Emerald and was discovered in 1967 in Kenya. The most popular shade is termed 'Forest Green'. It is not, as yet, treated.

Demantoid garnet. (Photo: MM/RH)

A lighter shade of this stone was discovered in the Tanzanite mines and is traded as 'Meralani Mint Green'.

The **Mali Garnet** was discovered in 1994 in the Republic of Mali in West Africa. Yellow-green, honey-green and chartreuse shades are available, and a chrome variety has also been reported.

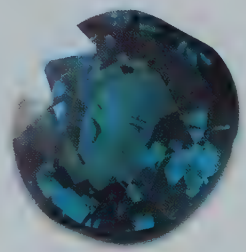
Another green garnet, the **Uvarovite**, occurs only in very small stones and is therefore little used. A colour change variety from East Africa also occurs.



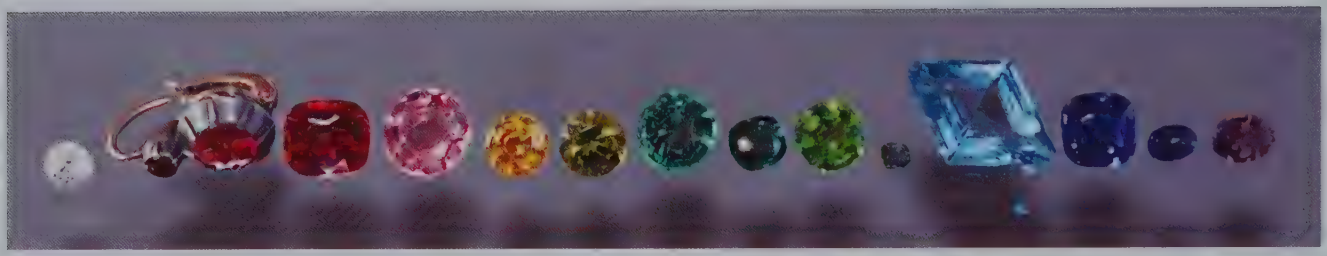
Mali garnet. (Photo: MM/RH)

Blue – A colour that is rare in Pyralspite garnets but has been found in Madagascar. This also tends to show a colour change to mauve in incandescent light.

Black – **Melanite** of the Andradite group of garnets is black and, with the increased popularity of black gemstones, is taking its place alongside diamond, onyx, etc. in the world of fashion.



Blue garnet 1.13 ct (Pyralspite). (Photo: AH)



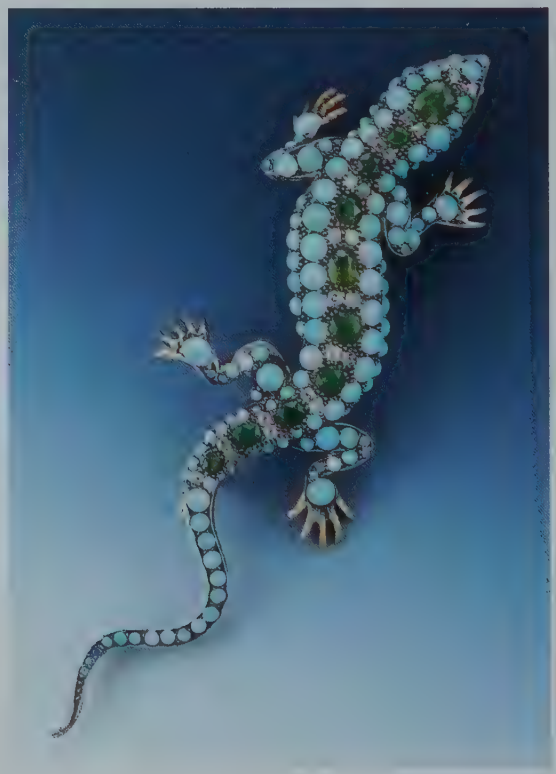
An assortment of garnet-topped doublets showing the wide range. (Photo: AH)

Garnet-topped doublets – As mentioned under the diamond section, doublets and triplets used to be common. Almandine garnet was commonly used as the top stone in doublets with the lower section being coloured glass. They were used to imitate various gemstones such as emerald, ruby, sapphire, topaz, amethyst and peridot, the colour of the glass determining the type of gem. When combined with a bezel or gypsy setting (*see* Jewellery section) they can be difficult to identify. Unset, the junction may be seen by immersing in water or immersion fluid, if available.

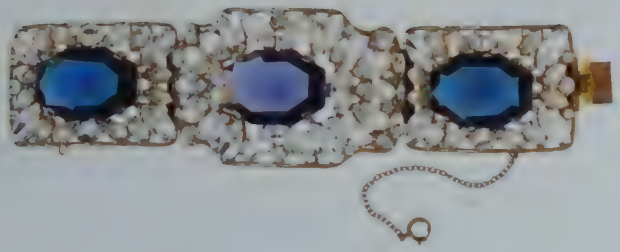
Colour change garnets from Kenya, 226 pt each (Photo: ATG/LAB)

Star garnets – Idaho in the USA is one of the few places to produce these. Mainly translucent purplish-red stones but some transparent deep reds are also found. They are cut *en cabochon*, the star being due inclusions of rutile and may be four or six ray.

Colour change garnets – As with several other gemstones, garnet has varieties that change colour or shade under different lighting conditions tungsten and daylight. A 'rainbow garnet' has been discovered in Japan that shows iridescent colours reminiscent of Labradorite.



Opal, diamond and demantoid garnets, c.1890. (Photo: WL)



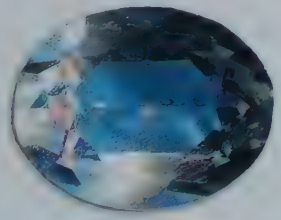
Bracelet with large oval navelle-cut 'sapphire' crystals, typical of the Austro-Hungarian style. Fine costume jewellery is highly collectible today for its historic significance and creative value. Fine pieces are being sought after by museums worldwide. (Image from *Vintage Costume Jewellery*, © 2006 Carole Tanenbaum © 2006 The Antique Collectors' Club)

Glass & Paste

You may consider it strange to include glass here under gems, but it is the most commonly used simulant for most of the gems. Two types of glass are used as simulants, Crown Glass and Flint Glass.

Crown glass is the same material used in the manufacture of bottles and windows. It is generally moulded and used for the cheapest types of jewellery.

Flint glass, however, is much more important for the gemmologist as it produces some very convincing

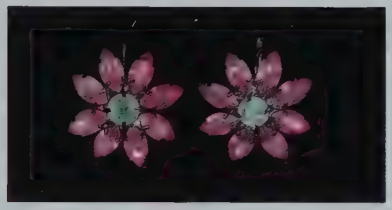


Paste 'gem'. (Photo: KW)

fakes. Lead oxide is used in its manufacture, often supplemented with thallium compounds to increase its brilliance. The best 'gems' are cut and faceted just like conventional stones; cheaper ones are moulded but finished and polished on a lap.

To increase the reflection and fire of some glass 'gems' they are backed with foil or mirrored then painted with gold lacquer; these are called 'chatons'.

These glass imitations come in all colours to imitate



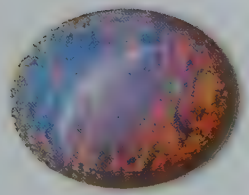
Paste earrings. (Photo: ACC)

very many gemstones. The hardness of glass varies but is usually between 5 and 7; it has a specific gravity between 2.00 and 4.20 depending on the lead content. The easiest method of identification is to look for bubbles or swirls as inclusions. Also chips have a typical shell-like (conchoidal) rippled form.

Chatons. (Photo: KW)

The term 'paste' comes from the Italian name for dough and was used for the cheapest of glass fakes and is now applied to plastic copies as well.

'Rhinestones' is a term that has been used for many



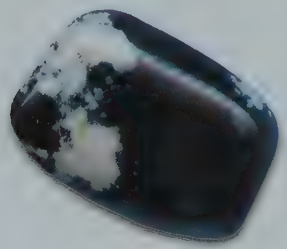
Fake glass opal. (Photo: KW)

years to name any coloured glass imitation gemstone. The name comes from the French *caillou de Rhin*, referring to Strasbourg where the such gems were made. 'Diamanté' is a term used for bright coloured pastes used to decorate fabrics and may also be used to describe costume jewellery set with bright glass imitation stones, particularly in pavé style.

There are also natural glasses. The main variety being Obsidian, which was used extensively by the North American Indians and South American Aztecs for arrow heads or knives, due to the razor-sharp edges of the stone. It contains a high percentage (66–72%) of silica.

Obsidian is found in volcanic areas particularly in the Americas but also in Japan, Iceland, Hungary and Hawaii. Obsidian comes in a wide variety of colours and types. The commonest is black or grey, but red and blue have been reported.

Black material with white spots is called 'snowflake obsidian' whilst that banded red and black is 'mahogany obsidian'. Other small clear pebbles are romantically called 'Apache tears'. Obsidian is often used in local jewellery such as necklaces. Other types of natural glass occur but are rarely used in jewellery.



Snowflake obsidian. (Photo: KW)

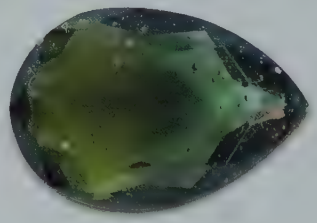
'Aventurine Glass' or 'Gold Stone' is a man-made material – a reddish-brown glass coloured by cuprous oxide that is treated to give masses of tiny copper crystals within the stone.

A recent newcomer into the costume jewellery market is a bright green glass coloured with depleted uranium; its radioactivity is far above safe limits! Extremely fluorescent under ultra-violet light, it is reported to emanate from the Czech Republic.

Aventurine glass. (Photo: KW)

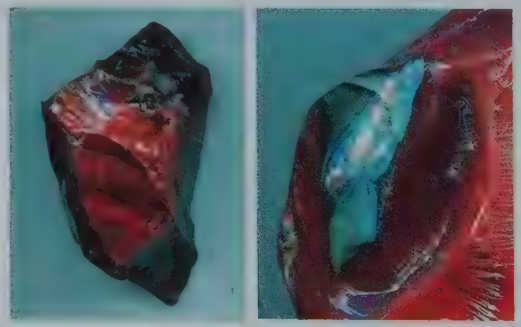
Uranium was used as a colouring agent in the manufacture of glass ornaments.

Tektite is a naturally occurring glass of uncertain origin. Some believe that this was contained in meteorites, others that it was formed in rocks hit by hot meteorites.



Moldavite. (Photo: KW)

Moldavite, named after Moldau in the Czech Republic where it was first discovered, is the only tektite that is transparent and suitable for faceting. In colour it is bottle green or brownish green. Tektites are found in other parts of the world, but rarely, if ever, of faceting quality. Inclusions are common, particularly bubbles; it is sometimes identified as glass.



Glass slag (left), inclusion (right). Glass slag maybe confused with Tektites. However, these samples are waste from a glass factory. (Photos: KW)

Plastics: almost all gemstones are now copied in plastic and, to the unwary, mounted stones may seem more realistic than one would imagine possible. They are of course much lighter even than glass. Remember that any genuine gemstone is set in a precious metal, plastic never.

Hematite necklace displayed on a piece of hematite ore. (Photo: AJ)

Hematite

Hematite, found in many places around the world including England, is, in fact, iron oxide. It was used in amulets in ancient Egypt and was believed by the Babylonians to "procure for the wearer a favourable hearing of petitions addressed to kings and a fortunate issue of lawsuits and judgments". A real boon in these litigious times. The variety used for jewellery is the crystalline form that has a blue-grey colour; when it is cut and polished it takes on a bright black metallic lustre. It has commonly been used for intaglios to be mounted in signet rings or pendants.

It is simulated by a material called 'hematine', which can be difficult to distinguish from natural hematite. Hematite is itself made into beads to simulate black pearls, though not very effectively as they are very heavy compared to the real thing. Some natural Brazilian hematite is magnetic.

Hematite. (Photo: DU)

It is approximately 6½ on the Mohs scale with an SG of approximately 5. If practicable it will give a red streak if rubbed on a unglazed porcelain tile. In fact, hematite becomes a bright red colour when crushed for use as a polishing agent, known as 'jeweller's rouge'.

Idocrase

More popularly known as Vesuvianite, taking its name after the region around the volcano Vesuvius, in Italy where it was originally discovered.

This commonly green gem also occurs in brown, yellow, blue or purple. It has a hardness of 6-7 and has also been found in Canada, East Africa, Russia, Switzerland and the USA.

Idocrase. (Photo: MM/RH)

Iolite

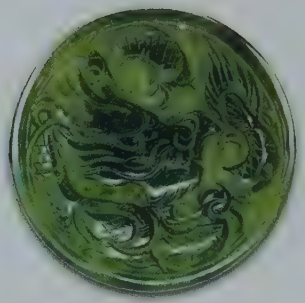
An unusual gemstone, also known as Dichroite, but a worthy one nonetheless. The mineralogical name is Corderite. It is a sapphire-blue in colour and competes with tanzanite as a cheaper alternative. It is strongly pleochroic showing yellow, light blue and dark violet-blue. It was once called 'water sapphire' but this term is now less common.

Two examples of faceted iolite. Note the pleochroism in the example on the left. (Photo: MM)

It can be mistaken for sapphire but the pleochroism gives it away as with other similar lookalikes.

It has a hardness of 7 to 7½ (Mohs) but is liable to chipping so the same care should be taken as with Tanzanite. The major sources of iolite are Sri Lanka, Burma (Myanmar), Madagascar (Malagasy Republic), S.W. Africa, Canada, Tanzania and India. Massive forms have been found and used for carvings.

Carved green jadeite. (Photo: RH)



Jade medallion. (Photo: RH)

JADE

Jade comes in two varieties – jadeite and nephrite, jadeite being the more valuable of the two.

Jadeite – Used by the Aztecs from sources in the Andes, jadeite was later discovered in Burma (Myanmar) about 300 years ago and became popular with the Chinese emperors. Burma is still the major source today, although marketed through Hong Kong. More recently it has also been found in California and Russia, though not of gem quality.

Jadeite is found in a range of colours: bright green, purple, orange, brown, black and, very rarely, red. It varies from translucent to opaque; the most valuable is the bright translucent emerald green called 'Imperial Jade'. Next is the purple, the least popular colour is the dark olive green-grey. The more opaque the stone, the lower the value.

Off-colour jadeite is commonly dyed to simulate Imperial Jade but its opacity belies the truth. Improvement is also achieved by bleaching and impregnating with resin, although there are doubts as to the permanency of this procedure.

Jadeite with a hardness of 6½ to 7 and an SG of 3.33,

Jadeite with ruby, sapphire and gold. (Photo: RH)

is slightly harder than Nephrite but it is less tough. It has a bright glassy shine.

Most gems are cabochon cut and quite often waxed to improve the polish, but this may be damaged by heat and overzealous cleaning.

The latest classification of jadeite jade is:
'A' jade – natural untreated
'B' jade – polymer treated
'C' jade – stained
'B&C' jade – polymer treated and stained.

Nephrite – is found in very many locations around the world and is not used in jewellery as much as jadeite. It is used mainly for carvings. Brown shading of parts of the rock is caused by oxidation and this is used by carvers to attain a two-colour effect.

Nephrite. (Photo: KW)

Nephrite jade comes in fewer colours than jadeite, white ('mutton fat jade'), dull green ('spinach jade') often with black spots of magnetite, brilliant green and yellow, which is the most valuable.

Treatments are basically similar for nephrite as for jadeite: dyeing, waxing and bleaching are common.

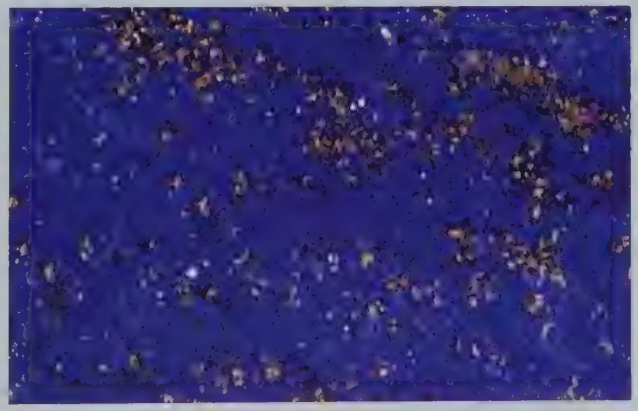
It has a hardness of 6½ (Mohs) and an SG of approximately 3.0. It is an extremely tough material, which makes it difficult to mine. The main sources are now New Zealand, the USA, Siberia, South America and Silesia.

There are very many simulants of jade: bowenite (a form of serpentine), chrysoprase, stained chalcedony, massive emerald, hydro-grossular garnet, amazonite, prehnite, Connemara marble and verde antique. Jade shows green under the Chelsea Filter where some simulants, particularly prehnite, show red. However, certain jades contain chromium and will also show red. A Hodgkinson's special filter can be used to identify dyed jade. This reinforces the doctrine of 'buy from a reliable source', not from street traders, and make sure that the receipt states that it is genuine untreated jade.

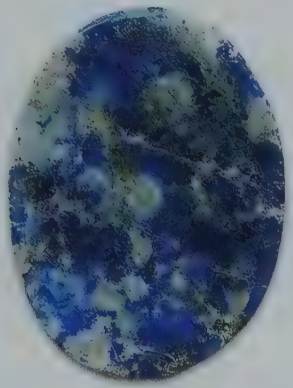
In South America 'antique' jade articles are made from current jade and aged artificially by heat treatment to simulate the oxidation found on genuine old jade: very convincing.

Lapis Lazuli

The ancients knew lapis lazuli as 'sapphire' and it was not until the Middle Ages that blue corundum took over the use of that name. All the properties of a cure for diseases of the eye previously claimed for lapis lazuli were then



Afghan lapis lazuli. (Photo: AJ)



Chilean lapis. (Photo: KW)

transferred over to the more valuable gem, sapphire.

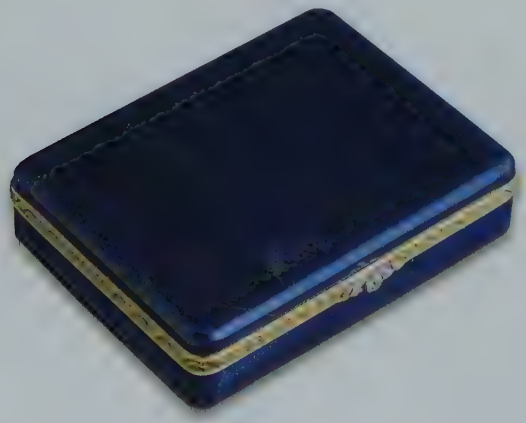
Lapis lazuli is, in fact, a mixture of different minerals: lazurite, hauynite, noselite, sodalite, calcite and pyrite. The best quality contains the least calcite and is found in Afghanistan and Russia. Lapis lazuli is also found in Chile but tends to be paler, containing bands of calcite and generally lacking the specks of golden pyrite that add to the attraction. It is also sourced from Burma (Myanmar) and the USA.

Up until 1828 this beautiful blue mineral was crushed by artists to provide the pigment for ultramarine used for their paint; this is now produced synthetically.

Lapis lazuli is often used for signet rings and cufflinks, though with a rating of only 5½ on the Mohs scale it can easily be scratched.

Paler lapis is dyed to improve the colour but it is not necessarily stable. It is often waxed to improve the polish. The quartz mineral jasper is also dyed and called 'Swiss Lapis' or 'German Lapis'.

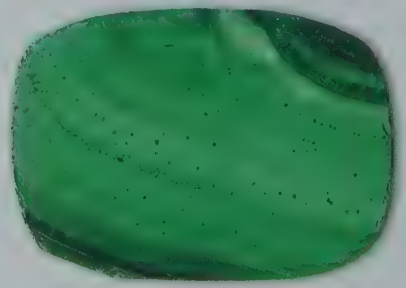
A synthetic sintered spinel, containing cobalt and which may contain gold specks, is produced in Germany to simulate lapis lazuli; it shows bright red under the Chelsea Filter where real lapis shows dull brownish-red. Gilson also produced a synthetic lapis lazuli. (See also Sodalite.)



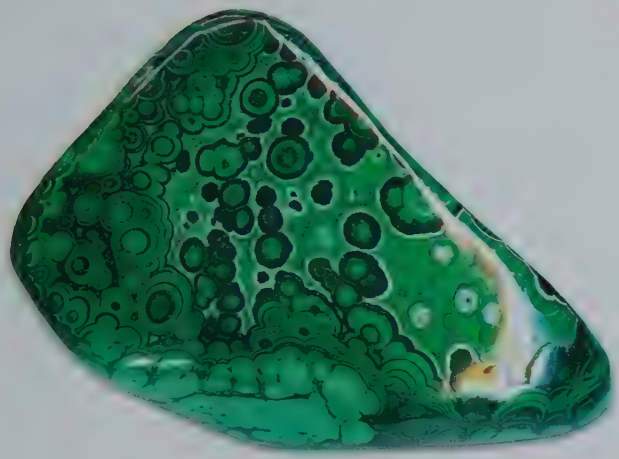
Fabergé cigarette case. Gold, enamel lapis lazuli, c.1900. (Photo: WL)

Malachite

Malachite, an important ore of copper, is a startling display stone. Large carvings and complete tabletops are made from this complex agate-like banded green mineral. Mined for thousands of years and long held precious as a talisman for the protection of children, it is as popular today as it has ever been. Occasionally set as ring stones or made into beads, its more usual use is in the manufacture of ornaments.

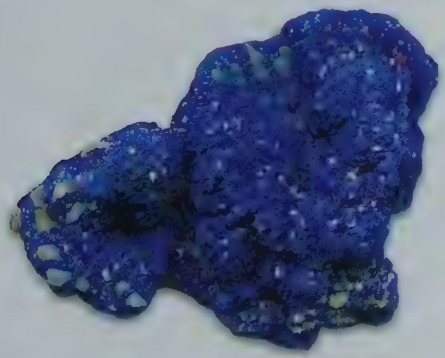


Malachite. (Photo: KW)



Malachite. (Photo: KW)

It has a hardness of only 4 on the Mohs scale, so is susceptible to damage. Its main source is the Congo, but good material is also found in Russia, Africa, Australia and New Mexico.

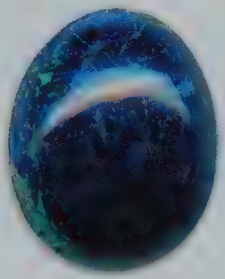


Azurite crystals. (Photo: KW)

Azurite is a sister mineral of Malachite but is a lovely azure blue, hence the name. Both materials occur together and are often cut to display both in the same cabochon when it is termed 'azurmalachite'. It is also found together with the quartz mineral chrysocolla and, again, cut together.

Synthetic malachite has been produced in Russia but, due to malachite's low value, synthetics are not common. A reconstructed material is sold in the form of ashtrays and small bowls at rock and gem shows.

A variety of azurite known as chessylite is found in France showing malachite bands.



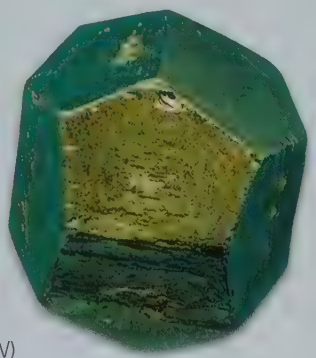
Azurite. (Photo: KW)

Black swan. (Photo: KW)

Marcasite

The 'gem' called Marcasite used in jewellery is in fact iron pyrites or 'fool's gold' and has been used for many centuries. The mineral marcasite, although chemically the same, is not suitable for use in jewellery. Popular with the Greeks and Incas alike large impressive crystal clusters are often found on sale as cabinet specimens.

Pyrites is cut a bit like rose-cut diamonds and



Crystal of iron pyrites. (Photo: KW)

Marcasite brooch. (Photo: KW)

polished to a high shine. They are usually set with small beads gouged from the setting with a graver and folded over the edge of the stone. In cheaper jewellery they are set with adhesive. Pyrites form the pretty golden flecks in lapis lazuli.

It is liable to chipping if knocked so care is required in wearing and handling. Marcasite jewellery tends to go in and out of fashion and is not as popular today as it was 40 or 50 years ago. It is not expensive but is still simulated by cut steel, which has the disadvantage of rusting. Glass is also used but easy to identify.

True Marcasite can be found, with patience, in the chalk of the South Downs in England.

Radial needle-like crystals of iron pyrites. (Photo: KW)

Opal

Opal is a form of silica but different from quartz insomuch as it contains water in varying degrees. It is classed as a solidified jelly or gel. Its beauty comes from the display, in the form of flashes, of a rainbow of colours. There is a wide range of types but the only ones that need to concern us are as follows:

Precious Opal – this is the most expensive and is divided into three main classes: *black,* where the body colour is black, blue, green or grey; *light opal,* where the body colour is cream to white; and *clear* or *water opal,* which is clear with a good play of colour.

Black opal is ten times more expensive than light opal and consequently various treatments are applied to the latter to give the appearance of black.

Fire Opal – transparent or translucent orange to red, generally without a play of colour.

Fire opal. (Photo: MM)

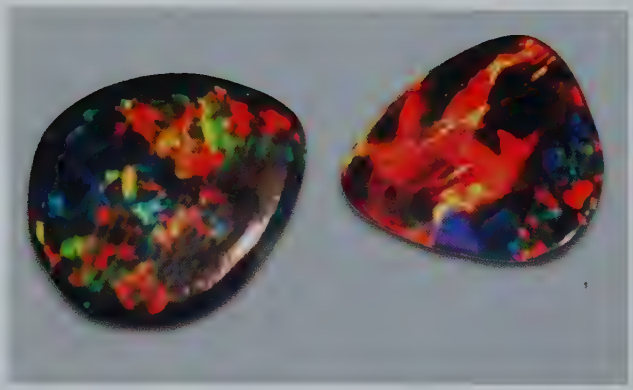
Jelly Opal or 'potch' – this is common opal that has no colour and is generally discarded.

Opal is different to most other gems in that it forms over a comparatively short timescale. It has even been found on the base of wooden fence posts. The main source of the gem is Australia, whose dealers give it a large number of descriptive names, based on the colour variations. Opals from the Yowah, Blackgate and Koroit areas are examples of opal in ironstone pebbles; these are polished and are unusual and attractive. Other sources are Hungary, the USA and Brazil. Fire opal and water opal are found mainly in Mexico. A pink and blue opal without fire is found in Peru.

Opal doublet. (Photo: KW)

Doublets and triplets are common and, when in closed mounts, are difficult to detect. They are, or should be, cheaper than the solid stone. There is one advantage, however, with doublets: as opal is much softer than other gems (rating only 5½ to 6½ on the Mohs scale), a quartz-topped doublet will give protection.

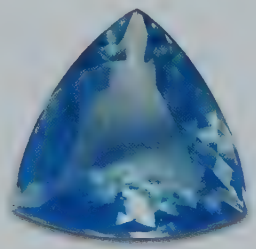
Opals and diamonds, c.1880. (Photo: WL)



Natural black opal (left) alongside a Japanese synthetic. (Photo: AH)

As with any gemstone always purchase from a recommended source and avoid opals shown to you in water or oil.

Opal has also been synthesised and identification is not possible for the layperson. Gilson produced an excellent synthetic, but this has now been taken over by Chatham, following Gilson's closure. Other simulants are made from glass or plastic, but never look quite right. 'Slocum Stone' was developed in the USA as a convincing simulant, but Hong Kong remains the main source of imitation opal.

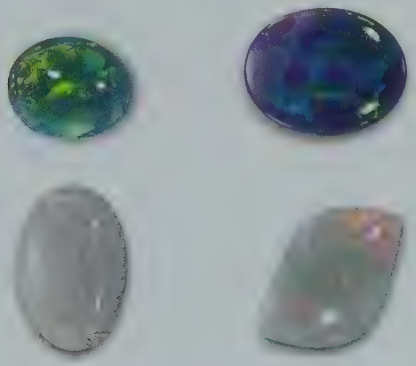


Blue opal. (Photo: MM/RH)

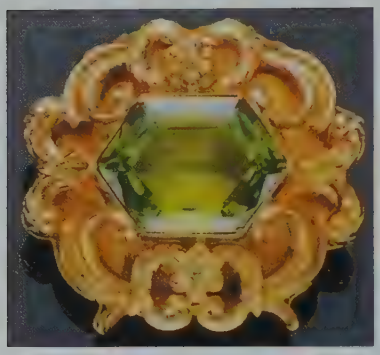
Opal is absorbent and will soak up water or any other liquid, so always take an opal ring off before doing the

Opals and diamonds, c.1900. (Photo: WL)

housework. They are also fragile so should be cleaned with care. A brief wash with a mild detergent in water is OK, but do not soak. As opals contain water, on average 10%, it is possible for them to dry out and crack, so heat should be avoided.



Group of opals – including a black opal at the top. (Photo: Christie's)



Peridot. (Photo: Sotheby's)

Peridot

An attractive stone, peridot is the gem variety of the mineral olivine. A gem beloved by the Victorians, it is a yellowish-green in light and dark shades, some

Cut peridot from San Carlos, USA. (Photo: AJ)

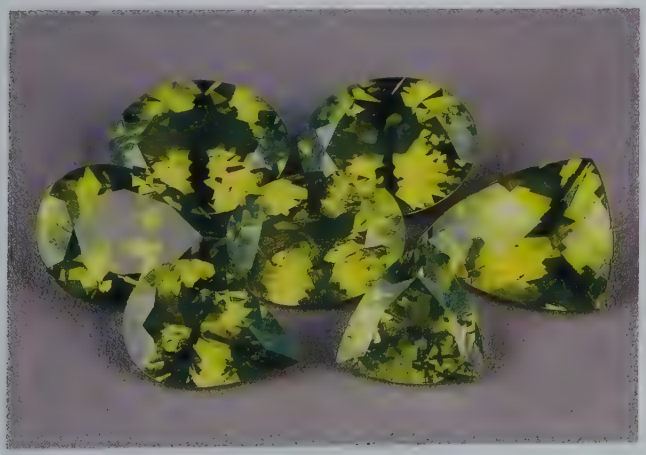
brownish. It is found in volcanic areas, commonly in basalts. The classic locality is St John's Island in the Red Sea, but it is also found in Arizona, Hawaii, Tanzania, China, Vietnam and the Canary Islands.

Peridot and diamond spider, c.1870. (Photo: WL)

Those from Hawaii sometimes contain inclusions of petrol.

Peridot rates 6½ on the Mohs scale, just below the recommended 7 for use in jewellery. Therefore it is liable to scratching or other damage if mounted high in a ring. Larger stones are to be preferred as the smaller ones fail to show the density of colour.

Peridot was frequently foil backed in antique jewellery to improve the colour of the lighter stones. Glass imitations are found, but do not show the double refraction of the natural stone. A convincing synthetic corundum simulant of peridot is now on the market.



Group of peridots. (Photo: AJ)

Prehnite

Another stone to appear on the shopping channels is prehnite. In shades of green it has a hardness of 6–6.5 and occurs in Scotland, Australia, South Africa and the USA where the better quality specimens are found. Commonly translucent, but attractive transparent stones are available. Care should be taken in cleaning and heating may cause changes in colour.

Prehnite cabachon. (Photo: KW)

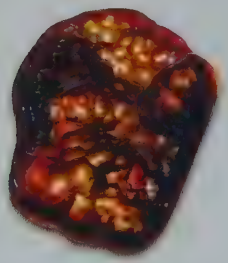
Enamel and gold pendant by Falize set with amethyst, c.1880. (Photo: WL)

QUARTZ

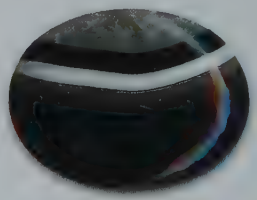
Quartz is pure silica, which constitutes approximately 60% of the earth's crust: the sandy beach upon which we sit on holiday while the children build sand castles is quartz, as are the desert sands of the world.

Quartz is a large family consisting of two categories: crystalline and cryptocrystalline. The crystalline are those transparent gems that include amethyst, citrine, smoky quartz or Cairngorm and rock crystal. The category of cryptocrystalline includes all the many translucent and opaque stones that are impure forms of the mineral.

Quartz also provides us with the most beautiful crystal clusters. Geodes, which are like bubbles formed during volcanic eruptions, come in a variety of sizes. If you are lucky, when they are sliced in half a marvellous display of amethyst, citrine or other minerals greets your eye. Other delights are water agates, which have water locked into their cavities that is millions of years old. When cut correctly the water can be seen through the stone moving about. In rare instances it can even be heard when the stone is shaken.



Fire agate. (Photo: ATG/LAB)

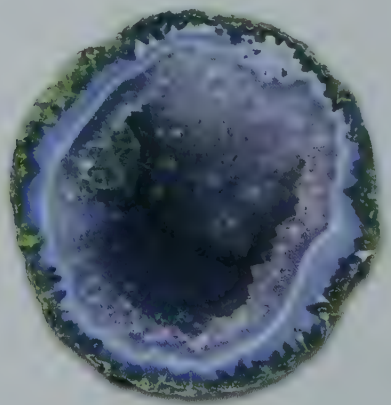


Agate cabochon. (Photo: KW)

Crystalline (transparent) quartz:

Amethyst – this can range in colour from pale lilac to deep purple. The darker colours tend to be preferred and are consequently more expensive.

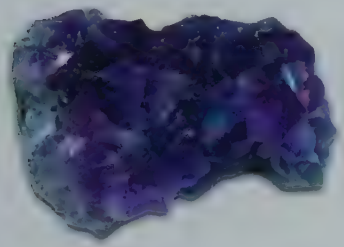
The main sources are Sri Lanka, the USA, Brazil, Russia and Madagascar (Malagasy Republic). Nearer to home, it



Amethyst geode. (Photo: KW)

can also be found in the china clay pits of Cornwall, together with smoky quartz, but not of gem quality.

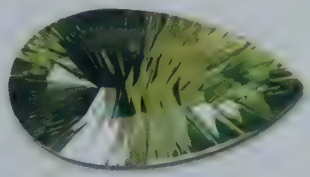
Even though supplies of natural amethyst are plentiful it is being synthesized. It can be very difficult to distinguish the new synthetics from the natural and, in fact, little effort is taken to sort the synthetic from the natural, due to its low value. A standard method to identify was to look for the 'thumbprint' inclusion that is diagnostic, but not all amethyst displays this. It looks, as it says, like a thumbprint or tiger stripes under the loupe.



Amethyst, crystal cluster. (Photo: KW)

Amethyst occurs in huge crystal-filled vugs or crevices, which are cut out for display. Some have legs and glass tops added to turn them into coffee tables.

A rather strange stone has recently become available – green amethyst. While it is possible for this to occur in nature, it is rare. This 'green amethyst' – which has been named 'prasiolite' – is, in fact, heat-treated amethyst. To call it 'green amethyst', to the author's mind, is a contradiction in terms, as amethyst is an accepted colour in its own right; this treated green version should only ever be called 'prasiolite', 'green quartz' or 'vermarine'.



Green quartz. (Photo: ATG/LAB)

Ametrine – this is where amethyst and citrine have blended together to produce a single bi-coloured gem. They are moderately priced but very attractive.

Ametrine. (Photo: DU)

Brown quartz:

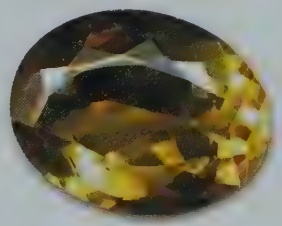
Smoky quartz and Cairngorm – Brown quartz is a transparent variety ranging in colour from pale to dark brown. Cairngorm gets its name from the Scottish mountain region where it was found; it was widely used in Celtic jewellery. This source is now exhausted and today's 'Cairngorm' is actually heat-treated amethyst from Brazil, similar to 'burnt amethyst'. The term 'smoky' is loosely applied to stones having a slightly cloudy look, although much brown quartz is still termed smoky. The sources are worldwide and the material is faceted in a range of styles as ring stones or beads.

'Burnt Amethyst'. (Photo: KW)

Cairngorm. (Photo: KW)

Cartier brooch. Citrine and gold, c.1940. (Photo: WL)

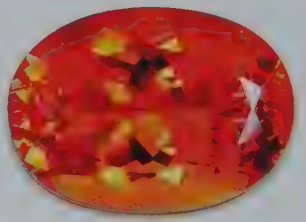
Citrine – the majority of citrine is actually heat-treated amethyst called 'burnt amethyst'. The colour change is permanent, often banded, but lacks the dichroism of natural yellow quartz. However, if citrine is irradiated, it converts back to amethyst.



Citrine. (Photo: KW)

Citrine also comes in a range of shades from pale to dark yellow and brownish, where it merges into Cairngorm or smoky quartz. It is often sold, wrongly, as yellow topaz but lacks the polish and brilliance. Clear quartz is now dyed to provide yellow shades and sold as citrine. Natural citrine does occur, but only rarely. Lemon and Orange Citrine have been treated.

Despite their relatively low price, amethyst, ametrine and citrine stones make a lovely display in a range of jewellery.



Orange Citrine. (Photo: ATG)

Rock crystal – this is transparent colourless quartz that has been used as a diamond simulant, though not very convincingly. It is glasslike in appearance and can easily be confused with glass. Quartz, like most natural gems, has a higher thermal conductivity than glass; therefore the tongue test (as described under the section on diamond) should pick out the difference. It is important that the material being tested is are held with tweezers rather than held in the hand, to avoid accidentally warming it. The test is momentary so the quickest of touch should give a result, i.e. the glass will feel warmer than the natural stone.

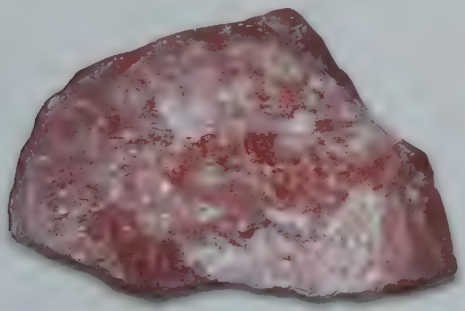
Rock crystal has often been the subject of large carvings in history and forms the best quality crystal balls used by fortune-tellers. In Sri Lanka it has long been used to make lenses for spectacles. It also has use in specialist lenses for optical instruments and as part of doublets and triplets.

Asteriated quartz occurs displaying 'stars' similar to ruby and sapphire. With correct lighting they can be very attractive. 'Venus Hair Stone' is quartz with needle-like inclusions of red or golden rutile, also called

'Fleches d'Amour'. It can occasionally contain black crystals of tourmaline. These can be found in Cornwall at Roche Rock.

'Bristol Diamonds', 'Herkimer Diamonds' and 'Saudi Diamonds' are all varieties of rock crystal named after the locations where they are found. The occurrence of rock crystal is very widespread and large crystals for display are readily available. Synthetic quartz is also on the market in a range of colours.

Rose quartz – this is a common, massive form of quartz. Mostly cloudy, it is usually cut *en cabochon* for jewellery purposes. The deeper shades are the most popular, and the darker colours do show dichroism. Some examples are prone to fading. Star stones can be found. Stones, clean enough to be faceted, do turn up occasionally but are rare. It is regularly carved into figurines and model animals, etc.



Rose quartz. (Photo: KW)

Rose quartz is found in many parts of the world, the best coming from Brazil.

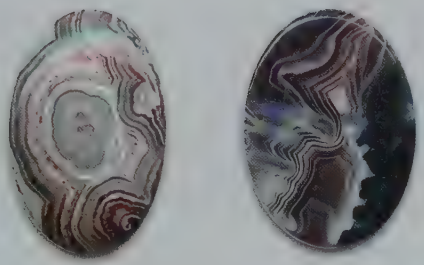
Cryptocrystalline (translucent) quartz:
The range of cryptocrystalline translucent and opaque quartz is huge. Many of the different types are used in a wide selection of jewellery.

Chrysoprase. (Photo: KW)

Chalcedony – this cryptocrystalline quartz comes in a range of colours. A particularly attractive variety is the bright green *chrysoprase,* which is coloured by nickel; good quality examples can command a high price. A blue stone is also found and is well collected. Interestingly the flint that you find in chalk and on the beach is a poor quality chalcedony. Occasionally fossils may be found within the flint.

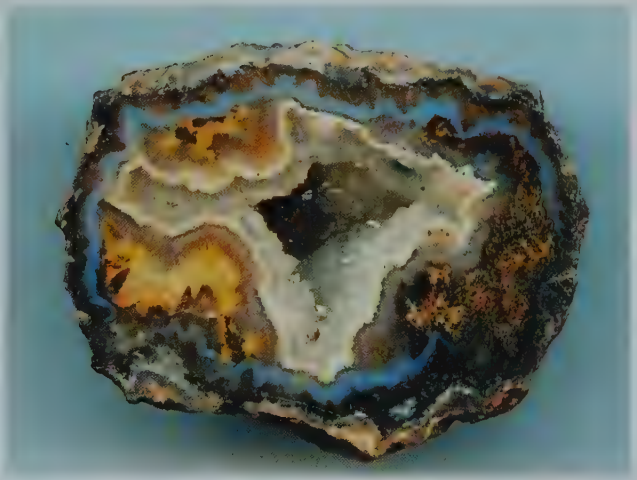
Agate is probably the best known of the chalcedony group. There is a wide range of patterns, all given individual names. Most are banded: opaque bands

Two of the many patterns of agate: Sucor Creek (left) and Apache Hills (right). (Photo: KW)



Two examples of agate. (Photo: KW)

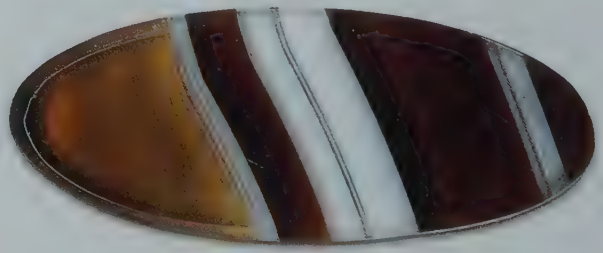
Agate and gold. (Photo: WL)



Mexican geode. (Photo: KW)

Gold box with agate cameo lid, decorated with diamonds, c.1760. (Photo: WL)

alternating with transparent or translucent bands. As with all chalcedonies, agate is porous and so takes up dye well; it is regularly dyed bright colours. Although it is used in jewellery it is also used for many other purposes, such as table tops, clock faces and cameos. Popular for the latter are the brown and white banded



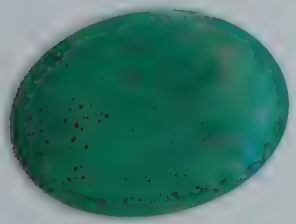
Sardonyx. (Photo: KW)

stone, *sardonyx*, and the black and white banded stone, *onyx* (not to be confused with the onyx-marble, which is a completely different material). Many cameos are of course carved from shell.

Landscape agate. (Photo: KW)

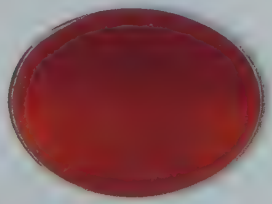
Other popular agates are 'moss agate', with inclusions that resemble plants, and 'landscape agate', where the inclusions give the appearance of a pictorial view of buildings.

Bloodstone or *Heliotrope* is an opaque dark green with splashes of red jasper. It got its name from the belief that it was the stone from below the cross of Christ, whose blood dropped upon it. NB: In Germany, 'Blutstein' [literally: bloodstone] is the name for hematite.



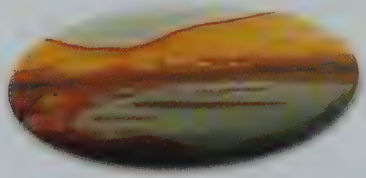
Bloodstone (Heliotrope). (Photo: KW)

Carnelian or *cornelian* is a red form of chalcedony popular, among other things, for intaglio seals set into signet rings.



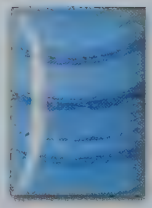
Carnelian. (Photo: KW)

Chrome chalcedony is another prized green variety, coloured by chromium and showing red under the Chelsea Filter. Dyed material shows as a weak brownish red. Main sources are Bolivia and Zimbabwe.



Owyhee Picture Jasper. (Photo: ATG)

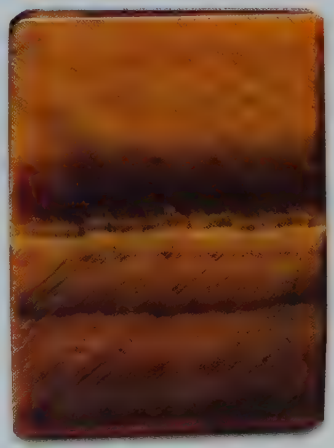
Jasper is an opaque form of microcrystalline (a compact mass of minute crystals) quartz that is strongly coloured by other minerals, mainly iron. Red, yellow, brown and green are fairly common; bright reds are prized and used for inlay and carvings. It has many varieties and it is found worldwide.



Blue lace. (Photo: KW)

Tiger's eye – this is an attractive golden-brown opaque stone displaying a cat's eye effect. The effect is caused by asbestos inclusions. A blue variety is known as 'Hawk's-eye'.

Synthetic quartz is now available in a range of colours, particularly blue.



Tiger's eye. (Photo: KW)

Rhodochrosite

A dainty, attractive, pink-and-white banded, translucent stone: it looks almost like a candy sweet. Transparent crystals are comparatively rare, but some have recently been offered at surprisingly low prices. Unfortunately this stone only has a hardness of 4, but is quite suitable for wear in pendants or brooches.

Originally found in Argentina, it was believed to be used by the Incas; indeed, it is sometimes called 'Rosinca' or

Rhodochrosite brooch. (Photo: KW)

'Inca Rose'. It only came into modern use in the late 1940s when it was rediscovered by amateur lapidaries during the rock-hunting craze, which peaked in the 1960s and '70s. It has been found in the USA, Romania, Hungary, India and the Saxony region of Germany.

Rhodonite

This stone is similar in colouration to rhodochrosite but with black marbling. Less common than rhodochrosite, it is also harder, registering 6 on the Mohs scale. Red transparent crystals of gem quality are occasionally found, but are rare.

Rhodonite. (Photo: MM/RH)

As it occurs in massive form it is generally used for carvings and ornaments. Rhodonite is believed by crystal healers to bring emotional stability.

It was first discovered in the Urals in the 18th century, but these deposits are now virtually worked out. Recently a new source of transparent gem-quality crystals has been discovered in Brazil, and cut stones are available in good sizes.

Rhodochrosite and rhodonite compared. (Photo: AJ)

Cornish serpentine. (Photo: KW)

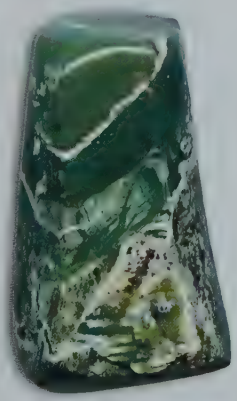
Serpentine

The most common form of serpentine encountered is the massive opaque variety, which forms rocky outcrops and is found in several localities, including around the Lizard in Cornwall. It is generally found in shades of green but it has a wide variation, sometimes with red blotches of bastite. The veined appearance is believed to have given rise to its name. It is mainly used for ornamental carvings. It is comparatively very soft, at 2½ on the Mohs scale.

The more desirable variety is *bowenite*, a translucent yellowish green with a greasy lustre. This may be mistaken for jade, except that it is much softer, registering 4 on the Mohs scale. Small inclusions of bowenite have been found with the common type of serpentine in Cornwall.

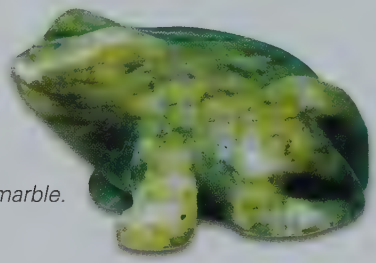
It was used by the Maoris of New Zealand where it was found on the South Island.

Other sources are China, Afghanistan, India, Russia (Zmeevik) and the USA. Both forms are found in South Africa. Italy has produced some excellent serpentine marbles.



Bowenite (at the top of the stone) with serpentine. (Photo: KW)

The west coast of Ireland produces a variety named 'Connemara Marble' or 'Irish Green' marble; this is a paler green with white veining. It is used locally for jewellery in a wide range of designs.



Connemara marble. (Photo: KW)

Soapstone

Soapstone is the massive variety of steatite or talc. Powdered and perfumed it is what we use on ourselves after a shower. It is very soft and can be scratched with a fingernail.

Soapstone carving. (Photo: KW)

It is widely spread and popular for carving, particularly in China, India and South Africa. Pure it is white, but impurities may make it green, brown, yellow or reddish. It has a greasy feel and is quite light in weight. It is popular as a tourist souvenir, and the carvings are often found at gem shows.

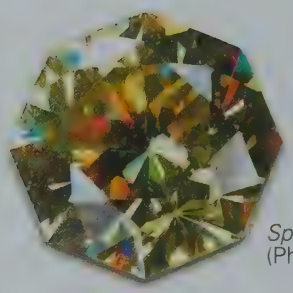
Sodalite

Sodalite can be one of the constituent minerals of lapis lazuli, but is often cut as a gem itself. It is an attractive blue stone marbled with white and may also be confused with lapis. It is also found in other colours but only the strong blue is used. It never reaches the ultramarine of lapis but the royal blue is very striking. It has also been called 'Canadian Bluestone'. Occasionally flecks of pyrites are found in the stones.

Sodalite cabochon. (Photo: KW)

Originally discovered in commercial quantity in Canada, it has subsequently been found in several other areas of the world: the USA, Norway, India, Brazil and British Columbia (Canada).

It has hardness of 5½ to 6 on the Mohs scale. It is tricky to cut due to a strong cleavage, but polishes into very attractive cabochons for pendants and brooches. It is also fashioned into beads and even into larger items such as boxes and clock cases.



Sphalerite 4.19 cts. (Photo: ATG)

Sphalerite

This rare ore of zinc is yellowish or green in colour with an adamantine lustre. Its dispersion is 3-times higher than diamond, making it a most impressive gem when cut. Unfortunately it is very soft – only 3.5 to 4 on the Mohs scale – and consequently is only cut for collectors. Its name comes from the Greek, meaning 'deceitful' or 'treacherous'. Sphalerite is found in mainly in Europe and the USA.

Sphene

Another stone appearing on the TV shopping channels, sphene, also known as titanite is strongly pleochroic (yellow, green and brown) with a high double refraction and an adamantine lustre. Until recently, it was classed as a collectors' stone. It is soft, at 5 to 5.5 on the Mohs scale, so consideration must be given to its mounting; rings would be vulnerable. It is sensitive to heat, which may change its colour, and to chemicals; ultra-sonic cleaning is best avoided. It is found in Burma (Myanmar), Brazil, Mexico, Austria, Sri Lanka, Canada and the USA.

Sphene 3.52 cts. (Photo: ATG)

Spinel dress studs. (Photo: AJ)

Various colours of spinel. (Photo: AJ)

SPINEL

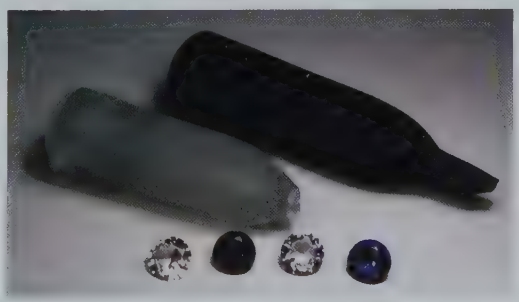
Spinel is an important gemstone in its own right, though it is somewhat overshadowed by ruby and sapphire. It is of the cubic system and, consequently, singly refractive; an identifying feature. Deep red, it is sometimes called 'Balas Ruby'; a famous example is the 'Black Prince's Ruby' set in the English Crown Jewels, which is, in fact, a spinel. Deep reds command a high price, whereas the paler shades of red, brownish and yellowish reds are much cheaper. Pale to deep blue, violet blue, purple and mauve are also important.

Victorian gold and spinel brooch. (Photo: KW)

It is hard, 8 on the Mohs scale of hardness, with a vitreous or glassy lustre, capable of a high polish. Sources are many: Burma (Myanmar), Sri Lanka, Afghanistan, Thailand, Australia, Sweden, Brazil and the USA.

Synthetic spinel has been produced commercially for very many years. It is made in colours not usual for natural spinel: blues simulating aquamarine and zircon, both showing a strong red under the Chelsea Filter. It is also used to simulate alexandrite and, of course, sapphire. A colourless variety is produced to simulate diamond but is not very successful as it lacks the fire when brilliant cut, so is often cut as baguettes.

Having been treated as the poor relation of the ruby for very many years, spinel is at last being appreciated for its natural beauty. This increased interest in the natural stone has led to a rise in the output of synthetic red spinel. This is probably also due to the increasing rarity and high cost of good rubies, now the most popular investment gemstone (untreated of course). The new synthetic spinels are more difficult to identify for the gemmologist and impossible for the layperson.



Synthetic spinel boules and the resulting cut stones. (Photo: RH)

Spodumene

Spodumene includes in its family Kunzite and Hiddenite.

Hiddenite. (Photo: ATG)

Hiddenite (discovered by W.E. Hidden in North Carolina in 1879) is the emerald green variety, its colour being due to chromium (as with emerald). It has a strong vitreous lustre and is pleochroic (yellowish-green, bluish-green, emerald green); great care is required when cutting in order to display the best colour. Though comparatively rare, it has also now been found in Burma (Myanmar), Brazil, Madagascar and California, USA. It is acceptably hard at 6.5 to 7 on the Mohs scale, but has a tendency to fade if left in strong light. Ultra-sonic cleaning should be avoided. It is usually heat treated.

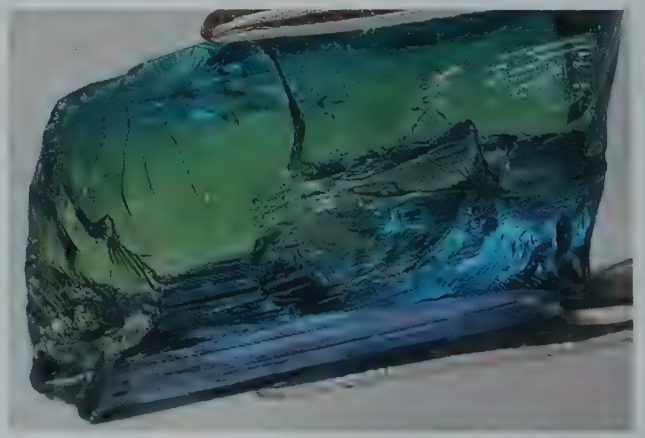
Kunzite. (Photo: ATG)

Kunzite is a lilac-pink stone that is strongly pleochroic: violet, deep violet and colourless. It was originally discovered in California in 1902, but not of gem quality. A yellow-green variety that is of gem quality is found in the same location. Madagascar (Malagasy Republic), Afghanistan and Brazil, however, produce gem-quality lilac-pink kunzite.

Although it has a hardness of 7 (Mohs), it is fragile gem with a strong cleavage making it very difficult to cut. It is also subject to fading when exposed to strong light for long periods. Kunzite is not in general use but makes a cheap attractive addition to any collection.

Tanzanite

Discovered at the Mererani mines of Tanzania in 1967, this gem is a variety of Zoisite. In nature it occurs in several colours, but all are usually heat treated to attain the beautiful violet blue that originally attracted the interest in this gem. A deep blue, which may be confused with sapphire, is expensive.

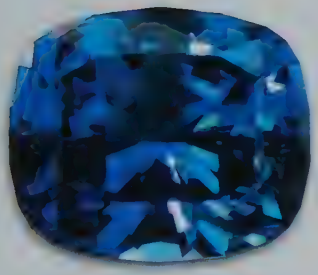


Zoisite crystal showing dichroism. (Photo: ATG)

Although of acceptable hardness, it is also somewhat fragile and ultra-sonic cleaning should be avoided. Use as a ring stone should be considered with care.

Tanzanite is strongly dichroic, showing red-violet and deep blue depending on the direction viewed. A green variety in gem quality has also been discovered.

It has been very strongly marketed, with pale colours of less appeal being coated or otherwise treated. However, supplies of good material are dwindling.

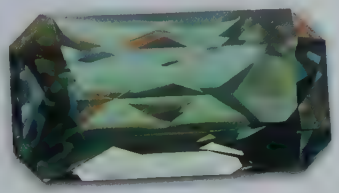


Blue Tanzanite. (Photo: ATG)

The Tanzanite Foundation has produced the Tanzanite Quality Scale (see Appendix 5), a grading system similar to that of diamond, covering colour, clarity and cut.

The American Gem Trade Association has now produced its own grading system based on this scale. Other grading systems have been quoted on shopping channels but carry no validity. Prices vary considerably; the higher the degree of violet saturation, the greater the value.

There are several simulants including synthetic corundum and synthetic garnet. As yet, Tanzanite itself has not been synthesized.

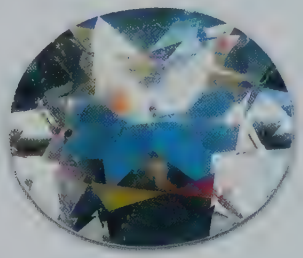


Green Tanzanite. (Photo: ATG)

Sales have dropped since its first introduction into the market. Paler stones have now been entering the marketplace with a cobalt coating to darken the colour. The coating may show signs of wear on facet edges.

Topaz

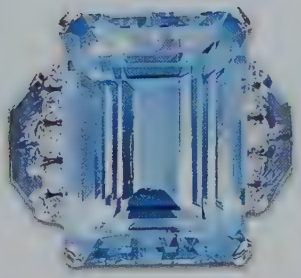
There are many treatments applied to topaz. White topaz is in ready supply and cheap, thereby lending itself to methods to make it more interesting and saleable. The most common treatment is to irradiate



White topaz. (Photo: KW)

the white stone to give a range of blues. Depending on the length of time, strength and type of radiation used, the shade of blue varies from Sky Blue through Swiss Blue to the deepest London Blue. Doubts have been expressed for some time as to the safety of irradiated stones and

Russian pink topaz and diamonds, c.1870. (Photo: WL)



Blue topaz. (Photo: Christie's)

Pink topaz. (Photo: MM)

Imperial topaz. (Photo: RH)

Brazilian topaz, c.1840. (Photo: WL)

import into the USA was halted for a while until safety for the wearer could be assured (*see* Treatments).

Coating with titanium results in 'Mystic Topaz', an eye-catching stone that has a wide range of colours and patterns but remains low in value. Cobalt diffusion is also used to enhance topaz. These coatings are subject to abrasion.

The range of colours of coated topaz is phenominal – and cheap. Blue can occur naturally but is rare.

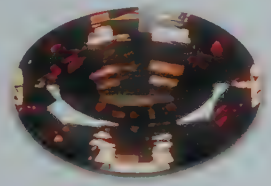
TOURMALINE

This gem is, in fact, one of the most interesting. It exists in a wide range of colours each with its own name, as follows.

Achroite – colourless.

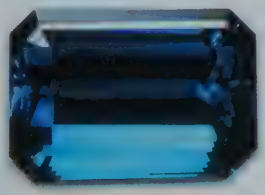
Chrome Tourmaline – green, containing chromium; may be mistaken for emerald.

Dravite – brown.



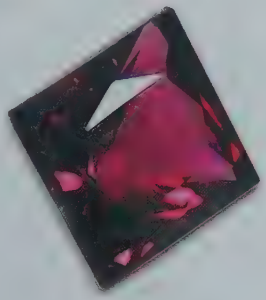
Dravite. (Photo: RH)

Indicolite – blue; has been passed off as sapphire. The yellow variety from Kenya has been sold as yellow sapphire.

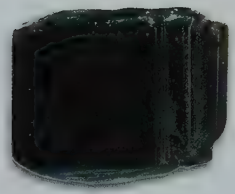


Indicolite. (Photo: RH)

Rubellite – red; in the deeper shades has been mistaken for ruby.



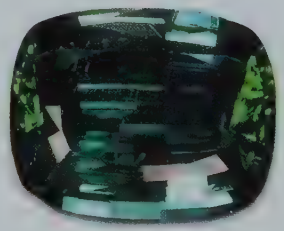
Rubellite. (Photo: MM)



Schorl crystal. (Photo: KW)

Schorl – black; was used for mourning jewellery.

Other varieties – green is the most common colour and ranges in shade from very pale to dark. A new variety was discovered in Brazil in 1987 that is a transparent, intense blue or bluish green. These are known as **Paraiba** or **Neon Tourmaline** and command extremely high prices.

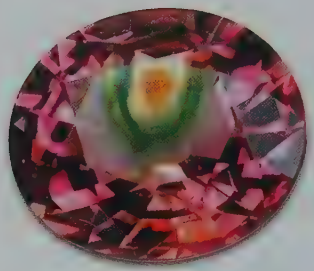


Green tourmaline. (Photo: RH)

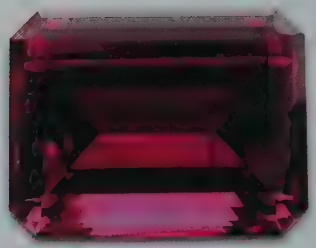
Pariaba is the area in Brazil where it was originally discovered and it owes its outstanding colour to the presence of copper in its makeup. A similar colour tourmaline has subsequently been discovered in Nigeria and Madagascar, both containing copper but to a lesser amount than the Brazilian. They are consequently cheaper. Initially these gems were called 'Paraiba', though the correctness of this term is still hotly debated. In the meantime terms like 'Paraiba type' or 'cuprian tourmaline' or even 'cuprian elbaite tourmaline' are being used.

Sometimes crystals form where the colours are in layers around the length of the crystal. In some the

Purple tourmaline, from Mozambique. (Photo: ATG/LAB)

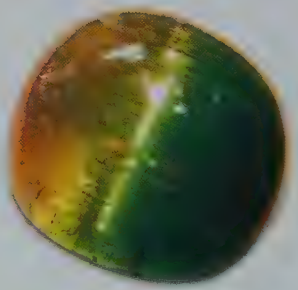


Pink tourmaline with 'watermelon' inclusion. (Photo: ATG/LAB)



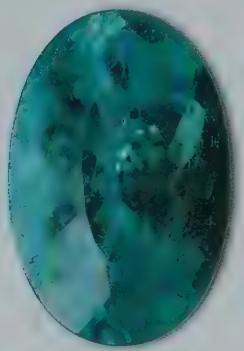
Red tourmaline from Maine, USA. (Photo: ATG/LAB)

Green tourmaline from Maine, USA. (Photo: ATG/LAB)

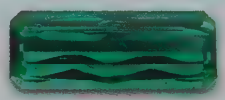


Bi-colour cat's eye. (Photo: ATG/LAB)

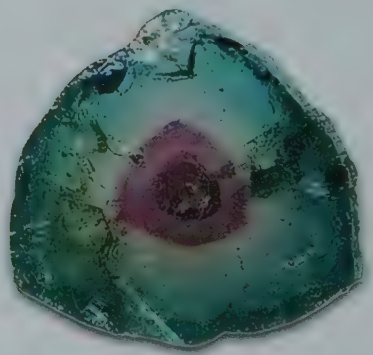
Paraiba Trilliant. (Photo: MM/RH)



Paraiba oval. (Photo: MM/RH)



Nuristani tourmaline. (Photo: ATG/LAB)

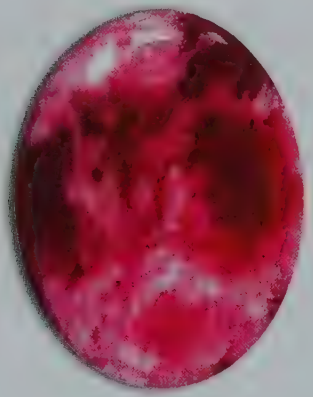


Watermelon tourmaline. (Photo: MM)

Gold brooch set with a large red tourmaline surrounded by diamonds in the form of a snake. This was a gift from Edward VII to Mrs Keppel, c.1890. (Photo: WL)

centre is pink and the outer green with a colourless layer in between. When a cross-section of the crystal is cut it is known as a **Watermelon Tourmaline**. Very attractive, but also expensive.

Tourmaline occurs in Brazil, Russia, the USA, Africa, India, Pakistan and Sri Lanka. Like quartz, tourmaline displays pyroelectric effects (upon heating, an electric charge is induced with opposite polarity at each end of the crystal) and piezoelectric effects (when under pressure an electrical charge is induced).



Tugtupite cabochon. (Photo: AH)

Tugtupite

An unusual name for an unusual stone: discovered in Greenland and approved as a gemstone in 1963, its name means 'Reindeer Stone'. It is carved locally for small ornaments and jewellery.

Shades include orange, pink and bright red. Unusually, when kept in the dark, the pale shades fade to white, but recover their colour when exposed to daylight. It is doubly refractive with a hardness of around 6.5, depending on impurities.

Although mainly found in its massive form, occasionally transparent specimens are found that may be faceted. It is still mainly sourced from Greenland, though it is also found in northwest Russia and Canada.

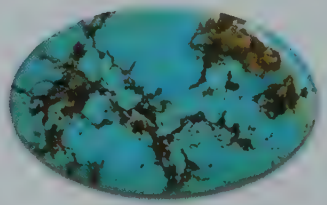
It is strongly fluorescent under ultra-violet light and may also fluoresce in strong sunlight.

Tugtupite is said by the Inuit to glow a bright red, indicating the depth of lovers' feelings for each other.

Turquoise

Turquoise has been used as decoration for thousands of years. It was highly prized by the Persians when first discovered. The Ancient Egyptians found it in the Sinai Peninsula: a huge mining operation involving 8,000 men took place there seven thousand years ago. It was also used by the Aztecs and by the North American Indians.

In the Middle Ages the Venetians gave it the name 'Turksea', meaning 'Turkey Stone', because although



Veined turquoise. (Photo: KW)

originating from Persia (now Iran), it was sourced through Turkey; and hence turquoise.

The turquoise from Persia has the clearest sky blue

Gold brooch, given by Queen Victoria to one of her bridesmaids. Turquoise, pearls and cabochon rubies. (Photo: WL)

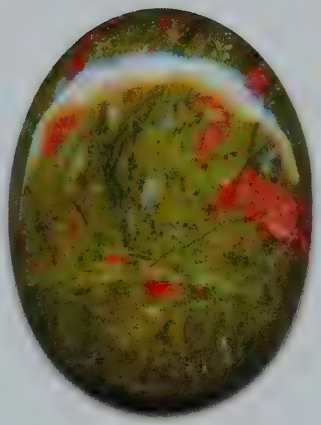
and is still classed as the finest, while that from Egypt has a greenish tinge. Other sources are New Mexico and California in the USA, and China. A veined variety is found around Medina in Saudi Arabia and is used in Bedouin jewellery.

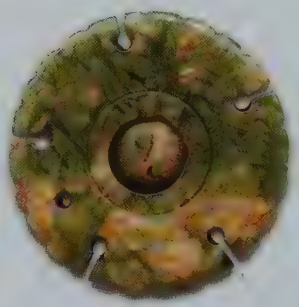
Turquoise has also been found near Liskeard in Cornwall, England, but only as a collector's specimen. A hardness of only 6 on the Mohs scale does make it liable to abrasion. 'Spider web' patterns across the stone distract from its value, although some people prefer to see it. It has remained a popular gem and is widely used.

Natural untreated turquoise from Iran. (Photo: KW)

Due to its variable fragility it is often 'stabilised' by impregnating with wax or plastic under pressure. It is also reconstituted by bonding pulverised turquoise, after removal of any impurities, into slabs that may be cut into gems.

It is simulated by glass, porcelain and plastic that may be identified by careful inspection with the loupe, which will show small bubbles. Dyed chalcedony or howlite are used as simulants but the former has a glassy lustre. It has also been synthesised by Gilson, now taken over by Chatham, but is expensive.





Unakite talisman. (Photo: KW)

Unakite. (Photo: KW)

Unakite

An uncommon mineral sometimes offered mounted in jewellery. It is a form of granite consisting of quartz, pink feldspar and green epidote. It is opaque, but when polished produces an attractive stone.

Unakite takes its name from the region where it is found, the Unaka mountain range in North Carolina, USA. It is also found in other regions of the USA, Zimbabwe and in Galway Bay, Eire (Ireland).

Zincite

Strictly speaking this 'gemstone' is synthetic. It was originally discovered growing in the smoke stack of a Polish factory. Zincite – a very dense material with a high refractive index – occurs in yellow, orange, orangey-red and yellowish green. Cut stones are very attractive although soft (4.5 on the Mohs scale). It has subsequently been found in similar processing in the USA.

Zincite, 924 pts. (Photo: ATG)

Zircon

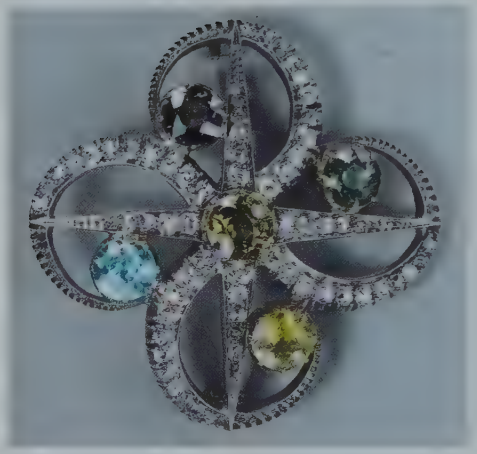
Among the heaviest of gemstones, the zircon only reached popularity in the 1920s. It was later found that, when heat treated, it produced a beautiful blue.

Unfortunately these stones tend to fade, but reheating can restore the colour. In their natural state, zircons are usually yellow, orange, brown, greenish brown and olive green. White zircon (also due to heat treatment), having a high refractive index and fire, competes with diamond in its brilliance and has been used as a simulant.

Zircon is readily identifiable to the practised eye, but not necessarily to the amateur. It has a very high double refraction that can be noted under the loupe, which of course diamond does not.

One unusual property of zircon is that it is faintly radio-active, though not at a level that it is harmful.

Zircon has had several names applied to it in the past, including 'jargoon' or 'cerkonier'. Yellowish-red and orange-red were called 'hycinth' and 'jacinth' (see the 'Most Noble Electuary of Jacinth' in the earlier History, Myths and Legends section).



Above: *Brooch by Giuliano. Coloured zircons and diamonds, c.1890.* (Photo: WL)

Care should be taken when handling these gems as they are somewhat brittle and the facet edges can get damaged.

Zircon is simulated by synthetic blue spinel, but is easily distinguished as zircon has large double refraction, whereas spinel is singly refractive.

Zircon is prolific in the gem gravels of Sri Lanka and in Burma (Myanmar). Red crystals are found near Le Puy in France. It is also found in the USA, Australia, Cambodia and Thailand.

Zircon. (Photo: AJ)

Organic Gems

Amber

Amber is the fossilised resin of Pine trees – mainly the *Pinus succinifera,* which thrived more than 30 million years ago. Amber is mostly to be found in Russia, along the shores of the Baltic Sea, and is washed up in Norway, Denmark and the east coast of the British Isles. It has recently been discovered in Australia and Turkey.

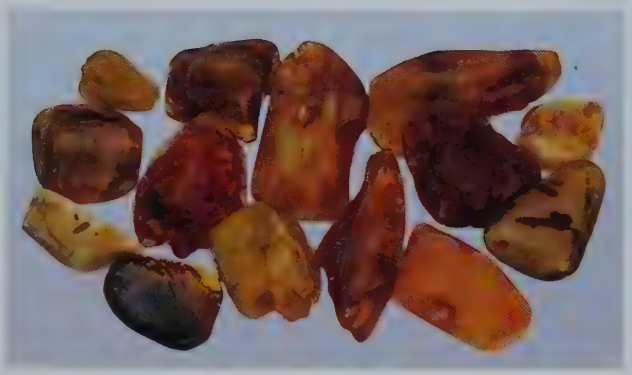
Amber appears in various colours: yellow, brown, near white and reddish. It has a hardness of about 2 and a greasy lustre.

Although most amber is washed up along the various coasts there is a variety that is open-mined in Russia termed 'pit amber'. It produces small pieces, which are pressed together and termed 'Venetian Amber', 'Compressed Amber' or 'Ambroid'. Copal was burnt as an offering to the gods.

A major source of tropical amber is found in the mud-stone mines of Amber Valley in the Dominican Republic, where amber was originally cherished by the native Taino tribes but forgotten until being 'rediscovered' in the 1960s.

In Greece, amber was called 'electron' because, when rubbed with a cloth, a negative electrical charge is induced that attracts small pieces of paper or other light material.

Silver bracelet set with three colours of amber. (Photo: ACC)



Shades of Baltic amber as found. (Photo: MCP)

In Germany, it is called 'Bernstein' where it is powdered and burnt as incense.

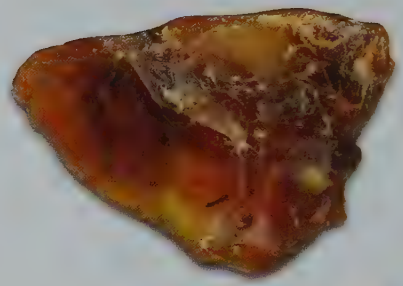
Sometimes it is possible to find insects trapped in the amber and these pieces are most collectable, but – and a very big BUT – there are a lot of fakes about. Copal resin is a 'modern' resin still being exuded by the trees and will not become true amber until it is fossilised in several million years' time. However, it is almost identical to amber and is the most popular simulant. In nature, an insect, trapped in a drop of amber resin as it dripped down the bark of the tree, had time to wriggle before it set. This may show as swirl marks around the moving parts of the poor imprisoned creature. In the fakes, dead insects are planted into copal resin and, consequently, there are no swirl marks. A particular copal resin from New Zealand comes from the Kauri

tree and is often sold to tourists. It is called Kauri Gum, but may be passed off as amber.

An easy way to tell amber and copal resin apart is to test with ether: a spot of ether will have no effect on real amber, but will leave a sticky patch on copal resin.

Other simulants are glass, bakelite, celluloid, casein and perspex. Again, detection is not difficult if the stone is not mounted. Mix up a saline solution in a glass of water, about two or three teaspoons of salt should do, according to the size of the glass. True amber will float; these other simulants, which have a greater specific gravity, will sink. Polystyrene has almost the same SG as amber but is attacked by toluene. Another test is to use a red-hot needle applied in an inconspicuous place. The smell from true amber, as opposed to plastic, is distinctive. Not applicable to copal.

Fly trapped in Dominican amber. (Photo: MCP)

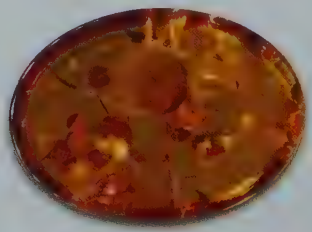


Kauri gum. (Photo: courtesy of Mark Faithfull)

One room in the palace at St Petersburg in Russia had a room entirely panelled in amber. Unfortunately, the panelling disappeared during WWII, but it has now been completely recreated.

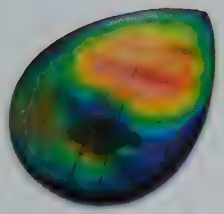
There is a current fashion for changing the colour of certain amber to green using heat and, sometimes, pressure. The so-called 'blue amber', also on the market, really only shows as a fluorescence under ultra-violet light.

Amber is regularly heat treated to improve appearance; however, this commonly causes the formation of 'spangles' within the piece. These may occur in nature but rarely and to a lesser extent.



Heat-treated amber. (Photo: KW)

Ammolite



Polished ammolite. (Photo: Korite)

Ammolite is the mineralised remains of the *Ammonite Placenticeras* – a hard-shelled squid-like sea creature from the Upper Cretaceous period, 65 million years ago. Its name was taken from the Egyptian god Ammon.

Ammonite fossils are fairly common worldwide; they are prolific on the beaches of Lyme Regis in England. However, the variety used as a gem, because of its beautiful colours, occurs only in the Canadian province of southern Alberta. It was classified as a gemstone by the Coloured Stone Commission in 1981. Its appearance is similar to black opal with a spectacular display of interference colours.

It is comparatively rare and expensive. It is very friable and subject to damage. It is therefore usually sold as doublets or triplets, the face being protected with a dome of synthetic spinel or quartz. The base of the triplets is usually a natural shale. Unprotected ammolite must be treated with even more care than opal, not being worn when it may be knocked or when liable to become wet. Cleaning should only be done with a barely damp cloth without soaking. Even as a doublet or triplet it should not be soaked.

The exponents of Feng Shui believe that ammolite absorbs cosmic energy, which is then given off to the owner – bringing health, wealth and enlightenment. It was used as an amulet by native Americans against evil spirits.

Ammonites. (Photo: KW)

Antler

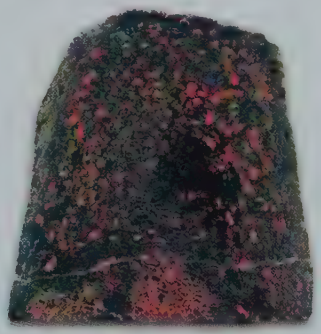
Deer or, more correctly, stag antler is in popular use having a hardness of 2½ on the Mohs scale.

Strictly speaking, antler is not horn as its construction is different, but this should not concern us when considering its use as a decorative organic material. As antlers are shed annually, the supply is fairly readily available.

Red stag antler (Photo: KW)

Bone

Bone has often been used as a cheap alternative or simulant for ivory (*see* Ivory). However, other types of bone are used today for decorative purposes, such as pendants. One such is fossilised Dinosaur bone.



Dinosaur bone. (Photo: MM)

Coral

Precious coral used for jewellery is not, in fact, the coral that builds enormous reefs in the South Seas but a particular variety called *Corallium Rubrum* or *Corallium Nobile*.

Pink coral, diamond and gold earrings. (Photo: Sotheby's)

Coral polyps are a plant-like animal and are extremely small, barely 2 millimetres in diameter. They are a bit like a small sea anemone but their external skeletons mass together to form tree-like structures. Precious coral is found around the Mediterranean, the Red Sea, the Malay Archipelago and Japan.

The most valuable colours are very dark red (ox blood) through to pink. Most of the fashioning of coral is in Italy, where cameos, cabochons and beads are cut. It is very beautiful but very soft: only 3½ on the Mohs scale.

Red coral brooch. (Photo: Sotheby's)

It contrasts extremely well with turquoise. Being composed of calcium carbonate, it is readily attacked by acids.

It is only to be expected that precious coral has many simulants. Stained vegetable ivory (*see* Ivory) is used but can be identified by the dot-like cell structure under the loupe. Glass, plastic and porcelain are also used. Pale coloured coral is also dyed to improve its appearance, but the dye will come off with nail polish remover.

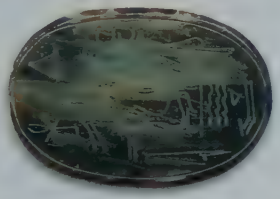
Coral and gold cross by John Brogden, c.1870. (Photo: WL)

Black coral, which is composed of conchiolin rather than calcite, is found in the Indian Ocean, Hawaii, West Indies and the Pacific Islands. This is also fashioned into jewellery. Its export is banned from several countries.

Coral has been used as talismans for thousands of years, but was believed to retain its powers only if it remained unworked. Red and white coral are both said to give safety to the wearer during storms and tempests.

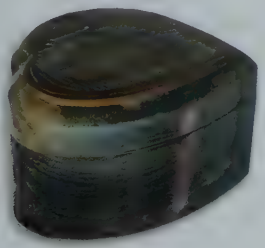
Horn

Although horn is at the very borders of our subject of gems it is worth noting that various types of animal horn are used in carvings and inlay and, occasionally, jewellery.



Horn scarab marked with hieroglyphs, from Egypt. (Photo: KW)

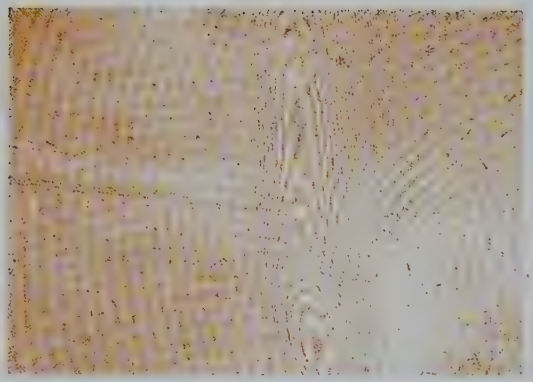
Buffalo horn is used in the developing countries for tourist souvenirs. Scarab beetles carved from horn are found in Egypt, suitably inscribed with hieroglyphs. In India, horn is fashioned into carved boxes.



Heart-shaped horn box, from India. (Photo: KW)

Ivory

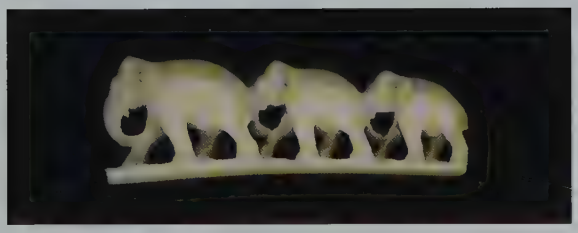
Ivory comes from different sources: we immediately connect it with elephant tusks, but it is also from the narwhale, mammoth (fossil), hippopotamus, walrus, boar and the cachalot whale. A gemmologist can identify each different type of ivory, but this is unnecessary for the amateur.



'Engine-turning' markings in elephant ivory. (Photo: MCP)

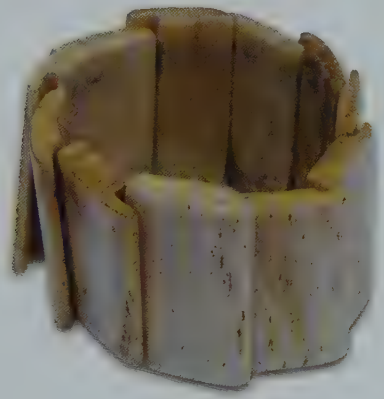
Strictly speaking, ivory is dentine, the same as all mammal teeth – even our own! The difference is that our teeth have a coating of enamel, whereas ivory, such as elephant tusks, does not. Elephant ivory is identified by patterning that sometimes occurs, which looks like engine-turning marks. However, as regards ivory (and all elephant products), import is banned. Another, very rare item is Hornbill 'ivory'. The term 'ivory' in this case is incorrect as it is of a keratinous material – part of the bird's bill – used mainly by Chinese craftspeople for small carvings.

Carved ivory pendant. (Photo: ACC)



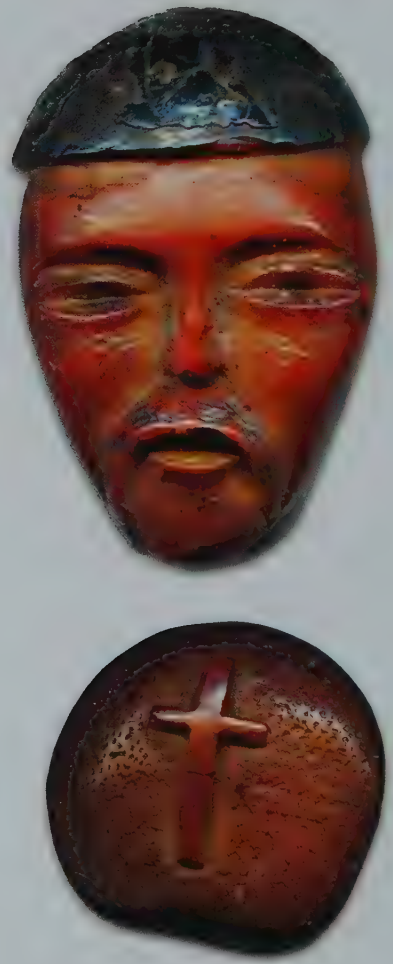
Carved ivory brooch. (Photo: ACC)

Bone is the most common simulant but is identifiable by a series of canals, which, upon inspection under the loupe, appear as short, broken, dark lines or little oval or circular spaces. Deer or stag horn is also used; its markings bear a resemblance to bone but are less defined.



Bone bracelet, note the canals. (Photo: ACC)

'Vegetable ivory' is made from the nuts of the Ivory Palm (*Phytelephas macrocarpa*), known as Corozo or Tagua Nuts, from South America. Its hardness is the same as true ivory, making a convincing simulant, particularly when carved. It was imported in large quantities in the 19th century and used for buttons, chess pieces and jewellery. The Doom Palm (*Hyphaene thebaica*), from North and Central Africa, also a



Carved and stained vegetable ivory.
(Photo: KW; courtesy of Joyce King)

produces a nut used to make an ivory simulant, but it is less hard than the corozo nut. Both these nuts can be stained successfully. Celluloid is also used to imitate ivory, and makes effective fakes. Other plastics are not as convincing.

Ivory from the fossilised tusks of mammoths found in Alaska and the Yukon is marketed freely in Canada and the USA. Complete tusks, when found, are not cut for jewellery but sent to museums.

Carved tagua nut. (Photo: MS)

Ancient fossil walrus ivory was excavated and used by the Yupik Eskimo of Alaska for tools and sled runners for more than 5,000 years.

A curiosity related to ivory is the 'elephant pearl'. This is a non-nacreous object found in the tusk of the animal. The 'pearl' is a rounded calcified mass of dentine (ivory) formed in the soft tissue pulps of growing tusks.

Coming in many differing shapes and colours, from white to brown, they are highly prized by Buddhists for bringing good luck. Sizes vary but can be as large as a hen's egg. They are sourced mainly from India.

The import and sale of ivory is illegal in the UK and several other countries. The only ivory allowed in is 'antique' (pre-1947) or fossil ivory carrying an authenticating document.

(Note: Guidance notes on importing and use of ivory and other materials taken from animals are given on the following website – www.defra.gov.uk/animalhealth/CITES/guidance/GN7.htm. Antique Collectors' Club has no responsibilty for the persistence or accuracy of URLs for external or third-party Internet websites referred to in this book, and does not guarantee that any content on such websites is, or will remain, accurate or appropriate.)

Examples of carving on fossil walrus ivory. (Photo: ATG)

JET

Jet is the fossilised wood of prehistoric trees that have been compressed over millions of years. It was known and worked long before the Romans came to England. They, in fact, were so delighted with it that they shipped large quantities back to Rome. It was mined from the coastal areas around Whitby in Yorkshire where it occurred in seams in the rock between one to six inches thick; it could also be collected from the beaches.

This dense black material, in the form of beads, pendants and charms, has been found in early burial mounds across the British Isles. The Victorians continued this association and, upon the death of Prince Albert, jet mourning jewellery proliferated. It became so popular that the local supply was supplemented by material from Spain to be worked in the Whitby workshops.

Jet necklace and pendant. (Photo: KW)

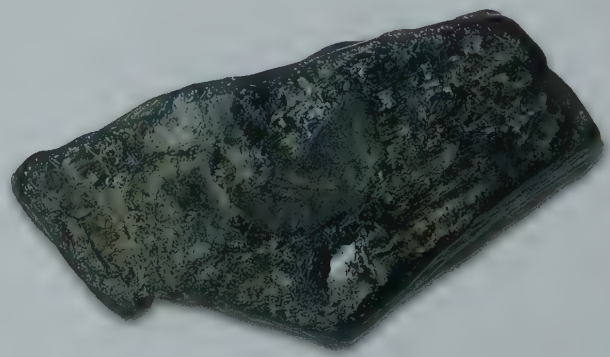
Jet pendant. (Photo: KW)

Jet is also found in France, Germany, the USA and Russia, although it does not appear to have been worked to any great extent.

Jet is soft, rating just 2½ on Mohs scale, so is easily carved. It takes a high polish in the hands of the skilled craftspeople.

Although the jet industry in Whitby has declined considerably since Victorian days, it is still a popular tourist attraction in Whitby, where jet jewellery may still be purchased.

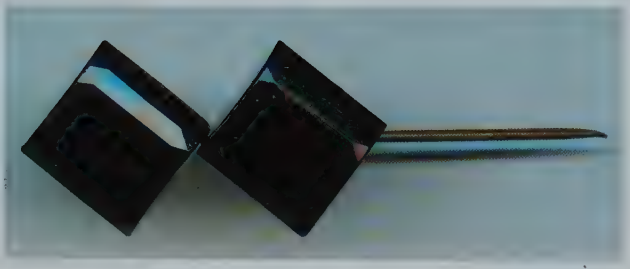
Simulants have abounded over the years. Black glass called 'Paris Jet' is commonly found but easily identified by its heavier weight. This was subsequently produced in England and called 'Vauxhall Jet'. Both are



Rough jet, as found. (Photo: KW)

Jet brooch. (Photo: KW)

cold to the touch. Goodyear Tyres introduced vulcanite, also known as ebonite, probably the most common simulant, a composition of rubber and sulphur in 1846. As with true jet, it is warm to the touch; it is also not as brittle and can be drilled. Always moulded to shape with pin fastenings attached by pinning; whereas, with true jet, fastenings are glued on (see illustrations).



Jet hatpin. (Photo: KW)

Other simulants include Bog Oak from Ireland, a semi-fossilised wood, which is paler in colour with a dull finish; Bois Durci, a little-used alternative consisting of compressed wood powder painted black; bakelite; dyed horn. Cannel coal and Kimmeridge shale closely resemble jet, the latter taking a high polish, the former lesser so. Neither have the best characteristics of Whitby jet.

Recently, models have appeared in the tourist shops that may have the look of dull jet and are marked 'Made of Coal'. They are, indeed, a compressed coal dust and not jet.

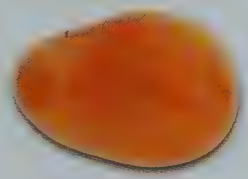
Vulcanite brooch, back and front. (Photo: KW)

PEARL

Pearls are the moon to the diamond's sun. They have been held in esteem for thousands of years; highly valuable, strings of them graced the necks and garments of kings and queens. A gem not produced by the high temperatures and pressures in the depths of our planet, but grown in the shell of a simple sea creature: the oyster.

A pearl is produced when a foreign body enters the oyster between the mantle and the shell – which must be a bit like having a stone in your shoe. The animal cures the aggravation by coating it with a substance called nacre, which keeps growing into a pearl.

In the 1890s a Japanese pedlar of noodles, Kokichi Mikimoto, started the commercial production of Cultured Pearls after many years of experimentation. The idea of accelerating the process of pearl production was not new. The Chinese began inserting objects into freshwater mussels in the 13th century, but it wasn't until Mikimoto appeared that they became a real threat to natural pearls. Nowadays 90% of pearls sold are 'cultured'.



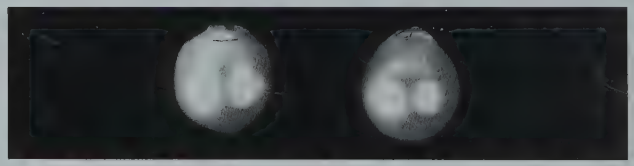
Melo pearl. (Photo: DD/PW)

Pearls can also come from snails – to be specific, the Melo Marine snail, which lives in the South China Seas. Interestingly, Melo pearls are orange in colour, due to their carotene content. Like the conch pearls, they don't have any nacre, whereas oyster and mussel pearls are both nacreous. Conch and Melo pearls are large and very similar in colour and appearance. (*For 'elephant pearls', see under Ivory.*)

Pearls are valued by size, shape, flawlessness, colour and lustre.

Japanese cultured pearls. Sizes, from the left: 2 mm, 3 mm, 4 mm, 5 mm, 6 mm, 7 mm, 8 mm, 9.5 mm, 10.5 mm. Shown actual size. (Photo: ACC)

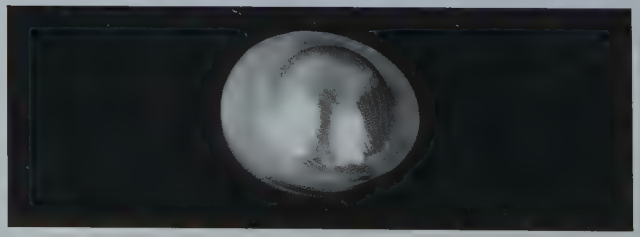
Size – Pearls are measured by weight in grains: there are 4 grains to the carat. That is the same carat by which all gems are weighed. However, it is not uncommon now for pearls to be quoted in millimetres.



Pair of South Sea pearls showing a growth formation. Shown actual size. (Photo: ACC)

Shape – The ideal shape for a pearl is perfectly round, though natural pearls are quite often imperfect. Cultured pearls, however, are usually round due to the way they are formed. Odd-shaped pearls are called 'baroque' and are particularly common in the freshwater variety.

'Blister pearls', formed when the growing nacre is



Mabé pearl cut from the inner surface of the oyster shell. This will be trimmed before being set. Shown actual size. (Photo: ACC)

attached to the shell, are usually shaped in a hemisphere. These are cut from the surface of the shell and set where the underside is hidden by the mounting. They may also be filled with a paste after removing the interior and covered with a mother-of-pearl backing. These are called Mabé pearls.

Flawlessness – Just as it implies, this refers to the pearl having no imperfections on its surface. Only three flaws will reduce a pearl's value by 50%. Sometimes these marks are hidden by the drilling of the bead.

Colour – Pearls come in a variety of colours and shades, depending on the source. Those from the Arabian Gulf tend to be creamy-white, whereas those from Australia are silver-white or yellow.

Lustre – This is known as the 'orient' of the pearl and is what gives it its unique beauty and value. Also termed 'iridescence', it is caused by refraction of light through the many layers of nacre.

German brooch. Conch pearl and diamonds, c.1900. (Photo: WL)

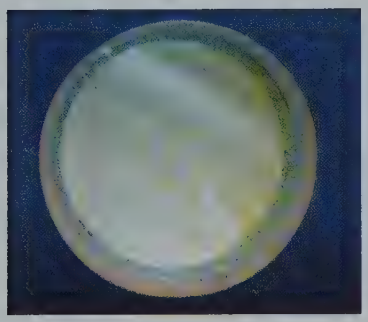
Detail of a Tiffany brooch. Mississippi pearls and diamonds, c.1900. (Photo: WL)

To correct a misconception, pearls are obtained from the pearl oyster (*Pinctada*), not the edible one you have in a restaurant. They are also found in abalone, producing green, yellow, blue and black pearls, and in the great conch, producing pink pearls. These are generally found in the Gulf of California.

The pearl oyster, abalone and great conch are all sea creatures and therefore produce salt-water pearls. Freshwater pearls are produced by mussels.

Mississippi pearls were popular around the beginning of the 20th century. They were found in the northern reaches of the Mississippi river in the freshwater mussel, mostly prized for its mother-of-pearl. The pearls are generally baroque in shape and come in a variety of colours.

Cultured Pearls – These are mainly produced using salt-water oysters. The process, in the simplest terms, consists of placing a bead of mother-of-pearl (usually between 6 and 13 mm in diameter) between the mantle and the shell of a live oyster in a laboratory and



Cultured pearl, cross-section. Note the mother-of-pearl bead core and the skin of nacre grown around it. The thicker this skin, the better quality the cultured pearl. (Photo: RH)

returning it to the oyster beds to grow. The length of time that they are left to grow determines the eventual quality of the final product. Several years ago, they would be left for two years or more to grow their coating of nacre but commercial pressure has reduced the growing time to six to eight months. Consequently, many cultured pearls have a very thin layer of nacre that tends to wear away or peel off. Better-quality pearls, sourced from the South Seas, are still available, but at a price. They are generally larger than the Japanese Akoya pearl.

Cultured oyster pearls. (Photo: RH)

Cultured pearls are also produced in a range of colours and some are dyed, particularly black pearls. Tahiti provides most of the coloured pearls and these are also larger than the Japanese pearls. The birthplace of the cultured pearl, Japan, is now the main marketing centre for the gem. The principle product is now the Akoya pearl.

Simulated Pearls – These have been produced for hundreds of years: it is believed that many of the pearls that adorned the costumes of Queen Elizabeth I were artificial.

One of the best simulated pearls is the 'Majorica', produced in Majorca; it was introduced in 1953 and is very difficult to distinguish from both the natural and the cultured pearl. The base is a glass bead, which is coated with a solution of powdered fish scales and bismuth oxychloride to give the iridescent quality. The complete process is a closely guarded secret.

Cheap copies are also made and sold in Majorca but they do not have to same lustre and beauty.

Simulants were also made in Czechoslovakia and France during the 1920s and '30s using wax-filled hollow glass beads and fish scales but tended to be dull when compared with a real or good cultured pearl. The flood of cheap cultured pearls has had severe repercussions on the market for simulants.

The standard test for whether a pearl is genuine or a simulant is to gently rub it against the edge of your top teeth, a real pearl will feel rough whereas a fake will feel smooth. This test will not identify a cultured pearl, however, as these also feel rough.

Range of Chinese cultured non-nucleated mussel pearls of varying quality. (Photo: MCP)

A natural pearl will always have a good lustre, which may identify it from a cheaper cultured pearl. If you look closely at the hole in a bead where the thread goes through, the coating of the cultured pearl may show signs of wearing away around the edge of the hole.

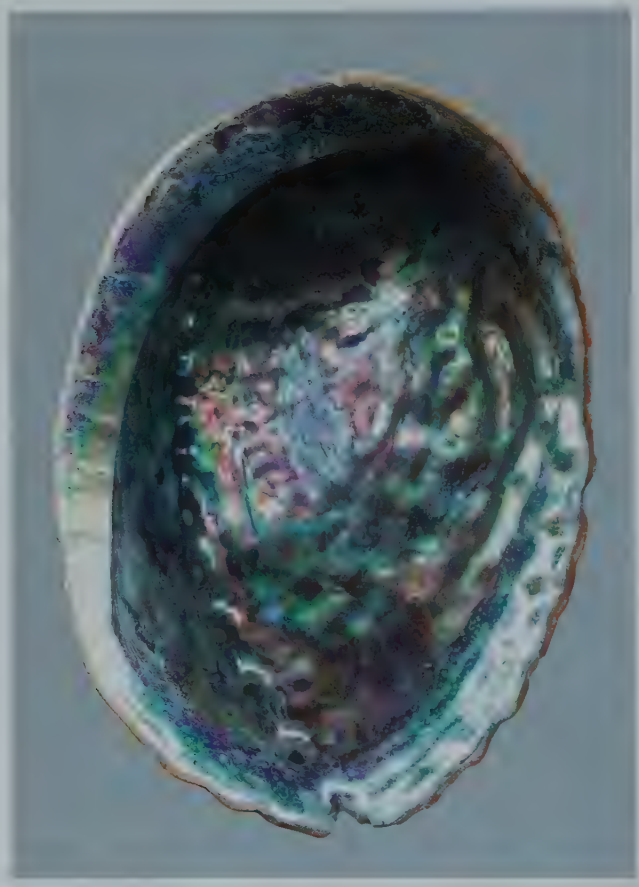
Freshwater Pearls – These are farmed in rivers and lakes. Japan began development of freshwater pearls using clams in the 1930s at Lake Biwa, which were first marketed in 1961. Unfortunately pollution of the lake eventually halted production.

Most, if not all, freshwater pearls are non-nucleated, meaning that, instead of a mother-of-pearl bead being inserted into the mollusc, a small piece of mantle is introduced instead. The pearl grown is 80-90% pure nacre. China has now taken up the production of the pearls and is the major supplier, with varying degrees of quality. Mussels are used in many places of the world, including Scotland, to produce pearls: strings of baroque (non-uniform shape) freshwater pearls are available quite cheaply at gem shows.

As noted earlier, a good way to distinguish natural and cultured pearls from simulated is with the tooth test. This involves rubbing the teeth (these need to be real, not false!) gently against the pearl; natural and cultured will feel slightly rough whereas simulated will feel polished. Occasionally cultured pearls are coated, which will give the feel of simulated. Natural pearls are almost always in graduated strings due to the rarity of matching sizes and are also slightly misshapen unless very valuable; cultured are often larger, perfectly round and of all the same size. Freshwater mussel pearls are quite commonly 'baroque' or odd shapes.

Shell

Abalone or **Paua Shell** – Used extensively for costume jewellery, it is easily identified by the iridescent play of colour and swirling patterns. It is found mainly around New Zealand and Queensland, Australia, as well as California and Florida in the USA. It also produces pearls in green, yellow, blue and black.



Abalone shell. (Photo: KW)

Oyster shell. (Photo: KW)

Mother-of-pearl – Produced from the shell of the large pearl oyster, this has been used for many years for the manufacture of buttons, inlays, knife handles, gaming counters, etc. It is often dyed.

Mother-of-pearl buttons. (Photo: KW)

Louis XV gold snuff box inlaid with mother-of-pearl. (Photo: WL)

Mother-of-pearl crucifix. (Photo: KW)

Pearl earrings, Giuliano. (Photo: WL)

Shell cameo, a relief carving of Poseidon, god of seas and oceans, c.1870. (Photo: MR)

Shell cameo. (Photo: Sotheby's)

Helmet Shell – This large shell of the *Cassis madagascariensis* is commonly used for the production of cameos. The cameos are white relief on a brown background. The giant conch is also used for cameos giving a white relief on a rose-coloured background, which has a tendency to fade. Both are found in the waters around the West Indies.

Bull mouth helmet shell (Cypraecassis Rufa), which is used for carving cameos. (Photo: KW)

Operculum (Latin for 'little lid') – Also known as the 'Chinese cat's-eye', this is actually the trap-door of the winkle; but not the small edible kind. It comes from a large snail-like mollusc *Turbo petholatus*. The operculum can range from a ¼ inch to 3 inches in diameter. The top is domed and is green, white and brown; the underside

Operculum. (Photo: KW)

is flat. When the mollusc retires into its shell the operculum closes behind him. Operculum is found around the islands off Singapore and the Phillipines. They have been used as eyes for grotesque statues and, on Stewart Island off New Zealand, as a form of currency.

Antique tortoiseshell card case inlaid with mother-of-pearl. (Photo: KW)

Tortoiseshell – This actually comes from a sea turtle, the Hawksbill Turtle, rather than a tortoise. It got its rather misleading name 'tortoiseshell' when family groupings were not as advanced as today and the two creatures were still confused. The source of the best shell is the East Indies (South Asia) but it is also found in the West Indies, Brazil and the Malay Archipelago.

Tortoiseshell is thermoplastic, which means that it softens and becomes pliable under heat, rendering it possible to flatten and smooth the curved plates of the turtle's shell. Sheets are also joined by 'welding' them together with heat and pressure.

Tortoiseshell has been used as facings for furniture, inlays, spectacle frames, combs ... a myriad of different articles. Precious metals and brass (as in 'Boule' furniture) are sometimes inlaid in the surface of the shell by placing them on the top and pressing them into the warmed tortoiseshell.

The amber or yellow colour is marked with darker patches that, when inspected under the loupe, show up as a series of dots; a bit like a photo in a newspaper. The closer the dots, the darker the patch. This distinguishes it from the plastic simulant where the mottling is in swathes and bands not dots. Blonde shell from the belly plates is also used but this does not have the mottling.

As with most organic materials, it has a hardness of 2½ according to the Mohs scale.

Plastic 'tortoiseshell'. (Photo: KW)

The import and sale of tortoiseshell is illegal in the UK and several other countries. The only tortoiseshell allowed in is antique and must be carrying an authenticating document.

Tortoiseshell and gold piqué, c.1740. (Photo: WL)

Fordite 'gems'. (Photo: ATG/LAB)

A Selection of Minor Gemstones

The term 'minor' does not reflect the monetary value of these stones but, rather, their rarity as regards their use in jewellery: most can be classed as 'collectors' stones'. However, in the present climate of introducing new gems to the public, it is possible that they may occasionally be offered over the internet or the TV shopping channels.

AMBLYGONITE (H.5.5-6) – a comparatively new gem to enter the market place. Its rather strange name comes from the Greek meaning 'blunt angles'. Its major source is Brazil, where amblygonite occurs as a bright yellow/green, but other sources are reported to produce blue, pink, purple and colourless stones.

It is not very hard and is somewhat fragile so handling and setting should be approached with care. Ultra-sonic cleaning should be avoided, and it is also affected by certain acids and chemicals.

It is relatively inexpensive. Sizes available are from 40 pts to 3 cts plus.

BARYTE (H.3-3.5) – a very soft stone found in a variety of colours. Cut for collectors only.

BERYLLONITE (H.5.5) – an unimpressive, soft, colourless stone for collectors only.

BRAZILIANITE (H.5.5) – a rare pretty gem cut mainly for collectors due to its fragility. It derives its name from Brazil, where it was found. Yellow to yellowish green with a vitreous lustre.

CASSITERITE (H.6) – an ore of tin found in Cornwall (England) and Bolivia. The reddish-brown transparent crystals are rare. It has an adamantine lustre and a high density. Cut only for collectors.

CAYMANITE (H.5) – only found in the Cayman Islands, it occurs in shades of brown and yellow. It is an opaque banded stone from the dolomite group and usually cabochon cut. A popular souvenir for the tourists.

CLINOHUMITE (H.6-6.5) – a rare stone, favoured by collectors, originally found in the area of Versuvius in Italy but since discovered in Finland, Malaga and the USA. The only gem quality material has come from Tajikistan, a republic adjacent to the north of Afghanistan that is rich in a variety of minerals. It has an intense orange-yellow colour with a reasonable hardness of 6–6.5 on the Mohs scale but is fragile and sensitive to both heat and acids.

DIOPTASE (H.5) – a beautiful brilliant emerald green stone with strong dispersion. It is occasionally cut for collectors, but with difficulty, as it is fragile.

ENSTATITE (H.5.5) – this commonly occurs in green and brown and is occasionally cut as a gemstone. The best variety is chrome enstatite, which is a very attractive emerald green stone. As it is rather soft at 5–6, care is required when setting and wearing; it is better suited to pendants rather than rings. It is sensitive to heat and acid.

It is dichroic – green and yellow green. Star stones and, more rarely, cat's-eye varieties are also found, as is a bronze-coloured variety called 'bronzite', which is mainly used as an ornamental stone.

Enstatite is found in several localities around the world including Burma (Myanmar), India, Kenya, Tanzania and the USA.

FORDITE (H.?) – though, technically speaking, this is not really a gemstone, it is rather a curiosity. Also known as 'Motor Agate', it was in fact a byproduct of the Ford Motor Company. When the cars were spraypainted, some paint would inevitably end up on the tracks and rollers on which the cars rested. Over time this would build up to such an extent that it would need to be removed. It was at this stage that some clever worker with an eye for beauty realised that these layers of paint could be cut and shaped into cabachons. Due to a change in the method of painting (to electrostatic powder coating), fordite is no longer available.

GASPEITE (H.4.5-5) – this mid to light green, translucent to opaque stone comes from Gaspe in Quebec, Canada, from where it takes its name. It has a vitreous lustre and is normally cabochon cut.

HEMIMORPHITE (H5) – this gem has the same unusual property as tourmaline, i.e. when the crystals are heated a positive and negative charge develop at the opposite ends of the crystal. This is called the pyroelectric effect. Fluctuating pressure will also generate a similar phenomenon but this is termed the piezoelectric effect. The mineral 'hemimorphite', its name meaning 'half-formed' due to each end of the crystal being different, occurs in blue, green and white. It is found in Africa, Siberia, Mexico, England and China. It is mostly translucent but gem quality has been found in Mexico and the Congo. Comparatively rare and being soft, it is classed as a collector's stone.

HODGKINSONITE (H.<5) – a rare gemstone only found in Franklin, New Jersey, USA. An attractive pink stone that is pleochroic (lavender and pale purple).

HOWLITE (H.3.5) – a soft white mineral used for ornamental purposes. Its main use, once dyed, is as a simulant of turquoise.

JEREMEJEVITE (6.5-7.5) – originally found in Russia in minute crystals, but subsequently discovered in gem quality in Namibia and the Eifel district of Germany. It is light blue, light yellow and colourless with a vitreous lustre, pleochroic and also has piezoelectric properties. Sensitive to heat and acids. Only found in small sizes and is normally cut as a baguette.

KORNERUPINE (H.6-7) – this comparatively rare stone occurs in shades of brown and green, with a vitreous lustre. It is found mainly in Sri Lanka and Madagascar, though a blue/green variety has been reported from Tanzania, and a cat's-eye is known. It is strongly pleochroic (brown to greenish/brown) and is sensitive to heat and acids.

PETALITE (H.6.5) – this is mainly colourless although pink and yellowish examples have been reported; it has a vitreous lustre. It is found in Australia, Brazil, Italy, Namibia, Sweden, Zimbabwe and the USA. Gem quality colourless crystals have only been found in Brazil. It is rare and should be classed as a collector's stone.

PEZZOTTAITE (H.8) – a raspberry coloured gem, which was discovered in Madagascar in 2002 and later in Afganistan. It was originally mistaken for red beryl but later named after the Italian mineralogist Dr. Pezzotta. Usually translucent due to heavy inclusions; a cat's-eye variety occurs. It is stable with a vitreous lustre. It is uncommon and has only briefly appeared on the gem shopping channels.

PHENAKITE (H.7.5-8.0) – a mainly colourless stone – though brown, greenish blue, pink and yellow have been reported – with a vitreous lustre. It is harder than rock crystal for which it may be mistaken. It is resistant to heat and chemicals.

Comparatively rare, it is found in Brazil, France, Madagascar, Mexico, Namibia, Norway, Russia, Sri Lanka, Tanzania, the USA and Zimbabwe.

PISTACITE – *see* EPIDOTE (in the Gemstones section).

SCAPOLITE (H.6) – also known as 'Wernerite', it occurs in blue, colourless, grey, pink, purple and yellow. A violet colour is also marketed but is allegedly enhanced. It has a vitreous lustre and is pleochroic. The yellow variety may be confused with Citrine or Imperial Topaz. Stones exhibiting a cat's-eye effect are also found. Sensitive to acids and chemicals; cleaning should be carried out with care.

It is found in Brazil, Burma, Canada, Kenya, Madagascar (Malagasy Republic), Sri Lanka, Switzerland and Tasmania.

SCHEELITE (H.4.5-5) – this dense, heavy stone is found in brown, brownish green, golden yellow, orange,

Verdite. (Photo: PR)

violet, grey and colourless. It has a high RI and dispersion that gives it a high fire and adamantine lustre. It is fragile and sensitive to acids and chemicals. Scheelite has been synthesised, and for a period was used as a diamond simulant, even being sold as the natural stone at inflated prices.

It is found in Japan, Korea, Mexico, Sri Lanka and the USA.

SINHALITE (H.6.5) – an attractive yellow-brown stone found mainly in Sri Lanka. It is uncommon, but sometimes cut for collectors.

SUGALITE (H. 6-6.5) – a pink to violet gem that is usually translucent, but recently a magenta transparent variety has become available. It has a resinous waxy lustre. Mostly found in South Africa, though it has also been found in Tajikistan and Quebec, Canada.

TAAFFEITE (H.5) – extremely rare. Violet, green, pink, red or colourless. Originally found in Ireland by Count Taaffe, also found since in Sri Lanka and Tanzania.

THORTVEITITE (H.?) – a purplish-blue gem with a very high vitreous lustre. Pleochroic (violet, blue straw-yellow). As yet to be confirmed as natural.

VARISCITE (H.4-5) – originally found in Germany, variscite is a relatively rare, translucent to opaque, green stone. It is similar in appearance to green turquoise and chrysocolla. Usually cabochon cut. It is claimed to have various healing properties.

VERDITE (H.3) – ornamental mineral in shades of deep green to black. Locally cut in South Africa for tourists.

WERNERITE – see SCAPOLITE

Jewellery

Although this book is primarily about gemstones, they are so interlinked with jewellery that including some basic information about it is felt to be important. This section gives detailed information on the various metals used, and the marking of them, where appropriate, a glossary of terms used in jewellery and some notes on their care.

Regarding the history of jewellery, several reference books are suggested in the list given at the end of this book.

Precious Metals

Platinum – 30 times rarer than gold, platinum is the purest metal used in jewellery; 95% pure, in fact. It is this purity that makes it hypoallergenic. Known since ancient times, it only came into its own in the early 1900s; the discovery in 1924 of the world's largest deposit near Johannesburg secured its future. It became popular for use in jewellery at the beginning of the 20th century due to it being whiter than white gold and its resistance to tarnishing. It has recently been used as a coating on silver to stop it tarnishing.

Platinum jewellery is expensive but very popular, particularly for wedding rings. It is commonly used for gem settings in gold rings.

Rhodium – a member of the platinum family, rhodium is used for plating silver to stop it tarnishing and for white gold to give a whiter finish. It is not suitable to use on its own for jewellery because it is difficult to form, as well as being prohibitively expensive. Rhodium is the hardest metal associated with jewellery. Problems can occur when rhodium plating is applied to a finished gem-set item, as the coating will occasionally cover the gem itself, therefore detracting from its appearance. Platinum itself has been used recently as a coating on silver for the same reasons.

Palladium – although of the same family, palladium is approximately a fifth of the price of platinum and a third of that of gold. Palladium is a crisper white than white gold and therefore does not require rhodium plating. It has had a particularly strong influence in the Chinese jewellery market. Palladium wedding bands are becoming popular. The percentage purities available are 500, 950 and 999. A compulsory hallmark is now required for palladium (*see* under 'Hallmarks').

Gold – pure gold is 24 karat, but it is generally alloyed with other metals to produce a range of coloured golds. For instance, to achieve red, yellow or green, the gold is alloyed with varying proportions of silver, copper or tin. White gold is an alloy with nickel, palladium and zinc. All these mixes reduce the eventual gold content to 75% or 18 karat. Nine karat gold is the lowest quality legally accepted in the UK. Rose gold is a variation of red gold achieved by the addition of copper.

White gold sometimes has a slightly yellowish tinge and rhodium plating helps reduce this and makes it more reflective.

Distinguishing platinum from palladium and white gold
To identify one unmarked metal from the other, a simple test is to apply a small drop of iodine to the article (source: Johnson Matthey):

Palladium – the iodine turns black;
Platinum – the iodine turns mostly colourless;
14 and 18 karat white gold – the iodine turns brown (if the item has been rhodium plated this should be scraped off in an inconspicuous spot before testing).

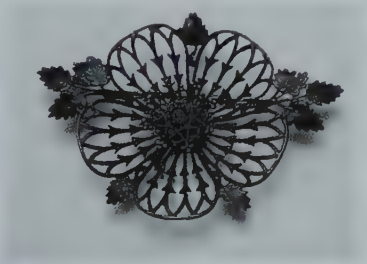
Silver – there are two grades of silver used in the UK: sterling silver 92.5% pure and Britannia Silver 95.84% pure, the latter is rarely used these days. Sterling silver is an alloy of 92.5% silver and 7.5% copper; Britannia Silver has 5% of copper and cadmium, the latter to soften the alloy.

Silver jewellery is usually rhodium plated to prevent it from tarnishing. The present standard for purity in Europe is 80% but this has varied in the past. Silver from other parts of the world can be of lower purity. The problem with the lower purity is that it tarnishes badly, faster than higher grades.

Base and Plated Metals

Aluminium – a lightweight silvery metal in common use and sometimes used for costume jewellery. It is soft and most often anodised to give a wide range of colours. However, this is may be liable to damage from scratching.

Berlin Ironwork – even iron has been used in jewellery. Introduced by the Royal Berlin Factory in the early 1800s, intricate castings using the lost wax process were produced to sell to the Prussian aristocracy to encourage them to donate their gold and silver to the war effort against Napoleon; the iron jewellery being given as a replacement for their offerings. Berlin Ironwork was coated with black lacquer to prevent rusting. Today, it is still highly collectable.



Berlin Ironwork brooch. (Photo: ACC)

Brass – although little used in jewellery, for the sake of completeness, brass is an alloy of copper and zinc but is often supplemented by other metals to suit special applications.

Britannia Metal – not to be confused with Britannia silver. It is an alloy of 90% tin and 10% antimony. Used after 1850 to plate base metals and marked EPBM. (Electroplated Britannia Metal).

Bronze – an alloy of copper and tin used since ancient times. Mostly used for statues and figurines sometimes combined with ivory or other decorative minerals or stones. The best bronzes are usually signed by the artist.

Chrome Plating – sometimes used in costume jewellery for a bright finish.

Electro-gilding – a process developed in 1840 similar to the electroplated nickel silver (EPNS) known today. A very thin coating of gold was applied to made-up jewellery to give the impression of being solid gold; however, being so thin, the coating soon wore off.

Electroplated Nickel Silver (EPNS) – the most common finish for cutlery and decorative articles. It consists of a thin coating of silver usually on 'German Silver'. The quality varies, the best being A1 or 'Princess Plate'.

German Silver – an alloy of copper, zinc and nickel in highly variable proportions. Used as a base metal for electroplating.

Gunmetal – a copper, tin and zinc alloy similar to bronze but a blue/black colour was popular for jewellery in the 19th century. It provided an attractive setting for gems.

Nickel – is the most common cause of skin reactions (allergic contact dermatitis). It affects 10% of women

and 1% of men. Used in several forms in jewellery either in alloys or as plating. However, strict regulations are in force to control the rate of nickel released from those parts of the product that come into direct contact with the skin. This is limited to 0.5 micrograms per square centimetre per week or less. Post earrings in pierced ears or body jewellery are the most likely to cause allergic reactions.

Niello – a powdered alloy of silver, copper, sulphur and borax used in place of glass in the enamelling process to give a black design, mostly on silver but sometimes on gold. It was very popular in Victorian jewellery and is still used today in Asian countries.

Ormolu – a gold-coloured complex alloy of copper, tin or zinc used mainly during the 19th century as a coating on clock casings to give the appearance of gold. Care is required in cleaning. Also known as *Mosaic Gold*.

Pewter – occasionally used in jewellery, it is an alloy of approximately 80% tin and 20% lead or copper. The proportions can vary widely. A French equivalent is termed Tombac.

Pinchbeck – is an alloy of 83% copper and 17% zinc, with a remarkable resemblance to gold; though much lighter in weight. It was invented by Christopher Pinchbeck (1670-1732), a London watchmaker, and was popular up to the beginning of the 19th century. It can still fool the unwary today. Sometimes called *Gilding Metal*.

Decorated pewter pendant. (Photo: KW)

Rolled Gold – was developed in 1817 and consists of a sheet of gold bonded under great heat and pressure to a thick sheet of base metal using a method similar to that used for producing Sheffield Plate. It was then rolled repeatedly between highly polished rollers (hence the name), until the right gauge of thickness was achieved.

Spelter – impure zinc, a cheap alternative to bronze, but softer and lighter. Can sometimes deceive when items are bronzed and internally weighted to feel like bronze. A sure test is to scratch the item in an unobvious place; if the result is a silver-coloured metal under the finish, it is spelter. Bronze will show a brass-like colour.

Stainless Steel – steel to which chromium has been added to prevent rusting. Sometimes used as a simulant for platinum or palladium.

Titanium – a relative newcomer into the jewellery world. A greyish lightweight metal that does not tarnish and is hypoallergenic. Apart from jewellery it is used for watch casings. Titanium occurs naturally in sphene ($CaTiSiO_5$) and rutile (TiO_2).

White Metal – a zinc-based alloy with varying amounts of lead, copper and antimony. Sometimes used as a cheap metal for prototype jewellery prior to finalising a design in a precious metal.

Zirconium – a relative of titanium, it is used for wedding rings sometimes combined with other metals. It has an unusual property in that when heated it forms a black skin on the surface that is extremely hard and scratch resistant. Zirconium metal should not be confused with the diamond simulant cubic zirconia or the gemstone zircon, although there are chemical connections.

HALLMARKS

(All symbols courtesy of British Hallmarking Council)

A hallmarking system has been in use in the UK for hundreds of years. In 1972 the UK became a signatory to the International Convention on Hallmarks; other signatories include Austria, Cyprus, the Czech Republic, Denmark (and Greenland), Finland, Hungary, Ireland, Israel, Latvia, Lithuania, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Sweden and Switzerland. This means that a Convention hallmark struck by a UK assay is recognised by all members of the Convention. Conversely, the same mark on precious metals by other Convention members will be recognised in the UK as indicating that the item is of the required standard of purity.

European countries that are still not members include Spain, Belgium, France, Italy, Germany, Greece and Luxembourg.

According to the UK Hallmarking Act (as amended in 1999), only three of the previous five marks are now compulsory: the maker's or sponsor's mark, the purity mark and the assay office mark; the traditional fineness mark and date letter are no longer obligatory.

Traditional fineness symbols (optional)

Gold *Platinum* *Silver (Sterling)* *Silver (Britannia)* *Silver (Sterling Scotland)* *Palladium*

Prior to the introduction of the Convention marks, all imported items made of precious metals had to be marked by the assay office before sale. A special import symbol was used. However, the use of these marks ceased in 1998 and all imported jewellery outside the Convention area now has to have the standard British marks applied by an assay office before sale.

London import symbols (now obsolete)

Gold *Silver* *Platinum*

It is illegal in the UK to offer for sale any item of precious metal without the three compulsory marks, with the following exceptions:

A single item comprising of one metal only and below the following weight –

Gold	1.0 grams
Silver	7.78 grams
Platinum	0.5 grams.

There are other exceptions, such as thin chains or filigree work, where it is impractical to apply a hallmark. The marking of platinum was only introduced in the UK in 1975; therefore earlier pieces will not bear a hallmark. For further details, contact your local assay office or write to The British Hallmarking Council, P.O. Box 18133, London EC2V 8JY.

UK Assay Offices

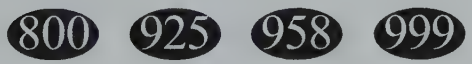
London *Birmingham* *Sheffield* *Edinburgh*

Until 1932, 12 karat and 15 karat purities were standard but these were superseded by the 14 karat used today. Overleaf (illustrated) are the accepted fineness or purity marks under the Convention. The hallmarking of palladium became compulsory in January 2010; up until then it had been voluntary since its introduction in July 2009. The head is that of Pallas Athene, goddess of war and wisdom, after whom palladium was named. It becomes the traditional fineness symbol for the metal.

Gold

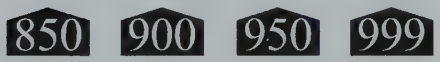
9kt *14kt* *18kt* *22kt* *??* *24kt*

Silver



Continenta *Sterling* *Britannia (UK only)* *Pure*

Platinum



UK standard

Palladium

UK standard as from Jan. 2010

The following countries already had the marking of palladium in hand: Denmark, Lithuania, Poland, Slovenia, Switzerland and Ukraine.

Alternative Convention fineness symbols may also be used:

Alternative fineness symbols

Gold *Silver* *Platinum* *Palladium*

Hallmarks have traditionally been applied by the use of punches struck with a hammer; however, laser marking has now been available by choice. Fears have been expressed that the laser mark is more easily removed by filing.

Traditional stamped hallmark on a silver pocket fruit knife. The series of stamps show, from left to right, the Sheffield Assay Office, the lion passant, the year mark (1898-99) and the maker's mark (unknown). (Photo: KW)

Example of a laser hallmark on palladium.
(Photo: KW/courtesy of Birmingham Assay Office)

For more details about hallmarks and dating earlier items, see one of the specialist books on the subject, e.g. *Jackson's Silver and Gold Marks of England, Scotland and Ireland* edited by Ian Pickford (published by the Antique Collectors' Club). (Symbols here included by courtesy of Birmingham Assay Office.)

Jewellery Terms

Acrostic pendant. (Photo: JB)

Acrostic – jewellery that contains a message spelt out by the initial letter of gem-stones. The pendant shown here represents the word 'regard' (ruby, emerald, garnet, amethyst, ruby and diamond). Many different words were used, often combined with symbols.

Bail – attachment at the top of a pendant to take the chain.

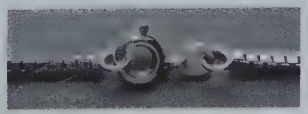
Bail. (Photo: KW)

Bangle – a bracelet that slips over the wrist without a clasp.

Bezel setting. (Image: KW)

Bezel Setting – a surround setting used mainly for cabochon-cut gems and to disguise the join in doublets.

Bolt Ring – a simple necklace fastening.



Bolt ring. (Photo: ACC)

Butterflies. (Photo: ACC)

Demi-parure – a matching set of jewellery (parure) consisting of only three items.

Double d'or (gold plated) – a laminate consisting of a thin sheet of gold pressed onto a metal plate, most commonly copper.

Fede ring. (Photo: ACC-WL)

Foldover Clasp – clasp where the hinged part opens, passes through a ring then snaps shut holding the bracelet or watch securely in place.

Butterfly – a clip that slides over the post of an earring for pierced ears to secure it in place.

Crown Setting – claw setting for a gemstone.

Crown setting. (Photo: KW)

Fede Ring – a friendship ring with two clasped hands.

Festoon Necklace – a short neckace with a design where the middle is broader than the sides.

Foldover clasp. (Photo: ACC)

Gimmel ring. (Photo: ACC)

GALUCHAT (Shagreen) – the skin of a ray fish dyed and commonly used in the Art Deco period.

GIMMEL RING – ring that can be divided into two or three separate parts, dating from the Renaissance period.

GIRANDOLE – type of hanging earring popular in the 17th and 18th centuries.

GYPSY SETTING – a recessed setting for rings with the gemstone sunk into the metal. Dating from the early 1800s. Can disguise doublets and 'piggy back' stones.

Gypsy setting. (Image: KW)

JOIE (Joy) – imitation jet made of black faceted glass paste; heavy. Commonly termed 'French Jet'.

Lava cameo. (Photo: ACC/JB)

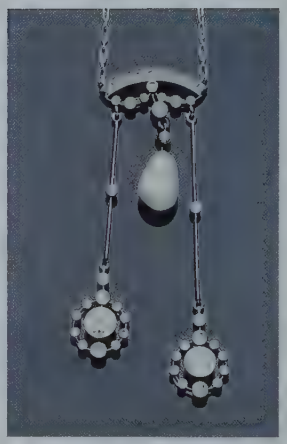
LAVA CAMEO – cameo carved from volcanic lava, i.e. Versuvius.

LAVALIER (NEGLIGÉE) PENDANT – a pendant with a stone hanging from it or a necklace with a double pendant. It was named after Louise de la Vallière, mistress of King Louis XIV of France.

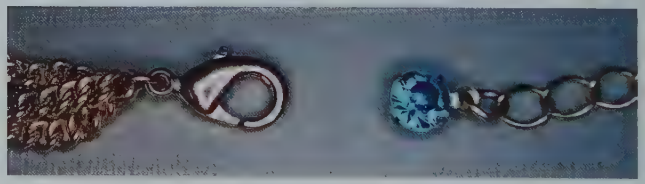
LOBSTER CLAW – a necklace connector with a hook and spring lever catch.

LUCITE – invented by Dupont (USA) in 1931, this was a crystal-clear plastic that was used by the aircraft industry during WWII. Post war, it was used in cheap jewellery to imitate rock crystal.

MICROMOSAIC – a picture made from small pieces of coloured glass or gemstones and set in a mount.



Lavalier, or Negligée, pendant. (Photo: ACC/UJ)



Lobster claw. (Photo: KW)

Micromosaics (set in gold) bracelet, c.1830. (Photo: ACC/UJ)

MILLEGRAIN – a type of setting consisting of an edge beading to retain the gem.

NAVARATNA – based on Hindu astrology, this ring combined nine coloured stones each representing a planet. Ruby,

emerald, yellow sapphire, hessonite garnet, cat's-eye chrysoberyl, diamond, blue sapphire and coral. The ring is believed to bring wealth and good luck to the wearer.

NEGLIGÉE PENDANT – *see* LAVALIER.

PARURE (ornament) – a matching set of jewellery comprising a necklace, ring, bracelet, brooch and earrings. Common today in Arab countries.

PAVÉ (paving stone) – where stones are set closely together (to show as little metal as possible).

Posy ring. (Photo: ACC/JB)

PLIQUE À JOUR – a form of enamelling.

POSY RING – plain gold ring with an insciption engraved either on the inside or outside.

REVERSE CRYSTAL – dome-shaped rock crystal cabachon, with carving on the reverse.

RIVIÈRE (river) – 18th century-style necklace consisting of a graduated row of precious stones, mounted individually.

SAUTOIR – long necklace, a name usually applied to a waistlength string of pearls; popular in the 1920s.

TOMBAC – alloy consisiting of 80-90% copper and 10-20% zinc, used to resemble gold. *See* Pinchbeck.

TORCHON – necklace formed of multiple strands entwined to form a twisted cord.

VERMEIL (SILVER GILT) – gilded silver.

NOTES ON THE CARE OF JEWELLERY

1. Only put on jewellery after washing and applying make-up, particularly after using hairspray. Many decent pearls are spoilt with hair lacquer.

2. Remove rings before washing or working in the kitchen. Several stones are absorbent, particularly opal, and may be stained by cleaning fluids and washing up liquids.

3. Some stones (including amethyst, apatite, blue zircon, yellow beryl, kunzite, padparasha sapphire, spodumene and topaz) may fade if left in bright sunlight. Better to keep them all in the jewellery box. It is important to keep opals protected from heat as they can dry out and crack. Pearls are also vulnerable; water may damage them if immersed for any length of time. However, a periodic clean with water is advantageous as they have a tendency to dry out. The nacre surface is porous and is liable to staining, so storage is important.

4. The use of ultra-sonic cleaners is not recommended, as so many gems are liable to damage, particularly if fissure filled (e.g. diamond, emerald, ruby), which can shatter or crack. Ultra-sonic should never be used on opal or organic gems (i.e. amber, copal, coral, pearl, ivory, etc.). Most reputable jewellers are aware of this, but always ask them to check your stones first; preferably, avoid the process altogether.

5. Several stones used in jewellery, particularly organics, are soft in comparison to the recognised precious gems and consequently need careful storage, and should not be thrown higgledy-piggledy into a box. For example, turquoise, lapis

Jewellery box. (Photo: KW)

lazuli, malachite and those listed in the book as being under 5 on the Mohs scale of hardness need special attention. Also they should be worn with consideration given to their vulnerability.

6. Clean earrings regularly with surgical spirit to avoid infection.

7. Clean gem-set jewellery with care using warm water and a soft brush (not nylon). If the stones are not absorbent, washing-up liquid may be used.

8. Gold needs only an occasional buffing with a soft cloth. A suitable cloth is available from Gem-A that can also be used on gemstones. Remember that the higher the fineness of the gold, the softer it is and therefore easier to scratch. Wedding rings are usually 18 or 22 karat and may wear if a harder dress or engagement ring is worn alongside them.

9. Fine gold chains are very vulnerable to damage by stretching and impossible to repair once broken, so try not to chew them! Gate bracelets are also easily damaged and are usually impossible to repair.

10. Tarnished silver, if not rhodium plated, may be cleaned with care using proprietary 'dips' or creams. Overcleaning can result in rubbed hallmarks or, in the case of silver plate, wearing of the plating. For valuable items, it is best to take them to a professional cleaner. Never immerse set stones into cleaning solutions as severe damage can result.

11. Always remove your wristwatch to wind or adjust the hands to avoid damaging the winder.

Buying Gemstones

Treatments

Throughout the book we have discussed the many ways in which precious stones are simulated, synthesized and subjected to various treatments. Wherever possible simple identification techniques have been suggested but it must be borne in mind that even these basic methods require a certain amount of practice and experience.

Today, 90% of gemstones undergo some form of treatment and we must decide what our reaction is to this situation. How important is it to us that the beautiful gem that pleases our eye has probably been heat treated to achieve that appearance? Perhaps you take the view that we can all do with some enhancements to look our best, so why shouldn't we allow the same to be done to the ruby, sapphire or emerald that we so admire.

The range of treatments has expanded enormously over past years, so we have many more types to consider. We will take each in turn and look at the effect on value to the gems, how common they are and how difficult to spot. However, the range is so great that we can only cover a limited number.

Pressure and heat treatment (HPHT) – heat is the oldest form of treatment, dating back hundreds, if not thousands, of years. It was discovered that if a stone was dropped or fell into the fire changes took place, either in colour, depth of colour, or even clarity. The same treatment is used today but sometimes pressure is also added. A small percentage of off-colour diamonds have high pressure and high temperature (HPHT) applied to remove any brownish or yellowish tone. In the early days of diamond synthesis this was also used to correct the yellowish shade that was common to the process. This has now been mainly overcome.

Heat is a very common treatment and applies particularly to ruby, sapphire, tanzanite, aquamarine, tourmaline, zircon and demantoid garnet. It is also used to produce citrine and green 'amethyst' from the normal purple amethyst.

The result is usually permanent with the exception of stones that have a tendency to fade in strong sunlight, i.e. amethyst, apatite, citrine and padparasha sapphire. However, HPHT may affect certain identification features such as pleochroism.

Recognising heat treatments is difficult but possible to the trained eye.

Fracture filling – this is common practice with emeralds, rubies and diamonds. Disfiguring fractures regularly occur in otherwise attractive stones; the fractures are usually filled with a high refractive-index lead glass or resin that makes them prone to damage by later application of heat during repair or by ultrasonic cleaning. Laser-drilled gems sometimes have the drill hole filled creating similar problems.

Recently the practice of deliberately creating fractures in synthetic rubies and then filling them to give the impression of a filled natural stone has been used to dupe the unwary buyer and attract a higher price.

As mentioned under Ruby, the marketplace is becoming flooded with glass-filled stones that are very convincing. This glass content can be high. Only buy from the most reputable dealers.

Filled fractures can be difficult to see for the

inexperienced eye. This type of improvement cannot be classed as permanent for the reasons stated.

Emeralds have been treated this way for many years and have been oiled as a standard practice, to improve the colour of the stone.

Dyeing and bleaching – dyeing is generally applied to jade to improve the colour and to pass it off as the beautiful emerald-green imperial jadeite, to fool tourists. It is easy to spot as it is opaque and not translucent as it should be. Agate is often dyed or stained to produce very attractive slices for decorative purposes but this is generally accepted. Turquoise may also be treated to improve the colour. Bleaching and dyeing are sometimes used to improve the colour of cultured pearls. The many different shades of cultured pearls on the market have been subject to this process, particularly those emanating from China. Suspect black pearls, as genuine examples are rare and expensive.

Coatings – the latest thorn in the side of the gemmologist is the cobalt coating being applied to sapphires and tanzanite to improve their colour. This is extremely difficult to recognise. It may show up as wear on the facet edges or when the stone is immersed in water, but not always.

Other coatings have been out for some time. Diamonds have been given a pink coating on the pavilion to give the impression of being a genuine rare pink diamond. Nail polish remover or spirit can remove the coating.

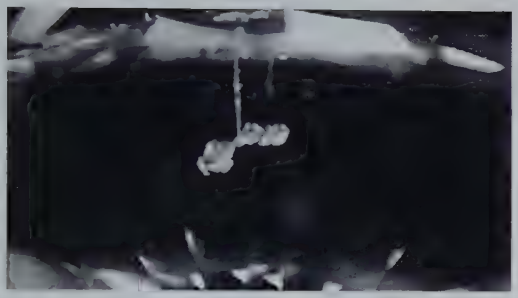
Of course, Swarovski crystal is a coated stone that has been out for many years. Over the past three or four years, we have also seen the appearance of 'Mystic Topaz'. It has fawned an enormous range of different colours with exotic names such as 'Cassiopeia Topaz', 'Flamingo Topaz' and many more. All are produced by coating white topaz with a thin layer of titanium (called Azotic coating) to just the pavilion of the stone, therefore protecting the coating from scratching. Fading has been reported, as has removal with alcohol, so once again ultrasonic cleaning is out. However there is no doubt that they make a very attractive gemstone.

Other forms of coating include oiling and waxing; this treatment is commonly applied to amazonite, red beryl, coral, jade, lapis lazuli, malachite and several porous stones. Heat and ultrasonic cleaning should never be used on these stones.

Irradiation – this was first developed at the beginning of the 20th century using radium; over the past 20 or 30 years it has been used to change the colour of diamonds to those not normally found in nature. They are very attractive, but the treatment is superficial, giving a surface colouration to the stone that may be lost if recut. Diamonds however do not retain any radioactivity.

Of late this treatment has caused more controversy than any other. Although used on several stones its use on topaz has been the most problematic. White or colourless topaz is an attractive gemstone, but it is common and of low value. When treatment with radiation was discovered it took on a new life and blue topaz – uncommon in a natural state – hit the marketplace. Using different strengths of this treatment a variety of shades of blue are produced, from sky blue (the lightest) to Swiss and London blue (the darkest). Beautiful and cheap, these gems became very popular and every TV channel offered them. Then, the crunch – residual radioactivity. Active steps were taken to ensure that all treated materials were subjected to a 'cooling off' period of a year or more before being allowed onto the market. In fact, the USA banned the import of radiated gems for a period. However, it has now been deemed safe and trading is again allowed, subject to checks by licensed distribution centres. However, sales have been hit by this controversy, particularly the darkest shade.

Among other stones irradiated are yellow beryl, smoky quartz and pink tourmaline.



Laser-drilled diamond. (Photo: Gem-A)

Laser treatment – this is most commonly used to remove carbon inclusions in diamond and, unless the minute holes left are filled, it is possible to see them with the loupe. This treatment, however, even on the limestone, can reduce its value by 15-40%, depending on the number of laser holes.

Beryllium diffusion – this treatment, discovered by Thai cutters, uses beryllium in conjunction with heat to enhance the colour of rubies and sapphires. It is difficult to detect.

All of the above treatments must be declared on the sales receipt or certificate and all stones thus treated should sell at a lower price than untreated stones.

Having said that, discussions among the professional bodies are ongoing as to which treatments ought to be declared. The main topic is heat treatment used to improve the colour of coloured gems; due to its widespread use and its acceptance as standard practice some experts believe that, particularly for the run-of-the-mill gems, declaring such treatment is irrelevant.

Synthetics

A synthetic has to possess all the chemical features of a natural stone. In fact, it is identical to the gem that was created over millions of years under the earth.

Synthetics allow the person who cannot afford the real thing to wear that beautiful ruby, sapphire or emerald, etc. at a fraction of the price. Many people feel that, as neither they nor their friends can tell the difference anyway, they are happy to wear synthetic gems. This simply depends on your attitude to gemstones.

For me there is an indefinable romance in the genuine article; there is no romance in a synthetic or simulant. I feel that they are fine for an everyday dress-ring but that for a commemoration of a special moment in one's life, such as an engagement, anniversary or the birth of a child, only the beauty formed by Mother Nature will suffice. Even if the bigger price tag means a smaller gem, it will mean more to you. You never know, it may even still carry those special mystic components in which the ancients believed.

In my opinion, simulants – things that are made to *look* like the real thing – are common and best avoided. Of course, some have a real value of their own: if you are wearing a blue spinel masquerading as a sapphire, it is still a spinel so value it as that – after all, there's a spinel in the crown jewels!

The danger in all these fakes, forgeries or imitations is that someone is going to try to sell them to you at the price of the genuine natural stone. That is why it is so important to buy from a recognised jeweller or gem merchant. Although, even then, genuine mistakes can be made. Look for a jeweller with recognised qualifications: FGA, Fellow of the Gemmological Association of Great Britain (now called Gem-A), the oldest and most respected qualification and also represented in the USA; or GG, Graduate Gemologist of the Gemological Institute of America (GIA). They usually display their certificates.

Both Gem-A and the GIA have world-recognised test laboratories. You will only need the services of a laboratory if you require a particularly valuable or unusual stone to be identified; usually these come with a verification certificate upon purchase. Always ask advice

from a reliable source, not the seller, for the best laboratory to use. There are many reliable laboratories across the world. The European Gemological Laboratory (EGL) is widely represented – in the UK by Huddlestone Gemmological Consultants in Hatton Garden, London.

A reputable supplier will always issue a sales receipt stating full details of the gemstone with any treatment it has undergone. Always insist on this; if the supplier is reluctant to give these details, buy elsewhere.

A point regarding pearls. Due to the proliferation of cultured pearls over natural, the word 'cultured' in some countries is being dropped when describing pearls. This is becoming particularly prevalent in the USA, although Europe still declares authenticity.

Synthetic diamond – The most important of the synthetics has to be the diamond and this is covered in some detail in the chapter on Precious Stones. Synthetic diamonds do present a great problem as they are becoming more prolific and, once in the supply chain, are difficult to protect against. The best advice, given so many times in this book, is to buy only from reliable sources and, if you are considering the investment aspect, ensure that what you are buying is fully certified. There is a school of thought that says there should be a fifth 'C': colour, clarity, cut, carat and *certificate* – this is wise advice. A certificate must be from a recognised laboratory; a sales receipt does not count.

Synthetic corundums – ruby and sapphire have been synthesized for very many years. Sapphire in all its colours is common, but it is worth taking especial care over padparasha – as a real natural stone it is rare and very valuable. Synthetic 'star stones' are also sold. As a general rule of thumb: if the price seems too good to be true, then it usually is.

Synthetic emerald – this is covered fully in the chapter on Precious Stones. The market is full of good synthetics. Identification is by inclusion and refractive index, which is outside the limits of the layperson.

Synthetic opal – has been synthesised, and an illustration of a synthetic is shown in the Gemstone section of this book.

Synthetic quartz – surprisingly, this has been synthesised for many years producing a range of colours: blues, browns, yellows and greens. Amethyst is prolific and, as it is fairly cheap, little effort is made to separate real from synthetic. Quartz crystals are also grown for commercial purposes.

Alexandrite, the form of Chrysoberyl that shows a colour change, has been grown since the early 1960s and is quite convincing.

Synthetic spinel – has been available as a synthetic for many years, but recently an increase in the production of red has come about due to the shortage and high price of ruby. The new synthetics are very difficult to identify, even for the expert. Equipment costing many thousands of pounds, such as Ramon Spectroscopy, is required to ensure correct identification. The cost of the stone does not always jusify the expense of this investigation and is therefore only used in special cases, where several thousands of pounds may be involved. Blue spinel is often passed off as sapphire.

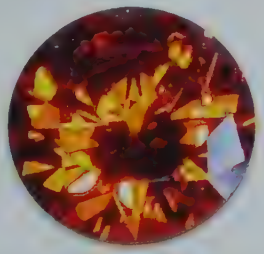
Simulants

There are very many to consider but let us take some synthetics that perform as simulants. The most notable is the cubic zirconia (CZ), which was introduced in the 1970s. The trade was used to seeing zircon, white sapphire or white topaz masquerading as diamond but CZ was something different. It was singly refractive and had a excellent dispersion; lots of jewellers were taken in and lost money. I remember whilst studying gemmology in 1975

being approached by a rather shady character, friend of a friend, in a coffee bar, who asked if I could obtain some CZ with inclusions. Diamonds, of course, commonly contained inclusions but CZ did not. I realised his interest and left.

CZ now is an accepted as a jewel in its own right. Sold in a wide range of colours, the latest being black to cash in on the fashion for black stones, particularly diamond.

Quality may vary regarding cut, which affects the dispersion, so pick and choose from the many sources available. Wearing CZ is nothing to be ashamed of; it is an excellent jewel, and arguably the best simulant for diamond at a ridiculously low price. It is now produced simulating tanzanite, peridot, citrine, padparasha and other gems. It is also diamond coated as mentioned elsewhere.



CZ Padparasha sapphire. (Photo: KW)

Previous synthetic look-a-likes for diamond were YAG (Ytrium Aluminium Garnet) and GAG (Gadolinium Aluminium Garnet); both were originally produced for the scientific industry but found their way into the gem market. They also came in different colours and were sometimes given attractive names, as was CZ. Strontium Titanate was also used for a time; however most of these have been superseded by CZ but may still turn up. Synthetic moissonite tended to take over as the contender for the best simulant for diamond, but, being much more expensive than CZ, and with the increase of availability of synthetic diamonds, it has fallen behind (for more details, see the section on Diamond).

Quite often a cheap but genuine gem will be passed off as a more expensive or rare one. Examples include natural red spinel as ruby; kyanite, blue tourmaline or blue zircon as sapphire; chromium diopside as emerald. As mentioned in the Diamond section, even rough diamond crystals are being forged. The advice is, as always: only buy from a reliable source.

Frauds

Scams still abound in the gem market. The Internet has helped proliferate the problem. The most common fraud is where precious stones are advertised at attractive prices, claiming to be genuine, but it must be remembered that the word 'genuine' can equally apply to synthetics as, chemically, they are practically identical. 'Natural' is the word that should mean that a stone is not synthetic.

Some scams sound very believable and people are easily taken in by them. One example is a seller advertising, on an auction site, a supposedly quality gemstone or piece of jewellery at a very attractive price and they do offer a refund if the customer wishes to return the goods. The shipping cost is excessive, and, when the stone is received, the buyer realises it is very poor quality and asks for his money back. He receives a friendly apology from the seller with the offer of the refund, as advertised for a 10% restocking fee but the shipping cost is not refunded. This is all on the understanding that the buyer provides the seller with positive feedback for his good will and service. This he can then add to his high rating on the website in conning more people. Rather than lose a lot of money, the buyer usually agrees. If this scam is done several times the con-man can make a lot of money from the overpriced shipping costs and 'restocking fee' and not lose the initial goods. Always remember that if it sounds too good to be true, it probably is.

Another point to understand is that stones are sometimes named according to their source, such as 'Kashmir Sapphire', 'Burmese Ruby', or 'Kanchan Sapphire'. These names are sometimes given by dealers to signify a colour, and not its true locality, so ask!

INVESTMENT

Putting capital into gemstones is not the same as investing in the Stock Market. It should be considered as a long-term store of wealth; no dividends are paid, there is no interest as with a bank or building society account. It could be compared with keeping your savings under the bed. So is there any short-term advantage? Gemstones are readily portable; a single gemstone with a potential value of hundreds, if not thousands, of pounds can be carried in a small jacket pocket. The same value in gold would take a car to transport it. Obviously with a collection of diamonds, rubies and sapphires a bank would be the right place to put it, to be safe. Or would it? If the bank was robbed, you would be almost certain to lose them; banks do not insure customer's deposits.

So what precautions must be considered if the decision is taken to put your savings into gemstones? Buying for this reason is entirely different from buying stones or jewellery to suit the latest fashion or what suits your latest outfit. Large sums of money may be spent and it must be spent wisely. Here are some basic rules to follow:

1. Take advice from a qualified gemmologist; Gem-A may be able to suggest a suitable contact.
2. To start with, consider only the four accepted most 'precious stones'. Others may be suggested during the course of the preliminary discussions, but they may fluctuate in value due to fashion or new finds.
3. Only buy from reliable sources; some reputable auction houses have specialist auctions of gems and jewellery. The Internet proliferates with sites offering stones for sale but these are best avoided, and that includes auction sites. Scams abound, ready to entice the layperson with money to spend, not just on the Internet, but also through newspaper adverts.
4. Ensure that what you are buying for your collection are of the best colour, clarity and quality that you can afford. In the case of colourless diamonds remember the importance of the 4 Cs. With coloured varieties or fancies (some of these are extremely valuable); 50% of the value is in the depth and purity of colour, 25-30% in the clarity, with the carat weight coming last. It is suggested that it is better to purchase stones in the 2 to 4 carat range rather than larger, as these are more readily traded; if that is your intention.
5. It is imperative that your collection contains only stones that are untreated in any way. Some gems such as tanzanite are nearly always treated to achieve the beautiful colour, therefore leave them out of your collection.
6. It is a good tip to always view the gem in different lights (artificial and daylight, for example; they should look good in both).
7. Most important, obtain a certificate of authenticity (remember this is the 5th C for diamonds) with every gem you buy, mounted in jewellery or not. Several labs are available; Birmingham Assay Office can provide certification as well as assaying of precious metals. Some laboratories will issue a 'passport' for a gem, which should be passed on with the gem when it is sold.
8. A valuation for your collection of mounted gems may be obtained from a registered valuer, who can be contacted through The National Association of Goldsmiths Institute of Registered Valuers (email – irv@jewellersonline.org).

The Genuine Article

Buying antique jewellery is no guarantee of gems being genuine; fakes have been around for a long, long time – the gemstone in that Victorian ring may not be all it seems to be! And, of course, it is a lucrative business to fake antiques themselves.

This was particularly prevalent just after WWII when the jewellery industry was going through a very hard time. Purchase tax of up to 125% had been put on luxury items, including all new jewellery, but antique items were exempt. Consequently many jewellery workshops

began to produce 'antique' jewels, mostly Victorian in style, and sell them to antique dealers. This practice lasted from 1947 through to the late '50s. It was highly illegal but a way for the struggling industry to survive. The materials used tended to be genuine: precious metals of hallmarking standard (but, of course, not hallmarked so as not to give the game away) and real gems were used. The stones were carefully chosen to match the period being copied. So the buyer was getting his money's worth, just not the history. No one knows how many of these replicas are still around and probably never will.

Collecting and Hobbies

So, if you do not have the large capital to invest, but would like to expand your interest in gems and jewellery, where do you go? There are a few ways open to you; firstly, collecting.

A collector's case. (Photo: KW)

Mineral Heritage issue, USA 1974.

Collecting gemstones as a hobby can be very rewarding and you do not have to collect top-quality stones, although, of course, the better they are, the better the collection will be. As with any collection, whether stamps, porcelain or gems, taking a thematic approach can add interest: collecting only colourless stones, or varieties of agate, or a particular colour or family of gems; the potential is enormous. Go to a good gem show or museum and see for yourself and use your imagination. When purchasing make sure that you are told the source of the particular stone you are buying and get a receipt. Cases to hold your collection are readily available.

There are regular issues of postage stamps worldwide that illustrate gems and minerals that could supplement your collection. Catalogues of thematic subjects are available from stamp dealers, to help finding them.

There is even a more hands-on approach – 'making' your own gems is fascinating and practical possibility. A good starting point is to buy a stone polishing or tumbling machine. There are several types available at

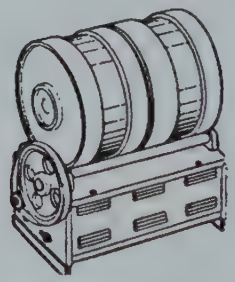
Tumbled and polished stones. (Photo: KW)

a wide range of prices. They consist of one or more plastic barrels resting on a pair of rotating rods driven by a small electric motor. They are fairly quiet in operation so should not disturb the neighbours. A selection of rough gem material is readily available at gem shows or specialist shops. This is usually bought by weight; try to select stones of similar hardness and size. The shop will advise you. You will also need grits, two grades will be sufficient – 80 (coarse) and 400 (fine) – as well as some cerium oxide (polish) and plastic pellets.

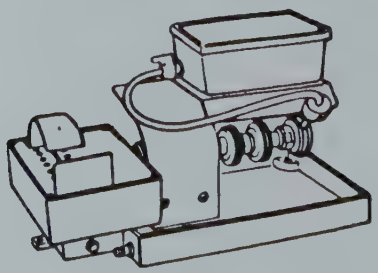
Put your rough stones and the coarse grit into the first barrel with some water and turn on. It may need to run for a few days depending on the hardness of the stones you are tumbling. Thoroughly rinse out the stones and put them into the next barrel. The next stage will not take quite as long, but check that the stones have a dull fine finish before thoroughly rinsing again. Then you can move on to the final stage of polishing. Cerium oxide is a pinkish powder and plastic pellets should be added for the best result. Cleanliness is paramount to ensure perfect results.

Always mark the barrels with the grit it contains so that contamination is avoided. Full instructions will be provided with your machine.

The tumbled stones can be mounted into jewellery with 'findings' available from craft shops.



Tumbling machine. (Image: KW)



Composite machine. (Image: KW)

The next stage to move onto is cutting cabochons. This however does require additional investment in the form of a composite machine, which consists of a circular diamond saw and grinding and polishing wheels.

It is possible to buy small, ready-cut slabs of a variety of gem materials to save time, but a saw is very useful

for trimming the slabs to rough size. The shape can be marked on the blank using a template and aluminium stylus. Once roughly shaped the blank is then attached to a dop stick; this is a short piece of wooden dowel of a diameter to suit the size of stone you are cutting. The blank is stuck to the dop stick with doping wax (sealing wax is good enough). The stone is then shaped on the first wet grinding wheel (make sure you wear goggles) and smoothed on the fine wheel before polishing. There are books available to give full details.

Of course you are still not at the stage of producing the faceted gem that you would like to see. However, all is possible for the keen amateur, but at greater expense. Faceting machines are available but before buying it is better to join a local club who have machines on which you can learn. Such clubs often have stands at the gem shows.

However, the bad news is that, due to Health and Safety regulations, severe limitations have been applied to the teaching of lapidary. The reason being that combining electricity and water, which is essential in the work, is dangerous. However, a search on the Internet will show up the few courses that are still available. The good news is that there are many good books published to enable you to teach yourself. (*See* Further Reading appendix).

Another field that may be considered is that of enamelling. This is where powdered glass is fused to a metal base in a kiln. It has been used extensively over hundreds of years for decorative purposes, particularly in jewellery. Courses may be easier to find than those teaching lapidary and a good way to try out your skills without buying your own kiln. For the true DIY expert it is possible to build most of these machines, with the exception of a kiln, yourself.

These are all the stages that the author has taken, from finding the first quartz crystals in the rocks in Daymer Bay in Cornwall and watching the craftsmen shaping their models from the local serpentine in the Lizard. Many happy hours of searching the mine dumps, in various locations with my wife and children, all armed with hammers to find mineral specimens, are still remembered. This was followed by a course in silversmithing, faceting and a diploma course in gemmology. If you feel inspired to become a gemmologist, you do not have to follow my path, but I hope that whichever road you follow, it will be as exciting and satisfying as mine.

Gemstones Around the World

Note – always refer back to the relevant entry on a particular gem where mentioned under a country for more details.

On holiday or on a business trip we often consider bringing home a nice gift for the husband or wife. Time is sometimes short and, in the rush to pick the right gift or memento for ourselves, we might not be as thorough as we ought in checking what we are buying and are most likely to fall prey to a con. It is critical to plan early in the trip and decide the sort of item you want, be it a gemstone or a piece of jewellery.

So the next few pages are designed to give a little help on where to buy and what to avoid. Obviously, many countries have reliable jewellers who can provide many gems either set or unset, so it is unnecessary to list these. Instead, unusual items that may be found locally are described. In fact, as a souvenir or unusual gift, it may be better to purchase an item made from a local stone rather than an imported gemstone, as there is less chance of being conned. It is impossible to cover every country in the world so I have grouped them loosely into continents.

Africa

Botswana – The largest producer of diamonds and a relatively wealthy African country. The Jwaneng open pit mine (co-owned by De Beers and the Government) produced 14.3 million carats of rough, high-quality diamonds in 2003. Other mines include the Lethakane ('little reeds'), Orapa ('resting place for lions') and the Damtshaa ('water for the tortoise').

It has a very active tourist business with many safari tours available to make the most of the flora and fauna.

Egypt – This is a popular holiday destination and once an historic source of emerald. The emerald mines are now exhausted but in the excellent Geological Museum in Cairo emerald, turquoise and peridot are on show, together with gems from other countries.

You will be offered a guide, but before accepting check his authenticity with your hotel. All guides have special shops that they will take you to where they get a commission. Do not be taken in by the respectable, well-dressed gentleman 'with a brother in London' who offers to take you to a very good jewellers.

Madagascar (formerly the Malagasy Republic) – Its tourist trade is little developed and poverty is still rife. The potential in the production of gemstones will, hopefully, bring better conditions to the people. The centre of the gem trade is Antsirabe. Some tour operators include visits in their itinerary.

With the discovery of sapphires in 1998, Madagascar became a major producer of high-quality gems, rivalling Sri Lanka. Lines of gem dealers' shops have appeared in the towns, where once there was little of interest. A wide range of precious stones have now been found on the island, including sapphire, garnet, chalcedony, chrysoberyl, iolite, emerald, kunzite, ruby, topaz, tourmaline and zircon. Many of these are exported to Thailand for cutting and marketing.

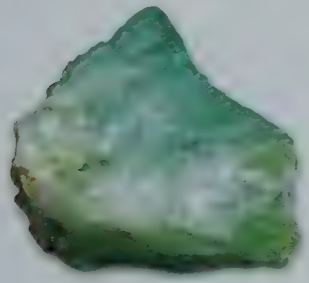
Unfortunately the infrastructure lags behind the enormous potential of the recent discoveries, but investment is now being received to improve the primitive nature of the mining. Gem-A has now set up training courses in French using approved tutors, so that local students can sit the usual diploma examinations.

Morocco – This is a source of attractive fossils, particularly ammonites and orthoceros, which are formed into pendants. Mudstones are also available; they are an attractive dark brown stone with patterns of white quartz.

Mozambique – A small selection of gems is produced here, including aquamarine, ruby, morganite and purple tourmaline; notably, there was a recent find of Paraiba-type tourmaline.

Purple Tourmaline. (Photo: ATG/LAB)

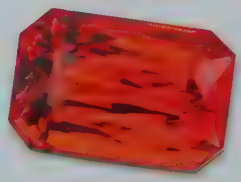
Namibia (formerly South West Africa) – A beautiful country for its wildlife, it is also fascinating for gems, renowned as the place where you could pick up diamonds from the sands along the coast. (This area has now been partitioned off and is patrolled by armed police.) Several other interesting gems are found here: aquamarine, tourmaline, fluorite, dioptase, prehnite, mandarin garnet and demantoid garnet. A very rare gemstone is also reported – Jeremejevite (*see* Minor Gemstones).



Prehnite Rough. (Photo: KW)

The best place to buy is in the capital, Windhoek, where there are many jewellery shops. There are several organised tours, some visiting the gem-producing areas. Beware: you are likely to be offered stones off the street that will turn out to be not you wanted.

Nigeria – This is the source of many gemstones, mainly centred around Jos, the capital of the Plateau State. Sapphire, ruby, tourmaline (including Paraiba type), aquamarine, garnet (spessartine, called Orange Garnet) and quartz are found here. However this is not a place for the layperson to go buying; strictly for the hardened professional gemmologist.



Spessartine Garnet. (Photo: ATG/LAB)

South Africa – Contains the largest sources of precious metals and gemstones in the African continent. The Premier Mine, supplier of the Cullinan diamonds and many other of the world's largest diamonds, is situated here (*see* under Diamonds), together with several other important mines.

Premier Mine, South Africa. (Photo: PR)

Lesotho, an independent kingdom, produced a diamond rivalling those from the Premier Mine in 2006. It was called the 'Light of Leseng', weighed 478 carats and sold for $18.43 million.

The largest gold mines in the world are located around Johannesburg, the largest city and capital of the Witwatersrand area.

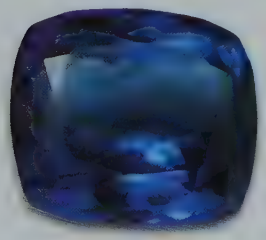
Jewellery stores sell a wide range of loose certified

gems and jewellery to suit all tastes and purses. The craft markets, of which there are many, are a good source of gem-related souvenirs. In Cape Town, visit Greenmarket Square, an open market that sells just about everything. At the V&A Waterfront is the Red Shed Craft Workshop where items can be made to order.

If you plan to visit Durban, the Gateway Theatre of Shopping, a vast modern leisure and retail centre, should provide some interesting finds. Another large shopping centre is to be found in Westville.

Tanzania – As the name suggests, this is the home of tanzanite. If you are considering buying, read the details in the Gemstone section of this book and refer to the recognised scale in the Appendices. There are many fakes on offer, so only buy from authorised dealers and never off the street. Beware of the cobalt coatings that are being applied to some pale tanzanite (see under Treatments); inspect them closely with your loupe for any wear on pavilion edges. Also be sure you comply with the country's export procedure.

Tunisia – Common in the souks are amber necklaces made of fake or compressed amber impregnated with amber perfume. The amber used in perfumes actually comes from whales' ambergris and has nothing to do with fossil amber. Silver here is not to be recommended, being low grade. The best red coral is fished along the shores of Algeria and Tunisia but generally sent to Italy for working. Strict controls apply to collecting and exporting.



Tanzanite. (Photo: RH)

West Africa – Several West African countries, including Angola, the Congo, Sierra Leone and Liberia, are in states of political unrest. The Rebels trade rough diamonds to buy armaments. Approximately 4% per annum of diamond rough is smuggled out. In May 2000 South Africa led a group of 40 governments to set up the Kimberley Process. This involved a certification procedure for all rough diamonds crossing international borders. Unfortunately, once the stones have been smuggled out into the hands of the unscrupulous dealers and faceted, they are impossible to identify. These are known as 'Conflict Diamonds'.

Central & South America

Brazil – A visit to Rio de Janeiro is the highlight to any trip to South America. Brazil supplies the world with an enormous range of different gemstones, from amethyst to tourmaline. Possibly the two most important gems are diamond and emerald, but it also provides a rich supply of topaz. Also, the best alexandrite outside of Russia is found here.

Diamond was originally discovered in 1725 and soon began to flood the market. Emerald was discovered much later. The many shops in Rio and São Paulo have superb displays of the many types of gemstones. Unfortunately, as in so many of the gem cities of the world, crime is always a problem. Awareness is of paramount importance in these areas and it is important to buy only from reputable jewellers.

As well as selling gems, 'Realgems' in Rio runs gemmology courses and has a well-equipped laboratory. To the south of the country is Rio Grande Do Sul, which is a wonderful source of geodes and crystal clusters. These are on ready sale in the local tourist shops.

Diamentina, a charming colonial town, was the centre of the world diamond production for 150 years. Minas Gerais is famous for its gold and diamonds.

Chile – A few gems of interest are here: lapis lazuli is available but the quality is variable, having calcite veins running through and often lacking the pyrites that

makes the Afghan variety so attractive. Chrysocolla and turquoise are also found.

Colombia – Provides the world's finest emeralds. The mines operate erratically due to the influence of the criminal element and the supply of the gem is inconsistent. This has had an effect on the market for natural emerald, allowing the excellent synthetics to take a larger market share.

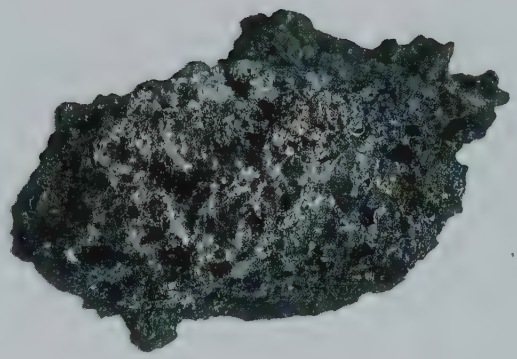
Dominican Republic – An increasingly popular holiday spot. It has a fascinating secret: a supply of amber. Not, however, the amber we are used to seeing, but a tropical variety. It is found in what is now called the 'Amber Valley' and, instead of bees and flies as

Larimar. (Photo: KW)

inclusions, tropical insects are found, even small lizards. It is worth looking out for.

Another unusual gem is larimar, a sky-blue translucent-to-opaque stone with white cloud-like markings. It is also known as Atlantis Stone with a hardness between 5 and 7 on the Mohs scale. It is cut *en cabochon*.

Guatemala – Gold mining has developed rapidly over the past few years, much to the dislike of the locals. However, for the volcano lover, this small country has



Native gold in matrix. (Photo: KW)

several. The most active is Pacaya, which produces some gold and small specimens are occasionally available on the organised tours.

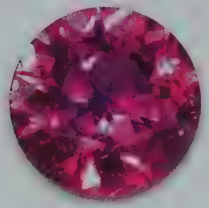
Mexico – This country is famous for the fire opal but other opals are also found there. An opal with a tan body is sold, which is often smoked to enhance the tan colour and thereby increase the fire of the stone. A test for this is to wet the stone with saliva, this will reduce the fire, which will return on drying. Water opal is also offered.

Carved jadeite is also marketed but probably sourced from South America.

West Indies – In certain countries, particularly Jamaica, Trinidad and Tobago, cases have been reported of illicit dealing in black coral. The export of black coral is strictly forbidden and if found by Customs will lead to confiscation and heavy fines.

In the Cayman Islands, a unique stone is to be found: Caymanite is sold in shops across the islands. With a hardness of 5 on the Mohs scale, this opaque banded sedimentary stone, which occurs in earthy shades of brown, yellow to white, makes an attractive and unusual memento.

North America & Canada



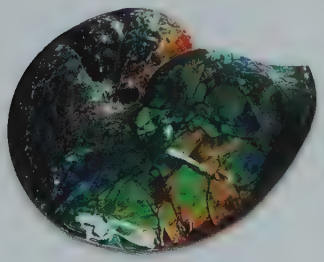
Canadian Ruby. (Photo: TNG)

Canada – In 1991 the first diamonds were discovered at Point Lake, near Lac de Gras in the Northwest Territories. Two diamond mines are now in production: the 'Ekati' 300 km northeast of Yellowknife and 'Dravik', 100 km southeast of 'Ekati'. A third mine 'Jerico' has opened within 400 km of Yellowknife and the fourth, owned by De Beers, started production in 2007. At the end of 2003 Canada was the third largest producer of diamonds; Botswana and Russia being the top.

The diamonds produced are of the highest quality, being very clean. It has also been reported that they are the oldest, being formed 3.5 billion years ago. The 'Canadamark', which is laser engraved on the girdle, identifies the cut stones.

Canada is becoming one the major sources of gemstones; not only for diamonds but also for emeralds, rubies and sapphires. True North Gems are the major players in this field. Emeralds were produced in 2005 from the Yukon with rubies following from Greenland. It is perhaps surprising that all these gems are found close to the Arctic Circle, as one tends to associate hot countries as being the source of most gems.

Sapphire was accidentally discovered on Baffin Island in 2001 and subsequent finds produced stones of excellent colour and quality, not requiring any heat treatment to improve the colour, as is common with sapphires from other sources. Now marketed as Beluga sapphires, they are on show in many jewellers' shops in the cities.



Ammolite. (Photo: MT)

Do not forget to look at Ammolite (*see* Organic Gemstones) while you are there.

United States of America – It is impossible in a book this size to try and describe what to find and where to look in such a massive country. There are some excellent guides produced locally.

A good place to see what is available is at the Annual Intergem Tucson Show usually held in February. More than 4,000 exhibitors from all over the world exhibit the latest gems and minerals, from small to large; some items for sale require a forklift and truck to get them home!

But even here one needs to be aware. The Trade Descriptions Act we have in the UK does not apply in the USA and they do not have an equivalent.

The USA is the biggest gemstone market in the world. The Gemological Institute of America (GIA) is the second oldest institute and its laboratories are second to none. GIA diamond certification is accepted worldwide.

The Smithsonian Museum in Washington has one of the finest collections of gemstones and this is where to see the Hope diamond.

The gem and jewellery market has been badly affected by the credit crunch and gem dealers have had to increase prices to compensate.

Allen Brown of ATG digging for sunstone in Oregon. (Photo: ATG/LAB)

Asia

Burma (Myanmar) – Due to the political situation and the imposition of economic sanctions (the import of gemstones from Burma is banned by the USA), Burma is not a popular place to go on holiday.

Burma, historically, has been one of the great sources of gemstones. The rubies particularly are held in the highest esteem. They will, however, still be available to accredited buyers at the state-run Myanmar Gem Enterprise auctions that are held in Rangoon. Most of their best gems now go to India and Thailand.

Cambodia

If you are visiting Thailand and Vietnam, Cambodia may well be worth a visit. Both ruby and sapphire were mined around Pailin. Allegedly this region was the first to employ heat treatment to improve the local gems, passing on the technique to the Thai mines. The communist rebels and the large Thai mining companies stripped the mines of the majority of their precious stones during the Khmer Rouge period and the subsequent civil war.

The small gem traders around Ratanakiri are able to provide a limited selection of cut stones for the tourists from the new mines in Chum Rom Bei Srok or even elsewhere. Zircon is being offered, but almost certainly heat treated.

Like Vietnam, Cambodia is more a market for the professional gem dealer rather than the keen amateur; you really need to know what you are being offered. If you must have a souvenir, buy in the main cities at regular jewellers, but do not expect that the gems offered necessarily originated in Cambodia.

Hong Kong – A trading centre for everything: a shopper's paradise. Naturally there are many jeweller's shops and several gemmologists display their certificates. Hong Kong is not a producer of gemstones but has an impressive display in the large shopping

Hong Kong. (Photo: KW)

centres. It is an important diamond market.

Gold sales are different here as the dealers quote in the Tael, which is 37.429 grams, as opposed to the Troy ounce of 32 grams. Buying from street vendors is as inadvisable here as anywhere else. There is a lot of dyed jade offered to the unsuspecting.

India – India was the historic provider of many of the most famous gems of today. The ancient diamonds engraved with religious inscriptions were highly prized by the Princes and Maharajahs. Both the Koh-I-Nor, discovered around Hyderabad in 1304, and the Great Mogul diamonds were from India.

Emeralds, although mentioned in Indian history, were not in fact discovered in the country until the early 1940s.

India today has an active diamond-cutting industry, with a few stones still being mined in the north of the country. The range of gems apart from diamond is quite wide and they are readily available. Only deal with recognised dealers and do not buy off the street.

India is the greatest consumer of gold in the world and jewellery plays a big part in women's lives there. Serious consideration is given to design and to matching coloured stones with the outfit. Although traditional preferences for particular gemstones has changed, the jewellery, as in the Middle East, although beautiful, does not always suit the European taste.

Pakistan – A source of numerous gemstones: amethyst, aquamarine, emerald, morganite, peridot, quartz, ruby, sphene, topaz (in a variety of colours), tourmaline and zoisite. However, as yet, Pakistan has not set up a co-ordinated control system for the handling of its mineral deposits. Pakistan has a wide range of gems available to purchase; only buy from recognised dealers, do not buy off the street.

Singapore – Jewellery shops abound, so pick a recommended one. The Singapore Gem factory is a tourist attraction where gem cutting and polishing may be witnessed. The Tael unit of weight is also used.

Operculum cat's eyes are found around the shores of the islands.

Sri Lanka – The 'land of gems', just about every gemstone except diamond and precious opal is found in Sri Lanka. The 'City of Gems' is Ratnapura to the east of Colombo, where many gem shops are to be found. Because this is the 'City of Gems' it does not mean that you can take everything at face value. Street sellers have synthetics and simulants mixed up with some indifferent natural stones, so, as always, only buy from recognised outlets. There are Government-approved shops but their prices are generally high so you're unlikely to find a bargain. Museums displaying many of the precious stones found on the island are a good starting point to get used to seeing the different varieties and what they look like.

Gem dealers at Ratnapura. The buyers are qualified gemmologists; the amateur should avoid buying this way. (Photo: CW)

Thailand – Probably the largest gem centre in the Far East. Bangkok is a thriving city with gemstone supermarkets, which are well organised and offer a dazzling display of stones. Certification is also possible on the premises, but remember the advice given under 'Buying Gemstones'.

The gemstones offered come from Thailand itself as well as from other countries, such as Sri Lanka, Burma (Myanmar), India and Madagascar.

Chantaburi, about 150 miles from Bangkok, is the major trading centre for the sapphires and rubies found locally around Khao Ploei Waen, the gem mountain. The vast majority of the rubies and sapphires are heat treated to improve their colour. It was here that the Thai craftsmen developed the latest technique of beryllium diffusion.

At weekends the gem market located in the centre of the old town is a thriving mass of dealers from all round the Far East. This market is for the professional so it is better to do your buying in the Bangkok supermarket.

A word of warning: scams are very common and the unscrupulous prey on the unsuspecting tourist. A casual meeting with a local 'businessman' who offers an apparently good source of jewellery tax free or at a special tourist rate is a common set-up. You will be sold possibly genuine goods but of inferior quality and worth less than half what you paid for them. These con artists are very convincing, so do not be caught. Many have been.

Vietnam – More people are visiting this country now so a few notes may be of interest. Hanoi is the capital and caters for tourists, including those interested in the local gemstones. There is a gemstone museum in Ruby Plaza. Good quality rubies including a star variety are mined near Yen Bai. Other areas produce good sapphires, aquamarine, topaz and peridot. A range of quartz gems are also commonly found – amethyst, smoky, rose and rock crystal. Red spinel also occurs, a good buy if natural and untreated. A gem market opens daily in Yen The. As with all countries, be prepared to bargain and be aware of fakes.

AUSTRALASIA

Australia – Home of the opal (the national stone), Australia also produces huge quantities of diamond, though mainly industrial. Sapphire is also mined.

Of course, you can buy all these in the jewellers' shops in Sydney, Melbourne, Canberra or any of the large cities, but, if you want to see opals and sapphires in their natural state, you need to go to the mining areas. Unfortunately, some of these are pretty remote although some tours do include visits.

Opal is mined in Queensland, New South Wales, South and Western Australia. Perhaps the most famous mining area is Coober Pedy, the aboriginal name meaning 'white man in a hole'. Which is, in fact, how many of the miners live.

There is an amazing variety of opals on offer: black, white and precious, as well as an unusual selection of opalised wood and polished ironstone with opal inclusions, well worth considering for pendants. Avoid buying opals displayed in water.

The main mining centre for sapphires is Inverell, New South Wales. Visitors can visit the Mining Museum and even 'fossick' for gems themselves. Apart from blue (not always dark, as rumoured), a wide range of colours is found, including yellow, green, red, orange and pink as well as bicoloured. The output has dropped over the past few years and much has been bought by Thailand to be sold on as coming from other sources.

Emeralds are also found, though not in commercial quantity and generally of low quality. Good-quality chrysoprase is mined, the total output being sent to Hong Kong for processing and sale.

Australia also has the highest output of top-quality nephrite jade in the world. Geodes (hollow spheres) and thundereggs (also round but the middle is solid, filled with agate or quartz) are found in New South Wales and Queensland; they are on sale in the collectors' shops.

Mookite Necklace. (Photo MM)

Another material used for beads and cabochons is a variety of jasper called Mookite. It occurs in a wide variety of earthy shades.

New Zealand – Nephrite jade, soapstone, garnet, bowenite and paua shell are all found in New Zealand. The Maoris carve jade and soapstone. Kauri gum, a copal resin, is also found here and may be mistaken for amber.

Europe

Belgium – Antwerp rivals Amsterdam in its handling of diamonds. Fifty per cent of rough diamonds pass through the city. The Diamond District near the railway station is a vast cluster of dealers' shops. The Diamond Market is where traders buy not only diamonds but also a wide range of precious stones.

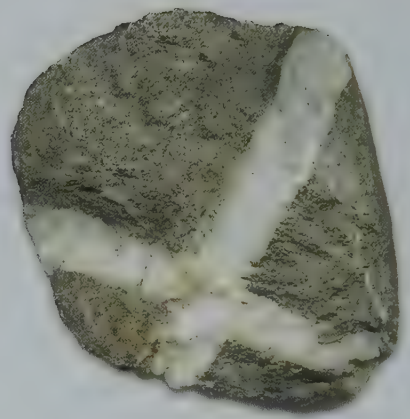
The large Diamond Museum houses a priceless collection covering the history of this favourite of all gemstones.

An excellent little folding map of the Antwerp Diamond Square Mile is available from the Antwerp World Diamond Centre.

Eire (Ireland) – County Galway is the source of Connemara Marble, which can be confused with jade. Jewellery is produced locally. Kilkenny Marble is black and contains numerous fossils; as well as its major use in churches, it is used to make rosary beads.

France – The Auvergne region is volcanic and consequently heavily mineralised. It is not unusual to see the sale of local minerals in lay-bys along the sides of the roads. Among the local specimens you may find amethyst, rock crystal, fluorspar, sapphire, ruby, aquamarine, emerald, peridot and zircon. These will not be of gem quality, but good as shelf objects or talking points.

France has several lapidary museums, such as those in Avignon, Perigueux and Castlenay Castle. Of particular interest is the diamond museum in St Claude in the Jura. This has a good display of gemstones both natural and synthetic. The equipment used for the manufacture of the synthetic diamonds is also shown together with the tools used for diamond cutting. The work done in the associated workshops supplies the clock and watch industry in nearby Switzerland. A video is available describing the various processes. An excellent annual Mineral & Gemstone Fair is held at St Marie-aux-Mines in Alsace each July. It is possible to visit the silver mines (not recommended if you suffer from claustrophobia).



Unusual Cross Stone, France. (Photo: KW)

Silver nugget from St Marie-aux-Mines. (Photo: KW)

The local area also produces excellent briar trees used for pipe making and a museum of pipes and their history is adjacent.

Agate cutter at Idar Oberstein. (Photo: KW)

Germany – Idar Oberstein is the main centre for the production of stone carved cameos. The magnificent Edelstein museum of gemstones is enough to take your breath away. If you want to see what real gems look like, then this is the place to visit. Not far away are the traditional cutting mills where you can see agate being worked on giant grindstones; the variety of agates is fascinating. There is a wealth of gem and jewellery shops in the town: Ruppenthals is well worth a visit, as is the Schmuck und Mineralien Haus [Jewellery and Mineral House] in Wasserschieder Strasse.

An important gem and mineral show is held in the Munich Trade Centre each autumn.

Italy – If you are near Naples, the centre for coral working is at Torre del Greco, which is also the biggest jewellery manufacturing area, including cameo carving. Cameos are carved from coral, agate and shell; quality varies so go for the best you can afford.

The Netherlands – If you are flying into Schiphol Airport at Amsterdam, you can buy your diamonds *in situ* while you are waiting for you next flight!

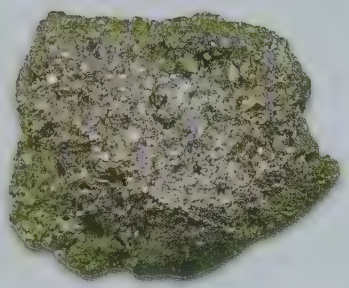
Amsterdam is one of the biggest diamond cutting centres in the world. The factories of Stoeltie Diamonds and Gassan Diamonds offer guided tours where cutting may be seen. The Amsterdam Diamond Centre is also open to the public. Stones can be purchased at all these places.

Portugal – Lisbon has a good selection of museums well worth a visit, with gemmological or jewellery associations. These include the Nacional de Arte Antiga, Oriente, Patriarcas and Arqueologia.

Russia – Alongside Botswana, Russia is the biggest supplier of diamonds in the world. It is also the country where one of the best methods of producing synthetic diamonds was developed.

The most famous gem from Russia is, of course, alexandrite, but this is becoming increasing rare from this source. Most gems on offer are the opaque materials, such as malachite, charoite, serpentine (known as Zmeevik), jasper, rhodonite, amazonite, nephrite, agate and dolerite. These are found mostly in the form of ornaments, boxes and occasionally as cabochons in jewellery. Be warned: Russia is a major supplier of synthetics.

Spain – Andalusia first gave the world that beautiful pleochroic gemstone Andalusite. Although today it is mainly sourced from Brazil, you may still find some on sale in Cordoba, which is a good centre of jewellery



Pyrites Nugget. (Photo: KW)

with a jewellery museum, the Museo de Joyeria Regina. There are mineralogical museums in Valverde de Camino and Seville.

Andalusite's associated mineral chiastolite is found in Northern Spain and is particularly treasured in this strongly religious area due to the cross formed in the stone. Fine pyrite crystals are found at a mine at Navajun in the La Rioja district where purchases may be made. Amethyst is very popular and is in plentiful supply.

Majorica simulated pearls are produced on the island of **Majorca** and are an extremely good and popular souvenir. They should not be confused with cultured pearls, though they are difficult to distinguish.

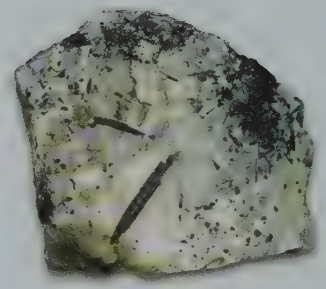
Peridot is prevalent throughout the **Canary Islands**. The gem variety of the olivine found in the basalt lava around the area; it is easy to pick up pieces of the black rock and see the olive green crystal within. Peridot jewellery is found in many of the local shops. Quality varies so ensure you buy only the best colour and exclude the pale stones.

Switzerland – Geneva is a major centre for the sale of precious gems. Auctions of some of the world's finest jewellery are held there: the Duchess of Windsor's collection was sold for millions of pounds a few years ago. One of the best gemmological testing laboratories, the Gubelin, is based in Lucerne.

Turkey – Probably the best-known mineral to come from this country is Meerschaum, long used for bowls of tobacco pipes and cigarette holders. They are beautifully carved and antique examples command high prices.

A gem that has recently entered the marketplace is diaspore, a pretty pleochroic stone similar in its coloration to andalusite. This is now marketed as Zultanite.

Meerschaum Cigarette Holder. (Photo: KW)

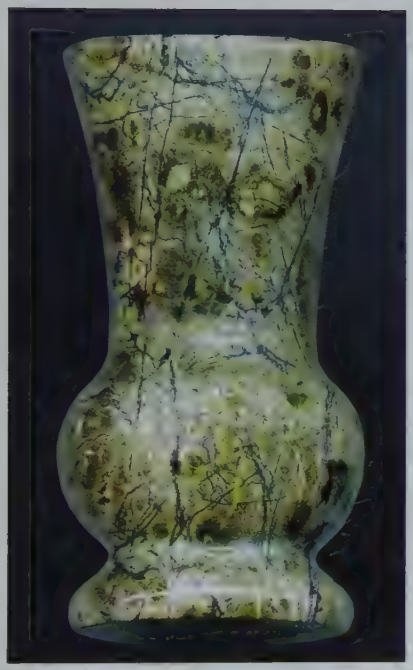


Tourmaline in quartz, Roche, Cornwall. (Photo: KW)

United Kingdom – There are few gemstones found in the UK and even those are not of gem quality. There are, however, some organics: amber from North Yorkshire, jet from Whitby, Blue John, together with other fluorspars, and Jasper from the Peak District, Slate (though not normally thought of as material for jewellery, it can be attractive) may be found in the factory shops of North Wales. There are also still two gold mines in Wales: one near Llandovery and the other near Dolgellau, where jewellery may be purchased containing approximately 10% of the local gold.

Smoky or brown quartz was sourced in the Cairngorm mountains of Scotland but is nearly exhausted. It was used extensively in Celtic jewellery, which now uses heat-

Spar box. (Photo: KW)



Serpentine vase, Cornwall. (Photo: KW)

Alabaster vase, Derbyshire. (Photo: KW)

treated amethyst imported from Brazil as a simulant. Iona Stone, a form of serpentine found in the Hebrides, is used locally in the making of jewellery. An excellent gem and rock museum is situated in Creetown, Newton Stewart.

Cornwall is a highly mineralised area and, although amethyst, smoky quartz and turquoise have been found in the china clay pits, they are sold only as mineral specimens. Some fine serpentine material is found around the Lizard. Camborne has an excellent Museum of Mining and Minerals. Derbyshire provides a couple of decorative minerals. Alabaster is carved into ornaments and Ashford black marble, while a rarity, is still available (at a price) on the antiques market. It is a jet black limestone inlaid with coloured stones. Another museum related to mining is the Killhope Museum in County Durham. It holds a huge collection of Spar Boxes, amazing ornaments made by the miners in their spare time. They are made from a collection of various minerals – fluorite, aragonite, galena, etc. – many of which are found locally.

Caradon Hill Engine Houses, Cornwall. (Photo: KW)

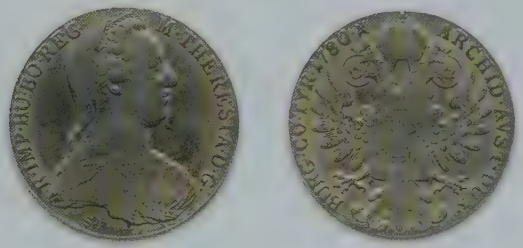
China Clay Pit, St Austell, Cornwall. (Photo: KW)

Gold souk in Kuwait. (Photo: KW)

The Middle East

Gold is held in high esteem in all Arab countries and the quality in terms of karatage is very important. That is why most gold on sale is either 18 or 22 karat. This is sold by the gram. There are 32 grams to the Troy ounce (not the 28 grams to the ounce as in domestic cooking). Gold is always sold in this way. The small tola bars are sold in troy ounce sizes.

When you visit the gold souks in **Saudi Arabia**, **Kuwait**, **Bahrain**, **Dubai** and **Qatar** you will be amazed at the quantity of it on display. Some of it will be unlike anything you have seen before. Much of it provides the necessary items that the bridegroom has to buy, by tradition, to give to his bride as a dowry. There will also be other items more suitable for Western wear.

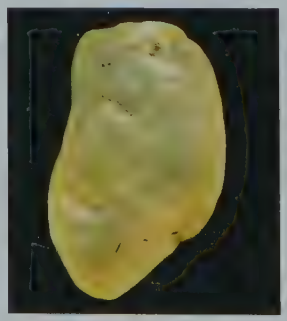


Maria Theresa Taler. (Photo: KW)

When you decide to buy, the first thing to do is to ask the price per gram, as this varies from day to day. Then, when you have selected the piece you want, it is weighed and you are given the price for the piece.

A point to watch: avoid buying jewellery containing many 'gemstones', as these are generally not very good quality, possibly glass or paste and are also included in the weight of the item. Don't pay a gold price for glass!

The gold is good. Silver tends not to be so good; it is usually not of Sterling quality and can be considerably lower. It is best avoided. An exception is if you visit the **Oman**. Here, the silver Maria Theresa Taler has been accepted as a trading token by the hill tribesmen for hundreds of years and they will not accept anything else. The Taler, originally minted in Austria, is still being minted in several countries today; it always carries a date of 1780, regardless of when it was actually produced. They are readily available around the souks of Muttrah. They are not sterling silver (925) but 833 fine containing 0.752 oz.



Uncut 'Saudi diamond'. (Photo: KW)

Bahrain and **Dubai** were once the major pearling centres around the Arabian Gulf. The production of pearls has now dropped considerably, due to the influx of cultured pearls and to pollution, but it is still possible to find a few dealers around. Dubai has a very

Gypsum 'sand rose'. (Photo: ACC)

interesting museum showing pearling in days gone by.

The good news is that Gem-A are now running courses in Dubai to support the renewed interest in natural pearls following the flooding of the market with cultured pearls, mainly by China.

The annual Middle East International Gold, Jewellery, Watch and Clock Exhibition is held in Bahrain, usually in October.

Turquoise, mostly veined, is found around Medina together with chalcedony and is used in the local jewellery.

'Saudi diamonds' are found in the deserts around Riyadh and are, in fact, quartz pebbles. They were collected by the ex-pats and sent off for cutting and polishing as souvenirs. Another local oddity is the 'Sand Rose' found in the deserts. This is gypsum that has formed into interlocking plate-like crystals. These are readily available for a modest price in the souks. They come in a wide range of sizes, from a few inches across to a foot or more.

Israel – Next only to Antwerp in importance to diamond trading, it is also a major cutting centre. Ramat Gan is the hub of this business housing both the Israeli Diamond and Coloured Stone Exchanges.

Israel's national stone is the Eilat named after the popular port and coastal resort on the shores of the Gulf of Aqaba. Reputedly found in the legendary mines of King Solomon, which are a few miles away, it is used *en cabochon* for pendants, rings and earrings, set in gold or silver. Usually green, and similar to malachite, it has a wide range of shades and markings.

This now brings our trip around the world to a close. It is not possible to list all the wonderful rarities and oddities, but it is hoped that it has aroused a sense of awareness of what is out there and how to go about adding it to your own personal collection.

Eilat Stone. (Photo: KW)

Gems on the Internet

There are hundreds of websites on the Internet dealing with gems and subjects dealt with in this book. Most offer a wide range for sale in the form of loose stones or set in jewellery. Bear in mind there are risks involved in purchasing from these sources as you don't see what you are buying until you have paid.

However, there are several useful and informative sites and some of these are listed below:

www.atggems.com
All That Glitters – An American dealer in gemstones, based in Methuen, MA. The website offers particularly good coverage of unusual gems.

www.chatham.com
Chatham Created Gems – Read the story of Chatham synthetic diamonds, emeralds, etc.

www.cigem.ca
Canadian Institute of Gemmology.

www.debeersgroup.com
De Beers – Home page of the biggest and oldest diamond dealer.

www.edelsteinmuseum.de
Idar Oberstein – Information on the famous gem museum.

www.gem-a.com
The Gemmological Association of Great Britain (Gem-A) – Details of membership, instrument sales, books, etc. Gem-A provides in-house and correspondence courses for its prestigious FGA and DGA qualifications in gemmology.

www.gem.org.au
Gemmological Association of Australia – Gallery of Australian gems.

www.gemesis.com
Gemesis Diamonds – A major manufacturer of synthetic diamonds.

www.gemrock.net
Creetown Museum – A UK website in south-west Scotland. Plenty of useful information.

www.gemstone.org
International Coloured Gemstone Association – Excellent database of gemstone information.

www.giagem.org
The Gemological Institute of America (GIA) (USA) – Details of membership, instrument sales, books and educational facilities.

www.holtsgems.co.uk
R. Holt Ltd – Based in Hatton Garden, this is one of the largest gem dealers in the UK. Also runs a school of gemmology and jewellery.

www.killhope.org.uk
Lead mine and museum with largest collection of Spar boxes.

www.manchesterminerals.co.uk
Supplier of tumbling kits and associated goods.

www.multicolour.com
Multicolour – An American company selling gemstones. Their catalogue serves as a very good database of illustrations and properties.

www.nhm.ac.uk
Natural History Museum – London home of the national gemstone collection.

www.nmnh.si.edu/minsci
Smithsonian Institute – Visit here to see the Hope diamond, amongst others.

www.stonepolishing.co.uk
Supplier of lapidary machines.

www.ukfcg.org
United Kingdom Facet Cutters Guild. Help and advice for those interested in taking up gem faceting.

www.ukge.co.uk
Supplier of geological and tumbling machines.

www.whamond.com
W. Hamond – A UK dealer in jet.

Appendix 1 – Glossary

Adularescence — Name given to the 'opalescence' seen in moonstone.

Allochromatic — (Other coloured) Gemstones that are coloured by impurities.

Alluvial — Deposit of gem materials in dried-up riverbeds.

Asterism — The feature shown in star stones, i.e. Ruby and Sapphire.

Birefringence — The difference between the refractive indices of a doubly refractive stone.

Chameleonism — A stone that exhibits both photochromic and thermochromic properties (*see* Chameleon diamonds).

Conflict diamonds — Illegal stones smuggled out of countries where mining is done by slave labour or in the control of criminal organisations. All reputable dealers outlaw trading in these diamonds.

Cat's eye — An effect exhibited by some gems where fine fibrous inclusions cause a changeable band of light to appear and to move across a cabochon-cut stone. Known as 'chatoyancy', this is often seen in quartz, chrysoberyl and tourmaline.

Cleavage — The tendency of crystals to break along certain definite directions producing more or less smooth surfaces. This is a feature used particularly in the cutting of large diamonds.

Density — *See* **specific gravity**.

Dichroism — An effect seen in some doubly refractive gems where a stone appears as different colours when viewed from different directions.

Dichroscope — Instrument used to study dichroism.

Dispersion — A property of gems generally referred to as their 'fire'.

Enhancement — Any process that artificially improves the appearance of a gemstone, i.e. heat treatment, laser drilling to remove inclusions, dyeing, etc.

Fisheye — Particularly applied to diamonds, this refers to a shallow cut stone that exhibits a white circle when viewed through the table.

Fluorescence — A property shown by some minerals and gems to glow when exposed to ultra-violet light.

Heavy liquids — Liquids used by gemmologists for checking the specific gravity of gemstones. They are all corrosive or poisonous.

Idiochromatic — (Self-coloured) Gemstones whose colour is intrinsic when pure.

Inclusion — Any foreign body or cavity within the body of a stone. Often used by gemmologists to aid identification of the gem.

Intaglio — A gem with an engraved design.

Irradiation — A radioactive treatment to improve or change the colour of a gem.

Lustre The surface appearance of a polished gemstone, i.e. quartz – glassy, diamond – adamantine, turquoise – waxy. Also the orient of pearl.

Matrix The base rock enclosing a crystal or mineral.

Phosphorescence Certain minerals phosphoresce when excited by light (usually UV), when the light source is removed. The effect lasts only a few seconds.

Photochromic A stone that exhibits a temporary or reversible colour change under different lighting conditions. Applies to colour change gems, but also to several other materials, such as certain sunglasses.

Piezoelectric An effect wherein an electrical charge is developed across opposite crystal faces when subjected to compression.

Pleochroism As dichroism but displaying more than two colours.

Polariscope An instrument used to, among other things, inspect gems to indicate single or double refraction.

Polymorph Gem of the same chemical composition but crystallising in more than one crystal form.

Pyroelectric An effect seen in some minerals that causes an electric charge to develop across opposite ends of the crystal axis when heated.

Refraction The specific angle at which light bends when passing through a gem, which is measured and interpreted into the *refractive index* for that stone. Double refraction means that the stone splits the light ray into two and each ray has a different angle so the stone has two refractive indices. Gemmologists use a refractometer to establish the refractive index of a gem.

Simulant Any stone that is purported to be another type of stone without having any of its chemical properties. (*See also* **synthetic**.)

Specific gravity The specific gravity (SG) of a gemstone refers to its weight in air compared to the weight of an equal volume of water. Therefore, the higher the SG of a stone, the heavier it will weigh compared to gems of a lower SG. Consequently, a one-carat diamond (SG 3.51) is smaller in size than a one-carat tourmaline (SG 3.00) because the diamond is denser than the tourmaline. So, the higher the SG, the smaller the stone of an equivalent weight. (*See* Table 12.)

Spectroscope An instrument used to view the spectrum of a gem in order to assist in its identification. A rainbow of colours forming the spectrum is crossed by a series of black vertical lines signifying various chemicals in its makeup.

Star Stone A stone that exhibits a star effect or 'asterism' as described in the section on ruby.

Synthetic A laboratory-made gem that is, to all intents and purposes, chemically identical to the natural stone. (*See also* **simulant**.)

Thermochromic A stone that exhibits temporary or reversible colour change due to heat. The level of heat required to obtain a change varies with different materials. Mood rings rely on this property.

Zoning Colour banding that occurs in natural and synthetic gemstones. The banding is generally straight or angular in the natural gem, but curved in the synthetic.

Appendix 2 – Rainbow of Colours

The following lists just some of the range of colours of the gems detailed throughout the book.

COLOUR	GEMSTONE
Red/Pink	Almandine Garnet
	Amber
	Beryl
	Coral
	Danburite
	Diamond
	Fire opal
	Fluorspar
	Kunzite
	Morganite
	Pyrope Garnet
	Rhodochrosite
	Rhodolite Garnet
	Rhodonite
	Rose Quartz
	Rubellite (Tourmaline)
	Ruby
	Sapphire
	Spinel
	Topaz
	Zircon
Orange	Amber
	Fire opal
	Hessonite Garnet
	Sapphire (Padparadsha)
Yellow	Amber
	Beryl (Heliodor)
	Chrysoberyl
	Citrine
	Danburite
	Diamond
	Fluorspar
	Jadeite
	Spinel (very rare)
	Topaz
	Tourmaline
	Zircon

COLOUR	GEMSTONE
Black	Coral
	Diamond
	Jet
	Melanite Garnet
	Obsidian
	Onyx
	Sapphire
	Spinel
	Tourmaline
Brown	Amber
	Andalusite
	Beryl
	Cairngorm
	Diamond
	Fluorspar
	Hessonite Garnet
	Jadeite
	Obsidian
	Peridot
	Quartz (Smoky)
	Tourmaline
	Zircon
Blue	Aquamarine
	Benitoite
	Diamond
	Fluorspar
	Iolite
	Jadeite
	Lapis Lazuli
	Sapphire
	Sodalite
	Spinel
	Tanzanite
	Topaz
	Tourmaline (Indicolite)
	Turquoise
	Zircon

COLOUR	GEMSTONE
Green	Andalusite
	Beryl
	Chrome Chalcedony
	Chrysoberyl
	Chrysocolla
	Demantoid Garnet
	Emerald
	Fluorspar
	Grossular Garnet
	Hiddenite
	Jadeite
	Malachite
	Nephrite
	Peridot
	Sapphire
	Spinel (rare)
	Tourmaline
	Zircon
Violet	Almandine Garnet
	Amethyst
	Fluorspar
	Jadeite
	Kunzite
	Sapphire
	Tanzanite
	Tourmaline
	Zircon

Appendix 3 – Properties of Gemstones

GEMSTONE	SPECIFIC GRAVITY	REFRACTIVE INDEX	HARDNESS	CRYSTAL FORM
Water	***1.00***	***1.333***		
Alexandrite	3.70-3.78	1.742-1.759	8.50	Orthorhombic
Amber	1.03-1.10	1.54	2.00-2.50	N/A
Andalusite	3.15	1.633-1.644	7.00-7.50	Rhombic
Anglesite	6.30-6.39	1.877-1.894	2.50-3.00	Orthorhombic
Apatite	3.15-3.22	1.63-1.65	5.00	Hexagonal
Aquamarine	2.69	1.570-1.586	7.50-8.00	Hexagonal
Axinite	3.27-3.29	1.674-1.684	6.00-6.50	Triclinic
Benitoite	3.64	1.757-1.804	6.50	Trigonal
Beryl – Morganite	2.80	1.58-1.60	7.50-8.00	Hexagonal
– Heliodor	2.69	1.58-1.60	7.50-8.00	Hexagonal
Chrysoberyl	3.72	1.742-1.757	8.50	Orthorhombic
Chrysocolla	2.1-2.20	1.50	2.00-4.00	Amorphous
Clinohumite	3.17-3.35	1.625-1.668	6.00-6.50	Monoclinic
Coral	2.68	1.630-1.636	3.50	N/A
Corundum – Synthetic	4.00	1.76-1.77	9.00	Trigonal
Cubic Zirconia (CZ)	5.56-6.00	2.17	8.00-8.50	Cubic
Danburite	3.00	1.630-1.636	7.00	Rhombic
Diamond	**3.52**	**2.417-2.420**	**10.00**	**Cubic**
Diaspore	3.3-3.5	1.70-1.75	6.5-7.00	Orthorhombic
Emerald – Natural	2.71	1.585-1.593	7.50-8.00	Hexagonal
– Synthetic	2.66-2.71	1.56-1.563	7.50-8.00	Hexagonal
Enstatite	3.20-3.30	1.650-1.680	5.50	Orthorhombic
Epidote	3.25-3.50	1.735-1.765	6.00-7.00	Monoclinic
Fire Opal	2.00	1.453-1.455	5.00-6.50	Amorphous
Fluorite	3.17-3.19	1.43	4.00	Cubic
Garnet – Almandine	3.97	1.75-1.82	7.50	Cubic
– Demantoid	3.84	1.88-1.89	6.50	Cubic
– Hessonite	3.65	1.742-1.748	6.50-7.00	Cubic
– Pyrope	3.75	1.74-1.75	7.50	Cubic
Glass	2.00-6.00	1.44-1.90	5.50-7.00	Amorphous
Hackmanite	2.15-2.40	1.48	5.00-6.00	Cubic
Hematite	4.9-5.3	2.94-3.22	5.50-6.50	Trigonal
Hemimorphite	3.30-3.50	1.614-1.636	5.00	Orthorhombic
Hiddenite	3.17-3.23	1.660-1.659	6.00-7.00	Monoclinic
Hodgkinsonite	4.06-4.08	1.720-1.746	<5.00	Monoclinic
Idocrase	3.35-3.45	1.702-1.706	6.00-7.00	Tetragonal
Iolite	2.57-2.66	1.53-1.55	7.00-7.50	Rhombic
Ivory – Dentine	1.85	1.54	2.50	Amorphous
– Vegetable	1.40	1.54	2.50	Amorphous

Jadeite	3.30-3.50	1.65-1.68	6.50-7.00	Monoclinic
Jet	1.10-1.40	1.64-1.68	3.5	Amorphous
Kornerupine	3.27-3.45	1.660-1.699	6.5-7.00	Orthorhombic
Kunzite	3.17-3.23	1.660-1.679	6.00-7.00	Monoclinic
Kyanite	3.53-3.65	1.710-1.734	5.5-7.00	Triclinic
Labradorite	2.70-2.72	1.56-1.57	6.00-6.50	Triclinic
Lapis Lazuli	2.80	1.50	5.50	Cubic
Malachite	3.74-3.95	1.65-1.90	3.50	Monoclinic
Moissanite (synthetic)	3.22	2.65-2.69	9.25	Hexagonal
Moonstone	2.57	1.52-1.54	6.00-6.50	Monoclinic
Nephrite Jade	2.90-3.02	1.60-1.65	6.50	Monoclinic
Obsidian	2.40	1.50	5.50	Amorphous
Opal	2.10	1.44-1.47	5.00-6.50	Amorphous
Pearl – Natural	2.71	1.52-1.66	2.50-4.50	N/A
– Cultured	2.75	1.52-1.66	2.50-4.50	N/A
Peridot	3.34	1.654-1.689	6.50-7.00	Rhombic
Petalite	2.40	1.502-1.519	6.00-6.50	Monoclinic
Phenakite	2.95-2.97	1.65-1.67	7.5-8.00	Trigonal
Prehnite	2.80-2.95	1.62-1.65	6.00-6.50	Rhombic
Quartz	2.65	1.544-1.553	7.00	Trigonal
Rhodochrosite	3.45-3.70	1.597-1.817	4.00	Trigonal
Rhodonite	3.50-3.70	1.71-1.73	5.00-6.00	Triclinic
Ruby	3.99	1.759-1.779	9.00	Trigonal
Sapphire	3.99	1.759-1.779	9.00	Trigonal
Scapolite	2.57-2.74	1.54-1.579	5.50-6.00	Tetragonal
Scheelite	5.90-6.30	1.918-1.937	4.50-5.00	Tetragonal
Sodalite	2.20-2.40	1.48	5.50-6.00	Cubic
Spahlerite	3.90-4.10	2.368-2.371	3.50-4.00	Cubic
Sphene (Titanite)	3.52-3.54	1.843-2.110	5.00-5.50	Monoclinic
Spinel – Natural	3.60	1.714-1.736	8.00	Cubic
– Synthetic	3.63	1.725-1.728	8.00	Cubic
Spodumene	3.15-3.21	1.660-1.681	6.50-7.00	Monoclinic
Sunstone	2.62-2.65	1.54-1.55	6.00-6.50	Triclinic
Tanzanite	3.35	1.692-1.700	6.50-7.00	Orthorhombic
Topaz	3.53-3.56	1.607-1.637	8.00	Orthorhombic
Tortoiseshell	1.29	1.55-1.56	1.55	Amorphous
Tourmaline	3.05	1.616-1.652	7.00-7.50	Trigonal
Turquoise	2.60-2.80	1.61-1.65	5.00-6.00	Triclinic
Yttrium Aluminium Garnet (YAG)	4.58	1.834	8.50	Cubic
Zincite	5.68	2.01-2.02	4.00-5.00	Hexagonal
Zircon (Normal)	4.40-4.69	1.92-1.993	6.50-7.50	Monoclinic

Appendix 4 – Translations

English	German	French	Italian	Spanish
agate	Achat	agate	agata	ágata
amber	Bernstein	ambre	ambra	ámbar
amethyst	Amethyst	améthyste	ametista	amatista
aquamarine	Aquamarin	aigue-marine	acquamarina	aguamarina
beryl	Beryll	béryl	berillo	berilo
black	schwarz	noir	nero	negro
bloodstone (heliotrope)	Heliotrop	sanguine	eliotropio	sanguina
blue	blau	bleu	blu/azzurro	azul
carat	Karat	carat	carato	quilate
coral	Koralle	corail	corallo	coral
cornelian	Karneol	cornaline	carniola	cornalina
corundum	Korund	corindon	corobino	corindon
diamond	Diamant	diamant	diamante	diamante
emerald	Smaragd	émeraude	smeraldo	esmeralda
enamel	Emaille	émail	smalto	esmalte
garnet	Granat	grenat	granato	granate
glass	Glas	verre	vetrò	vidrio
gold	Gold	or	oro	oro
green	grun	vert	verde	verde
ivory	Elfenbein	ivoire/rohart/marfil	avorio	marfil
jade	Jade	jade	giada	jade
jasper	Jaspis	jaspe	diaspro	jaspe
jeweller	Juwelier	bijoutier	gioielliere	joyero/a
jewellery store	Juwelier	bijouterie	gioielleria	joyería
moonstone	Mondstein	adulaire	pietra di luna	tipo de opolo a feldspato
mother-of-pearl	Perlmut	nacre	madreperla	madreperla/nácar
pearl	Perle	perle	perla	perla
peridot	Peridot	péridot	peridoto	peridoto
pink	rosa	rose	rosa	rosado/rosa
platinum	Platin	platine	platino	platino
quartz	Quarz	quartz	quarzo	cuarzo
red	rot	rouge	rosso	rojo
rock crystal	Bergkristall	crystal de roche	cristallo di roccia	crystal de roca
ruby	Rubin	rubis	rubino	rubí
sapphire	Saphir	saphir	zaffiro	zafiro
silver	Silber	argent	argento	plata
topaz	Topas	topaze	topazio	topacio
tourmaline	Turmalin	tourmaline	tormalina	turmalina
turquoise	Türkis	turquoise	turchese	turquesa
white	weiß	blanc	bianco	blanco
yellow	gelb	jaune	giallo	amarillo
zircon	Zirkon	zircon	zircone	zircón

Appendix 5 – Tanzanite Values

Courtesy of the Tanzanite Foundation

COLOUR				*CLARITY*	*CUT*
	Violetish BLUE		*Bluish VIOLET*		
vBE	Violetish **Blue** Exceptional	**bVE**	Bluish **Violet** Exceptional	**EC** Eye Clean	Excellent
vBV	Violetish **Blue** Vivid	**bVV**	Bluish **Violet** Vivid	**SI** Slightly Included	Very Good
vBI	Violetish **Blue** Intense	**bVI**	Bluish **Violet** Intense	**MI** Moderately Included	Good
vBM	Violetish **Blue** Moderate	**bVM**	Bluish **Violet** Moderate	**HI** Heavily Included	Fair
vBL	Violetish **Blue** Light	**bVL**	Bluish **Violet** Light		
vBP	Violetish **Blue** Pale	**bVP**	Bluish **Violet** Pale		

Note: In the rare circumstance that intensity of color exceeds the Exceptional grade, it will be graded **Exceptional** +

Appendix 6 – Diamond Values

This chart demonstrates how the value of a 1 carat diamond depreciates according to colour and clarity. For example, a J colour stone with clarity classed at SI is worth only 17% of the value of a flawless D stone. (*See also* Table 9 'Diamond Clarity', in the Precious Stones section, for further details, e.g. on the acronyms used here.)

Colour	Clarity						
	FL	**VVS**	**VS**	**SI**	**I-1**	**I-2**	**I-3**
D, E	100%	70%	50%	30%	25%	20%	15%
F, G	80%	65%	45%	27%	20%	18%	13%
H	65%	45%	35%	25%	18%	15%	12%
I, J	50%	35%	30%	17%	15%	12%	11%
K, L	40%	25%	20%	15%	12%	11%	10%
M, N	35%	20%	17%	14%	11%	9%	9%
O, P	30%	18%	15%	13%	9%	8%	6%
Q, R	25%	15%	13%	11%	8%	6%	4%
S - Z	15%	13%	11%	9%	6%	4%	3%

Appendix 7 – Comparative Gem Values

The following charts are designed to give an indication of the comparative value of the most important gemstones covered by this book.

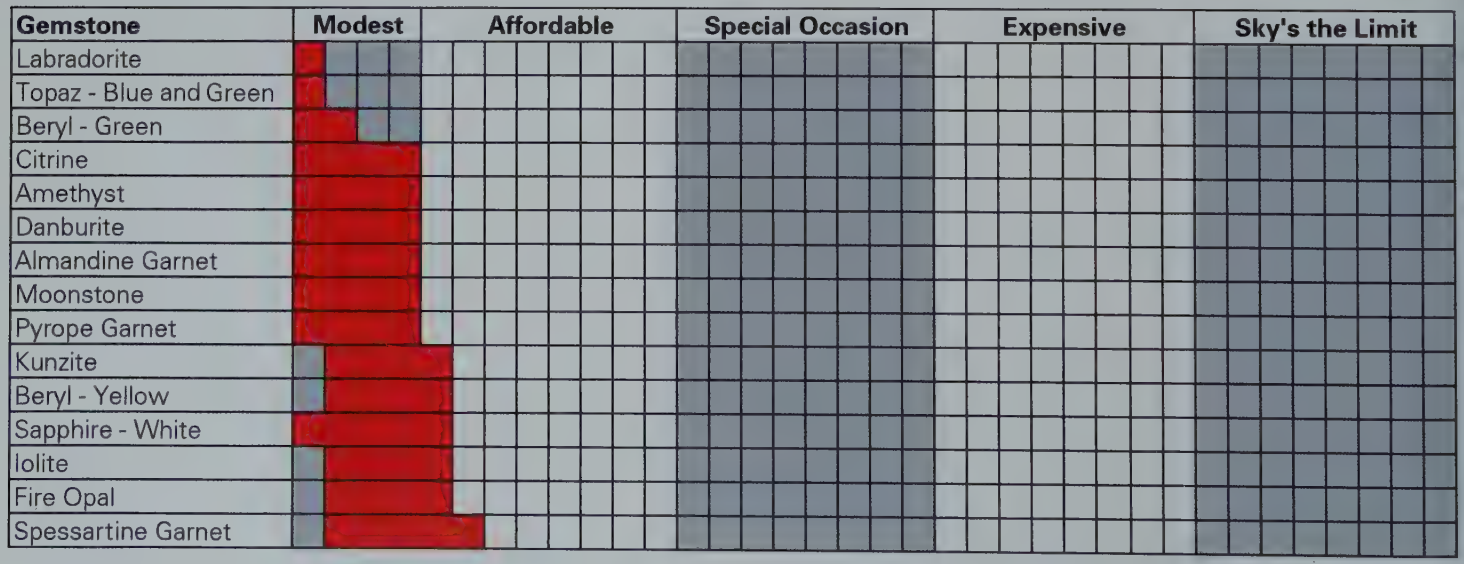
The gems are listed in order of approximate value, from the lowest price per carat up to the most expensive. It is inadvisable, if not impossible, to give the actual monetary value of stones as prices fluctuate greatly due to supply and demand, varying greatly depending on where the stones are purchased.

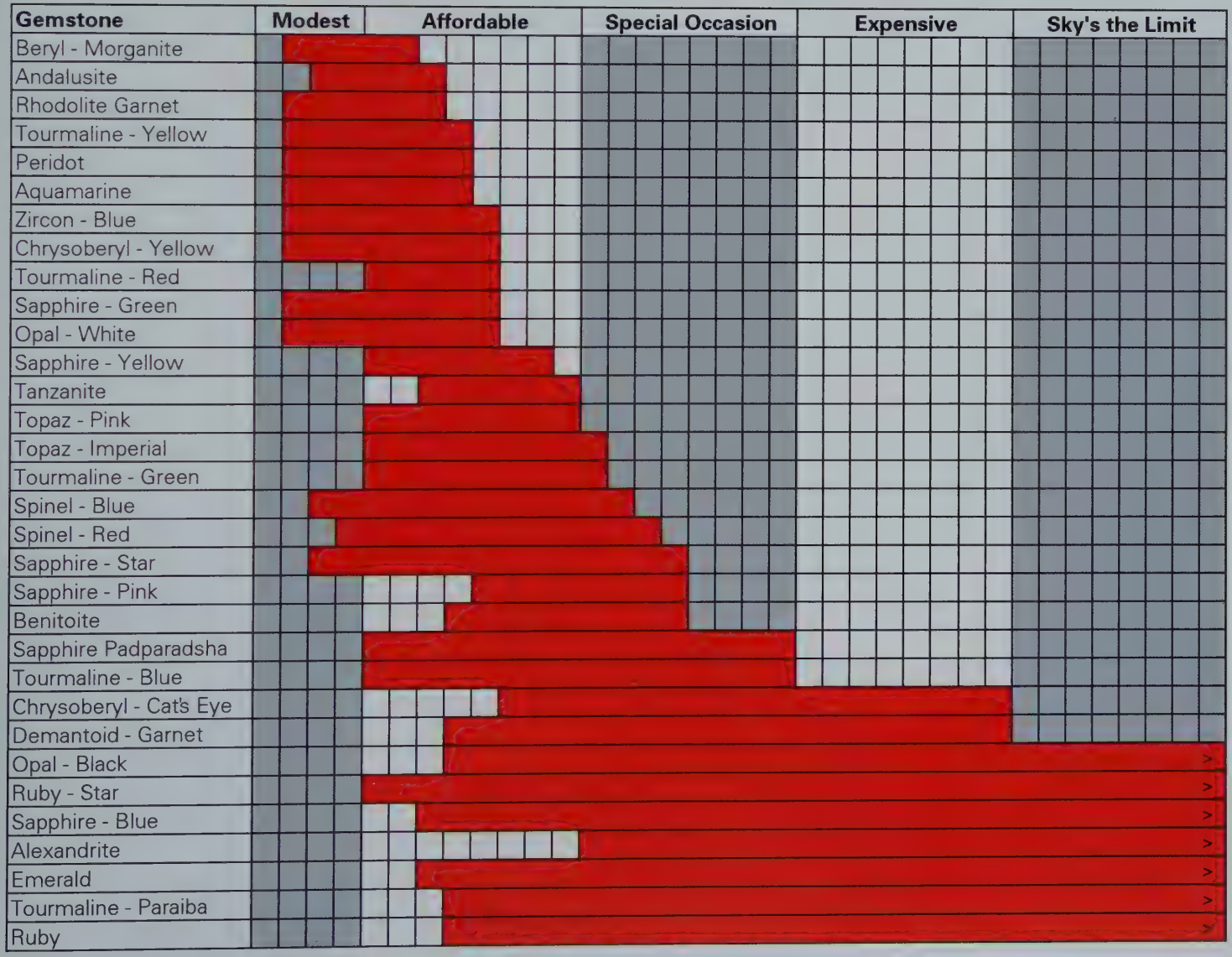
In the chart, the red bar indicates the range of price per carat of the generally available size and quality. For instance, the first column, labelled 'Modest', indicates stones costing under £100 per carat; the subsequent columns increase in steps up to approximately £5,000 per carat.

Please bear in mind that this chart is very approximate and is only intended as a guide to the comparative values of the various gemstones.

For each gem, the lower end of the price range reflects quality affected by treatments (as described earlier in the book), and the higher end of the range represents untreated, natural stones that are suitable for investment. Synthetic and manufactured stones, such as rainbow quartz and mystic topaz, have been excluded as they have little intrinsic value.

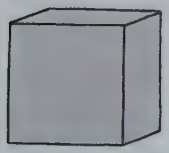
Diamonds are also excluded and reference should, therefore, be made to Appendix 6.



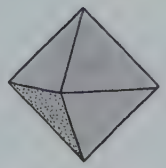

Gemstone
Modest
Affordable
Special Occasion
Expensive
Sky's the Limit
Beryl - Morganite
Andalusite
Rhodolite Garnet
Tourmaline - Yellow
Peridot
Aquamarine
Zircon - Blue
Chrysoberyl - Yellow
Tourmaline - Red
Sapphire - Green
Opal - White
Sapphire - Yellow
Tanzanite
Topaz - Pink
Topaz - Imperial
Tourmaline - Green
Spinel - Blue
Spinel - Red
Sapphire - Star
Sapphire - Pink
Benitoite
Sapphire Padparadsha
Tourmaline - Blue
Chrysoberyl - Cat's Eye
Demantoid - Garnet
Opal - Black
Ruby - Star
Sapphire - Blue
Alexandrite
Emerald
Tourmaline - Paraiba
Ruby

Appendix 8 – The Crystals System

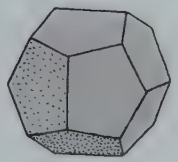
Single refractive



Cubic
(e.g., Pyrite
and Fluorspar)



Octohedronal
(e.g., Diamond
Spinel)



Dodecahedronal
(e.g., Garnet)

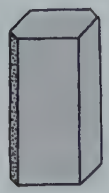
Double refractive

Tetragonal
(e.g., Zircon
and Idocrase)

Orthorhombic
(e.g., Tanzanite
and Topaz)

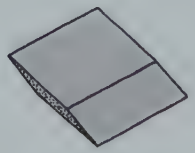
Monoclinic
(e.g., Kunzite
and Sphene)

Double refractive



Triclinic
(e.g., Kyanite
and Labrdaorite)

Hexagonal
(e.g., Beryl and
Apatite)



Trigonal
(e.g., Quartz
and Tourmaline)

The above are simplified descriptions of basic gem crystal forms used for identification of rough material.

Appendix 9 – Further Reading

Books

If you would like to develop your interest in the study of gemstones, the following books are suggested reading:

Balfour, I. (2008), *Famous Diamonds*. Antique Collectors' Club, Woodbridge

Benjamin, J. (2005), *Antique Jewellery*. Antique Collector's Club, Woodbridge

Bennett, D. & Mascetti, D. (2003), *Understanding Jewellery*. Antique Collectors' Club, Woodbridge

Campbell-Pederson, M. (2004), *Gem & Ornamental Materials of Organic Origin*. Elsevier Ltd, Oxford

Dake, H. C. (2001), *The Art of Gem Cutting*. Gem Guides Book Company, California, USA

Hodgkinson, A. (2010), *Gem Testing Techniques*. Gemworld International, Illinois, USA.

Kraus, P. D. (1987), *Introduction to Lapidary: Rock Tumbling, Cabochon, Cutting, Faceting*. Chilton Book Company, Pennsylvania, USA

Kunz, G. F. (1989), *The Curious Lore of Precious Stones*. Bell Publishing Co., New York, USA

Ogden, J. (2008), *Jewellery*. Independent Layman, London

Pickford, I. (Ed.) (1989), *Jackson's Silver & Gold Marks of England, Scotland & Ireland*. Antique Collectors' Club, Woodbridge

Price, M. T. (2007), *Decorative Stones – Complete Source Book*. Thames and Hudson, London

Read, P. J. (1999), *Gemmology*, 3rd Edition. Elsevier Ltd, Oxford

Schumann, W. (1999), *Gemstones of the World*. NAG Press, London

Sinkankas, J. (1963), *Gem Cutting*. Van Nostrand Reinhold, New York, USA

Tanenbaum, C. (2006), *Vintage Costume Jewellery*. Antique Collectors' Club, Woodbridge

Webster, R. (1998), *Gemmologists' Compendium*. Robert Hale Ltd, London

Magazines

There are very few specialist magazines available in the UK or USA. (The various gemmological associations, e.g. GEM-A or GIA, publish journals for members, but these are not generally available to non-members.)

Rock n'Gem Magazine – quarterly on subscription (www.earthly-gems.co.uk)

UK Journal of Mines and Minerals – twice a year on subscription. Concentrates on minerals, but photos are top class (www.ukjmm.co.uk)

Deposits Magazine – subscription only; for those interested in fossils (www.depositsmag.com)

Courses

For details of courses in Gemmology, please contact:

Gem-A
27 Greville Street
London EC1N 8TN
www.gem-a.info.

Gem-A also has accredited teaching centres in the following countries:

Australia	India	Norway
Canada	Italy	Singapore
China	Japan	Sri Lanka
Finland	Kenya	Sweden
France	Korea	Taiwan
Greece	Madagascar	Thailand
Hong Kong	The Netherlands	

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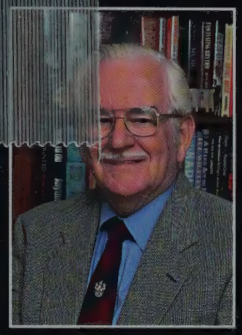

Keith Wallis obtained his diploma as a Fellow of the Gemmological Association of Great Britain in 1978. He believes in demystifying the complexities of the world of gemstones, and has been involved in the development of low-cost evaluation and test instruments and techniques for the gemmology student. Keith Wallis began his working life studying architecture, later moving into the field of building services. Travelling extensively as export manager of a major airconditioning company afforded him the opportunity to further his knowledge and experience of gemstones around the world. Now retired, Keith spends his time writing about gemstones and frequently travels to gemstone fairs and conferences.

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Starting to Collect Antique Jewellery
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ISBN: 978-1-85149-630-3

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