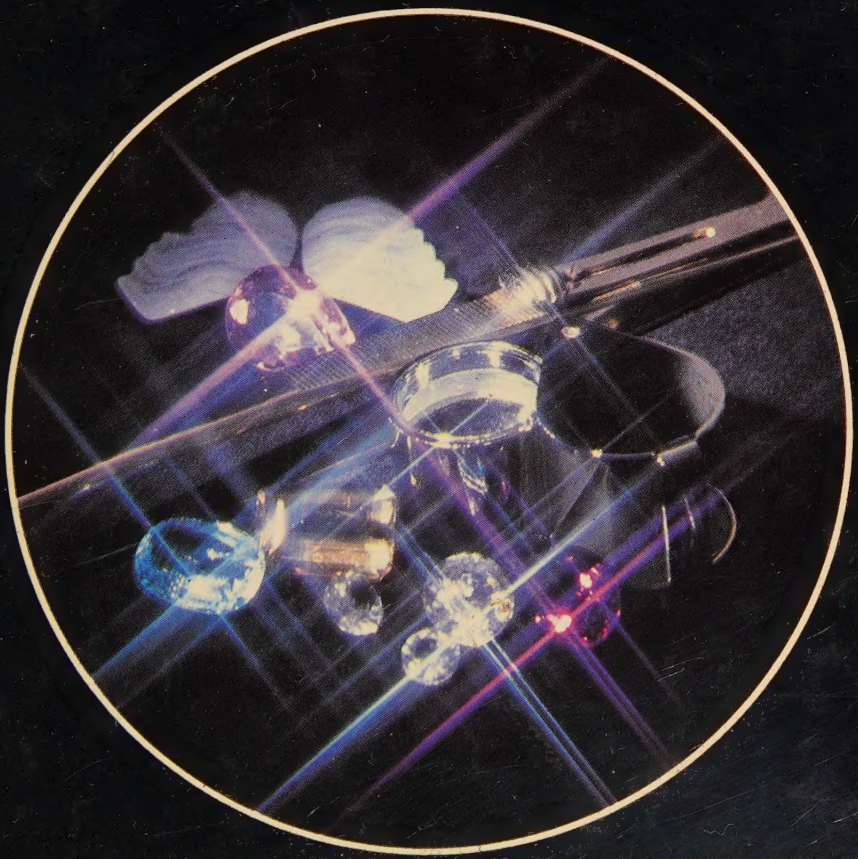
# Dictionary of Gemmology

P. G. Read



Butterworths

The *Dictionary of Gemmology* will be invaluable to the professional gemmologist and student alike.

This well-illustrated book provides comprehensive definitions of all gemmological and related scientific and jewellery manufacturing terms, together with concise descriptions of the principal gem materials and working explanations of the many types of gem test instrument. Trade names of gemstones, including names which are now either in disuse or considered misleading, are included and cross-referenced to the currently accepted name. Rare gems and collectors' stones are also included to cater for the needs of the researcher and the specialist.

The author, Peter G Read, is Technical Director of P G Read Consultancy Services Ltd and of Gemmological Instruments Ltd. His connections abroad include the Chairmanship of the United Gem Laboratory in Colombo, Sri Lanka, where he acts as a technical consultant in their research programme. He is a Fellow of the Gemmological Association of Great Britain and holds the Association's Diamond Certificate.

Peter Read's other books include the successful *Gemmological Instruments*—a comprehensive survey of commercial gemmological instruments designed for measuring the physical characteristics of gemstones: *Beginners Guide to Gemmology*—an introduction to the science of gemstones for those who have become interested in gemmology through such hobbies as lapidary and jewellery manufacture: *Questions and Answers on Gems*—an easy-to-follow introduction to gems in question-and-answer format.

£18.95

# Dictionary of Gemmology

To Holly,

With best regards,

from

Peter Read

*To Doreen for her invaluable help and encouragement*

# Dictionary of Gemmology

P. G. Read

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# Preface

The Dictionary of Gemmology represents an attempt to bring together in one volume concise descriptions of the principal gem materials, as well as definitions of associated scientific terms and brief working explanations of the many types of gemmological instrument. The subject matter has been selected with both the professional gemmologist and the student in mind, and includes not only the most recently introduced technology and materials, but also concepts of a more fundamental or historic nature.

For completeness, the dictionary contains trade names of both natural and man-made materials, together with names which are either now in disuse, or are considered undesirable or misleading. In each case these entries are cross-referenced to the currently accepted name for the material, or, where appropriate, the gem species or variety. Information on gem occurrence is restricted to the commercially important sources of gem-quality material (except in the case of rare or collectors' stones), gem-producing countries being given their new names where applicable (e.g. Thailand for Siam, the Malagasy Republic for Madagascar, Namibia for South West Africa, Sri Lanka for Ceylon, Tanzania for Tanganyika, Zaire for the Congo and Zimbabwe for Rhodesia).

To assist the user, rare stones and those 'near-gem' minerals which are cut mainly for collectors are described as such in the preamble to the relevant entry. For reasons of space, many self-explanatory terms have been excluded, and with words which have two or more meanings, only the gemmological definitions are given. Wherever possible, measurement details are quoted in international SI units, conversions factors being included for any less familiar scientific units of measurement such as electron volt and wave number.

Abbreviations used in the dictionary are as follows:

R.I. Refractive Index
D.R. Double Refraction (the prefix + or — indicating the optic sign)
S.G. Specific Gravity
H. Hardness on the Mohs scale
UV Ultra Violet
IR Infra Red
LW Long Wave
SW Short Wave

Errors and omissions are a particular hazard in a book which draws its information from a multitude of sources, and the author would welcome any corrections and additional entries for future editions.

The author's grateful thanks are due to Mr H. Wheeler, Secretary of the Gemmological Association of Great Britain, for his help with general information, and for making the Sir James Walton Memorial library available for research, to Mr B. W. Anderson and Dr E. Gübelin for their advice and information, to Mr E. A. Thomson, President of the CIBJO Coloured Stone Commission, who provided details on gemstone nomenclature, to Mr R. V. Huddlestone, formerly Managing Director of Diamond Grading Laboratories Ltd., who advised on diamond grading terms, to Mr J. G. Green, Director of the Rayner Optical Company for his help with metallurgical and optical data, and to Mr M. J. O'Donoghue for his up-to-date information on gem materials.

P.G.R.

# A

**abalone** An edible univalve mollusc (genus *Haliotis*) which has an ear-shaped shell prized for its multi-coloured lining of mother-of-pearl. The mollusc produces coloured baroque pearls having the same iridescent surface as the shell lining. Occurrence: American, New Zealand and Japanese waters.

**Abbé refractometer** A specialised refractometer designed for the measurement of the refractive indices of liquids.

**Abbé-Pulfrich refractometer** An instrument for determining a specimen's refractive index by the precise measurement of its critical angle.

**aberration** When applied to an optical component, such as a hand lens, this describes the failure of the lens to bring all the light rays from one point to the same focus. *Chromatic aberration* is caused by the dispersion of the lens glass, and results in colour fringes round the image. It is corrected by making the lens in two sections, one biconvex and the other biconcave, each one having a different dispersion. *Spherical aberration,* which occurs in strongly curved lenses, is caused by the focal point of rays passing through the edge of the lens lying closer to the lens than that of the rays passing through its centre. The resulting image has an out-of-focus circumference. To avoid this, the single lens is replaced by two or more lenses of differing radii. Alternatively, the outer circumference of the lens is blanked off.

**abrasion tester** In one version, this consists of a small cone-shaped grinding wheel, treated with diamond powder, which is used to measure the depth of abrasion produced in a specimen over a preset time. The relationship between abrasion hardness and hardness as measured on the Mohs scale can be seen from the fact that sapphire (H. 9) wears away 5000 times faster than diamond (H. 10) when both are tested in the direction of maximum hardness.

**abrasive** A substance which is used for grinding or polishing purposes. In the polishing of gemstones, the method employed is a combination of rough grinding using a coarse abrasive (e.g. diamond dust, emery powder or carborundum particles) followed

by a final polishing operation using a finer abrasive (e.g. cerium oxide, putty powder — tin oxide, jeweller's rouge — powdered haematite, or green rouge — chromium oxide). For diamond polishing both operations use diamond dust of the appropriate grade or particle size.

**Absolute temperature scale** Graduated in Kelvins (K) (having the same temperature interval span as degrees Celsius or Centigrade),

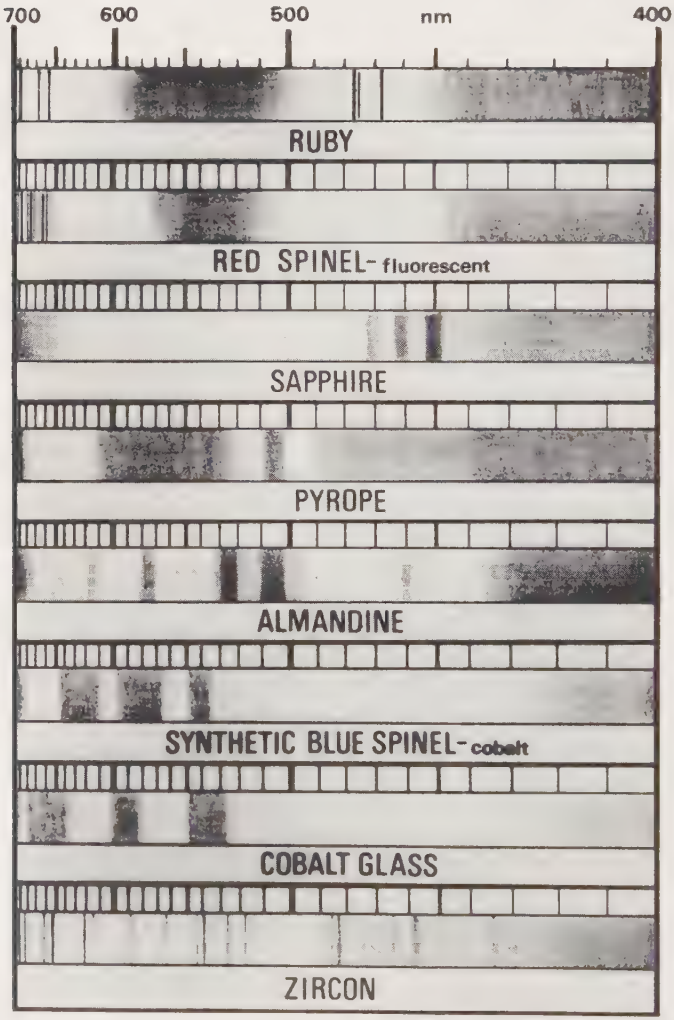



*Figure A.1* A selection of the more prominent of the gemstone absorption spectra.

the absolute temperature scale is used mainly for thermodynamic work or colour temperature measurement. 0°C = 273.16 K; zero Kelvin, or absolute zero = −273.16°C. See ***Absolute Zero.***

**Absolute Zero** The temperature (−273.16°C) at which no more energy can be extracted from an object, and the volume of a gas is theoretically zero.

**absorption spectrum** The pattern of dark bands or lines which become visible when the light passing through a gemstone (or reflected off its surface) is dispersed into its spectral components by an instrument such as a spectroscope. See ***spectroscope*** and *Figure A.1.*

**accabar** A black variety of coral.

**acetone** A colourless and volatile organic liquid ($CH_3COCH_3$) which is useful as a solvent of organic compounds. As a test liquid it can be used to identify cellulose-based plastics, which it softens. See ***amyl acetate.***

**acetylene tetrabromide** A 'heavy' liquid ($C_2H_2BR_4$) which can be used for specific gravity determinations (S.G 2.95). It can also be used for the immersion estimation of refractive index (R.I. 1.63). See ***Becke line method.***

**achrite** See **diopside.**

**achroite** The colourless variety of tourmaline.

**achromatic lens** A lens which has been corrected for chromatic aberration. See ***aberration.***

**acicular** Term describing a crystal having a slender needle-like habit (e.g. rutile needles in quartz). *Figure A.2.*

*Figure A.2* Acicular rutile inclusions in quartz.

**acidising** The cleaning of rough diamonds in a solution containing hydrofluoric acid.

**acid rock** A type of igneous rock containing a high proportion of silica.

**acrylic resin** A transparent plastic used in the production of gemstone simulants and for the cores of solid-bead type imitation pearls. R.I. 1.50; S.G. 1.18. (Trade name is Perspex.)

**actinolated quartz** Colourless quartz containing crystals of actinolite.

**actinolite** A constituent of some nephrites and a member of the amphibole group of minerals. $Ca_2(Mg,Fe)_5(Si_4O_{11})_2(OH)_2$. Monoclinic. R.I. 1.620, 1. 642; D.R. –0.022; S.G. 3.0–3.1; H. 5½–6. Transparent, green. Pleochroism (green, yellow). Occurrence: Tanzania.

**adamant** Ancient name for diamond derived from the Greek 'adamas' meaning 'untameable'. See ***adamantine.***

**adamantine** The high surface lustre or reflectivity associated with diamond, high zircons, demantoid garnet and some diamond simulants. See ***lustre.***

**adamantine spar** A silky brown sapphire.

**adamite** A collector's gemstone comprising the mineral zinc arsenate hydroxide, with some copper and cobalt. Orthorhombic. R.I. 1.76, 1.77; D.R. 0.01; S.G. 4.3; H. 3½. Transparent, green. Occurrence: Greece.

**adamite** Trade name for a synthetic corundum polishing powder.

**Adelaide ruby** A misleading name given to almandine garnet found near Adelaide, Australia.

**adularescence** An effect, also known as *Schiller*, caused by the interference between light rays reflected from thin laminated plates or layers within the gemstone (e.g. the bluish sheen seen in moonstone). See ***sheen.***

**adularia** A variety of orthoclase feldspar.

**aeroides** A pale sky-blue aquamarine.

**African emerald** A misleading name for green fluorite found in Namibia.

**African jade** A misleading name for green grossular garnet.

**agalmatolite** A dense variety of the mineral pyrophyllite. A hydrous aluminium silicate, it belongs to the same family as ***steatite*** and is used as a carving material. H. 1–1½. Occurrence: China.

**agaphite** A vitreous variety of Iranian turquoise.

**agate** A cryptocrystalline quartz variety. See ***chalcedony.***

**agatised coral** See ***fossil coral.***

**agatised wood** See ***fossil wood.***

**agglomerate** A mass of fused volcanic fragments.

**aggregate** A mass of particles or irregularly intergrown crystals.

**AGS** See ***American Gem Society.***

**agstein** See ***jet.***

**aigrette** A hair ornament in the form of a spray of gems.

**akabar** A black variety of coral.

**akori** A blue variety of coral.

**alabandine ruby** A misleading name for almandine garnet.

**alabaster** A fine-grained massive gem variety of gypsum (hydrated calcium sulphate) $CaSO_4.2H_2O$. Monoclinic R.I. 1.52–1.53; D.R. +0.01; S.G. 2.3–2.33; H. 2. Translucent to opaque, white, pink and light brown. Occurrence: England, Italy.

**alabaster glass** A special opalescent type of glass used in the manufacture of imitation pearls.

**alabaster onyx** A misleading name for a banded travertine or stalagmitic calcite.

**alalite** See ***diopside.***

**Alaska black diamond** A misleading name for haematite.

**Alaska diamond** A misleading name for the rock crystal variety of quartz.

**Alaska jade** A misleading name for pectolite.

**alasmodon pearls** Freshwater pearls found in the *Alasmodon margaritifera* mollusc in Nova Scotia, Canada.

**albertite** A mineral asphalt with a glistening pitch-like lustre. Used for carvings and as a jet simulant. R.I. around 1.55; S.G. 1.097; H. 2½.

**albite** Moonstone variety of plagioclase feldspar with chatoyancy.

**alencon diamond** A misleading name for the rock crystal variety of quartz.

**alexandrine** A misleading name for a colour-change synthetic corundum or spinel.

**alexandrite** A rare colour-change variety of chrysoberyl which appears red in tungsten lighting and green in daylight.

**alexandrite garnet** A misleading name for a natural colour-change garnet.

**allepo stone** See ***eye agate.***

**allochromatic gems** Gem minerals which owe their colour to impurities rather than to their basic chemical constituents (the term 'allochromatic' meaning 'other coloured'). When in their pure state, such minerals are colourless. The allochromatic gem ruby, for example, is a variety of corundum which owes its colour to a trace of chromic oxide, pure corundum being colourless. See ***idiochromatic gems.***

**allotrope** A chemical element which can exist in different forms of the same state (i.e. solid, liquid or gaseous). Carbon, for example, can exist as the solid allotropes graphite, diamond and amorphous carbon. See ***polymorphism.***

**alluvial deposits** Minerals carried by rivers and tidal currents from

their primary source and deposited in river beds, dried up river courses and marine terraces to form secondary deposits.

**almandine** A purplish-red species of the garnet group.

**almandine spinel** A misleading name for a natural purple spinel.

**almandite** A misleading name for a synthetic spinel.

**almaschite** A Romanian variety of amber.

**alomite** See ***sodalite.***

**alpha particles** Helium nuclei (once thought to be rays) emitted by radioactive substances. See ***beta particles*** and ***gamma radiation.***

**alpha rays** See ***alpha particles.***

**alpine diamond** A misleading name for pyrites.

**alshedite** See ***sphene.***

**altered diamond** See ***treated diamond.***

**alumag** Trade name for a synthetic spinel.

**alumina** See ***aluminium oxide.***

**aluminium oxide** A white or pink powder made from crushed natural or synthetic corundum, and used for polishing gemstones. Also called alumina, diamontine, Linde A and sapphire/ruby powder.

**amalgam** A mixture of a metal with mercury (e.g. gold amalgam).

**amarillo stone** A figured variety of chalcedony from Texas.

**amaryl** Trade name for a light green synthetic corundum.

**amatrice** See ***amatrix.***

**amatrix** *'American matrix'*, is a rock comprising variscite intergrown with quartz or chalcedony (also called variscite quartz). S.G. 2.6; H. 5–6. See also ***variscite.***

**amazonite** An opaque green variety of microcline feldspar (also called amazon stone).

**amazon jade** A misleading name for amazonite. See ***feldspar.***

**amazon stone** See ***feldspar.***

**amber** A fossilised pine-tree resin, consisting of a mixture of hydrocarbons plus succinic acid. Amorphous. R.I. 1.54; S.G. 1.07; H. 2½. Transparent to opaque, yellow, reddish-brown, greenish, bluish-violet, black. Occurrence: Sea amber — Baltic coast, the Black Sea, Sicily. Pit amber — Burma, Germany, Romania, USSR (near Kaliningrad, formerly Königsberg). See ***ambroid*** and ***black amber.***

**amber boron nitride** Trade name for a synthetic cubic boron nitride manufactured as an industrial abrasive by De Beers Industrial Diamond Division. Using the criterion of indentation hardness, it has just over half the hardness of diamond (i.e. 9½ + on the Mohs scale). See ***borazon.***

**amberine** A misleading name for a yellowish-green moss agate.

**amblygonite** A collector's stone comprising the mineral lithium aluminium phosphate. $LiAl(PO_4)(F, OH)$. Triclinic. R.I. 1.611,

1.637; D.R. +0.026; S.G. 3.015–3.033; H. 6. Transparent, yellow to colourless and pale purple. Occurrence: Brazil, USA. Pale purple variety from Namibia.

**ambroid** 'Reconstructed' or 'pressed' amber made by heating small pieces of amber to 180°C and welding them together under pressure to form larger pieces.

**American brilliant cut** See ***Tolkowsky brilliant cut.***

**American Gemological Institute** See ***Gemological Institute of America.***

**American Gem Society** (AGS) Founded by Robert M. Shipley in 1934 as a professional society of leading jewellers with the object of promoting high standards of business ethics and encouraging gemmological education among its members. The Society awards the titles of Registered Jeweler and Certified Gemologist to qualified members and member firms. Headquarters: 2960 Wiltshire Boulevard, Los Angeles, California 90010, USA.

**American jade** See ***californite.***

**American ruby** A misleading name for almandine garnet and rose quartz.

**amethyst** The purple variety of quartz.

**Amici prism** A double prism element (used in prism spectroscopes) consisting of two glasses of differing refractive indices, arranged to give dispersion with minimum deviation of the yellow wavelengths. In the prism spectroscope two Amici prisms are usually combined together, the abutting centre sections being formed as a single prism element. *Figure A.3.*

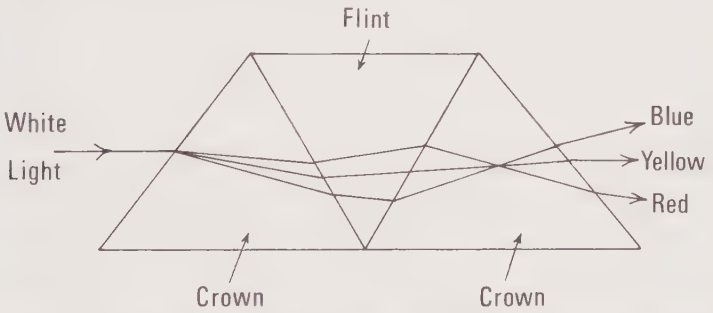



*Figure A.3* An Amici compound prism designed to give zero deviation in the yellow section of the spectrum.

**amino plastic** A variant of bakelite, in which urea replaces phenol. Translucent; dyed as a gemstone simulant (e.g. amber). R.I. 1.55–1.62; S.G. 1.50; H. 2.

**ammolite** An aragonite-based gem material derived from the nacreous layer of ammonite fossils. The polished surface of this

material consists of closely-connected patches having a play of colour similar to that of black opal. Occurrence: Alberta, Canada.

**ammonite** A fossil cephalopod with a flat spiral shell. Ammonites whose shells have been replaced by pyrite are sometimes used in jewellery. See ***ammolite.***

**amorphous** A substance in which the atoms and molecules are positioned randomly (the word 'amorphous' meaning 'without shape'). Because of its lack of internal order at the atomic level, an amorphous substance never has a naturally-occurring characteristic external shape (e.g. glass, amber and jet). See ***crystalline.***

**amourant** Trade name for a diamond simulant composite gem having a colourless synthetic corundum crown and a strontium titanate pavilion.

**amphibole** A collective name for a particular group of silicate minerals having similar physical and chemical characteristics. Members of the amphibole group include nephrite, tremolite, actinolite, smaragdite, asbestos and hornblende.

**amyl acetate** An organic liquid which can be used as a test liquid to identify cellulose-based plastics, which it softens. See ***acetone.***

**analcime** See ***analcite.***

**analcite** A collector's stone consisting of a hydrated aluminium silicate, which is a member of the zeolite group of minerals. $NaAlSi_2O_6.H_2O$. Cubic. R.I. 1.487; S.G. 2.22–2.29; H. 5–5½. Transparent, colourless. Occurrence: World-wide. Also called analcime.

**anatase** A collector's stone, which, together with rutile and brookite, is a polymorph of titanium oxide (also called octahedrite). $TiO_2$. Tetragonal. R.I. 2.493, 2.554; D.R.–0.061; S.G. 3.82–3.95; H. 5½–6. Transparent to translucent, brown or blue. Occurrence: Brazil, France, Switzerland, USSR.

**ancona ruby** A misleading name for rose quartz.

**andalusite** A rare aluminium silicate gem (polymorphous with kyanite and sillimanite). $Al_2SiO_5$. Orthorhombic. R.I. 1.633, 1.643; D.R. –0.01; S.G. 3.12–3.18; H. 7½. Transparent brownish-green and green with strong pleochroism (green, yellow, red). Occurrence: Brazil, Canada, Sri Lanka, USA, USSR. An impure variety, chiastolite, is an opaque yellow-white material containing carbonaceous inclusions in the form of a black cross (*Figure A.4*) (H. 5½). Occurrence: Australia, Bolivia, Burma, Chile, France, Sri Lanka, USA, USSR.

**Andamooka opal** A large piece of rough opal weighing in the region of 900 carats which was found in the Andamooka field, Australia, in 1949. After being cut into a 203-carat cabochon, it

*Figure A.4* The chiastolite variety of andalusite.

was set in a necklet and presented to Queen Elizabeth II.

**Anderson Medal** A silver medal awarded to the top candidate in the annual Preliminary Examination of the Gemmological Association of Great Britain, whose papers also meet the required standard set for the award. See ***Rayner Prize*** and ***Tully Medal.***

**andesine** A variety of plagioclase feldspar.

**andesine jade** A misleading name for andesine.

**andradite** A species of the garnet group which includes the varieties green demantoid and golden-yellow topazolite.

**angel skin** See ***coral.***

**angle of incidence** The angle between a ray of light meeting a surface and an imaginary line (called the *normal*) drawn perpendicular to that surface at the point of incidence.

**angle of minimum deviation** An angle measured using a table spectrometer or goniometer when determining the refractive index of a transparent faceted material such as a gemstone or a prism. It is the smallest angle which can be obtained between the line of the incident ray, and the line of the ray emerging (after refraction) from the material. The refractive index is then calculated from the formula:

$$\text{R.I.} = \frac{\text{sine } \tfrac{1}{2}\,(A+B)}{\text{sine } \tfrac{1}{2}\,A}$$

where $A$ = the angle between the two gem or prism faces transmitting the light ray, $B$ = the angle of minimum deviation.

**angle of reflection** The angle between a ray of light reflected from a surface and an imaginary line (called the *normal*) drawn perpendicular to that surface at the point of reflection.

**angle of refraction** The angle made between a ray of light after it enters a denser medium and an imaginary line (called the *normal*) passing through the medium and drawn perpendicular to its surface at the point of entry of the ray.

**anglesite** A collector's stone comprising the mineral lead sulphate. $PbSO_4$. Orthorhombic. R.I. 1.877, 1.894; D.R. +0.017; S.G. 6.30–6.39; H. 3. Transparent to translucent, colourless or with a yellow, green or bluish tint. Occurrence: World-wide.

**Ångström unit** A unit formerly used as the standard to quantify the wavelength of light rays and X-rays. One Ångström unit is equal to one ten-millionth of a millimetre (1 Å = $10^{-7}$ mm). The standard international (SI) unit now used for the measurement of these very short wavelengths is the nanometer (nm). 1 nm = 10 Å.

**anhedral** A term used to describe crystals having a badly-formed or abnormal external shape.

**anhydrite** Anhydrous calcium sulphate. $CaSo_4$. Orthorhombic. R.I. 1.57, 1.61; D.R. +0.04; S.G. 2.9; H. 3½. Transparent, colourless, bluish and mauve. Occurrence: Italy.

**anhydrous** A material containing neither free water, nor water of crystallisation.

**aniline** An organic oily liquid with a refractive index of 1.58. Can be used as an immersion liquid for the approximation of R.I. See ***Becke line method.***

**anions** Negatively charged ions. See ***cations.***

**anisotropic** An anisotropic crystal is one which splits up light entering it into two rays which are polarised at right-angles to each other and which travel at different velocities in the gem. As a result anisotropic gems have two refractive indices. See ***isotropic, ordinary ray*** and ***extraordinary ray.***

**annealing** A heat treatment process for softening work-hardened metals (i.e. metals that have been hammered, beaten, rolled or drawn). Silver is annealed to a more malleable state by heating it to a dull red temperature and then quenching it in water, or allowing it to cool more slowly in air.

**anomalous birefringence** Internal stresses in a singly-refracting material may result in the production of dark bands when it is rotated between the crossed filters of a polariscope. The resulting extinction of light through the material is never as distinct as that produced by a doubly-refracting material, which causes the polarised light viewed through the top filter to be transmitted and extinguished four times during a 360° rotation of the gem.

**anorthite** A calcium aluminium silicate ($CaAl_2Si_2O_8$) which is a

constituent of the plagioclase feldspars.

**antigorite** A leafy-green serpentine.

**antilles pearl** An imitation pearl formed from the shell of a sea snail.

**antique cut** A square or rectangular gemstone cut with rounded corners and sides (also called the cushion cut). *Figure A.5.*

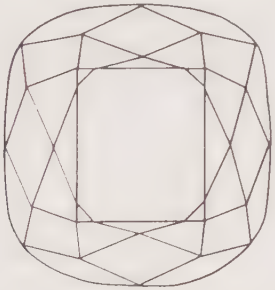


*Figure A.5* The antique or cushion cut.

**Antwerp rose cut** Also called the Brabant, this cut is similar to the ***Dutch rose cut,*** but the step angles are shallower. See also ***rose cut.***

**anyolite** A green zoisite containing black hornblende inclusions and large opaque ruby crystals. Because of its colour contrast it is used mainly as an ornamental rock. Occurrence: Tanzania.

**apache tears** A variety of obsidian.

**apatite** A calcium phosphate gem also containing fluorine or chlorine. $Ca_5(F,Cl)(PO_4)_3$. Hexagonal. R.I. 1.636, 1.639; D.R. −0.003; S.G. 3.2; H. 5. Transparent, blue, yellow (with rare-earth spectrum due to didymium), pink, green, violet. Pleochroism, strong in blue (blue, pale yellow). Occurrence: Brazil, Burma, Canada, Mexico, Sri Lanka, USA.

**aphrizite** A black tourmaline.

**aplanatic lens** A lens which has been corrected for spherical aberration. See ***aberration.***

**apochromatic** Term applied to a lens which has been corrected for both spherical and chromatic aberration.

**apophyllite** A collector's gemstone comprising the mineral hydrated potassium calcium silicate. Tetragonal. $KCa_4(Si_8O_{20})(OH,F).8H_2O$. R.I. 1.535, 1.537; D.R. ±0.002; S.G. 2.3–2.5; H. 4½–5. Transparent, colourless or with red, blue, yellow or green tint. Occurrence: Germany, India, Mexico, Switzerland, USA.

**appraisal** (of gemstones) An estimation of the value of gemstones or jewellery. An appraisal is often carried out for insurance purposes or estate valuation. It depends upon the correct

identification of the gemstones, and their detailed market assessment in terms of colour, clarity, cut and weight. An insurance appraisal is based on the retail replacement value. An estate valuation is based on an estimate of their realiseable market value.

**apparent depth** The distance of an inclusion beneath the surface of a gem as measured optically (e.g. by means of a dial gauge on a microscope) is a measure of the *apparent depth* of that inclusion. To obtain the *real depth,* the figure for the apparent depth must be multiplied by the refractive index of the gem. See ***direct method (of R.I. measurement).***

**apricotine** Trade name for apricot-coloured garnets or quartz from New Jersey, USA.

**apyrite** A peach-coloured tourmaline.

**aqua fortis** Nitric acid.

**aqua gem** A misleading name for a light blue synthetic spinel.

**aquamarine** A pale blue or pale blue-green variety of beryl.

**aqua regia** A mixture of nitric acid and hydrochloric acid capable of dissolving gold and platinum.

**arabian diamond** A misleading name for the rock crystal variety of quartz.

**arabian magic diamond** A misleading name for a synthetic colourless or yellow corundum.

**aragonite** A dimorphous form of calcite used as a carving and ornamental material (also a major constituent in pearls). $CaCO_3$. Orthorhombic. R.I. 1.53, 1.685; D.R. −0.155; S.G. 2.93–2.95; H. 3½–4. Translucent to opaque, white with grey, brown, green or blue tints. Transparent material (colourless or in various colours) is occasionally faceted for collectors. Occurrence: England, Germany, Hungary, Spain, USA. A yellow stalagmitic calcite from Namibia is also marketed as 'aragonite'.

**arandisite** A rare collector's stone consisting mainly of a tin silicate together with the surrounding brown limonite. R.I. 1.70; S.G. 4; H. 5.

**Archaean** The earlier part of the Precambrian era. See ***Precambrian.***

**Archimedes' Principle** This states that a body totally immersed in a fluid experiences an upward force equal to the weight of the fluid it displaces. This Principle is the basis of specific gravity measurements made by the hydrostatic weighing method, and with the aid of heavy liquids. See ***hydrostatic weighing*** and ***heavy liquids.***

**Argentinian Gemmological Institute** See ***Primer Instituto Gemologico Latin Americano.***

**Arizona ruby** A misleading name for pyrope garnet found in

Arizona, USA. See ***garnet.***

**Arizona spinel** A misleading name for garnet.

**Arkansas diamond** A misleading name for the rock crystal variety of quartz found in Arkansas, USA.

**arkansite** A transparent brookite.

**Armenian stone** See ***lapis lazuli.***

**artificial coloration** The improvement or inducement of colour in gemstones by staining, heat/chemical treatment or irradiation. Heat treatment is used, for example, to change yellow and brown topaz to pink, and to turn some brown zircons blue. Staining is used to change or improve the colour of gems having a porous surface (chalcedony varieties and jades). Heating and X-ray irradiation is used to improve the colour of sapphires. A surface colour can be induced into some gems (such as sapphire) by coating them with a chemical paste containing, for example, titanium and iron oxides, and heating them to around 1600 °C. Yellow cape series diamonds can be transformed to fancy coloured stones by nuclear irradiation followed by heat treatment. Only those processes which are permanent and irreversible are considered to be legitimate practices. High value gems such as rubies, sapphires and diamonds whose colour has been improved or changed in this way should be declared as 'treated'. See ***heat treated stones*** and ***treated diamonds.***

**aschentrekker** A Dutch word meaning 'ash puller' applied to tourmaline. Because of tourmaline's pyro-electricity, the Dutch, who first imported the gem material into Europe, used a heated piece of the rough stone to attract and remove ash particles from their meerschaum pipes.

**Ashover spar** A yellow fluorspar from Derbyshire, England.

**asparagus stone** See ***apatite.***

**assay** The determination of the constituents or purity of a substance by chemical analysis and other means. The testing of the gold, silver or platinum content of articles (in an Assay Office) before hallmarking. See ***carat*** and ***hallmarks.***

**assembled stones** See ***composite stones.***

**Associacào Brasileira de Gemologia** Headquarters: Caixa Postal 18154, Sao Paulo, S.P., Brazil.

**Association Espancia de Gemologia** Headquarters: Paseo de Gracia, 64 Ent. O2A, Barcelona 7, Spain.

**Association Française de Gemmologie** Headquarters: 17 Rue Cadet, 75009, Paris 9, France.

**asterism** An effect due to reflections from crystals, fibres or channels within a gemstone which produces a 'star' on the surface of the gem. See ***sheen.***

**asterated stones** Stones displaying a 'star' effect. They are usually

cut as cabochons to show the star to best advantage. See ***asterism.***

**astridite** A dark green chrome-rich jadeite with lighter coloured veins and intergrown with picotite, quartz, opal and limonite. S.G. 3.35. Occurrence: New Guinea.

**astrilite** Trade name for the man-made diamond simulant lithium niobate.

**astryl** Trade name for a synthetic rutile diamond simulant.

**atlas pearls** A misleading trade name for beads made from the white satin spar variety of calcite.

**atmospheric pressure** The pressure (due to the atmosphere) which exists at the surface of the earth. One atmosphere is the pressure exerted by a 760 mm column of mercury, and is equal to 1.05 kilogram per square centimetre.

**atom** The smallest part of an element which can take part in a chemical reaction. See also ***element, compound*** and ***molecule.***

**atomic number** Used in the periodic classification of the elements, this represents the number of unit positive charges on the nucleus of the atom of each element (the charge on the nucleus is normally neutralised by an equal number of orbiting electrons). See ***Table of Elements*** in Appendix H.

**atomic weight** The atomic weight of an element is its mass compared with that of an atom of hydrogen (the lightest element), (e.g. the atomic weight of carbon is 12.01 and that of oxygen is 16). See ***Table of Elements*** in Appendix H.

**augelite** A rare collector's stone comprising the mineral hydrated aluminium phosphate. $2Al_2O_3.P_2O_5.\ 3H_2O$. Monoclinic. R.I. 1.574, 1.588; D.R. +0.014; S.G. 2.7; H. 5. Transparent, colourless. Occurrence: Bolivia, USA.

**Australian Gemmological Association** See ***Gemmological Association of Australia.***

**Australian jade/turquoise** Misleading names for a material found in Australia and thought to be variscite.

**Australian ruby** A misleading name for garnet.

**australite** A variety of tektite found in Australia.

**Austrian Gemmological Association** See ***Erste Österreichische Gemmologische Gesellschaft.***

**autoclave** A thick-walled metal vessel which can be sealed and heated to produce high internal pressures. It is used in the hydrothermal production of synthetic stones. *Figure A.6.* See also ***hydrothermal process.***

**autoradiography** A technique for checking the radioactivity of a specimen in which the specimen is placed on a sheet of light-excluded photographic paper (or on a photographic plate). If the specimen is radioactive, a 'picture' of the field of radiation will appear on the photographic paper or plate when it is developed.

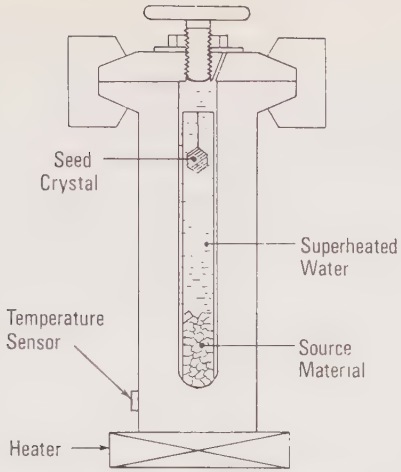



*Figure A.6* An autoclave as used in the hydrothermal synthesis of quartz and emerald. Source material is dissolved in superheated water and deposited onto a seed crystal.

The exposure time required to produce an *autoradiogram* of this nature is usually in terms of hours rather than minutes, and depends on the speed of the photographic material and the strength of the radioactivity.

**aventurine feldspar** Also called sunstone, this is a variety of plagioclase feldspar.

**aventurine glass** Made to simulate green and golden aventurine quartz and aventurine feldspar (or sunstone).

**aventurine quartz** An opaque green or golden-brown quartz with spangles of mica (colour caused by green mica or iron impurities).

**avory** Trade name for a microcrystalline cellulose polymer made from wood pulp and used as an ivory simulant.

**awabi** See ***abalone.***

**axestone** New Zealand nephrite.

**axinite** This collector's gemstone is a complex borate silicate. $Ca_2(Fe, Mg, Mn)Al_2(BO_3.OH.Si_4O_{12})$. Triclinic. R.I. 1.675–1.685; D.R. –0.01; S.G. 3.27–3.29; H. 6½–7. Transparent to translucent, reddish-brown, violet and blue. Occurrence: England, France, Mexico, USA.

**axis of symmetry** An imaginary line positioned so that when a crystal is turned round on it, the characteristic profile of the crystal appears two, three, four or six times during each complete revolution. There are usually several possible axes of symmetry in a crystal, and these are described as two-, three-, four-, or six-fold

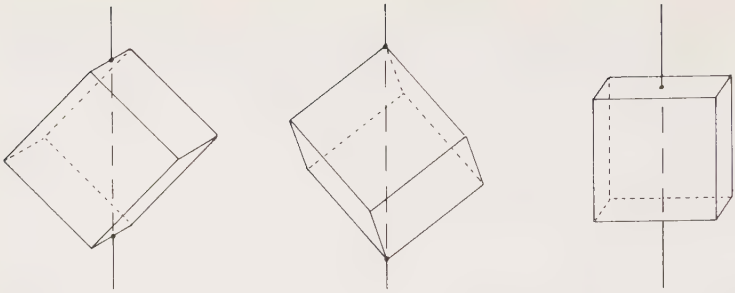


*Figure A.7* From left to right, examples of two-fold, three-fold and four-fold axes of symmetry in a cubic crystal.

axes, depending on the number of times the crystal profile appears during a single rotation. *Figure A.7.*

**Aztec stone** See ***smithsonite.***

**azules opal** A water opal with a bluish haze and red and green flecks.

**azure quartz** A blue variety of quartz also called siderite (which should not be confused with the mineral chalybite, also called siderite).

**azurite** A copper carbonate (also called chessylite). $Cu_3(OH)_2(CO_3)_2$. Monoclinic. R.I. 1.73, 1.84; D.R. +0.11; S.G. 3.7-3.9; H. 3½-4. Transparent to opaque, deep blue. Pleochroism, medium (dark blue, light blue). Occurrence: Australia, Chile, France, USA, USSR.

**azurite** A misleading name for synthetic blue spinel; also a trade name for blue smithsonite.

## B

**bacalite** A variety of amber from California, USA.

**baffa diamond** A misleading name for the rock crystal variety of quartz.

**baguette** An elongated rectangular gemstone cut, mainly used for small diamonds (sometimes called a *baton*). *Figure B.1.*

**baikalite** A name given to diopside found in Baikal in the USSR.

**bakelite** Trade name for a phenolic resin (patented in 1906)

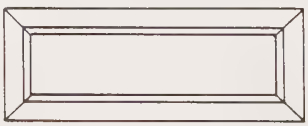


*Figure B.1* The baguette or baton cut.

sometimes used as an amber simulant, particularly in Edwardian times. Amorphous. R.I. 1.61-1.66; S.G. 1.25-1.30; H. 2.

**balance** Types of balance used for weighing gem materials range from the relatively insensitive spring balance to the substitutional beam balance and the electronic force balance. A brief description of each type is given under ***Balance Systems*** in Appendix A. See also ***hydrostatic weighing.***

**balas ruby** A misleading name for red spinel (dating back to the Middle Ages).

**bal de feu** Trade name for the man-made diamond simulant strontium titanate.

**bali** A Burmese weight equal to 58.32 carats. See also ***lathi, rati, tickal*** and ***viss.***

**ballas** See ***boart.***

**ballerina setting** A setting in which a central stone is surrounded by radially mounted baguette diamonds which give the effect of the skirt of a ballerina.

**Bannister's graph** A graph which enables the composition of glass imitation gems to be determined by relating their specific gravity to their refractive index. *Figure B.2.*

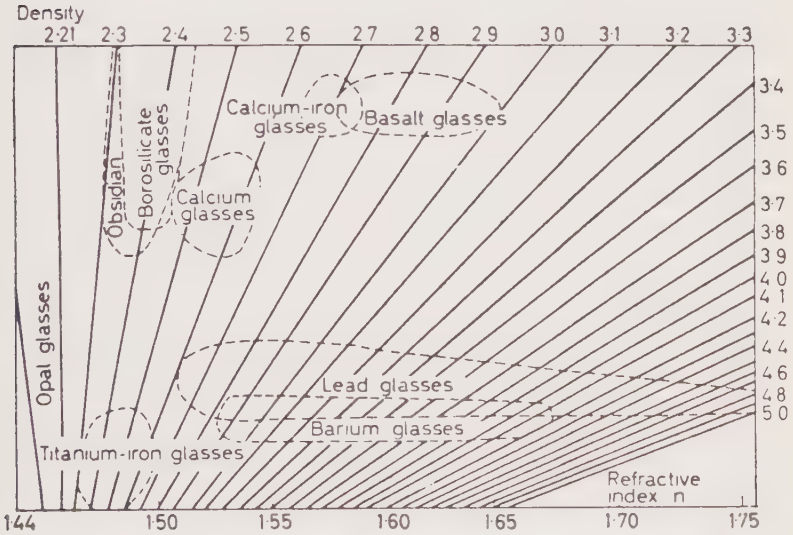



*Figure B.2* Bannister's graph, which helps to identify the composition of a glass from its refractive index and specific gravity or density. A vertical line is drawn from the bottom edge of the graph to correspond with the R.I. of the specimen. The appropriate glass group to which the specimen belongs is then indicated by the point where the vertical R.I. line crosses the appropriate radial line representing specific gravity.

**barion cut** A mixed cut for diamond, comprising an emerald-cut crown and a modified brilliant-cut pavilion. The barion cut, which has 61 facets (plus a culet), was introduced in 1971 to improve the brilliance and fire of the emerald cut when used for diamond.

**barite** Also called barytes and heavy spar, this collector's stone comprises the mineral barium sulphate. $BaSO_4$. Orthorhombic. R.I. 1.636, 1.648; D.R. +0.012; S.G. 4.47; H. 3. Transparent to opaque, colourless, yellow, green, red, blue, brown. Occurrence: World-wide.

**barium titanate** A man-made crystal with potential as a diamond simulant. $BaTiO_3$. Cubic (also tetragonal and hexagonal forms). R.I. 2.40; S.G. 5.90; H. 6-6½. Crystals are grown by the ***Czochralski process.***

**baroda gem** A trade name for a diamond simulant formed by faceted glass backed by metallic foil.

**baroque pearls** Pearls, both natural and cultured, which have an irregular shape.

**barytes** See ***barite.***

**basal cleavage** A cleavage plane parallel to a prism's lateral axes (e.g. a prismatic topaz crystal has perfect basal cleavage at right-angles to its length). See also ***cleavage.***

**basal pinacoid** The faces of a basal pinacoid are parallel to the crystal's lateral axes, and often form the terminating faces of a prism. See also ***pinacoid.***

**basalt** A dark igneous rock, low in silica, often occurring in columnar formations.

**basalt glass** A natural glass containing 50% silica. Amorphous. R.I. 1.58-1.65; S.G. 2.7-3.0; H. 6. Semi-transparent to opaque, black, grey-brown, dark blue and bluish-green. Also called tachylyte.

**basanite** A matt black variety of jasper, sometimes used as a streak plate for testing precious metals (called the Lydian stone in ancient times). See ***quartz.***

**basic rock** An igneous rock having a low silica content.

**bastard amber** A term used to describe amber whose cloudy appearance is due to bubble inclusions.

**bastard emerald** A misleading name for peridot.

**bastard ivory** An intermediate type of ivory whose hardness is between that of the hard and soft varieties. Ivory from Thailand, although generally soft, is sometimes of this type.

**bastite** An altered enstatite (also called schiller spar). Hydrated magnesium silicate. S.G. 2.6; H. 3½-4. Opaque, leek-green with a silky sheen. Occurrence: Germany.

**baton** See ***baguette.***

**bayldonite** A complex hydrated arsenate of lead and copper. Monoclinic. R.I. 1.95, 1.99; D.R. +0.04; S.G. 4.35; H. 4½. Translucent to opaque, greenish. Occurrence: England (Cornwall), Namibia.

**bearded girdle** A term applied to the series of fine fractures produced round the edge of a diamond's girdle when this has been polished (i.e. bruted or rondisted) too rapidly.

**beccarite** A green zircon.

**Becke line method** A method of approximating the refractive index of faceted transparent gemstones by immersing them in a series of liquids of known refractive indices. If, when viewed through a microscope, the facet edges of the gemstone change from light to dark when focusing down from the liquid into the stone, then the R.I. of the gemstone is *greater* than that of the liquid. If the opposite occurs, and the facet edges change from dark to light, then the R.I. of the stone is *less* than that of the liquid.

**beekite** See ***fossil coral.***

**Beilby layer** After polishing a specimen of calcite, Sir G. T. Beilby discovered that by lightly etching away its top surface, the underlying scratches caused by the initial stages of polishing were uncovered. He developed the theory that the final high polish on a gemstone (diamond excepted) is produced not by abrasive action, but by the high lapping temperature which causes the surface layer of the gem to flow in a liquid-like manner. The resulting highly reflective skin was called the *Beilby layer.*

Because of diamond's high melting point, the polish achieved on its facets is not due to the formation of a Beilby layer but is entirely the product of fine abrasive action.

In 1937 Professor G. I. Finch at Imperial College, London, substantiated and extended Beilby's findings using electron diffraction techniques at grazing incidence to the polished surface. At Diamond Grading Laboratories Ltd., London, R. V. Huddlestone confirmed the existence of the Beilby layer by the use of Nomarski interference contrast techniques. Results of this continuing investigation suggest that production of the layer is influenced by the lap speed and the difference between the hardness of the material and the abrasive.

With gemstones like corundum and quartz, the Beilby layer produced in this way immediately re-crystallises to conform to the gem's crystal structure. In other stones, such as calcite and kyanite, the Beilby layer tends to solidify as a molecular layer of amorphous material, which only recrystallises if it is parallel to a principal crystal plane. With stones such as spinel and zircon, the Beilby layer solidifies on all surfaces as an amorphous skin, but

because of its extreme thinness, it has no effect on the optical indices of doubly-refracting stones when these are measured on a refractometer. Despite the evidence, however, strong doubt has been expressed over the existence of the Beilby layer and the validity of the theory.

**Belgian Gemmological Society** See ***Société Belge de Gemmologie.***

**belonite** A rod-shaped variety of natural glass. See ***obsidian.***

**Bengal amethyst** A misleading name for purple sapphire. See ***corundum.***

**benitoite** A rare gemstone of barium titanium silicate. $BaTi(Si_3O_9)$. Trigonal (with maximum symmetry). R.I. 1.757, 1.804; D.R. +0.047; S.G. 3.65-3.68; H. 6½. Transparent to translucent, light and dark blue. Pleochroism, very strong (two shades of blue and colourless). Occurrence: San Benito County, California, USA.

**benzene** A liquid hydrocarbon. $C_6H_6$. Used as a dilutant for organic-based heavy liquids and for the approximation of R.I. by immersion. R.I. 1.50; S.G. 0.88.

**benzine** A mixture of liquid hydrocarbons derived from petrol.

**berigem** Trade name for a synthetic greenish-yellow spinel.

**bernat** A German amber simulant consisting of amber-coloured plastic having an R.I. close to 1.54, and an S.G. of 1.23. Specimens have been manufactured which contain plant and insect inclusions.

**bernstein** The German name for amber.

**Bertrand refractometer** The first direct-reading critical-angle refractometer for gemstone use was designed by Professor Bertrand in 1885. *Figure B.3.*

**beryl** A beryllium aluminium silicate. $Be_3Al_2(SiO_3)_6$. Hexagonal. Transparent to opaque. H. 7½.

Varieties:

*aquamarine* — light sea-green to sea-blue. R.I. 1.570, 1.575;

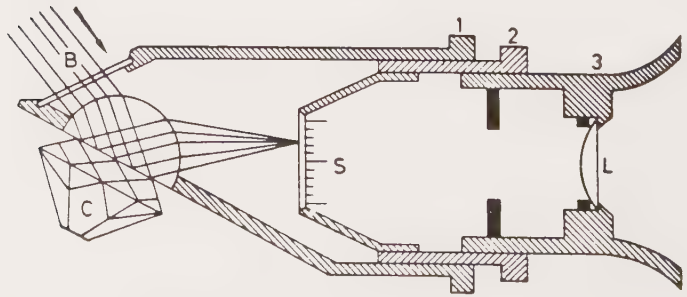



*Figure B.3* Sketch showing the optical system in the Bertrand refractometer. Focusing is achieved by the sliding sections 2 and 3.

D.R. −0.005; S.G. 2.69. Pleochroism, medium (blue, colourless). Occurrence: Brazil, Burma, the Malagasy Republic, Namibia, USA, USSR.

*bixbite* — red. R.I. and S.G. constants as for morganite. Occurrence (rare): USA.

*emerald* — R.I. 1.579, 1.585; D.R. −0.006; S.G. 2.71. Pleochroism, medium (yellowish-green, bluish-green). Occurrence: Afghanistan, Brazil, Colombia, India, Pakistan, South Africa, USSR, Zambia, Zimbabwe.

*goshenite* — colourless. R.I. and S.G. constants as for aquamarine. Occurrence (rare): USA.

*heliodor* — yellow. R.I. 1.568, 1.573; D.R. −0.005; S.G. 2.68. Pleochroism, weak (pale yellow, pale bluish-green). Occurrence: Brazil, the Malagasy Republic, Namibia.

*maxixe* — dark blue. R.I. 1.584, 1.592; D.R. −0.008; S.G. 2.80. Pleochroism, strong. Susceptible to fading in daylight. (In maxixe beryl, the colour is due to $NO_3$ impurity ions. See also ***maxixe-type beryl***). Occurrence (rare): Brazil.

*morganite* — pink. R.I. 1.586, 1.594; D.R. −0.008; S.G. 2.80. Pleochroism, medium (pink, bluish-pink). Occurrence: Brazil, the Malagasy Republic, Namibia, USA, Zimbabwe.

**beryl glass** A fused amorphous beryl. $Be_3Al_2(SiO_3)_6$. R.I. 1.50–1.52; S.G. 2.41–2.49; H. 7. Transparent, green, blue, pink. (Man-made; coloured by additives).

**beryllonite** A rare gem composed of sodium beryllium phosphate. $NaBe(PO_4)$. Monoclinic (pseudo orthorhombic). R.I. 1.553, 1.562; D.R. −0.009; S.G. 2.80–2.85; H. 5. Transparent, colourless or pale yellow. Occurrence: Finland, USA, Zimbabwe.

**beta rays** See ***beta particles.***

**beta particles** Fast moving electrons (once thought to be rays) emitted from a radioactive material such as a beta-emitting isotope. See ***alpha particles*** and ***gamma radiation.***

**Bethersden marble** A blue-grey to reddish-brown marble containing the fossilised shells of freshwater snails. The marble is similar to paludina limestone, or Purbeck marble, but contains larger shells. Occurrence: England.

**bevel cut** A simple step-cut crown used for portrait stones in which a large table facet has its edges bevelled in one or two steps to meet the girdle. See ***lasque diamond.***

**bezel** Also called the *crown,* that portion of a polished stone above the girdle.

**bezel facets** The eight four-sided facets surrounding the table facet of a brilliant-cut stone (also called kite facets and top main facets). See ***brilliant cut.*** *Figure B.6.*

**biaxial** The term used to describe a doubly-refracting crystal

having two optical axes or directions along which it is singly refractive. In the seven crystal systems, orthorhombic, monoclinic and triclinic crystals all have biaxial optical characters. See ***uniaxial.***

**billitonite** A variety of tektite found in Belitung Island (formerly Billiton Island) in Indonesia.

**binocular microscope** A microscope fitted with twin oculars. Less expensive versions have a single objective lens system whose image is shared between the oculars. A stereo binocular microscope uses two objectives, each coupled to its respective ocular. See ***Greenough microscope*** and ***magnifiers.***

**binghamite** A chatoyant quartz with goethite inclusions.

**bioluminescence** The luminous glow produced by fireflies, glow worms and decaying organic matter. It is the result of the oxidation of certain chemical constituents of the substance.

**biotite** A black, dark brown or greenish-black mica. $K(Mg,Fe)_3AlSi_3O_{10}(OH,F)_2$. Monoclinic. Transparent to translucent. S.G. 2.7-3.3; H. 2-3. Biotite is widely distributed in granites, schists, gneisses and contact metamorphic rocks.

**bipyramid** A crystal habit comprising two pyramids joined at the common base (e.g. an octahedron).

**bird's-eye marble** An encrinital Derbyshire marble from Ashford, England.

**birefringence** See ***double refraction.***

**bishop's stone** A traditional name for amethyst. See ***quartz.***

**bivalve** A mollusc with a hinged double shell (e.g. oyster, mussel and clam).

**Biwa pearls** Non-nucleated cultured pearls (often oval or baroque in shape) farmed round the shores of Lake Biwa in Japan. The pearls are grown in large freshwater mussels (*Hyriopsis Schlegeli*) by inserting small fragments of mantle into the body of the mussel. S.G. 2.67-2.70.

**bixbite** See ***beryl.***

**black amber** A misleading name for jet.

**black coral** A variety of coral which grows in the waters off the northern coast of Australia, around Malaysia and in the Red Sea.

**black diamond** A gem quality diamond whose colour is due to numerous microscopic black inclusions (e.g. the Amsterdam diamond, weighing 33.74 carats). Industrial quality black diamond is called carbonado. See ***boart.***

**black diamond** A misleading name for haematite.

**black moonstone** A misleading name for a dark variety of transparent labradorite having blue iridescence and some chatoyancy. See ***feldspar*** (plagioclase).

**blackmorite** A reddish-yellow potch opal from Montana, USA.

**black opal** An iridescent opal having a dark background (caused by the iron-rich matrix in which it is found).

**black pearls** Greyish, greenish or brownish-black pearls found in the Gulf of California, Mexico. The colour is said to be caused by the content of the sea water. R.I. 1.53–1.69; S.G. 2.61–2.69.

**Black Prince's Ruby** This stone, set in the front of the British Imperial State Crown, is a red spinel in a virtually uncut condition.

**blende** See ***sphalerite.***

**blende refractometer** See ***refractometer.***

**blister pearls** Pearls (also called chicot pearls) which have grown in contact with the shell of the mollusc. When they are extracted, the area which was in contact with the shell is bare of nacre. Because of this it is usually smoothed off and hidden by the setting.

**block amber** Pieces of amber (usually pit amber) which are large enough for fashioning into gems or ornaments.

**block caving** An underground mining technique used in most South African diamond mines. Concrete-lined 'scraper drift' tunnels are driven through the pipe. Cone-shaped draw points are cut upwards from openings in the roof of the scraper drifts into the overhanging 'blue ground'. The blue ground is then undercut and breaks up, falling via the draw points into the scraper drifts where it is pulled out by mechanical drag-line scrapers.

**blocker** See ***blocking.***

**blocking** A term used to describe the first stage of the diamond faceting operation in which the table facet and the first eight crown and eight pavilion facets are cut by the *blocker* or *cross cutter.*

**blonde shell** The yellow unmottled material obtained from the under-shell of the hawksbill sea turtle. See ***tortoiseshell.***

**bloodshot iolite** A reddish variety of iolite from Sri Lanka. The colour is caused by thin hexagonal platelets of either haematite or goethite. Because of the parallel orientation of these platelets, the depth of colour varies with the angle of viewing. See ***cordierite.***

**bloodstone** A dark green variety of cryptocrystalline quartz containing spots or streaks of red/brown jasper (also called heliotrope). It should not be confused with blutstein, the German word for haematite. See ***chalcedony.***

**blue alexandrite** A misleading name for a colour-change sapphire.

**blue earth** A greeny-blue sand consisting of grains of glauconite (a hydrous potassium-iron silicate) from which pit amber is mined.

**blue ground** See ***kimberlite.***

**blue john** See ***fluorspar.***

**blue malachite** A misleading name for azurite.

**blue moonstone** A misleading name for blue-stained chalcedony.

**blue opal** A misleading name for lazulite.

**blue pearls** Pearls having a leaden-grey colour which is caused by a central dark core rich in conchiolin.

**blue quartz** A coarse-grained quartz aggregate. The dull blue colour is produced by crocidolite fibres. Occurrence: Austria, Brazil, Namibia, Scandinavia.

**bluestone** See ***sodalite.***

**blue-white** A colour grading term applied to top white (i.e. colourless) diamonds. Its use is now strongly discouraged because of ambiguity and misuse. See also ***overblue.***

**boakite** A brecciated green and red jasper.

**boart** A term applied to a group of industrial-quality natural diamonds (e.g. microcrystalline diamonds of non-gem colour and quality). Because of its microcrystalline structure, boart is usually crushed for use as an abrasive powder. Varieties:

*hailstone boart* — consisting of alternate layers of diamond and other material.

*carbonado* — a mixture of microcrystalline diamond and amorphous carbon.

*framesite* — similar to carbonado, but more granular and containing less diamond.

*stewartite* — similar to carbonado, but containing some magnetite.

*ballas* or *shot boart* — microcrystalline diamond in which the cystals are orientated radially to form a sphere, usually free of inclusions.

Occurrence: In most diamond areas as a proportion of the 'run-of-mine' production. See ***diamond.***

**bobrowka garnet** A demantoid garnet.

**bog oak** A black oak (preserved in peat) which was used in Victorian mourning jewellery.

**Bohemian chrysolite** A misleading name for moldavite.

**Bohemian diamond** A misleading name for the rock crystal variety of quartz.

**Bohemian garnets** Pyrope garnets found in Czechoslovakia (formerly Bohemia) and used as rose-cut gems in Victorian jewellery.

**Bohemian ruby** A misleading name for red varieties of garnet.

**Bohemian topaz** A misleading name for citrine. See ***quartz.***

**boke** Rose-coloured Japanese coral.

**boleite** A collector's gemstone. $Pb_9Ag_3Cu_8Cl_{21}(OH)_{16}.H_2O$. Tetragonal (pseudo cubic). R.I. 2.03, 2.05; D.R. 0.02; S.G. 5.05; H. 3–3½. Transparent, blue. Occurrence: USA (California), Mexico.

**bolster crystals** Rough diamond crystals having a rounded

elongated form like a long pillow. See also ***cushion crystals.***

**Bombay bunch** See ***grading of pearls.***

**bonamite** See ***smithsonite.***

**bone** An organic skeletal material sometimes used to simulate ivory. It has a greater specific gravity than ivory and, under the microscope, bone peelings show a multitude of cracks. Ivory contains waxy parallel surface contours. See ***lines of Retzius.***

**bone turquoise** See ***odontolite.***

**boort** See ***boart.***

**boracite** A collector's gemstone comprising the mineral magnesium chloro-borate. $Mg_6Cl_2B_{14}O_{26}$. Cubic (pseudo isometric) or orthorhombic. R.I. 1.661-1.671; S.G. 2.96; H. 7. Transparent, pale green. Occurrence: Germany, USA.

**borazon** Trade name for a synthetic cubic boron nitride manufactured as an industrial abrasive by General Electric of America. Using the criterion of indentation hardness, it has just over half the hardness of diamond (i.e. 9½ + on the Mohs scale). See also ***amber boron nitride.***

**bornholm diamond** A misleading name for the rock crystal variety of quartz.

**bornite** A collector's stone comprising a sulphide of copper and iron, also known as 'peacock ore' because of the iridescence produced by surface tarnish. S.G. 4.9-5.4; H. 3. Opaque, copper-red.

**boron** The element which is responsible for the semi-conductor properties and blue colour in Type IIb diamonds.

**boron carbide** A synthetically produced industrial abrasive with a hardness superior to that of carborundum (silicon carbide).

**bort** See ***boart.***

**bortz** See ***boart.***

**botryoidal** An external mineral shape or habit resembling a bunch of grapes (e.g. malachite)

**bottlestone** A misleading name for gems cut from moldavite.

**boule** A cylindrical or pear-shaped synthetic crystal grown by the Verneuil flame-fusion process. *Figure B.4.*

**bourguignon pearls** Wax-filled glass pearl simulants.

**bourse** A business exchange, association or club, whose members deal in diamonds or gemstones.

**bouteillenstein** See ***moldavite.***

**bowenite** A hydrated magnesium silicate comprising a hard variety of serpentine (used to simulate jade). Monoclinic (cryptocrystalline). R.I. 1.56; S.G. 2.58-2.59; H. 4-5. Translucent, yellow-green to blue-green (often containing whitish patches). Occurrence: Afghanistan, China, New Zealand.

**bowr** See ***boart.***

*Figure B.4* Synthetic corundum and spinel boules grown in a Verneuil furnace.

**Brabant** See ***Antwerp rose cut.***

**brachy axis** The shorter of the two unequal-length lateral axes in an orthorhombic or triclinic crystal. The longer of these two axes is called the *macro* axis.

**brachy pinacoid** The faces of a brachy pinacoid are cut by the shorter (brachy) axis in an orthorhombic or triclinic crystal. See ***pinacoid*** and ***macro pinacoid.***

**Bragg's Law** A law first enunciated by W. L. Bragg which states that the reflection of a beam of X-rays by a family of parallel atomic planes when passing through a crystal can only take place when

$$n\lambda = 2d\sin\theta$$

Where $n$ is an integer, $\lambda$ the wavelength of the rays, $d$ the spacing between the planes and $\theta$ the angle of incidence and reflection of the beam. $\theta$ is sometimes referred to as the 'Bragg angle'. This equation lies at the root of all X-ray crystal analysis.

**Brazilian Gemmological Association** See ***Associacào Brasileira de Gemologia.***

**brazilianite** A hydrous sodium aluminium phosphate discovered as a new gem mineral in Brazil in 1944. $Al_3Na(PO_4)_2(OH)_4$. Monoclinic. R.I. 1.603, 1.623; D.R. +0.02; S.G. 2.980-2.995; H. 5½. Transparent, yellow. Occurrence: Brazil, USA.

**Brazilian aquamarine** A misleading name for blue topaz.

**Brazilian diamond** A misleading name for the rock crystal variety of quartz.

**Brazilian emerald** A misleading name for green tourmaline or synthetic yellowish-green spinel.

**Brazilian onyx** A misleading name for banded calcite.

**Brazilian peridot** A misleading name for light green tourmaline.

**Brazilian ruby** A misleading name for pink topaz or pink tourmaline.

**Brazilian sapphire** A misleading name for blue topaz or blue tourmaline.

**Brazilian topaz** A yellow variety of topaz.

**brazing** High-temperature soldering using an alloy of brass and zinc and a gas-operated brazing torch.

**breccia** The description given to angular fragments of mineral which are cemented together into a rock by secondary mineralisation (e.g. brecciated agate, jasper, marble and serpentine). Breccia is distinguished from conglomerate by the angular nature of the fragments.

**break facets** The triangular facets which are adjacent to the girdle on a brilliant-cut stone. There are 16 break facets on the crown and 16 break facets on the pavilion (also called upper and lower break facets respectively, and cross, skew or skill facets). See ***brilliant cut*** and *Figure B.6.*

**breath test** A simple test for diamond. If the surface of a diamond is breathed on, the resulting moisture film will evaporate much more rapidly that it will from the surface of a simulant. The effect is due to diamond's much larger thermal conductivity. It is valid only as a comparative test, and then both the test stone and a diamond sample must be at the same temperature.

**breithauptite** A collector's stone comprising the mineral nickel antimonide. S.G. 7.54. Copper-red.

**Brewster angle** The angle of reflection at which light rays undergo maximum plane polarisation at a flat surface (also called the polarising angle).

**Brewster's law** A law that states that complete polarisation of a monochromatic ray reflected from the surface of a denser medium occurs when it is normal (i.e. at right-angles) to its associated refracted ray in that medium (Brewster angle = arc tan of R.I. of reflecting medium; R.I. of reflecting medium = tan of its Brewster angle). *Figure B.5.*

**briancon diamond** A misleading name for the rock crystal variety of quartz.

**Bridgeman-Stockbarger process** A method of growing synthetic crystals in which the source material is first placed in a crucible in the upper part of a vertical furnace. Then the crucible is slowly lowered to the cooler part of the furnace, and crystals begin to grow as the melt temperature falls. The process is used to

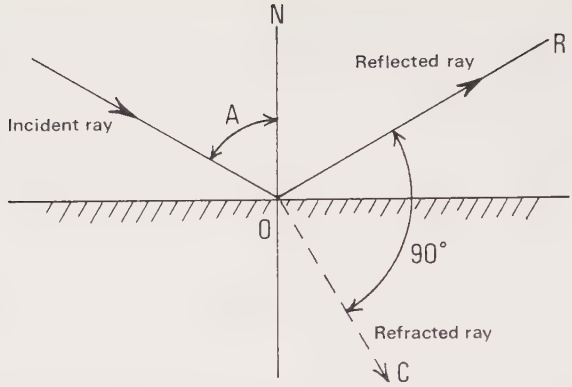



*Figure B.5* A light ray *OR,* reflected from the surface of a denser medium becomes completely polarised when it is at 90° to its refracted ray *OC.* Angle *A* is called the Brewster or polarising angle.

manufacture laser crystals and gemstone materials such as synthetic scheelite.

**bright-line spectrum** A spectrum which contains emission rather than absorption lines. These bright emission lines are caused by electronic disturbances within the atoms of a specimen when it is vaporised (e.g. in a flame, an electric arc or a laser beam). Bright-line spectra are used principally in the analysis of materials, the pattern of the lines making possible the identification of constituent elements.

**Brighton diamond** A misleading name for the rock crystal variety of quartz.

**Brighton emerald** A misleading name for a glass emerald simulant.

**brilliance** The term applied to a polished gemstone to describe the effect of the light reflected from its surface and (by means of total internal reflection) from within the stone. See also ***fire*** and ***scintillation.***

**brilliant** The term used for a diamond cut in the round brilliant profile.

**brilliant cut** The most often used cut for diamonds, this consists of 57 facets (plus a culet, or collet, polished on the pointed end of the pavilion to safeguard it from damage). There are 33 crown facets (including the central table facet) and 24 pavilion facets. Variants of the round brilliant cut are the marquise (or navette), the oval and the pear-shape, all of which have 57 facets. *Figure B.6.*

**brilliante** Trade name for a synthetic rutile diamond simulant.

**brillianteerer** A name, derived from the Dutch word *briljanteerder,* given to the diamond cutter who polishes the final

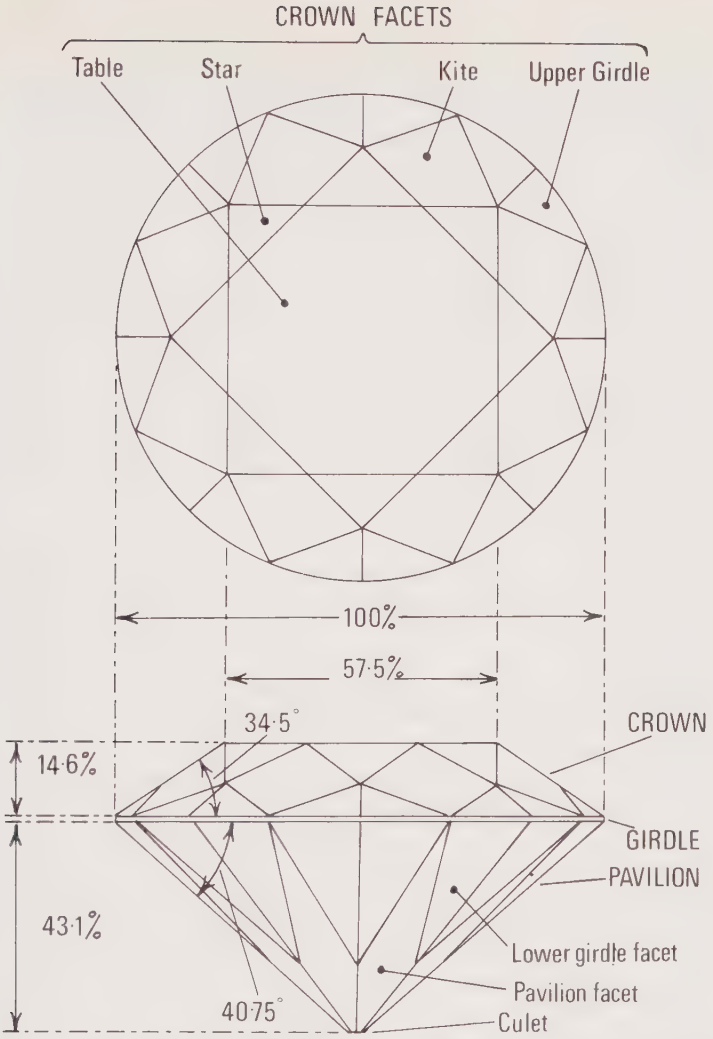



*Figure B.6* The ideal Scan DN proportions and angles for a brilliant-cut diamond. The Tolkowsky ideal cut has a slightly smaller table (53%) and a deeper crown (16.2%).

sequence of 24 crown and 16 pavilion facets, and gives all the facets their finishing polish.

**briolette** An elongated pear-shaped stone having a circular cross-section, whose surface consists entirely of triangular facets.

**Bristol diamond** A misleading name for the rock crystal variety of quartz.

**britannia metal** An alloy of tin, copper and antimony. See also *pewter.*

**britannia silver** An alloy having a higher silver content (and a softer working character) than sterling silver.

**brittleness** A weakness in a gemstone which, despite its hardness, makes it susceptible to fracture damage. Zircon, with a hardness of 7-7½ on the Mohs scale, is particularly brittle, and its facet edges are susceptible to chipping.

**bromoform** A volatile 'heavy' liquid used in the approximation of specific gravity and as an immersion fluid for the estimation of refractive index. $CHBr_3$. R.I. 1.59; S.G. 2.89.

**bronzite** An iron-rich enstatite having a chatoyant bronze-like lustre.

**brookite** A collector's stone which together with anatase and rutile is a polymorph of titanium oxide. $TiO_2$. Orthorhombic. R.I. 2.583 −2.741; D.R. +0.122 to +0.158; S.G. 3.87-4.08; H. 5½-6. Translucent, yellowish, brown, reddish-brown. Occurrence: France, Switzerland, USA.

**brown diamonds** Next in frequency of occurrence to the yellow cape series diamonds. The brown tints in diamond are thought to be due to the presence of both nitrogen and amorphous carbon. See ***brown series.***

**brown quartz** Faceted brown quartz gems are known as cairngorms, a name derived from a now much-depleted source in the Cairngorm Mountains, Scotland. Occurrence: Switzerland, USA. Brown quartz with a greyish tinge is known as smoky quartz. Occurrence: Australia, Japan, Spain, USA.

**brown series** A diamond category containing the range of brown to brownish-yellow and greenish stones which show the characteristic 504 nm absorption spectrum (brown grades include finest light brown, fine light brown, light brown and dark brown).

**bruting** Also called rondisting and girdling, this is the production of the basic girdle profile of a brilliant-cut diamond. The sawn or cleaved rough diamond is rotated on a power-driven spindle, and another diamond is brought into contact with it as a cutting tool.

**bruter** The craftsman who specialises in producing the girdle profile of a polished diamond.

**buddstone** A bright green chlorite-rich crypto-crystalline quartz from Southern Africa. See ***chalcedony.***

**buergerite** An iron-rich tourmaline.

**buoyancy error** A weighing error which becomes noticeable when weighing bulky objects whose volume is significantly different from that of the counterweights (or the calibration weights). This error is due to the difference between the 'buoyancy' or air displacement of the object being weighed and that of the

counterweights (owing to differences in their specific gravities. See ***Archimedes Principle***). As a cubic metre of air weighs only 1.29 kilograms (compared with 3520 kilograms for the same volume of diamond), this error is very small. By mutual agreement (and the use of standard materials for balance counterweights) buoyancy error is ignored in normal commerce. This error does become important, however, when a high degree of accuracy is required (e.g. in research work where it may be essential to determine the absolute mass of a substance). One laboratory method of eliminating buoyancy error is to carry out weighings in a vacuum. For precision weighing in air, manufacturers of analytical balances supply a correction formula which compensates for differences in specific gravity (i.e. air displacement) between the object being weighed and the counterweights.

**Burma sapphire** A misleading name for a synthetic blue corundum.

**Burmese shell** Pearl shell from the Mergui Archipelago, Burma.

**burmite** A reddish variety of amber found in Burma.

**burnt amethyst** Amethyst which has been heat treated to produce yellow quartz. See also ***heat-treated stones.***

**button pearls** Also called *boutons,* these pearls have a rounded top and a flattened base.

**buxton diamond** A misleading name for the rock crystal variety of quartz.

**bye** A term used at the mines for colour grading rough yellow diamonds (i.e. first bye, second bye, etc.). An alternative term is by-water. Stones of top white colour and top quality are described as 'first water'.

**by-water** See ***bye.***

**byon** The native name given to the gem-bearing alluvial gravel of Upper Burma.

**bytownite** A reddish or pale yellow plagioclase feldspar. See ***feldspar.***

**Byzantine mosaic** See ***Roman mosaic.***

## C

**cabochon** A gemstone cut having a curved or domed top surface and a hollow flat or convex base (the latter being called a double cabochon). Used mainly for opaque stones and stones exhibiting chatoyancy or asterism. *Figure C.1.*

**cacholong** A variety of common opal having a mother-of-pearl lustre (also called mother-of-pearl opal). Translucent to opaque, white or yellowish-white, highly porous.

*Figure C.1* Profile of the cabochon cut. Stones are sometimes hollow-cut (as shown on the right) to lighten their colour.

**cacoxenite** A hydrous iron phosphate, $Fe_4(OH)(PO_4)_3.12H_2O$, sometimes found as a sheaf-like inclusion in quartz.

**cairngorm** See ***brown quartz.***

**calaite** See ***turquoise.***

**calamine** Name used for both hydrous zinc silicate and zinc carbonate. See ***hemimorphite*** and ***smithsonite.***

**calbenite** See ***myrickite.***

**calcentine** Trade name for a treated Canadian aragonite. Opaque with patches and bands of red, blue and yellow.

**calcite** A calcium carbonate which is a component in many rocks. It is also the basis of all true marbles and limestones. In its orthorhombic aragonite form it is a major constituent of pearls, and is also used for carving . $CaCO_3$. Trigonal. R.I. 1.486, 1.658; D.R. −0.172; S.G. 2.71; H. 3. Transparent to opaque, colourless, white, black and shades of yellow, brown, grey. Optical quality calcite is called Iceland spar, and is used in instruments such as the dichroscope. Satin spar is a fibrous form of calcite, and a banded stalagmitic variety (sometimes sold as aragonite) is used for carving. Occurrence: World-wide.

**calibré stones** A term used to described small square trap cut stones which are polished to standard sizes to fit channelled settings in jewellery.

**Californian iris** The kunzite variety of spodumene.

**Californian jade** A misleading name for californite.

**Californian moonstone** A misleading name for chalcedony.

**Californian onyx** A misleading name for a banded stalagmitic calcite and aragonite.

**Californian ruby** A misleading name for garnet.

**Californian tiger's eye** A chatoyant bastite.

**Californian turquoise** A misleading name for variscite.

**californite** A massive green variety of idocrase used to simulate jade. Occurrence: Pakistan, USA (California).

**caliper gauge** (for gemstones) A specialised gauge for estimating the weight of gemstones, and in particular diamonds. The gauge is used to measure the distance between the culet and table facets, and the diameter of the girdle. The weight of the gemstone is arrived at by referring these measurements to a table supplied with the gauge. A more refined version of the caliper gauge is the Leveridge dial gauge. *Figure C.2.* See also ***Moe diamond gauge.***

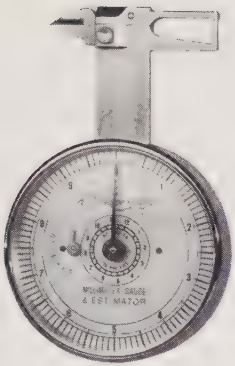


*Figure C.2* The Leveridge dial gauge for estimating the weight of mounted gemstones.

**callais** An ancient name for turquoise.

**cambay stone** An Indian cornelian.

**Cambrian** A rock system on the earth's surface comprising the rocks laid down during the Cambrian period, 570-500 million years ago. The Cambrian period is the first part of the Palaeozoic era. See ***Palaeozoic.***

**cameo** A relief carving in which the differently coloured layers of a gem material such as agate, shell or coral are used to produce a contrasting background to the main figure or design.

**Canada balsam** A resin from the balsam fir tree which is used as a cement between glass components in optical instruments, and as a mounting medium for microscope specimens. Because of its refractive index (1.53) it is also used in nicol polarising prisms (made from Iceland spar) to reject the 'ordinary' ray (R.I. 1.658) while allowing the 'extraordinary' ray (R.I. 1.486) to pass through. See ***nicol prism.***

**Canada moonstone** A name for the peristerite variety of albite feldspar.

**Canadian blue stone** See ***sodalite.***

**Canadian Gemmological Association** Headquarters: Box 1106, Station Q, Toronto, Ontario, M4T 2P2, Canada.

**Canadian jade** A nephrite from British Columbia, Canada.

**canary diamond** A strongly coloured yellow diamond (termed a *fancy*).

**canary glass** Glass coloured yellow by uranium.

**canary stone** A yellow variety of cornelian.

**cancrinite** A rare semi-opaque yellow or orange gemstone having a complex hydrous silicate composition containing carbon, sodium, calcium and aluminium. Hexagonal. R.I. 1.491, 1.513 to 1.502, 1.524; D.R. −0.022; S.G. 2.42-2.50; H. 5-6. Occurrence: Canada, Norway, USA, USSR.

**candite** A blue variety of spinel.

**candle** The ceramic or fireclay pedestal on which boules are grown in a Verneuil furnace.

**candling** (of pearls) A technique for revealing the difference between cultured and natural pearls. To make the test, the pearl is rotated slowly in front of a strong light which is completely masked except for a 1 mm square test aperture. If the pearl is a cultured one, the structure of the mother-of-pearl bead will be projected onto its surface as parallel lines. If the pearls are in a necklace, they can be tested by stretching the necklace taut between its two ends and rotating it under a strong light. If any of the pearls are cultured, the internal bead will reflect the light through the nacreous covering, producing two gleams or flashes of light for each complete rotation of the pearl.

**cannel coal** A bituminous coal from Scotland and the north of England (the name means candle, as this coal was a source of wax for candle making). Occasionally used as a simulant for jet (distinguished by its brittleness).

**cape** A colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**cape cut** A term used to describe a polished gemstone whose facets are irregularly or haphazardly cut.

**cape emerald** A misleading name for prehnite.

**cape chrysolite** A misleading name for prehnite.

**cape ruby** A misleading name for pyrope garnet.

**cape series** See ***cape stones.***

**cape stones** A diamond category which includes all stones having a discernible trace of yellow (e.g. in the CIBJO grading system, White, Slightly Tinted White, Tinted White, Tinted Colour). The term *cape series* is applied to diamonds which show the characteristic 415.5 nm absorption spectrum. These range from top white to deep yellow stones. See also ***brown series,*** and ***Colour Grading Standards*** in Appendix B.

**capra gem** Trade name for a synthetic rutile diamond simulant.

**carat** A measure of the purity of gold used in jewellery. It is based on a scale of twentyfourths, 24 carat gold being pure gold, and 9 carat gold, for example, containing 9 parts of pure gold to 15 parts of alloy (also expressed as 0.375, i.e. 9/24). The usual metals

alloyed with gold are silver, nickel, platinum and palladium (all of these being used to produce 'white' gold), zinc (green gold in combination with silver) and copper (red gold).

**carat weight** A unit of weight for gemstones. Originally derived from the seed of the middle-eastern Carob tree, the carat weight was standardised world-wide in 1914 as the metric carat. There are five metric carats to the gram; 141.747 carats to the ounce Avoir, and 155.517 carats to the ounce Troy. One carat is also equal to 4 grains (a measure for pearls and small rough diamonds) and 100 points (a measure for small polished diamonds).

**carbonado** See ***boart.***

**carbon disulphide** A liquid used for the immersion approximation of refractive index. R.I. 1.63. See ***Becke line method.***

**Carboniferous** A rock system on the earth's surface comprising the rocks laid down during the Carboniferous period, 345-280 million years ago. The Carboniferous period is part of the Palaeozoic era. See ***Palaeozoic.***

**carbonyl** Trade name for carbon tetrachloride in the USA.

**carbon tetrachloride** A volatile liquid used as a grease solvent and a cleaning agent. $CCl_4$. As with other volatile liquids used in gemmology, inhalation of its vapour should be avoided. R.I. 1.44; S.G. 1.59.

**carborundum** Trade name for silicon carbide. SiC. Used as a polishing and industrial abrasive, it is made by fusing together sand and coke (i.e. silicon and carbon). Some crystals of the material have been grown and faceted. Hexagonal. R.I. 2.65, 2.69; D.R. +0.043; S.G. 3.17; H. 9-9½. Transparent, colourless to bluish-green.

**carbuncle** Name given to a cabochon-cut almandine garnet popular in Victorian times.

**carnegiegem** Trade name for a composite diamond simulant consisting of a synthetic spinel crown section and a strontium titanate pavilion.

**carnelian** A common alternative spelling for cornelian.

**carneol** Trade name for a pink-dyed chalcedony.

**carob** See ***carat.***

**carré** Name given to a square trap-cut stone.

**cascalho** Name given to diamond-bearing gravel in Brazil.

**casein** A synthetic material made from the protein of milk, and used as a simulant for amber, ivory and tortoiseshell. R.I. 1.55-1.56; S.G. 1,32-1.34; H. 2-2½.

**cassiterite** A collector's stone comprising the mineral tin oxide. $SnO_2$. Tetragonal. R.I. 1.997, 2.093; D.R. +0.096; S.G. 6.8-7.1; H. 6-7. Transparent to translucent, colourless and shades of yellow, brown and brownish-red. Occurrence: Australia, Bolivia,

England, Malaysia, Namibia, Spain, Tasmania.

**castor oil** A vegetable oil sometimes mixed with diamond dust to produce the abrasive paste which is applied to the polishing surface of a scaife when faceting diamonds. See also ***olive oil.***

**catalin** Trade name for a phenolic resin sometimes used as an amber simulant.

**catalinate** A jasper from Santa Catalina Island, Gulf of California, Mexico.

**catalyst** A substance which accelerates a chemical reaction but is unchanged by the reaction.

**cateye** See ***operculum.***

**cathay cat's eye** An imitation chrysoberyl cat's eye made from fused mosaics of parallel coloured glass fibres which are either clad or embedded in a glass of lower refractive index. R.I. 1.8; S.G. 4.58; H. 6.

**cathay stone** See ***cathay cat's eye.***

**cathodoluminescence** The fluorescent effect displayed by some materials when they are bombarded with a beam of electrons. Television pictures are generated by the cathodoluminescence of the phosphors on the screen of the cathode ray tube. For minerals, this type of luminescence was discovered as a side effect when viewing samples in an electron microscope. It has been developed into a useful research tool for detecting the presence of rare earths and specific minerals in agglomerates.

**cathode rays** Electrons emitted from the cathode of a high-vacuum tube under the influence of an electric field.

**cations.** Positively charged ions. See also ***anions.***

**cat's eye opal** An opal with harlequin iridescence and a chatoyant streak.

**cat's eyes** Stones possessing the property of chatoyancy (e.g. chrysoberyl, quartz, tourmaline, tiger's eye). See ***chatoyancy.***

**catsteyte** See ***cathay cat's eye.***

**catty** A Thai weight equal to approximately 3015 carats.

**cave pearls** Concretions of calcium carbonate (having a pearly lustre) which form in limestone caves.

**cedarite** A variety of amber from Manitoba, Canada.

**celestial stone** See ***turquoise.***

**celestine** A collector's stone (also called celestite) comprising the mineral strontium sulphate. $SrSO_4$. Orthorhombic. R.I. 1.623, 1.633; D.R. +0.01; S.G. 3.97-4.00; H. 3½. Transparent, colourless and pale blue. Occurrence: Namibia, USA.

**celestite** See ***celestine.***

**cellon** Trade name for a non-flammable variety of celluloid.

**cellosolve** See ***oxitol.***

**celluloid** A plastics material made from camphor and cellulose

nitrate or cellulose acetate (safety celluloid). Sometimes used as an amber simulant. R.I. 1.49–1.51; S.G. 1.36–1.42 (nitrate) or 1.29–1.40 (acetate); H. 2½–3. See ***rhodoid.***

**Celsius temperature scale** Also known as Centigrade. The degree Celsius has been adopted as the international standard for temperature measurement. On this scale, the freezing point of water is 0°C, and its boiling point 100°C. To convert from the Celsius scale to the Fahrenheit scale, multiply by nine and divide by five then add 32.

$$F = \frac{9}{5}C + 32$$

**Cenozoic** The latest of the four eras into which geological time and rock sequences can be divided. It stretched from 65 million years ago to the present day and comprises the ***Quaternary*** and ***Tertiary*** periods. See also ***Mesozoic, Palaeozoic*** and ***Precambrian.***

**centre of symmetry** A crystal has a centre of symmetry when identical faces and edges occur on exactly opposite sides of a central point.

**Central Selling Organisation** (CSO) The De Beers group which receives, sorts and markets 80% of the world's rough diamonds. Within this group, gem diamonds are handled by the Diamond Trading Company, and industrial diamonds by Industrial Distributors Ltd.

**cephalopod** A mollusc with a distinct tentacled head. See ***ammonite.***

**ceragate** A waxy yellow-coloured chalcedony.

**ceric oxide** See ***cerium oxide.***

**cerium** A rare-earth used in oxide forms ($CeO_2$ and $Ce_2O_3$) as a colour dopant in cubic zirconium oxide to produce orange and red varieties.

**cerium oxide** A yellowish-pink abrasive powder used in the polishing of gemstones (also called ceric oxide and cerium).

**cerkonier** An ancient name for zircon.

**certificate** A document recording all the details (e.g. constants, weight, dimensions, grading for colour, clarity and cut, etc.) of a polished gemstone. Usually issued by grading laboratories, and mainly used for diamonds.

**Certified Gemologist** (CG) A title awarded by the American Gem Society to members of the Society who have passed the qualifying examinations. See ***American Gem Society.***

**ceruleite** A hydrated copper aluminium arsenate. $CuAl_2(OH)_2AsO_4.7H_2O$. Cryptocrystalline. R.I. 1.60; S.G. 2.7. Opaque, sky-blue (similar in appearance to turquoise).

**cerulene** See ***ceruline.***

**ceruline** Calcite coloured with malachite and azurite.

**cerussite** A collector's stone comprising the mineral lead carbonate. $PbCO_3$. Orthorhombic. R.I. 1.804, 2.078; D.R. −0.274; S.G. 6.46-6.57; H. 3½. Transparent, colourless, greyish, brown, green, black. Occurrence: Austria, Czechoslovakia, Namibia, USA.

**Ceylon chrysolite** A misleading name for yellowish-green tourmaline.

**Ceylon cut** A mixed cut, usually consisting of a brilliant-cut crown, a step-cut pavilion and an oval girdle. To obtain maximum yield, the cut is often lacking in symmetry.

**Ceylon diamond** A misleading name for colourless zircon.

**Ceylon Gem Society** See ***Gem Society of Ceylon*** (now Sri Lanka).

**Ceylon opal** A misleading name for moonstone.

**Ceylon peridot** A misleading name for yellowish-green tourmaline.

**ceylonite** A dark green spinel found in Sri Lanka. R.I. values of 1.77-1.80, and S.G. values of 3.63-3.90, are higher than for the normal range of spinels.

**CG** See ***Certified Gemologist.***

**chalcedony** A cryptocrystalline form of quartz. $SiO_2$. R.I. 1.53, 1.54; S.G. 2.58-2.64; H. 6½. Trigonal. Translucent to opaque. Varieties:

*agate* — all colours with curved wavy concentric bands.
*bloodstone* — opaque, dark green with spots of red jasper. Also called heliotrope.
*chalcedony* — translucent, unbanded greys and blues.
*chrysoprase* — translucent, apple-green.
*cornelian* — translucent, reddish-orange.
*fire agate* — reddish iridescent botryoidal stone overlaid with translucent chalcedony.
*moss agate* — colourless translucent chalcedony with dendritic green inclusions of hornblende.
*onyx* — black and white with straight or even banding.
*plasma* — dark green containing chlorite.
*sard* — translucent, brownish-red.
*sardonyx* — brownish-red and white with straight banding.

Occurrence: World-wide.

**chalcopyrite** Also known as copper pyrite. $CuFeS_2$. Tetragonal. S.G. 4.1-4.3; H. 3½-4. Opaque, brass-yellow. Occurrence: World-wide.

**chalmeleonite** A colour-change tourmaline.

**chalumeau** The inverted oxy-hydrogen burner used in the Verneuil furnace.

**chalybite** See ***siderite.***

**chambersite** A rare collector's stone comprising the mineral manganese borate. $Mn_3B_7O_{13}Cl$. Orthorhombic. R.I. 1.732, 1.744; D.R. 0.012; S.G. 7.0; H. 7. Transparent, brownish-lilac or purple. Occurrence: Switzerland.

**champagne diamond** A brownish-yellow diamond whose colour is not deep enough for it to be classified as a fancy.

**champlain marble.** A misleading name for a massive dolomite from Vermont, USA.

**charoite** An ornamental fibrous rock, consisting mainly of a calcium or sodium potassium silicate. $(Ca,Na,K,Sr,Ba)Si_4O_{10}(OH,F).H_2O$. Cryptocrystalline. R.I. 1.55; S.G. 2.6-2.78; H. 5½-6. Opaque, purple with swirls of greenish-black and orange. Occurrence: USSR (bank of the Chara river, Yakutia).

**chasing** A method of decorating metal surfaces by hammering a hardened steel punch along the lines of a design to produce grooves. See ***embossing.***

**Chatham synthetic emeralds** Marketed as Chatham Created Emeralds, these are synthetic emeralds grown by a flux-melt process developed in 1940 by C. F. Chatham of the USA. A 1014-carat Chatham synthetic emerald is displayed in the Smithsonian Institution, and another, weighing 1275 carats, is in the Harvard Museum. Probably because of an absence of iron in the synthetic product, its constants are slightly lower than those of the natural gemstone. (More recent productions may contain iron and have higher constants.) R.I. 1.560, 1.563; D.R. −0.003; S.G. 2.65; H. 7½.

**Chatham synthetic rubies** Marketed as Chatham Created Rubies, these are synthetic rubies grown by a flux-melt process. They have constants substantially the same as the natural gemstone, but unlike natural rubies lack any trace of iron (normally detected with an X-ray spectrometer or by SW UV transparency).

**chaton** A glass gem whose pavilions are treated with a mercury amalgam to produce a reflecting mirror surface.

**chatoyancy** An effect caused by groups of parallel crystals, fibres or channels within a gemstone which create a 'cat's eye' line of light across the surface of the stone. Chatoyant gems are usually cut as cabochons to show the effect to best advantage. See ***sheen.***

**checky** A Turkish weight equal to 1600 carats.

**Chelsea filter** Also called an emerald filter, this consists of a combination of two carefully chosen filters, whose combined transmission response is intended to match the red transmission and yellow-green absorption of emerald. Emeralds (natural and synthetic) appear pink or red when viewed through the filter, but most emerald simulants appear green. The filter can also be used to detect cobalt coloured synthetics (e.g. light and dark blue

spinels) which, unlike the gems they simulate, appear red through the filter. The filter was developed in 1934 by B. W. Anderson and C. J. Payne in collaboration with the gemmology class at the Chelsea College of Science and Technology, London (hence the name Chelsea filter).

**chemawinite** A variety of amber found in Canada and the USA.

**chemiluminescence** The glow given off by a substance such as phosphorus when it oxidises (not be be confused with phosphorescence, which is now exclusively applied to an 'after-glow' effect occurring after the source of excitation is removed).

**cherry opal** A North American name for fire opal. Also the name for a cherry-red and a yellow non-iridescent opal found in Mexico.

**chert** A flint-like variety of quartz.

**chessylite** See ***azurite.***

**chevvü** A Sri Lankan weight equal to 21.86 carats. Also called a chow. See also ***manchadi.***

**chiastolite** A variety of andalusite.

**chicken bone jade** A yellowish burned or buried (tomb) jade.

**chicot pearls** See ***blister pearls.***

**Chinese cat's eye** See ***operculum.***

**Chinese jade** See ***nephrite.***

**Chinese turquoise** A misleading name for a mixture of calcite, quartz and blue-dyed soapstone.

**chips** Cleavages or broken rough diamonds under 2.0 carats. See also ***macles, melée, shapes*** and ***stones.***

**chlorastrolite** A fibrous rock (also misleadingly called green stone) consisting mainly of pumpellyite (a complex hydrated calcium aluminium silicate). Orthorhombic. R.I. 1.70; S.G. 3.1-3.5; H. 5-6. Opaque, chatoyant green with circular white and green markings. Occurrence: USA (Lake Superior).

**chloromelanite** A black-speckled green variety of jadeite. S.G. 3.4; H. 6½-7.

**chlorospinel** A grass-green variety of spinel.

**chlor-utalite** See ***variscite.***

**chondrodite** A collector's stone comprising the mineral magnesium silicate (with fluorine and hydroxyl). $2Mg_2SiO_4.Mg(F,OH)_2$. Monoclinic. R.I. 1.59, 1.62 to 1.60, 1.63; D.R. +0.03; S.G. 3.1-3.2; H. 6½. Translucent, yellow, red, brown. Occurrence: Sweden, USA.

**chow** See ***chevvü.***

**chromatic aberration** See ***aberration.***

**chrome chalcedony** A green variety of chalcedony (also called mtorodite) which owes its colour to chromium. It should not be confused with the chrysoprase variety of chalcedony which is coloured by nickel. The two green chalcedonies can be

distinguished by means of a strong chromium doublet in the deep red, or by a narrow nickel absorption band at 632 nm. Chrome chalcedony appears red under the Chelsea filter, while chrysoprase appears green. Occurrence: Zimbabwe.

**chrome diopside** A bright green variety of diopside. Occurrence: Republic of South Africa.

**chrome epidote** A deep green variety of epidote (also called tawmawite) having strong pleochroism (green, bright yellow). Occurrence: Upper Burma, Zimbabwe.

**chrome idocrase** An emerald-green idocrase.

**chrome tourmaline** A variety of tourmaline which owes its green colour to chromium. Occurrence: Tanzania.

**chromium** One of the eight transition metals which are mainly responsible for colour in gemstones. Cr. Stones coloured by chromic oxide include ruby, emerald, red spinel, pyrope garnet, demantoid garnet, jadeite and pink topaz. Atomic number 24; atomic weight 52.01; melting point 1900°C; S.G. 7.1.

**chromium oxide** A dark green abrasive powder used for polishing gemstones (also called green rouge and green chrome).

**chromosphere** The gaseous envelope of the sun which is the main cause of the fine-line absorption spectra seen in daylight. See ***Fraunhofer lines,*** also ***Table of Principal Fraunhofer Lines*** in Appendix J.

**chrysoberyl** A beryllium aluminium oxide. $BeAl_2O_4$. Orthorhombic. R.I. 1.744, 1.753 to 1.749, 1.759; D.R. +0.009 to +0.01; S.G. 3.68-3.78; H. 8½.

Varieties:

*alexandrite* — transparent, green in daylight, red in tungsten light.

*chrysoberyl* — transparent, green, yellow, brown.

*chrysoberyl cat's eye* — translucent, yellowish, also called cymophane.

Pleochroism, strong in alexandrite (green, yellowish, pink in daylight; red, yellowish-red, green in tungsten light). Occurrence: Alexandrite originally in USSR, now in Brazil, Burma, Sri Lanka, Zimbabwe. Other varieties from Brazil, Burma, the Malagasy Republic, Sri Lanka, Zimbabwe.

**chrysoberyllus** A misleading name for greenish-yellow beryl.

**chrysocolla** A cryptocrystalline gem usually cut as a cabochon. $CuSiO_32H_2O$. R.I. 1.50; S.G. 2.00-2.45; H. 2-4 (may be as high as 6 if quartz content is significant). Semi-translucent to opaque, green, blue. Occurrence: Chile, USA, USSR, Zaire.

**chrysolite** A now discarded gemmological name for yellow, yellow-green and greenish gems (e.g. chrysoberyl, peridot, tourmaline). See ***Ceylon chrysolite*** and ***peridot.***

**chrysolithus** A yellow beryl.

**chrysopal** A green common opal.

**chrysophrase** A misleading name for a green-dyed chalcedony.

**chrysoprase** A bright green cryptocrystalline quartz. See ***chalcedony.***

**chrysoquartz** Green aventurine quartz.

**chrysotile** A fibrous serpentine which forms a valuable scource of asbestos. $Mg_3Si_2O_5(OH)_4$. Monoclinic. S.G. 2.5-2.6; H. 2½-4. Translucent to opaque, greenish, brownish, grey, yellow, white. Occurrence: World-wide.

**CIBJO** Confédération Internationale des Bijoutiers, Joaillers et Orfèvres. An international confederation of jewellery and silverware trades.

**CIE** Commission Internationale de l'Eclairage. An international body which specifies standards of illumination, colour measurements and colour description.

**CIE chromaticity chart** A colour chart plotted in chromaticity co-ordinates $(x,y)$ derived from red/green/violet tristimulus values $(X,Y,Z)$. The chart enables colour hue and colour saturation to be specified in terms of $x,y$ co-ordinates.

**cinnabar matrix** A quartz containing red cinnabar inclusions.

**cinnamon stone** An orange-brown hessonite garnet.

**cipollino marble** A marble having alternating bands of white and green, quarried on the Greek island of Euboea.

**cire perdue** See ***lost wax casting.***

**cirolite** Trade name for the man-made diamond simulant yttrium aluminium garnet.

**ciro pearl** Trade name for an imitation pearl.

**citrine** A yellow variety of quartz

**clarified amber** Cloudy amber which has been clarified by heating it in oil. See ***rape seed oil.***

**clarity** A classification term in the grading of polished gemstones (particularly diamond) which denotes the degree of freedom from those features such as inclusions which would inhibit the passage of light through the stone. The term *quality* is similarly used in the sorting of rough diamonds. See ***Clarity Grading Standards*** in Appendix C.

**claw setting** A setting in which the gemstone is secured by claws just above the line of the girdle.

**cleavage** A property possessed by some crystalline materials which enables them to be divided or cleaved along a plane of weak molecular bonding. Cleavage planes exist in many gem materials, and these stones are said to have *imperfect, easy* or *perfect* cleavage (e.g. beryl, diamond and topaz, respectively). See ***basal cleavage, prismatic cleavage*** and ***octahedral cleavage.***

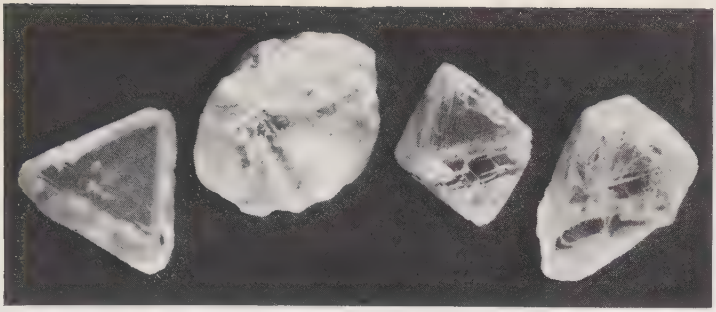


*Figure C.3* Rough diamond crystals showing, left to right, a triangular twinned 'macle', a 'shape' (distorted unbroken octahedron), a 'stone' (octahedron) and a 'cleavage' (broken crystal). (De Beers)

**cleavages** A shape category for rough diamonds over 2.0 carats consisting of broken crystal fragments or crystals damaged by cleavage of fracture. *Figure C.3.* See also ***chips, macles, melée, shapes*** and ***stones.***

**cleaving** A method of dividing a diamond crystal in two along one of its four cleavage planes (parallel to the octahedral faces). Cleaving is performed by first scratching a notch or 'kerf' along the surface of the diamond. A cleaver's blade is then inserted into the notch, and when tapped acts as a wedge to part the stone in two. *Figure C.4.*

**cleiophane** See ***zinc blende.***

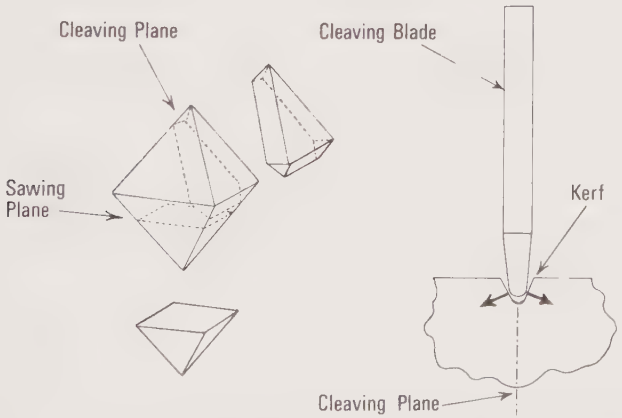



*Figure C.4* Sketch showing one of the four cleavage planes in a diamond together with the cleaving technique. The tip of the cleaver's blade functions as a wedge to part the crystal.

**Clerici's solution** A water-based 'heavy' liquid used in the approximation of specific gravity. It contains thallium malonate and thallium formate, and should be used with care because of its poisonous and corrosive nature. S.G. 4.15.

**clino axis** The lateral axis in the monoclinic crystal system which is inclined to the vertical axis. See ***ortho axis.***

**clinozoisite** A light green to greenish-brown or red variety of epidote, having little iron content. Monoclinic. Light green to greenish-brown variety R.I. 1.724, 1.734; D.R. +0.01; S.G. 3.37; H. 6-7. Red variety R.I. 1.715, 1.731; D.R. −0.016; S.G. 3.30; H. 6-7. Occurrence: (light green, greenish-brown) Burma, Zimbabwe; (red) Norway.

**closed form** A crystal form which is made up entirely of similar and interchangeable flat crystal surfaces or faces. See ***form.***

**close set** A gemstone mounted so that only its top surfaces are visible.

**closed setting** A gemstone setting consisting of a metal rim or collet fitted with a closed base.

**close goods** A sorting classification used at diamond mines for good quality crystals.

**coated beryl** See ***Lechleitner emerald simulants.***

**coated diamonds** Diamonds which are covered with a thin translucent to opaque skin of low quality green, grey or black diamondiferous material. Under the coating the diamond may be of a good colour and quality. Coated diamonds are 'opened' for appraisal purposes by polishing two 'windows' on opposite sides of the stone. Occurrence: Mainly Sierra Leone and Zaire.

**cobalt** One of the eight transition metals which are mainly responsible for colour in gemstones. Co. Mainly seen in synthetic blue spinels and cobalt glass, it is also the cause of colour in pink smithsonite and some pink non-gem materials. Atomic number 27; atomic weight 58.94; melting point 1492°C; S.G. 8.6.

**cobalt glass** A blue glass coloured by cobalt which is used in the manufacture of gem simulants.

**cobaltite** A collector's stone comprising a sulphide of arsenic and cobalt. CoAsS. Cubic. S.G. 6.0-6.3; H. 5½. Opaque, silver-white tinged with pink (metallic lustre). Occurrence: Canada, England, Norway, Sweden.

**coesite** A rare form of quartz which crystallises under high temperatures and pressures and is sometimes found as an inclusion in diamond.

**coin silver** An alloy consisting of 9 parts fine silver and 1 part copper. Used for USA silver coins.

**colemanite** A collector's stone comprising the mineral hydrous calcium borate. $Ca_2B_6O_{11}.5H_2O$. Monoclinic. R.I. 1.586, 1.614;

D.R. +0.028; S.G. 2.42; H. 4½. Translucent, colourless to milk white. Occurrence: USA.

**collet** See ***culet.***

**collet** The metal rim (on a ring shank or on a piece of jewellery) in which a gemstone is set.

**collimate** To make divergent or convergent rays parallel.

**collimator** A lens system used to align divergent rays (from a point source) into a parallel path. A collimating lens is included in the design of the hand spectroscope, and exists as a separate unit in the table spectrometer or goniometer.

**colloid** A finely divided substance forming a viscous solution or semi-solid jelly.

**Colorado diamond** A misleading name for a transparent smoky quartz.

**Colorado goldstone** Aventurine quartz.

**Colorado jade** A misleading name for green microcline feldspar.

**Colorado ruby** A misleading name for pyrope garnet.

**Colorado topaz** A misleading name for the citrine variety of quartz.

**colorimeter** An instrument for measuring the colour of a specimen. This is usually done by measuring the intensity of the red, green and violet light transmitted by (or reflected from) the specimen via colour filters (the results approximating the CIE tristimulus values). Tristimulus values are generally converted into the *x,y* co-ordinates of the CIE system. See ***diamond colorimeter*** and ***visual colorimeter.***

**colour blindness** See ***defective colour vision.***

**colour centres** Colour in some gemstones is caused by defects in the crystal produced either by irradiation (e.g. diamond and zircon) or by the presence of impurity atoms within the lattice structure (e.g. dispersed nitrogen in yellow cape series diamonds). These lattice defects are known as colour centres.

**coloured diamonds** See ***diamond.***

**colour grading** The criterion used for the colour grading of cape and brown series polished diamonds is the degree of freedom from colour when viewed under specified conditions. See ***Colour Grading Standards*** in Appendix B.

For coloured gemstones, the criteria are hue, colour saturation, brightness and colour purity (i.e. freedom from contaminating colours). See ***diamond colorimeter, spectrophotometer*** and ***visual colorimeter.***

**colour temperature** The effective temperature of a light source (compared with an incandescent source) which determines its emission spectrum. A light source having a colour temperature of 4000 K will have its maximum output towards the red end of the

spectrum and will be deficient in violet. Sources with colour temperatures of 5000 K and 6000 K will have a more balanced visible emission spectrum.

**colour zoning** The distribution of colour in a gemstone. Colour zoning forms an important identification feature with natural and flame-fusion sapphires. The zones of colour in natural sapphires are straight and parallel. In synthetic flame-fusion sapphires the zones are curved and concentric.

**columbite** A tantalate and niobate (niobium is also called columbium) of iron, related to samarskite. S.G. 5.2-8.0; H. 6. Opaque, black with a semi-metallic lustre.

**columnar** A crystalline structure composed of a series of slender prisms. When these are very slender the material is called fibrous.

**colza oil** See ***rape seed oil.***

**commercial white** A UK colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**common opal** An opal without iridescence (potch opal).

**complementary colour** Gemstone colours are the result of the gem absorbing part of the spectrum of the white light passing through it (or reflected off its surface). If yellow is absorbed, the stone will appear to be coloured with the complementary colour violet. Conversely, if violet is absorbed the stone will appear yellow. If blue/green is absorbed the complementary colour red will result.

**compound microscope** The standard modern microscope in which magnification is carried out in two stages, first by the objective lens and then by the eyepiece lens or ocular. See ***magnifiers.***

**composite stones** Except for opal doublets and triplets, these stones are made for the purpose of deception. Common forms are doublets in which the crown can be of the gem mineral being faked, and the pavilion of a cheaper material such as quartz or coloured glass. Many doublets were produced in Victorian times in which a thin crown section of garnet was fused to a coloured glass pavilion (known as a garnet-topped doublet or GTD). Triplets, such as *soudé emerald,* consist of a crown of quartz, synthetic white spinel or colourless beryl, with a quartz or synthetic spinel pavilion. The colouring element completing the triplet consists of a thin layer of gelatine or sintered glass (or, in the case of an alexandrite simulant, a colour filter), which is fused or cemented between the crown and pavilion sections. Opal doublets are formed from a thin top layer of precious opal and backed by common opal or plastic, the latter being hidden by the mount. Opal triplets are formed by cementing a dome of clear quartz to the thin top layer of the opal doublet. *Figure C.5.*

**compound** A chemical combination of two or more elements. Unlike a simple mixture of elements, a chemical combination is

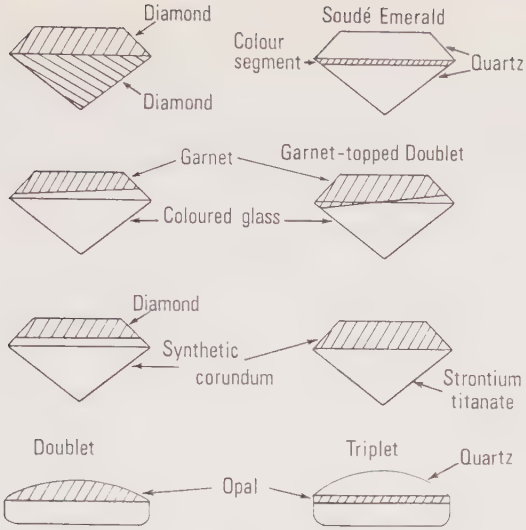



*Figure C.5* A selection of composite stones.

accompanied by the absorption or emission of heat, and the properties of the resulting compound may be quite different to those of the constituent elements (e.g. the chemical combination of hydrogen and oxygen to form water).

**comptonite** See ***thomsonite.***

**conchiolin** The dark brown organic substance secreted by molluscs and forming the outer coating of their shells. Pearls consist of approximately 12% of conchiolin.

**conchoidal fracture** See ***fracture.***

**conchology** The study of shells and shellfish.

**conglomerate** Water-worn fragments of rock cemented into a sedimentary mass (e.g. pudding stone).

**Congo emerald** A misleading name for dioptase.

**Congo ivory** A misleading name for an ivory simulant manufactured in South Africa.

**Connemara marble** A serpentine variety of marble (also known as verde-antique). See ***ophicalcite.***

**contact angle** See ***water contact angle.***

**contact liquid** The liquid used to make a good optical contact between the test surface of the critical angle refractometer prism and the facet of the gemstone under test. To maintain the full measuring range of the refractometer, the R.I. of the contact liquid must not be lower than the maximum scale reading. The standard liquid (devised by B. W. Anderson and C. J. Payne) is a solution of sulphur and tetraiodoethylene in methylene iodide

(R.I. 1.81). With extended range refractometers (i.e. blende and diamond prism versions), West's solution is used. This has an R.I. of 2.05, and consists of an 8:1:1 mixture of yellow phosphorus and sulphur in methylene iodide. Because of the presence of phosphorus in the mixture, the dried residue is spontaneously combustible, and the liquid must therefore be handled with care. An alternative, which, while easier to prepare, is still dangerous, consists of selenium bromide in methylene iodide.

**contact metamorphism** The metamorphic alteration of pre-existing rock induced by thermal contact with intrusive molten rock magma. A feature of contact metamorphism is the development of successive zones round the intrusion.

**contact twin** A crystal whose two halves have grown with one half rotated through 180° to the other. In diamonds a contact twin is called a *macle.* Repeated twinning produces a *lamellar* structure. See ***interpenetrant twins, parallel growth*** and ***polysynthetic twinning.***

**contemporary inclusion** See ***inclusions.***

**contra luz** A rare variety of opal from Brazil which resembles a water opal with a slightly bluish milkiness. Its play of colour is visible both by transmitted and reflected light.

**copal** A 'young' tree resin, sometimes used as a simulant for the fossil resin, amber. Although copal resin has constants similar to those of amber, unlike amber it is softened by ether, and crumbles easily under a knife blade. Also called kauri gum.

**copper** One of the eight transition metals which are mainly responsible for colour in gemstones. Cu. Stones coloured by copper include malachite, turquoise, dioptase and synthetic green sapphire. Atomic number 29; atomic weight 63.57; melting point 1083°C; S.G. 8.93.

**copper emerald** A misleading name for dioptase.

**copper lapis** A misleading name for azurite.

**copper pyrite** See ***chalcopyrite.***

**coque de perle** An imitation pearl (resembling a blister pearl) which is cut from the central whorl of the nautilus shell. Because of the thinness of the shell, it is usually filled with wax or a cement to strengthen it.

**coral** A branching plant-like structure formed by the skeletal remains of various types of marine polyp, and consisting mainly of fibrous calcite. $CaCO_3$. R.I. 1.486, 1.658; D.R. −0.172; S.G. 2.6-2.7 for white and pink varieties; 1.34 for the black variety; H. 3½. Occurrence: In shallow sub-tropical waters around the coastlines of the Mediterranean, Australia, Japan, Malaysia, the Persian Gulf. Varieties: white, pink ('angel skin'), red, black.

**coral agate** See ***fossil coral.***

**coralline** Trade name for a red-dyed chalcedony.

**coralline marble.** A fossil marble containing various corals. See ***red ogwell marble*** and ***petoskey stone.***

**cordierite** A complex silicate of magnesium and aluminium, also called iolite and dichroite. $Mg_2Al_4Si_5O_{18}$. Orthorhombic. R.I. 1.53, 1.54 to 1.54. 1.55; D.R. −0.008 to −0.012; S.G. 2.57-2.61; H. 7-7½. Transparent to translucent, blue. Pleochroism, strong (light blue, dark blue and yellow). Occurrence: Brazil, Burma, India, the Malagasy Republic, Namibia, Sri Lanka, Tanzania.

**cornelian** See ***chalcedony.***

**cornish diamond** A misleading name for the rock crystal variety of quartz.

**coro pearl** Trade name for an imitation pearl.

**corozo nut** The fruit grown by the Ivory palm. As the nut matures it develops a hard white kernel which provides a source of vegetable ivory. R.I. 1.54; S.G. 1.40-1.43; H. 2½. Occurrence: Colombia, Peru.

**corundolite** Trade name for a synthetic spinel diamond simulant.

**corundum** An aluminium oxide. $Al_2O_3$. Trigonal. R.I. 1.764, 1.772; D.R. −0.008; S.G. 3.96-4.01; H. 9. Varieties: *Ruby* (red); *Sapphire* (colourless, blue, pink, orange, yellow, green, purple). Also star rubies and sapphires (asterism caused by rutile needles). Pleochroism: ruby, strong (deep red, yellowish-pink); blue sapphire, medium (blue, pale greenish-blue); none in yellow sapphire, in other colours second ray has a yellowish tint. Occurrence: Ruby from Burma, Sri Lanka, Tanzania, Thailand. Sapphire from Australia, Burma, Cambodia, Kashmir, Sri Lanka, Thailand, USA.

**Cotham marble** A light grey marble with dark brown dendritic markings resembling trees. Also known as landscape marble. Occurrence: Cotham, England.

**craquelées** A cracked rock crystal.

**crater glass** A natural glass, associated with meteor craters, consisting of approximately 90% silica. R.I. 1.46-1.54; S.G. 2.10-2.31. Slaggy, white, greenish-yellow or black. See also ***queenstownite.***

**creedite** A rare collector's stone comprising a complex hydrated aluminium fluorine calcium sulphide. Monoclinic. R.I. 1.460-1.485; D.R. −0.025; S.G. 2.71; H. 3½. Transparent to opaque, white, purple. Occurrence: USA.

**creolin** A variety of brecciated jasper.

**creolite** A red and white banded jasper from California, USA.

**crescent vert** Trade name for a synthetic emerald produced by the flux-melt process. R.I. 1.564, 1.568; D.R. −0.004; S.G. 2.66.

**Cretaceous** A rock system on the earth's surface comprising the

rocks laid down during the Cretaceous period, 135-65 million years ago. The Cretaceous period is the last part of the Mesozoic era. See ***Mesozoic.***

**crispite** A quartz or agate with green hair-like inclusions.

**cristobalite** A form of quartz found as sub-microscopic spheres in precious opal. See ***opal*** and ***sheen*** (iridescence).

**critical angle** (of total reflection) The incident angle at which a ray of light, travelling from a denser medium into a rarer one, is refracted at 90° to the normal and travels along the interface between the two media. *Figure C.6.* At angles greater than the

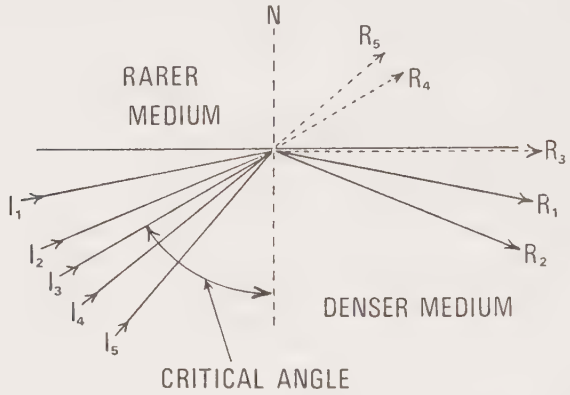



*Figure C.6* Light rays meeting a rarer medium at angles greater than the critical angle are totally reflected ($I_1$,$R_1$ and $I_2$,$R_2$). At the critical angle, the ray $I_3$ is refracted along the interface of the media. At angles less than the critical angle, the rays are refracted into the rarer medium ($I_4$,$R_4$ and $I_5$,$R_5$).

critical angle the ray is reflected (see ***law of reflection***) from the interface; at angles less than the critical angle the ray is refracted into the rarer medium (see ***law of refraction***). The phenomenon of critical angle is made use of in the *critical-angle refractometer,* and is an important factor in the optics of many gemstone cuts (e.g. the brilliant cut).

$$\text{Critical angle} = \text{arc sine } \frac{\text{R.I. of rarer medium}}{\text{R.I. of denser medium}}$$

See ***refractometer.***

**crocidolite** A quartz pseudomorph of blue asbestos, better known as tiger's eye. As this is also the name given to the blue variety of the original asbestos mineral, the quartz pseudomorph is more correctly called pseudocrocidolite. See ***quartz.***

**crocidolite opal** A chatoyant opal with included crocidolite.

**crocoite** A collector's stone comprising the mineral lead chromite.

$PbCrO_4$. Monoclinic. R.I. 2.31, 2.66; D.R. +0.35; S.G. 5.9-6.1; H. 2½-3. Transparent to translucent, red, orange. Occurrence: Brazil, Romania, Tasmania, USA, USSR.

**crocus** An iron oxide polishing powder.

**cross cut** See ***scissors cut.***

**cross cutter** The name given to the diamond cutter who grinds the table facet, the sixteen main crown and pavilion facets and the culet. Also called a blocker.

**cross facets** See ***break facets.***

**crossed filters** Chromium-rich gemstones often fluoresce red when irradiated with blue light. B. W. Anderson adapted the technique of crossed filters to make use of this phenomenon for gem identification purposes. Crossed filter equipment (*Figure C.7*)

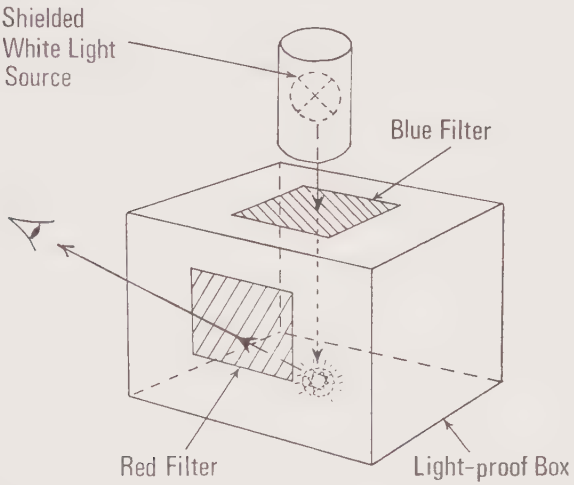



*Figure C.7* Sketch illustrating the use of crossed filters to verify luminescence.

consists of a strong source of white light, a blue filter (which can be a flask of copper sulphate solution) and a red filter. If, when viewed through the red filter, the specimen is seen to glow red, then it must be fluorescing. The effects are commonly far brighter than those seen under ultra-violet light.

**cross work** See ***blocking.***

**cross stone** Name given to twinned crystals of staurolite (also called 'fairy stone') and the chiastolite variety of andalusite.

**crown** The section of a polished gemstone above the girdle. Also called the bezel.

**crown angle** The angle between the plane of the girdle and the crown facets. See ***brilliant cut.***

**crown glass** A group of glasses which have no lead oxide in their composition. See also ***flint glass*** and ***Bannister's graph.***

**crown height** The perpendicular distance between the plane of the girdle and the plane of the table facet, measured as a percentage of the girdle diameter. See ***brilliant cut.***

**crown jewels** Trade name for a synthetic corundum diamond simulant.

**crusite** See ***andalusite*** (chiastolite).

**cryolite** A sodium aluminium compound, $Na_3(AlF_6)$, sometimes found as a crystal in three-phase inclusions in topaz.

**cryptocrystalline** A crystalline material composed of an aggregate of microscopic crystals or crystalline fibres. Such materials are always massive in habit, and are generally semi-translucent or opaque.

**crystal axes** Imaginary lines of reference which pass through the centres of crystal faces (or edges) to meet at a point inside the crystal called the *origin.*

**crystal lattice** Structure formed by the regular three-dimensional arrangement of atoms and molecules in a crystal.

**crystalline** A term used to describe a substance in which the atoms and molecules are aligned in a regular and symmetrical three-dimensional pattern. In most instances, this underlying symmetrical structure makes itself visible in the external shape of the rough specimen. The most important feature possessed by a crystalline substance (and absent from an amorphous one) is that many of its physical properties vary with the orientation of the crystal.

**crystallography** The science of crystal structures.

**crystal systems** Crystals can be grouped into seven basic crystal systems: *Cubic, tetragonal, hexagonal, trigonal, orthorhombic, monoclinic* and *triclinic.* These crystal systems are defined in terms of imaginary lines of reference called crystal axes, and by their elements of symmetry. See ***axis of symmetry, elements of symmetry,*** and the seven crystal systems under their respective names.

**CSO** See ***Central Selling Organisation.***

**cubic system** A crystal system (also called isometric) having the highest order of symmetry of all the seven systems. The cubic system has three axes, all of which are of equal lengths and intersect each other at right-angles. There are thirteen axes of symmetry (six two-fold, four three-fold and three four-fold), nine planes of symmetry and a centre of symmetry. *Figure C.8.*

**cubic boron nitride** See ***amber boron nitride*** and ***borazon.***

**cubic zirconium oxide** A man-made diamond simulant introduced in 1976. $ZrO_2$. Cubic. R.I. 2.09-2.18; S.G. 5.54-6.0; H. 8

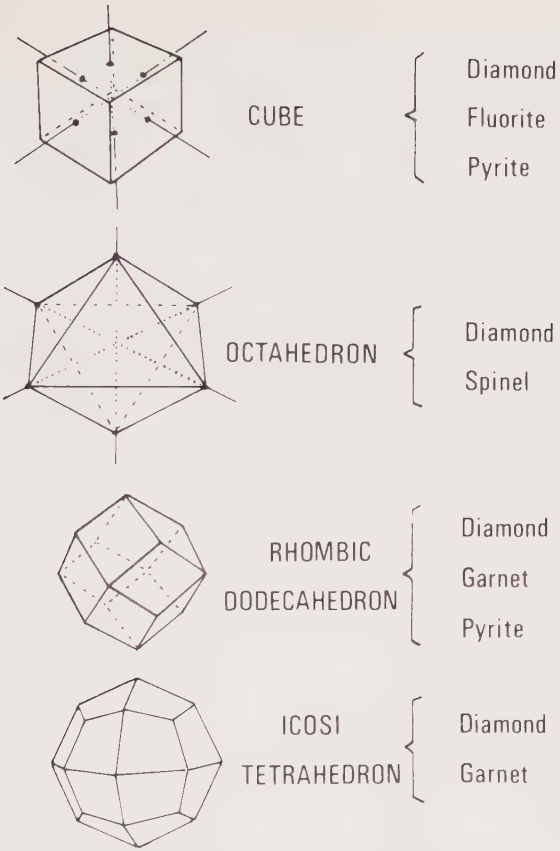



*Figure C.8* The cubic crystal system.

(constants vary with proportion of stabiliser). Colourless and various colours (pink, orange, red, yellow, green, purple) produced by the addition of rare-earth and transition metal oxides. Crystals are grown by the 'skull crucible' process and stabilised in the cubic crystal system by the addition of calcium oxide or yttrium oxide.

**culet** A small facet cut at the pointed junction of the pavilion facets to prevent damage to the otherwise vulnerable tip.

**Cullinan** The largest rough diamond ever found was discovered in a side wall of the Premier mine near Pretoria in South Africa. Weighing 3106 carats the Cullinan (also known as the Star of Africa) was cut into nine major stones and 96 smaller ones. Of the major stones, the 530.2-carat Cullinan I is a pear-cut stone and is mounted in the Royal Sceptre of the British Crown Jewels (it is the

largest cut diamond in the world). The 312.4-carat Cullinan II is a cushion-cut stone which is set in the British Imperial State Crown.

**cultured pearl** A pearl which was initiated by the manual insertion into the pearl mollusc of an artificial nucleus, usually in the form of a mother-of-pearl bead. S.G. 2.72-2.78. See ***Biwa pearls*** and ***mabe pearls.***

**cuprite** A collector's stone comprising the mineral red copper oxide. $Cu_2O$. Cubic. R.I. 2.85; S.G. 5.85-6.15; H. 4. Transparent to opaque, carmine red. Occurrence: World-wide. Gem quality crystals from Namibia and New Mexico, USA.

**cupellation** A method of refining (or assaying) gold and silver. The metal is heated with lead on a porous block. The lead melts and carries with it into the block all the base metal impurities.

**cushion cut** See ***antique cut.***

**cushion crystals** Rough diamond crystals having a flattened cushion shape. See ***bolster crystals.***

**cut** The criteria by which a polished diamond is graded for its proportions, facet angles and overall symmetry as compared with those of the ideal cut (e.g. Scan DN or Tolkowsky proportions). Also called the diamond's *make.*

**cuts of gemstones** See ***antique cut*** (cushion), ***brilliant cut*** (round, marquise/navette, oval, pear-shape), ***baguette*** (baton), ***cabochon, emerald cut*** (trap), ***rose cut*** (Antwerp rose/Brabant) and ***scissors cut*** (cross).

**cuvette** Small glass or plastic container, sometimes used as an immersion cell.

**cyanite** See ***kyanite.***

**cyclotroned diamonds** See ***treated diamonds.***

**cymophane** See ***chrysoberyl.***

**cyprine** A blue variety of idocrase.

**cyst pearl** A pearl which has formed within the body of the pearl mollusc and is spheroid in shape. See ***blister pearl.***

**Czochralski process** A method of growing synthetic crystals in which a seed crystal is dipped into a heated crucible containing the molten source material, and is then very slowly raised out of the melt at a carefully controlled rate. The molten source material crystallises on the seed and grows downwards as it is 'pulled' out of the crucible. Used to grow rare-earth garnets, synthetic alexandrite, lithium niobate and synthetic scheelite.

## D

**dallasite** A green and white variety of jasper from Vancouver Island, Canada.

**damonite** Trade name for the diamond simulant synthetic rutile.

**damburite** Trade name for synthetic pink corundum.

**danburite** A misleading name for synthetic yellow corundum.

**danburite** A calcium boro-silicate. $CaB_2(SiO_4)_2$. Orthorhombic. R.I. 1.630, 1.636; D.R. −0.006; S.G. 3.0; H. 7. Transparent, colourless, pale yellow, pink. Occurrence: Burma, Japan, the Malagasy Republic, Mexico, USA.

**daourite** A red tourmaline.

**dark brown** A colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**dark cape** A colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**dark-field illumination** Illumination in which the light is directed sideways into the specimen, and there is no direct light path between the source of illumination and the eye. For both hand lens and microscope inspection of gemstones, this is the preferred method of illumination when viewing internal features such as inclusions, and enables these features to be seen clearly against the dark background of the gem. See also ***incident illumination*** and ***light-field illumination.***

**Darwin glass** Also called Queenstownite, this is a natural glass. Amorphous. R.I. 1.47-1.50; S.G. 2.27-2.29. Transparent to opaque, colourless, yellowish-green, olive-green, black. Occurrence: Tasmania.

**datolite** A collector's stone comprising the mineral calcium boro-silicate. $Ca(B,OH)SiO_4$. Monoclinic. R.I. 1.625, 1.669; D.R. −0.044; S.G. 2.90–3.00; H. 5-5½. Transparent to opaque, colourless, pale yellow or green, milk white (cut as cabochon). Occurrence: Austria, Canada, England, USA.

**dauphine diamond** A misleading name for the rock crystal variety of quartz.

**De Chaulnes' method** (of R.I. measurement) See ***direct method.***

**decraqueler** A method of 'healing' cracks in the surface of pearls by soaking them in warm olive oil (warning — pearls tend to turn brown when heated to around 150°C).

**defective colour vision** Known as colour blindness, one common form is an insensitivity to those wavelengths in the red longer than 680 nm (normal vision extends to 750 nm). In another type of deficiency, red and green produce the same sensation as yellow. Under poor lighting conditions these effects become more marked.

**De la Mar pearl** Trade name for an imitation pearl.

**delatynite** A Romanian variety of amber.

**delawarite** An aventurine feldspar found in Delaware, USA.

**delta pearls** Trade name for an imitation pearl.

**demantoid** A green variety of andradite garnet.

**dendritic** A term used to describe the 'branching' or fern-like type of inclusion as seen in moss agate. Also used to describe the branching habit of some minerals.

**density** The density of a substance is defined in terms of its mass per unit volume (it should not be confused with specific gravity, which is the ratio of a substance's mass compared with the mass of an equal volume of pure water at 4°C). The international SI units chosen for density measurement are the kilogram and the cubic metre ($kg/m^3$). Using these units, the density of diamond is 3520 $kg/m^3$ (S.G. of diamond is 3.52). See ***specific gravity*** and ***relative density.***

**density bottle** Also called a specific gravity bottle, this provides a means of accurately determining the specific gravity of a gemstone by using heavy liquids. The heavy liquids are first blended until the gemstone becomes freely suspended within the mixture. The S.G. of the liquid (and hence that of the gemstone) is determined by pouring the resulting mixture into the density bottle (the capillary channel in its stopper ensuring a complete fill) and then weighing the bottle. The weight of the liquid is found by substracting the weight of the empty bottle. The S.G. of the gemstone is calculated by dividing the weight of the liquid (in grams) by the internal volume of the bottle (in millilitres). This latter figure is usually engraved on the side of the bottle. *Figure D.1.*

**dentine ivory** Ivory derived from elephant tusks, the tusks of the walrus and the hippopotamus, the front teeth of the narwhal (a dolphin-like arctic whale) and, more rarely, the tusks of fossilised mammoths. Dentine ivory consists almost entirely of dentine, although enamel and other organic substances are associated with the complete tusk or tooth. R.I. 1.54; S.G. 1.7-2.0; H. 2-3.

**derbyshire spar** A variety of fluorspar.

**desert amethyst** A misleading name for solarised glass.

**detritus** Debris produced from rocks by wearing action, i.e. gravel, sand and silt.

**deuterium** A heavy isotope of hydrogen having a neutron as well as a proton in its nucleus, which doubles its atomic weight to 2.

**Deutsche Gemmologische Gesellschaft** Headquarters: 6580 Idar-Oberstein 2, Gewerbehalle, Postfach 2260, West Germany.

**Devonian** A rock system on the earth's surface comprising the rocks laid down during the Devonian period, 395-345 million years ago. The Devonian period is part of the Palaeozoic era. See ***Palaeozoic.***

**dewpoint** The temperature at which the water vapour present is just sufficient to saturate the air fully. At temperatures below the dewpoint, condensation occurs.

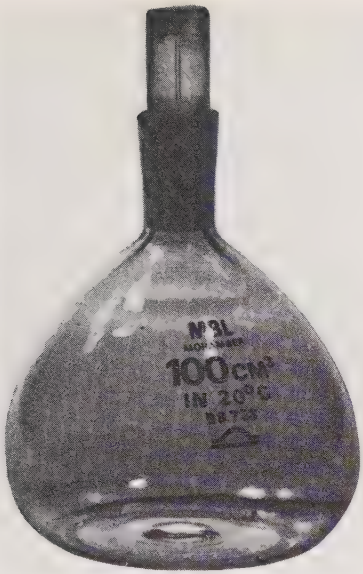



*Figure D.1* Density bottle. (Baird and Tatlock)

**DGemG** See ***Deutsche Gemmologische Gesellschaft.***

**diadem** A plain or gem-set headband or crown.

**diagem** Trade name for the man-made diamond simulant strontium titanate.

**diakon** Trade name for a transparent acrylic resin plastic sometimes used for imitation gems.

**dialite** Trade name for a diamond simulant doublet comprising a synthetic spinel crown and a strontium titanate pavilion.

**diamagnetism** See ***magnetism.***

**diamanite** Trade name for the man-made diamond simulant yttrium aluminium garnet.

**diamanté** Colourless glass gems used to decorate fabrics. Also a term for jewellery set with glass imitation stones.

**diamantiferous** Diamond-containing material.

**diamite** Trade name for the man-made diamond simulant yttrium aluminium garnet.

**diamogem** Trade name for the man-made diamond simulant yttrium aluminium garnet.

**diamonair** Trade name for the man-made diamond simulant yttrium aluminium garnet.

**diamonaura** Trade name for the man-made diamond simulant yttrium aluminate.

**diamon-brite** Trade name for the man-made diamond simulant yttrium aluminium garnet.

**diamond** Crystalline carbon. C. Cubic. R.I. 2.417; S.G. 3.52; H. 10. Transparent, colourless and shades of yellow (cape series), brown and green; also rare 'fancy' shades of pink, orange, yellow, brown, blue, green. Industrial diamonds are of poor colour and quality, and are often micro-crystalline (See ***boart***). Occurrence: Australia, Brazil, China, India, Southern Africa (including Namibia), USSR. See ***type I diamond, type II diamond*** and ***lonsdaleite.***

**diamond bourse** See ***bourse.***

**diamond colorimeter** An instrument for colour grading polished diamonds. The American Gem Society *Shipley colorimeter* (no longer manufactured) and the Eickhorst *Diamond-Photometer* both assess the yellowness of a diamond by measuring the ratio of its light transmission in the yellow and in the blue. The Okuda DC-530A measures a diamond's absorption in the blue and red by means of an integrating sphere. All of these instruments are more correctly described as filter-photometers. Before testing, diamonds are checked for fluorescence, as blue fluorescing stones (which appear whiter under normal lighting) will give incorrect readings. *Figure D.2.*

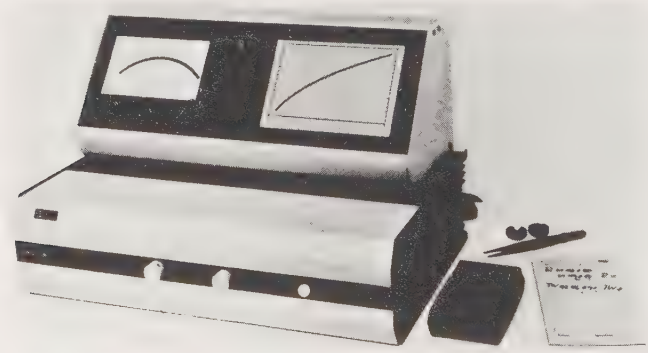


*Figure D.2.* The Diamond-Photometer uses the ratio of yellow and blue light transmission to measure the depth of colour in cape series polished diamonds. (Eickhorst and Co.)

**diamond-cut** Term used by lapidaries to describe brilliant-cut gemstones other than diamond.

**diamond cutter** Any craftsman employed in the sawing, bruting and polishing of diamonds.

**diamond gauge** A stencil gauge consisting of a thin sheet of metal or plastic containing a series of holes marked in carat weights. The

weight of a diamond is estimated by finding the hole which just fits over the girdle of the brilliant-cut stone. A more sophisticated version, designed by Dr E. Gübelin in 1946, enabled the cut of a diamond to be assessed by providing the means for measuring the angles and proportions between the girdle, the pavilion and the crown. This was later superseded by the GIA Proportionscope. See also ***caliper gauge.***

**diamond grading** The classification of polished diamonds by *colour, clarity, cut* and *carat* weight (i.e. the four Cs of diamond grading). See ***grading standards*** in Appendices B, C and D.

**diamond grading lamp** A lamp designed to provide a diffused illumination matching that of north daylight. The colour temperature of these lamps is usually in the region of 5000-6200 K. Some lamps are fitted with a LW UV tube so that any fluorescence in the diamond can be detected. See also ***grading lamp*** and *Figure 7* in Appendix B.

**diamond identification tests** See ***breath test, dot-ring test, fingerprinting, light spill test, reflectivity meter, thermal conductivity diamond tester, water contact angle*** and ***X-ray diamond tester.***

**diamondiferous** Diamond-containing material.

**diamondite** Trade name for colourless synthetic corundum used as a diamond simulant.

**diamond mine** Usually associated with a diamond pipe, this initially takes the form of an open-cast operation with a spiral roadway cut down into the surrounding rock to provide access to the diamond-bearing kimberlite. When a certain depth is reached it becomes more economic to sink a shaft and to extract the kimberlite by driving shafts horizontally through the pipe. A completely different type of diamond mine exists along the desert coastline of southern Namibia, where diamonds are extracted from the gravels which lie up to thirty feet beneath the sand on ancient marine terraces. See ***kimberlite.***

**diamond paper** A folded paper container for diamonds, usually with an inner liner. See ***Stone Papers*** in Appendix E.

**diamond powder** Crushed diamond which is carefully graded for particle size (from one micron upwards) and used for sawing, grinding and polishing diamonds and other hard gemstones such as corundum. Also used as an industrial abrasive.

**diamond proportions** See ***brilliant cut*** and *Figure B.6.*

**diamond proportion scope** An optical instrument containing a graticule which enables the proportions and angles of a brilliant cut diamond to be checked. The graticule can either be printed on the face of a shadowgraph screen (*Figure D.3*), or can be part of a special microscope eyepiece.


*Figure D.3* The GIA ProportionScope is used to check the proportions and angles of a brilliant-cut diamond's crown and pavilion.

**diamond refractometer** See ***refractometer.***

**diamond simulant** A transparent colourless product having a superficial resemblance to diamond. Diamond simulants range from naturally-occurring colourless gemstones (e.g. white sapphire, zircon, topaz, quartz) to man-made materials (including glass), and composite stones. See ***cubic zirconium oxide, gadolinium gallium garnet, lithium niobate, strontium titanate, synthetic rutile, yttrium aluminium garnet, composite stones.***

**diamond sorting** The classification of rough (uncut) diamonds for

colour, quality (freedom from inclusions), shape and carat weight. See ***Sorting Standards*** in Appendix D.

**Diamond Trading Company** See ***Central Selling Organisation.***

**diamone** Trade name for the man-made diamond simulant yttrium aluminium garnet.

**diamonesque** Trade name for the diamond simulant cubic zirconium oxide manufactured by the Ceres Corporation of Waltham, USA.

**diamonette** Trade name for colourless synthetic corundum used as a diamond simulant.

**diamonflame** Trade name for colourless synthetic corundum used as a diamond simulant.

**diamonique I** Trade name for the man-made diamond simulant yttrium aluminium garnet.

**diamonique II** Trade name for the man-made diamond simulant gadolinium gallium garnet.

**diamonique III** Trade name for the man-made diamond simulant cubic zirconium oxide.

**diamonite** Trade name for the diamond simulant synthetic rutile.

**diamonte** Trade name for the man-made diamond simulant yttrium aluminium garnet.

**diamontina** Trade name for the man-made diamond simulant strontium titanate.

**diamontine** See ***aluminium oxide.***

**diamothyst** Trade name for the diamond simulant synthetic rutile.

**diarita** Trade name for a colourless doublet comprising a synthetic spinel crown and a strontium titanate pavilion.

**diaspore** A collector's stone, comprising the mineral aluminium hydroxide, which has a distinct colour change (greenish-brown in daylight to pinkish-brown under tungsten light). AlO(OH). Orthorhombic. R.I. 1.702, 1.750; D.R. +0.048; S.G. 3.35-3.40; H. 6½-7. Pleochroism, medium (pinkish-brown, green). Occurrence: Czechoslovakia.

**diasterism** A star effect produced by light passing *through* a gemstone rather than by being reflected from its surface. Rose quartz contains microscopic needles of rutile which produce the effect of diasterism when the gem is viewed against a light source in the correct direction.

**diatomic** See ***molecule.***

**diatomite** Also called 'fossil tripoli', this is a polishing powder made from the soft silica remains of diatoms (i.e. microscopic unicellular algae which form fossil deposits).

**dichroism** An optical property possessed by some coloured doubly-refracting gemstones in which the two refracted rays undergo differential selective absorption and emerge differing in

colour or in depth of colour. In uniaxial stones two colours or shades can occur, and in biaxial stones three colours or shades may be seen (trichroism). The general term covering all such effects is pleochroism. See ***differential selective absorption.***

**dichroite** See ***cordierite.***

**dichroscope** An instrument for detecting the presence of pleochroism in coloured doubly-refracting gemstones. The two polarised rays passing through the gemstone are separated (either by using a crystal of Iceland spar, or by using polarising filters) and presented side-by-side in the eyepiece to facilitate the detection of colour or shade differences. *Figure D.4.*

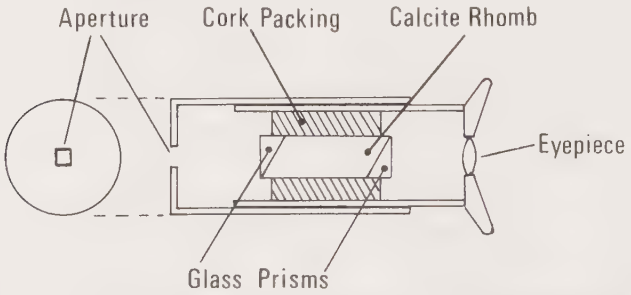



*Figure D.4* Diagram showing the construction of the prism-type dichroscope.

**didymium** Collective name for two rare-earths neodymium and praseodymium which are inseparable in nature. Didymium is present in yellow apatite. Neodymium oxide ($Nd_2O_3$) and praseodymium oxide ($Pr_2O_3$) are used as colour dopants to produce lilac and amber-coloured varieties of cubic zirconium oxide.

**differential selective absorption** In some coloured doubly-refracting gems, the light passing through the gem in the form of two polarised rays may emerge differing in shade or colour. When this happens the two rays are said to have experienced differential selective absorption (i.e. a different portion of the visible spectrum has been absorbed from each ray). The resulting effect is called pleochroism. See ***dichroism.***

**diffraction** The bending or fanning out of light rays when they pass through a narrow aperture. With a diffraction grating, the subsequent path-length-difference interference between the rays results in the production of a colour spectrum. See ***diffraction grating.***

**diffraction grating** An optical grating consisting of a series of fine parallel lines printed or engraved on the surface of a glass plate.

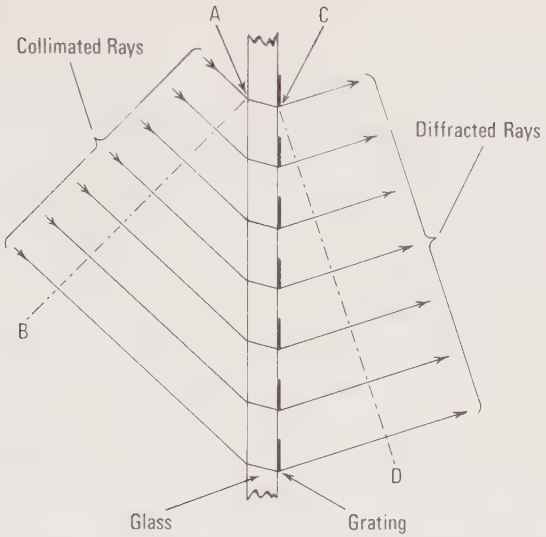



*Figure D.5* Sketch showing the diffraction of rays as they emerge from a diffraction grating. The resulting differences in path lengths (*AB* to *CD*) produce a spectrum by means of interference effects between the rays.

Collimated light rays passing through (or reflected from) the grating are dispersed into a spectrum by the mutual interference between the emerging rays. The pitch of the lines is in the order of 15000-30000 per inch. Diffraction gratings are used in some spectroscopes, and produce a spectrum which is evenly spaced out from red to violet (unlike the prism spectroscope where the spectrum, although brighter, is bunched at the red end and spread out at the violet end). *Figure D.5.* See ***spectroscope.***

**diffusion column** A glass column containing a diffused mixture of heavy liquids in which the specific gravity decreases progressively from the bottom to the top. Gemstones having specific gravities within the top and bottom limits of the column will settle at the appropriate level. This affords a rapid means of measuring the S.G. of individual stones in a mixed group.

**di-iodomethane** See ***methylene iodide.***

**dike** See ***dyke.***

**dimorphism** Term describing the ability of a mineral to crystallise in two different crystal systems (e.g. carbon crystallises in the hexagonal system as graphite, and in the cubic system as diamond).

**dinny bone** A fossilised dinosaur bone used as a carving material. Occurrence: USA.

**diopside** A calcium magnesium silicate. $CaMg(Si_2O_6)$. Monoclinic. R.I. 1.670, 1.700; D.R. +0.03; S.G. 3.29; H. 5½. Transparent to translucent, bottle-green; colourless, violet/blue, yellow and brownish stones are sometimes found. Occurrence: Austria, Brazil, Burma, the Malagasy Republic, South Africa, Sri Lanka, USA.

**dioptase** An emerald-green hydrous copper silicate. $Cu(SiO_3).H_2O$. Trigonal. R.I. 1.644, 1.697 to 1.658, 1.709; D.R. +0.053; S.G. 3.28-3.35; H. 5. Transparent to translucent, green. Occurrence: Chile, Namibia, USA, USSR, Zaire.

**dioptre** The power of a lens or mirror system which is expressed as the reciprocal of the focal length in metres.

$$\text{Power in dioptres} = \frac{1}{\text{focal length in metres}}$$

The power is positive for a converging lens and concave mirrors, and negative for a diverging lens and convex mirrors.

**diorite** Also called orbicular diorite, a decorative rock composed of feldspar, hornblende, biotite and quartz. Whitish-grey with circular black patterns. Also a greenish-black granular plutonic rock whose composition lies between that of acid rocks such as granite, and basic rocks such as gabbro.

**directional hardness** In some crystalline materials, hardness varies with the orientation of the crystal. Kyanite, for example, has a hardness of 4 in one direction, and a hardness of 7 at right-angles to this. With diamond, the hardest directions are parallel to the octahedral faces, and the softest direction is parallel to the axis of the crystal (i.e. the plane of the dodecahedral face).

**direct method** (of R.I. measurement) A method of approximating the refractive index of a transparent gemstone by measuring its apparent depth and dividing this into its real depth. These measurements can be made with a microscope fitted with a vernier focus scale (or a dial gauge attachment). The gemstone is mounted, table facet up, on a glass slide and focus readings are taken on the table (A) and the culet (B). The microscope is then focused onto the surface of the glass, and a third reading is taken (C).

$$\text{Refractive index} = \frac{C-A}{B-A}$$

*Figure D.6.*

**dirhem** An Iranian unit of weight equal to 72.88 carats. See also ***miscal.***

**dirigem** Trade name for synthetic green spinel.

**dispersion** Dispersion of white light occurs when it enters an optically denser or rarer medium (at an angle other than normal).

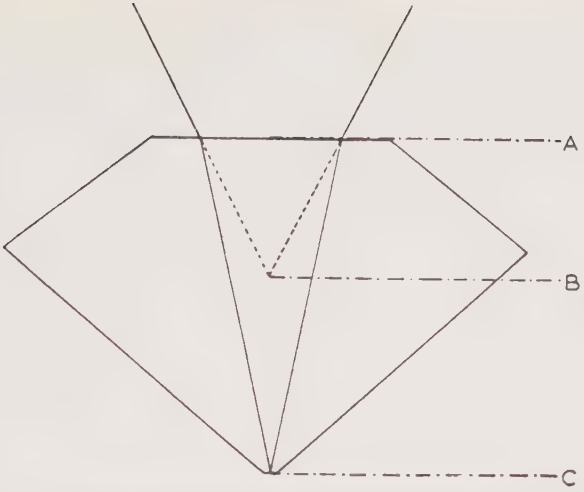



*Figure D.6* The principle of determining the refractive index of a gemstone by the 'direct method'.

The white light is split into its spectral colours, each of which is refracted by a different amount (red is refracted least, and violet most). Dispersion is the cause of the coloured 'fire' exhibited by diamond (*Figure D.7*). The dispersion of a gem is measured as the difference in its refractive index when this is measured at two selected wavelengths, one in the red and one in the violet. These two wavelengths are chosen as the B and G Fraunhofer lines. The B line is in the red at 687 nm, and the G line is in the violet at 430.8 nm. See ***Dispersion*** in Appendix F.

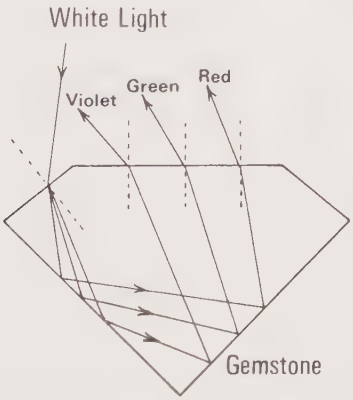



*Figure D.7* The white light entering a brilliant-cut diamond is dispersed into its spectral colours, and totally internally reflected as 'fire'.

**distant vision method** (of R.I. measurement) Also known as the 'spot method', this enables refractive index measurements to be made on the curved surfaces of cabochons. A drop of contact fluid is first placed on a flat surface. The smallest possible spot of contact fluid is then transferred to the centre of the curved cabochon surface by lightly touching the drop of contact fluid with the surface of the cabochon. Next, the cabochon is placed on the refractometer glass with its spot of liquid acting as an optical coupler. Finally, the refractometer scale is viewed with the eye positioned about 18 inches from the eyepiece. By careful movement of the line of sight it is possible to see the small contact liquid spot as a 'bubble'. If the line of sight is moved in line with the scale, this bubble will change from dark to light. When the bubble is exactly half light and half dark this will coincide on the scale with the R.I. reading for the cabochon. The Rayner Dialdex refractometer was designed to facilitate distant vision readings by removing the problem of focusing the eye on an internal scale. See ***refractometer.***

**disthene** See ***kyanite.***

**distrene** Trade name for a glass-like polystyrene synthetic resin.

**ditroite** See ***sodalite.***

**di' Yag** Trade name for the man-made diamond simulant yttrium aluminium garnet.

**djevalite** Trade name for the diamond simulant cubic zirconium oxide manufactured by Hrand Djevahirdjian SA of Monthey, Switzerland.

**dobo pearls** Pearls fished from the Aru islands north-west of Darwin, Australia.

**dodecahedron** A twelve-sided crystal in the cubic system. The rhombic dodecahedron has twelve rhomb- or lozenge-shaped faces.

**dolomite** A collector's stone comprising the mineral calcium magnesium carbonate. Also called pearl spar. $CaMg(CO_3)_2$. Trigonal. R.I. 1.502, 1.681; D.R. −0.179; S.G. 2.85-2.95; H. 3½-4½. Transparent, colourless, pastel colours. Occurrence: Australia, Brazil, Spain, USA.

**domeykite** A collector's stone comprising the mineral copper arsenite. S.G. 7.2-7.9; H. 3½-4. Opaque, tin-white to steel-grey (quickly tarnishes in air). Occurrence: Michigan, USA.

**dome** A form whose faces intersect the vertical axis and one horizontal axis, but are parallel to the third axis (e.g. the termination on a topaz prism).

**doom palm nut** The kernel of fruit from the doom palm providing a source of vegetable ivory. R.I. 1.54; S.G. 1.38-1.40; H. 2. Occurrence: Central and North Africa.

**dop** A device for holding a gemstone during sawing or faceting. It may be as simple as a metal cup (on the end of a rod) in which the stone is cemented or soldered, or it may be a mechanical claw-type clamp which grips the gem in the area of the girdle. More elaborate dops incorporate indexing devices which enables the stone to be rotated accurately to the appropriate facet angles. See *Figure T.1.*

**dot-ring test** A simple test which makes use of the total internal reflection characteristic of an unmounted brilliant-cut diamond (of ideal proportions) to distinguish it from its simulants. A small black pencil or ink dot is made on a sheet of white paper, and the suspect stone is laid table facet down so that the dot is positioned symmetrically under its culet. If the stone is a simulant having a significantly lower R.I. than diamond, the dot will appear as a black ring round the culet. If the stone is a diamond, a strontium titanate or a rutile, no ring will be visible (strontium titanate and rutile can be distinguished from diamond by their excessive dispersion or fire).

**double refraction** When a light ray enters a gem belonging to any crystal system but the cubic one, it is split into two rays which are plane polarised at right-angles to each other. These two rays travel through the gem at different velocities and are therefore refracted by different amounts. Gems which cause light to split into two polarised rays are called doubly-refracting, birefringent or anisotropic. See also ***ordinary ray, extraordinary ray*** and ***isotropic.***

**doublets** See ***composite stones.***

**dravite** A brown variety of tourmaline.

**drilling** An industrial diamond classification which includes stones below the quality of 'near gem' diamonds. These stones are mainly used for mounting in the heads of rock drills.

**druse** A rock cavity lined with crystals whose chemical composition is derived from the surrounding rock. See also ***geode*** and ***vug.***

**dry diggings** A diamond deposit based on a pipe source rather than an alluvial source. See ***wet diggings.***

**ductility** The pliability of a metal which allows it to be reduced in cross-section by being drawn or stretched under tension.

**dugong pearls** Imitation pearls made from the teeth of the sea cow.

**dullam** The concentrated Sri Lankan gem gravels which result from the initial washing operation.

**duluth agate.** An agate variety from Lake Superior, Canada.

**dumortierite** An ornamental stone consisting of a complex aluminium borate silicate, often found in gem quality impregnating quartz. $(Al,Fe)_7BSi_3O_{18}$. Orthorhombic. R.I. 1.686, 1.723; D.R. −0.037; S.G. 3.41; H. 8 (in quartz, R.I. 1.54-1.55;

S.G. 2.8-2.9). Opaque, dark blue, violet-blue and red-brown. Pleochroism, medium (black, deep red-brown, brown). Occurrence: Brazil (transparent bluish-green variety, R.I. 1.668, 1.688; D.R. —0.02; S.G. 3.35; H. 7½–8), Canada, France, USA.

**durangite** A collector's stone comprising the mineral sodium aluminium fluo-arsenate. $Na(Al,F)A_5O_4$. Monoclinic. R.I. 1.66, 1.712; D.R. —0.05; S.G. 3.97-4.07; H. 5. Transparent, orange-red. Pleochroism, strong (colourless, orange-yellow). Occurrence: Durango, Mexico.

**dust pearls** Very small seed pearls.

**Dutch rose cut** A flat-based cut with a pyramid crown consisting of triangular facets. Similar to the ***Antwerp rose,*** or Brabant, but with a higher pyramid. See also ***rose cut.***

**dyed gemstones** Many stones, such as turquoise, serpentine, opal, jadeite, nephrite and the chalcedony varieties have porous surfaces which are easily stained or dyed to enhance their appearance. As this treatment is not always permanent, such stones, if identified, should be described as dyed or treated.

**dyke** (US *dike*) A geological formation comprising a fissure in ancient rock strata which has been filled by the intrusion of igneous rock.

**dynagem** Trade name for the man-made diamond simulant strontium titanate.

## E

**ear shell** See ***abalone.***

**earth stone** Ancient name for amber.

**ebonite** Vulcanised rubber, used in Victorian times as a simulant for jet.

**eclogite** A pyroxene garnet rock found in South African diamond mines.

**edenite** See ***smaragdite.***

**edinite** See ***prase.***

**egeran** A Hungarian variety of idocrase.

**Egyptian alabaster** A banded stalagmitic marble found in Egypt.

**Egyptian pebbles** Jasper pebbles of variegated yellow and brown.

**Eickhorst diamond photometer** See ***diamond colorimeter.***

**eight cut** A simplified version of the 57-facet brilliant cut used for very small diamonds (below 2 mm girdle diameter). The table facet is surrounded by eight 4-sided crown facets, and the pavilion consists of eight triangular facets. Also called old English cut and single cut.

**eilat stone** A blue/green mottled stone consisting of the mineral chrysocolla intergrown with turquoise and malachite. Also known as elath stone. S.G. 2.8–3.2. Occurrence: Israel.

**ekanite** A metamict radioactive calcium thorium silicate. $K(Ca,Na)_2ThSi_8O_{20}$. Amorphous. R.I. 1.597; S.G. 3.28; H. 6–6½. Translucent, green, occasionally with asterism (4-rayed star). Occurrence: Sri Lanka.

**elath stone** See ***eilat stone.***

**elbaite** Pink lithium tourmaline from Elba and the USA (zoned 'watermelon' elbaite from Newry, Maine). Elbaite tourmalines may also contain potassium and sodium. They are predominantly pink, red or pale green, and include the majority of gem tourmalines.

**Elbe brilliant cut** A diamond cut developed by Dr M. G. Elbe which achieved extra brilliance by means of a deep faceted girdle.

**elco pearls** Trade name for an imitation pearl.

**el doradoite** A yellowish quartz from California, USA.

**eldoradoite** A blue chalcedony.

**electric emerald** A misleading name for a green glass emerald simulant.

**electro-conductivity** A property possessed by a few gemstones which are capable of passing an electric current if a voltage is applied across them (e.g. natural type IIb blue diamonds whose semiconductor characteristic is due to boron impurities; artificially-coloured blue diamonds do not possess electro-conductivity).

**electroforming** The building up of a metal form by electrolytically depositing metal onto a conductive matrix or template. See ***electroplating.***

**electroluminescence** A type of luminescence produced in some gemstones when an electric current is passed through them (e.g. natural blue diamonds).

**electromagnetic spectrum** This covers the broad range of radiated electromagnetic energy from very long-wave radio transmissions through the visible spectrum to the ultra-short wavelengths of X-ray, gamma and cosmic rays. *Figure E.1.*

**electron** A negatively charged stable particle of elementary matter which orbits the electrically positive nucleus of an atom, and also acts as a carrier of electricity.

**electron microprobe** An instrument used in gemmological research for the non-destructive analysis of gemstone constituents and inclusions. It consists of a vacuum chamber for the specimen, an electron gun, X-ray spectrometers and an inspection microscope. The gem to be analysed is positioned under the focused beam of electrons using the microscope. As the electrons hit the surface of

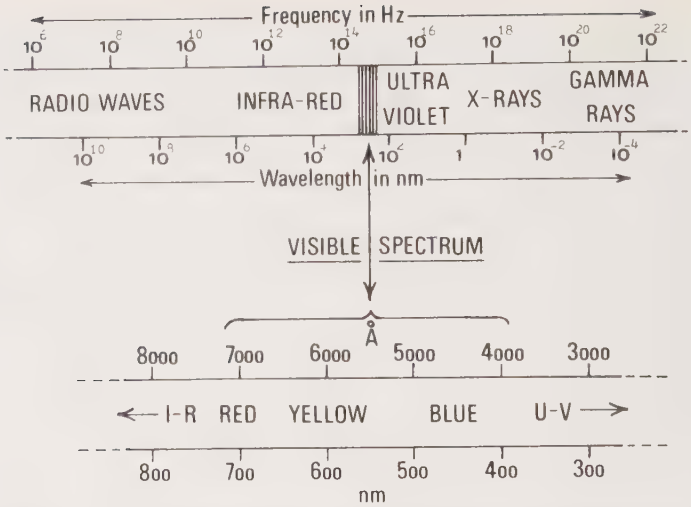



*Figure E.1* The electromagnetic spectrum, showing the wavelengths and relative position of the visible section.

the gem, X-rays are emitted, each constituent element in the bombarded area emitting X-rays at a characteristic wavelength. This X-radiation is detected and its wavelengths measured by the spectrometers. Tables of emission spectra are used to identify the elements responsible for the recorded X-radiation wavelengths.

**electron microscope** A microscope which uses electrons instead of light rays to scan or illuminate a specimen. The electrons are generated by a heated cathode and focused on the specimen in a vacuum chamber. The electrons scattered by the specimen are re-focused onto a fluorescent screen to produce an image of 25 000 to 250 000× magnification.

**electron spin resonance spectrometer** An instrument used in gemmological research for the non-destructive analysis of crystalline impurities. It consists of a powerful magnet assembly (containing the specimen holder), a microwave generator and detector, and a control unit. The spectrometer measures the magnetic resonance of defect elements in the specimen's crystal lattice by detecting the microwave energy absorbed by the elements at characteristic magnetic field strengths. The ESR spectrometer was used in De Beers Diamond Research Laboratory, Johannesburg to correlate the yellowness of diamonds with the amount of dispersed nitrogen in the crystal lattice. *Figure E.2.*

**electron-treated diamond** See ***treated diamond.***

**electron volt (eV)** The kinetic energy gained by an electron as it

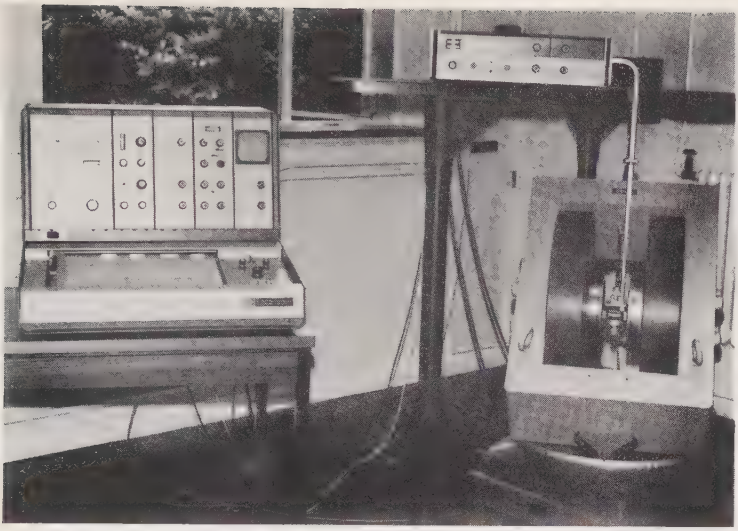


*Figure E.2* The Varian E109 electron spin resonance spectrometer (ESR). The magnet assembly is on the right-hand side with a microwave-guide leading up from the specimen cavity (between the magnet's pole pieces) to the microwave generator above it. (De Beers)

passes through a potential difference of 1 volt in a vacuum ($1\text{eV} = 1.6 \times 10^{-19}$ joules). This unit of photon energy is often used by physicists to specify wavelength. In this context, the visible spectral range of 400 nm–700 nm is equivalent to 3.10eV–1.77eV, i.e.

$$\text{wavelength in nm} = \frac{10\,000}{\text{eV} \times 8.006}$$

$$\text{eV} = \frac{10\,000}{\text{nm} \times 8.066}$$

See also ***wave number.***

**electroplating** The deposition of one metal on another by means of an electric current in a solution of a salt of the metal being deposited. The article to be plated, and an anode of the plating metal, are suspended in the solution, and a voltage applied across them. Silver is normally plated on copper or nickel, and gold is plated on silver. See ***electroforming.***

**electrum** Name given by the ancient Greeks to amber, from which the word electricity is derived. Also a natural alloy of gold and silver.

**element** A substance that cannot be changed by chemical means into a simpler substance. Elements which occur in nature range from hydrogen (the lightest) to uranium (the heaviest). Elements

normally exist in chemical combination with other elements. See ***compound*** and ***molecule.***

**elements of symmetry** See ***axis of symmetry, centre of symmetry*** and ***plane of symmetry.***

**elephant ivory** See ***dentine ivory.***

**elie ruby** A misleading name for pyrope garnet.

**elite pearl** Trade name for an imitation pearl.

**elixirite** A banded rhyolite from New Mexico, USA.

**ellandra pearls** Trade name for an imitation pearl.

**eluvial deposits** Deposits which are intermediate between residual or 'primary' deposits and alluvial or 'secondary' deposits. These deposits are usually of heavier minerals (diamond, gold, platinum) which have been weathered from their original rock outcrop, and carried a short distance downhill.

**embossing** The raising of a decorative design on the surface of a metal by means of a metal punch and a hammer. See ***chasing.***

**emerala** A synthetic yellow-green spinel.

**emerald** See ***beryl.***

**emerald-coated beryl** See ***Lechleitner emerald simulants.***

**emerald cut** A cut originally developed for emeralds. The cut was designed both to enhance the colour of emerald and to allow for its shock sensitivity by removing the otherwise vulnerable corners. The cut is also known as the step or trap cut, and is used additionally for diamonds and other gems. *Figure E.3.*

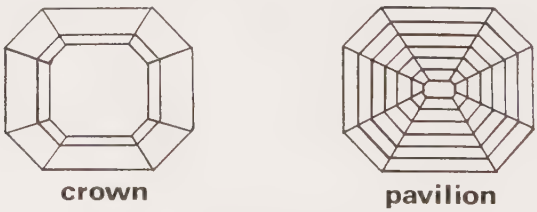



*Figure E.3* The emerald, trap or step cut.

**emerald filter** See ***Chelsea filter.***

**emeraldine** Trade name for dyed green chalcedony.

**emeraldite** A misleading name for green tourmaline.

**emerald malachite** A misleading name for dioptase.

**emerald matrix** A misleading name for green fluorspar.

**emeralite** A misleading name for pale green tourmaline.

**emerauldine** A misleading name for dioptase.

**emerita** Trade name for coated Lechleitner emerald simulants.

**emery** A coarse carborundum powder used for polishing.

**emildine** A South African spessartite garnet.

**emilite** A South African spessartite garnet.

**emission spectrum** A spectrum containing bright emission lines (as seen with a spectroscope). The bright lines are either characteristic of elements in an incandescent radiation source, or may be due to fluorescent effects (e.g. the emission lines seen in the spectrum of a fluorescent lamp or in chrome-rich red spinel). See also ***bright line spectrum.***

**enantiomorph** A crystal which has mirror image habits and optical characteristics, occurring in both right- and left-handed formations.

**encrinital marble** A marble with attractive mosaic-like markings produced by the fossilised remains of the stalks of crinoids (sea lilies). Occurrence: Derbyshire, England.

**endogenetic** A term applied to inclusions which were formed by or resulted from internal causes. See ***exogenetic.***

**endoscope** An optical instrument, now no longer available, designed for the identification of natural and cultured drilled pearls (medical versions are used to view internal organs). An

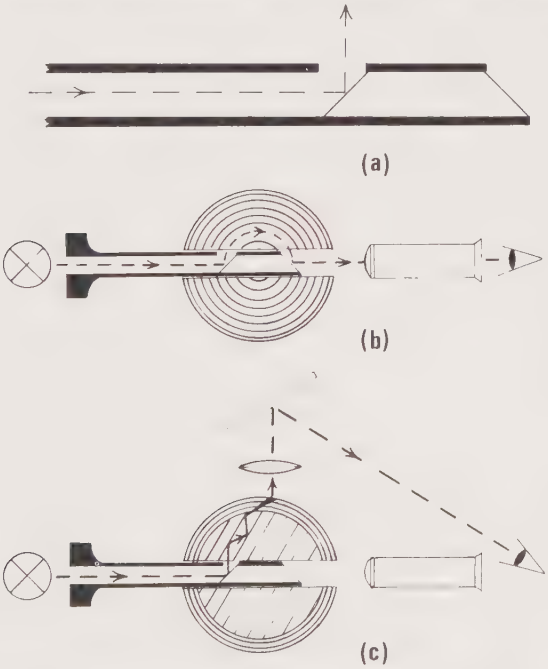



*Figure E.4* The construction of the needle section of the endoscope is shown at (a). A natural pearl is identified by its concentric layers, which channel light rays into the viewing telescope (b). Light escapes through the mother-of-pearl bead in a cultured nucleated pearl and can be seen as a line of light on the pearl's surface (c).

explanatory sketch, showing the main components of the pearl endoscope, can be seen in *Figure E.4.*

**endura emerald** A misleading name for a green glass simulant of emerald.

**enhydros** Also known as water agate, this is a cloudy-white chalcedony pebble containing sealed-in water. When an enhydros is shaken this water can be heard splashing in the cavity. Occurrence: Brazil, USA.

**enstatite** A magnesium-iron silicate. $(Mg,Fe)SiO_3$. Orthorhombic. R.I. 1.663, 1.673; D.R. +0.01; S.G. 3.26–3.28; H. 5½. Transparent to opaque, brownish-green, green, grey, bronze (called bronzite), grey-green cat's eye. Occurrence: Austria (bronzite), Burma, India (star enstatite), Norway, South Africa, Sri Lanka (cat's eye), USA.

**Eocene** A division of the Tertiary period of the Cenozoic era of geological time, 54–38 million years ago. See ***Cenozoic.***

**eosite** A close-grained carving quartzite of bluish-white colour with veins or splotches of brownish red. Occurrence: USSR.

**eosphorite** A collector's stone comprising a hydrated aluminium phosphate. $(Mn,Fe)AlPO_4(OH)_2.H_2O$. Monoclinic. R.I. 1.638, 1.667 to 1.639, 1.671; D.R. −0.029 to −0.032; S.G. 3.05; H. 5. Transparent, pale pink, yellow, yellowish-brown, brownish-pink. Pleochroism, strong in pink (yellowish, pale pink, colourless). Occurrence: Brazil.

**epiasterism** A star effect seen in reflected rather than transmitted light (e.g. in star rubies and sapphires). See also ***diasterism*** and ***sheen.***

**epidosite** See ***epidote.***

**epidote** A calcium aluminium silicate with some iron, also called pistacite. $Ca_2(Fe,Al,OH)Al_2(SiO_4)_3$. Monoclinic. R.I. 1.736, 1.770; D.R. −0.034; S.G. 3.4; H. 6½. Transparent to translucent, green, brownish-green, black-brown. Pleochroism, strong (green, brown, yellow). Occurrence: Austria, Mexico, Mozambique, Norway, USA.

**epigenetic inclusions** See ***inclusions*** (post-contemporary).

**Eppler brilliant cut** One of several 'ideal' cuts for diamond, mainly favoured in Europe. It has table facet width, crown depth and pavilion depth of 56%, 14.4% and 43.2% respectively compared with the girdle diameter. The crown angle is 33.17°, and the pavilion angle is 40.83°. See ***Johnson and Rösch brilliant cut, Parker brilliant cut, Scan DN brilliant cut*** and ***Tolkowsky brilliant cut.***

**Erb and Gray refractometer** The first gem refractometer to be designed and manufactured in the USA, this model had an eyepiece which pivoted to cover the scale range, and in its first

version was fitted with a rotateable glass hemisphere.

**erinide** Trade name for a sythetic yellow-green spinel.

**erinite** Trade name for a synthetic yellow-green spinel.

**erinoid** Trade name for a casein-based plastic sometimes used as an amber simulant.

**Erste Österreichische Gemmologische Gesellschaft** Headquarters: Graben 12, 1010 Vienna, Austria.

**essence d'orient** Paste made from the scales of a fish called a *bleak*. Imitation pearls made of glass or mother-of-pearl are dipped in the paste to give them a lustrous outer coating.

**essonite** A hessonite garnet.

**etching** The decoration of metal surfaces by means of controlled erosion achieved through the use of acids and alkalies. The metal surface is first coated with an etch-resistant layer (e.g. a resin or bituminous compound), and the decorative pattern is scratched through this layer prior to etching.

**etch pits** Pits or etch marks exhibited on the faces of crystals. These may be either raised or sunken features. They are due to solvent action on the crystal and are related in orientation to the underlying lattice structure (e.g. trigons on diamond crystals whose apices point to the edge of the octahedral face).

**ether** A colourless volatile liquid. $C_2H_5$-O-$C_2H_5$. Used as a test liquid to distinguish copal from amber. Copal is softened by ether, but amber is unaffected.

**ethylene dibromide** Liquid having a low surface tension which is sometimes used in place of water for specific gravity determinations by the hydrostatic weighing method. $C_2H_4Br_2$. (S.G. 2.1998 at 10°C; 2.1798 at 20°C). *Note: Care should be taken when using ethylene dibromide as it is a suspect carcinogenic liquid.*

**euclase** A collector's stone comprising the mineral beryllium aluminium silicate. $BeAl(SiO_4)OH$. Monoclinic. R.I. 1.652, 1.672; D.R. +0.02; S.G. 3.1; H. 7½. Transparent, colourless, pale green, pale blue, sapphire blue (rare). Occurrence: Brazil, Tanzania (colourless), USSR, Zimbabwe.

**euhedral** Term used to describe crystals having a well-formed characteristic shape.

**eureka can** A metal container, fitted with an overflow pipe, which is used to determine the specific gravity of solid specimens (method invented by Archimedes to assess the purity of gold). The container is first completely filled with water, and then the specimen is gently lowered into the can until it is fully immersed. The water displaced by the specimen through the overflow pipe is weighed and the S.G. of the specimen is calculated by dividing its weight by the weight of the water displaced.

**evening emerald** A misleading name for peridot.

**exceptional white** A CIBJO colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**exogenetic** A term applied to inclusions, which were formed by or resulted from external causes. See ***endogenetic.***

**extraordinary ray** Of the two polarised rays passing through a uniaxial crystal (i.e. one belonging to the tetragonal, hexagonal or trigonal crystal system), the extraordinary ray is the one whose velocity and associated R.I. ($\varepsilon$) varies according to its orientation in the crystal. When this ray produces a higher-value R.I. reading than the ordinary ray the gemstone is optically positive, when it produces a lower reading the stone is optically negative. See also ***ordinary ray*** and ***optic sign.***

**extrusive rock** An igneous rock formed by the rapid cooling of molten rock magma on the surface of the earth (e.g. volcanic rock).

**eye agate** A variety of agate having bands in the form of concentric circles or as ovals.

**eye stone** See ***thomsonsite.***

## F

**fabricated gemstones** See ***composite stones.***

**fabulite** Trade name for the man-made diamond simulant strontium titanate.

**facet** A flat surface polished on a gemstone.

**faceting head** A device for holding a gemstone while polishing it on a rotary lap or scaife. A faceting head may also include index stops for pre-setting the facet angles, and may form part of a semi- or fully-automatic faceting machine. See ***dop.***

**Fahrenheit temperature scale** A temperature scale used mainly for domestic purposes. The freezing point of water on this scale is 32 °F and its boiling point is 212 °F. To convert from the Fahrenheit to the Celsius (Centigrade) scale, subtract 32; then divide by 9 and multiply by 5.

$$C = (F-32) \times \frac{5}{9}$$

**faience** A glazed siliceous material (originating from ancient Egypt) used for beads, pendants and rings, and in decorated earthenware and porcelain. It consists of a gritty inner core, probably of powdered quartz or steatite, and an outer coating of coloured glaze.

**fairburnite** See ***fortification agate.***

**fairy stone** See ***staurolite.***

**falcon's eye** See *quartz.*

**fales** Any gemstone containing differently coloured layers.

**false amethyst** A misleading name for purple fluorspar.

**false chrysolite** A misleading name for moldavite.

**false cleavage** Also called pseudo-cleavage or parting, this occurs in gem minerals which, although they do not possess cleavage planes, have a direction of weakness called a parting plane. Parting is usually caused by secondary or lamellar twinning of the crystal, and occurs in ruby and labradorite.

**false diamond** A misleading name for the rock crystal variety of quartz.

**false emerald** A misleading name for green fluorspar.

**false lapis** A misleading name for lazulite or dyed jasper.

**false topaz** A misleading name for citrine or yellow fluorspar.

**falun brilliants** Trade name for lead glass or paste imitation stones.

**fancy coloured diamonds** See *diamond.*

**fancy cut** Any style of diamond cut other than the round brilliant or eight cut (e.g. emerald cut, marquise, oval, pear shape, heart shape, etc.)

**fancy pearls** Naturally coloured oriental pearls.

**fashoda garnet** A pyrope garnet.

**fatty amber** A type of amber which resembles goose fat owing to a cloudy appearance caused by included bubbles.

**fayalite** An iron silicate forming an end member of an isomorphous series containing peridot. $Fe_2SiO_4$. See *peridot.*

**feather** See *inclusions.*

**feather gypsum** Satin spar. See *calcite.*

**feldspar** A group of gem mineral species comprising orthoclase and microcline, $KAlSi_3O_8$ (monoclinic), and plagioclase $(Ca,Na)Al_2Si_2O_8$ (triclinic).

Varieties:.

*orthoclase* — adularia (transparent, colourless), moonstone (translucent, yellow and colourless with opalescence), orthoclase (transparent yellow). R.I. 1.520, 1.525; D.R. −0.005; S.G. 2.56-2.59; H. 6. Occurrence: Burma, India, the Malagasy Republic, Sri Lanka, USA.

*microcline* — amazonite (opaque green). R.I. 1.522, 1.530; D.R. −0.008; S.G. 2.56-2.58; H. 6½. Occurrence: Brazil, Canada, India.

*plagioclase* — andesine (opaque, jade-green), bytownite (reddish and pale yellow), labradorite (opaque, multi-coloured sheen and transparent yellow), albite moonstone (white, cream, fawn or brownish-pink with blue iridescence), oligoclase (transparent yellow), sunstone or aventurine feldspar (opaque to translucent, bronze or green spangled). R.I. 1.54, 1.55 to

1.56, 1.57; D.R. −0.01 (labradorite +0.008); S.G. 2.62-2.65; H. 6. Occurrence: Canada, USA, USSR.

**feldspar-apyre** A misleading name for andalusite.

**Fellow of the Gemmological Association** (FGA) A title awarded by the Gemmological Association of Great Britain to candidates who have passed the qualifying examinations. See ***Gemmological Association of Great Britain.***

**ferrer's emerald** A misleading trade name for a glass simulant of emerald. Also known as ferros emerald.

**ferric oxide** See ***jeweller's rouge.***

**ferrolite** Trade name for a black iron slag.

**ferros emerald** See ***ferrer's emerald.***

**FGA** A suffix used by qualified gemmologists who are Fellows of the Gemmological Association of Great Britain.

**FGAA** A suffix used by qualified gemmologists who are Fellows of the Gemmological Association of Australia.

**fibre optics** A technique for transmitting light by means of flexible glass or acrylic fibres which act as light guides. The light is channelled down the length of the guide by means of total internal reflection from the walls of the guide. When a large bundle of fibres is used to transmit, for example, a coherent image from one end to the other, light leakage or 'cross-talk' between the fibres is minimised by coating each one with a material of lower refractive index. In gemmology, non-coherent fibre optic light guides are used as a convenient means to channel light from a high-intensity source to the specimen under inspection (e.g. for microscopic or spectroscopic work).

**fibrolite** A rare stone which is polymorphous with andalusite and kyanite. Also called sillimanite, it comprises the mineral aluminium silicate. $Al_2SiO_5$. Orthorhombic. R.I. 1.658, 1.678; D.R. +0.02; S.G. 3.25;.H. 6-7½. Transparent, blue, pale blue-green (chatoyant). Pleochroism, strong (green, dark green, blue). Occurrence: Burma, Sri Lanka, USA.

**fictile ivories** Castings made from plaster of Paris which are coloured with yellow ochre and coated with a mixture of wax, spermaceti or stearine.

**filigree** Jewellery metalwork consisting of fine wires twisted into ornate patterns.

**filter** An optical component used to modify the spectrum or the polarisation of light rays. Colour filters are used in spectroscopy to enhance spectral bands by eliminating unwanted sections of the spectrum. Polarising filters are used with both the spectroscope and the refractometer to separate out the polarised rays emerging from doubly refracting gems. See also ***crossed filters, polarised light*** and ***UV lamps.***

**findings** The component metal parts which are used in the manufacture of jewellery.

**fine light brown** A colour grade for polished diamonds. See *Colour Grading Standards* in Appendix B.

**fine line spectra** See *rare-earth spectra.*

**finest light brown** A colour grade for polished diamonds. See *Colour Grading Standards* in Appendix B.

**finest white** A UK colour grade for polished diamonds. See *Colour Grading Standards* in Appendix B.

**fine white** A UK colour grade for polished diamonds. See *Colour Grading Standards* in Appendix B.

**fingerprinting** A term used to describe various methods of positively identifying one polished diamond from another. These methods cover the use of a laser to produce a pattern of reflected and refracted light spots unique to the gem (Gemprint), the use of X-ray topography to map its internal crystal features (De Beers), the photographing of surface-visible crystalline features by means of Nomarski interference contrast techniques (DGL Identiprint), and the printing of a metalised code on the table facet of the diamond (Okuda). See *laser fingerprinting, X-ray topography* and *Nomarski interference contrast.*

**finish** The excellence of polish, freedom from external flaws and overall symmetry of a faceted diamond. Sometimes classified as the diamond's external clarity.

**fire** A term used to describe the effect of a gemstone's dispersion in splitting up white light into its spectral colours. Fire is particularly evident in highly dispersive colourless gems such as diamond and white zircon, although it can also be detected in coloured gems such as demantoid garnet and sphene. See *dispersion.*

**fire agate** See *chalcedony.*

**fired topaz** See *heat treated stones.*

**fired zircon** See *heat treated stones.*

**fire jade** A misleading name for a rock having the appearance of tiger's eye and containing mainly opal.

**fire marble** A rare fossil marble used for small ornamental objects. It is a dark brown marble containing small whitish shells which contain areas of iridescence similar to that of opal. Also known as lamachella (a word meaning little snail). Occurrence: Austria, USSR.

**fire marks** Small cracks seen at the edges of facets, particularly in corundum. They are caused by overheating due to too rapid polishing.

**fire opal** See *opal.*

**fire pearl** A misleading trade name for billitonite.

**firestones** Rock crystal which has had cracks induced in it

artificially by heating. Natural cracked quartz is known as ***rainbow quartz*** or ***iris quartz.***

**first bye** See ***bye.***

**first water** A comparative term used occasionally to denote a top colour / top quality diamond or other gemstone; a slightly lower quality stone is described as one of the second water.

**fisheye** An optical effect caused by the reflection of the girdle through the table facet in a diamond having a shallow pavilion.

**fish-eye stone** See ***apophyllite.***

**fissure** An elongated cavity, fracture or cleavage fault in the surface or in the body of a gemstone.

**FL** A clarity grade for polished diamonds meaning flawless. A similar grade IF means internally flawless. See ***Clarity Grading Standards*** in Appendix C.

**flame-fusion process** See ***Verneuil furnace.***

**flame spectrum** A spectrum produced by spectroscopic analysis of a bunsen flame coloured by a sample of the specimen. See ***bright-line spectrum.***

**flame spinel** An orange-red natural spinel.

**flash opal** An opal with a single-colour flash of iridescence.

**flats** A shape category for rough diamonds comprising flat irregular-shaped or triangular stones. See also ***chips, cleavages, macles, melée, shapes*** and ***stones.***

**flaw** A surface or internal fracture or cleavage in a gemstone. May also be applied to an inclusion or a polishing defect.

**flawless** A gemstone free from both external flaws and from internal flaws or inclusions. Also a clarity grade for polished diamonds, often abbreviated as IF (internally flawless) or FL. See ***Clarity Grading Standards*** in Appendix C.

**flêche d'amour** See ***sagenitic quartz.***

**flinder's diamond** A misleading name for colourless topaz.

**flint glass** A glass containing lead oxide, which produces a large dispersion. Also called lead glass, it is used for paste or imitation stones. See also ***crown glass*** and ***Bannister's graph.***

**Florence marble** See ***ruin marble.***

**Florentine mosaic** Also known as intasia and pietra dura, this is a mosaic made up from small pieces of coloured stone (coral, lapis lazuli, malachite, marble, turquoise). These are cemented into a recess cut into a slab of usually black marble to form a picture.

**flower agate** A chalcedony with flower-like inclusions.

**flowering obsidian** A variety of black obsidian containing rounded vitreous inclusions of a white mineral. Also known as snowflake obsidian. Occurrence: USA. See ***obsidian.***

**fluor** See ***fluorspar.***

**fluorescence** A form of luminescence which, like phos-

phorescence, can be stimulated in some gemstones by the application of energy (e.g. heat, UV, X-rays, etc.). Fluorescence ceases immediately the source of energy is removed, but phosphorescence persists for some time afterwards. See ***luminescence.***

**fluoride coating** Used to improve the colour of a yellow diamond. See ***treated diamonds.***

**fluorite** The mineralogical name for fluorspar.

**fluorspar** A calcium fluoride. $CaF_2$. Cubic. R.I. 1.434; S.G. 3.18; H. 4. Transparent, colourless, blue, violet, green, yellow, orange, red. Fluorescence strong under LW UV in most varieties (none in the 'Blue John' variety from Derbyshire, England). Occurrence: Canada, Czechoslovakia, Germany, Italy, Poland, Switzerland, UK, USA.

**flux** A borax-based compound used to facilitate soldering and brazing by preventing the heated metal surface from becoming oxidised.

**flux-fusion process** See ***flux-melt process.***

**flux-melt process** Also known as flux-fusion, this is a method of growing synthetic crystals using a high melting point solvent or flux. The constituent or source materials are dissolved in the flux. Seed crystals of the material to be synthesised are then lowered into the flux, and its temperature reduced to a point where it becomes supersaturated. At this point the source material is precipitated out and grows on the seed crystals. Crystals grown by

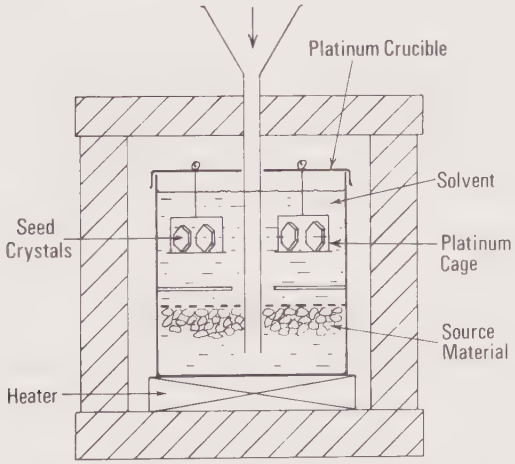



*Figure F.1* The flux-melt process is used to grow synthetic emerald crystals from source material dissolved in a lithium molybdate flux. The source materials consist of beryllium and aluminium oxides (plus chromium as a colouring agent) and slabs of silica glass, the latter being floated on top of the flux.

this method include synthetic emerald, ruby, spinel, quartz, alexandrite and the rare-earth garnets. *Figure F.1.* See also ***flame fusion process*** and ***Verneuil furnace.***

**focal length** When incident parallel rays are brought to a focus by a lens, the distance from the centre of the lens to the point of focus is called the focal length (f). In a convex lens, the focal point is on the opposite side of the lens to the parallel incident light, and the lens is said to have a positive focal length. In a concave lens, the focal point is on the same side as the incident light and the lens has a negative focal length.

**foiled stone** A gemstone mounted with a backing of silver or coloured foil to improve its brilliance or enhance its colour. See also ***chatons.***

**fool's gold** See ***pyrites.***

**fortification agate** An agate containing markings which are similar in appearance to the outline of a fortress.

**form** A group of similar crystal faces. A form made up entirely of identical interchangeable faces is called a closed form (e.g. a cube or octahedron). A form which is only completed by the addition of other forms is called an open form.

**form birefringence** The small double refraction sometimes measured in a singly-refractive or cryptocrystalline substance which also contains a material of different refractive index (e.g. chalcedony).

**forsterite** A magnesium silicate forming an end member of an isomorphous series containing peridot. $Mg_2SiO_4$. See ***peridot.***

**fossil** Vestiges of an ancient animal or plant preserved (usually by petrification) in the earth.

**fossil coral** A chalcedony pseudomorph in which the coral structure has been replaced by agate.

**fossil ivory** An ivory obtained from the tusks of mammoths (i.e. large extinct elephants) whose bodies have been preserved in frozen mud. Occurrence: Canada, USSR (Siberia). See also ***odontolite.***

**fossil marble** Marble containing the remains of shells, corals and crinoids or sea lilies.

**fossil opal** An opal pseudomorph of wood (also called petrified wood), freshwater shells, sea shells or bones.

**fossil pineapple** An opal pseudomorph replacing crystals of gaylussite, glauberite or gypsum.

**fossil resin** See ***amber.***

**fossil turquoise** A misleading name for odontolite.

**fossil wood** A chalcedony pseudomorph in which the wood fibres have been replaced by agate. Also called petrified wood. See also ***opal*** (wood opal).

**four 'C's of diamond grading** Polished diamonds are graded, among other things, for *colour, clarity, cut* and *carat* weight.

**four-point** A cutting orientation for diamond where the table is polished parallel to a possible cube face (i.e. parallel to the octahedron's pyramid-based natural girdle). See ***three-point*** and ***two-point.***

**fowlerite** See ***rhodonite.***

**fracture** The manner in which a gemstone breaks (other than by cleavage or parting). The type of fracture can sometimes be a useful identifying feature. Typical types of fracture are:

*conchoidal* — a shell-like fracture seen in glass, quartz and the garnets,

*splintery* — long fibrous splinters seen in jadeite, nephrite and ivory,

*hackly or uneven* — typical of the broken surface of rocks and of amber,

*smooth or even* — although not flat as with a cleavage, this type of fracture has no identifiable irregularities and can often be seen in rough diamonds.

**framesite** See ***boart.***

**Fraunhofer lines** If daylight is viewed through a spectroscope, its spectrum will contain a series of fine absorption lines. These lines are called Fraunhofer lines and are due mainly to the absorption of certain characteristic wavelengths by the vapour of various elements in the chromosphere surrounding the sun (see *Figure F.2*

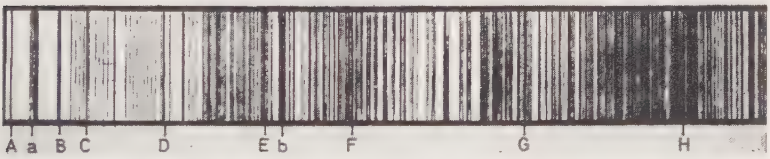



*Figure F.2* Reproduction of one of Fraunhofer's drawings of the solar spectrum.

and ***Table of Principal Fraunhofer Lines*** in Appendix J). In gemmology the Fraunhofer B line (caused by oxygen in the earth's atmosphere) and G line (caused by calcium) are used as standard wavelengths for measuring the dispersion of a gem. the B line is in the red at 686.7 nm, and the G is in the blue at 430.8 nm.

**free pearls** Pearls not attached to the mollusc's shell. Also known as cyst or mantle pearls.

**French colour rubies** Light red rubies.

**French Gemmological Association** See ***Association Français de Gemmologie.***

**frequency** A measure of the propagation characteristic of an electro-magnetic wave in terms of the number of cycles or oscillations per second (Hz).

$$\text{Frequency in megahertz (MHz)} = \frac{300 \times 10^9}{\text{nanometres}}$$

$$\text{Frequency} = \frac{\text{Velocity}}{\text{Wavelength}}$$

See ***electromagnetic spectrum.***

**freshwater pearls** Pearls found in various clam and mussel species in rivers and lakes in Canada, Scandinavia and the UK.

**Fresnel's reflectivity equation** A complex equation relating the reflectivity of a transparent isotropic mineral in air at normal incidence with the refractive index of the mineral. In a simplified version of the equation:

$$\text{Reflectivity} = \frac{I}{I_o} = \frac{(n-a)^2}{(n+a)^2}$$

where $I$ = intensity of reflected ray

$I_o$ = intensity of incident ray

$n$ = R.I. of gem

$a$ = R.I. of surrounding medium (for air = 1).

**frictional electricity** Also known as static or tribo-electricity, this is an electrostatic charge which can be generated on various materials by rubbing them. Amber, diamond, topaz and tourmaline are triboelectric materials.

**friedelite** A collector's stone comprising the mineral manganese silicate. $H_7(Mn,Cl)Mn_4Si_4O_{16}$. Trigonal. R.I. 1.63, 1.66; D.R. −0.03; S.G. 3.06-3.07; H. 4-5. Transparent to opaque, rose-red, orange-red. Occurrence: France, Sweden, USA.

**frit** A calcined mixture of sand and fluxes used in glass making. In ancient Egypt a frit consisting of a crystalline compound of silica, a copper compound, calcium carbonate and soda was used as a turquoise simulant.

**frost agate** An agate with white markings. Also called frost stone.

**frost stone** See ***frost agate.***

**frosted diamonds** Diamonds with a matt surface. Unlike coated diamonds, the surface of a frosted diamond is a thin film integral with the stone.

**fuchsite mica** A green chrome mica present in green aventurine quartz. See ***mica.***

**fukien jade** A misleading name for soapstone.

**fulgurites** Also known as lightning tubes, these are thin tubes of fused sand produced in the desert by the intense heat of a lightning strike.

**furnace slag** A lumpy vitreous material containing dark coloured stripes and patches, which may be mistaken for obsidian. S.G. in region of 2.82.

**fused beryl** See ***beryl glass.***

**fused quartz** An amorphous quartz made by fusing crystalline quartz. R.I. 1.46; S.G. 2.21.

**fused sand glass** See ***fulgurites.***

**futuran** Trade name for a phenolic resin plastic.

## G

**GA** See ***Gemmological Association of Great Britain.***

**GAA** See ***Gemmological Association of Australia.***

**GAAJ** See ***Gemmological Association of All Japan.***

**gabbro** A blackish-green basic rock of crystalline texture which is low in silica content but rich in magnesium.

**gadolinium gallium garnet** (GGG) A man-made diamond simulant (originally developed as a substrate for computer bubble memories) introduced in 1973. It has no counterpart in nature. $Gd_3Ga_5O_{12}$. Cubic. R.I. 1.97; S.G. 7.05; H. 6.

**gahnite** A collector's stone comprising the mineral zinc alumina. $ZnO.Al_2O_3$. Cubic. R.I. 1.805; S.G. 3.58–4.40; H. 7½–8. Transparent to opaque, blue, reddish-violet, green. Occurrence: Found in zinc deposits worldwide.

**gahnospinel** A blue spinel containing a high proportion of zinc. R.I. values of 1.725–1.753, and S.G. values of 3.58–4.06 are higher than for normal spinels.

**galalith** Trade name for a casein plastic sometimes used as an amber simulant.

**galliant** Trade name for the man-made diamond simulant gadolinium gallium garnet (GGG).

**gamma alumina** A cubic form of aluminium oxide used in the Verneuil flame-fusion production of synthetic corundum. It is produced by re-crystallising ammonium alum from solution in water until it is pure, and then calcining it in a furnace at 1100 °C. The calcining drives off ammonia and sulphur dioxide gases to leave pure gamma alumina. See ***Verneuil furnace.***

**gamma radiation** Electromagnetic rays of very short wavelength with very high penetration properties. Gamma rays are indistinguishable from X-rays and differ only in the way they are produced (i.e. from radioactive substances). See also ***alpha particles*** and ***beta particles.***

**gangue** Unwanted residue from which a gem concentrate is extracted.

**garnet** An isomorphous series of gem minerals forming (with the feldspar group) one of the two main groups of gemstones species comprising aluminium, calcium, chromium, iron, magnesium, manganese and iron silicates. Cubic. Species:

*almandine* (purplish-red). $Fe_3Al_2(SiO_4)_3$. R.I. 1.77–1.81; S.G. 3.8–4.2; H. 7½.

*andradite* $Ca_3Fe_2(SiO_4)_3$. Varieties, demantoid (green) yellow andradite, melanite (black). R.I. 1.89; S.G. 3.85; H. 6½.

*grossular* $Ca_3Al_2(SiO_4)_3$. Varieties, hessonite (orange-brown, green, pink), massive grossular or hydrogrossular (jade-green, also known as African jade), tsavolite (transparent green). R.I. 1.74; S.G. 3.63–3.68; H. 6½.

*pyrope* (blood-red). $Mg_3Al_2(SiO_4)_3$. R.I. 1.75-1.77; S.G. 3.7–3.8; H. 7½.

*spessartite* (orange, yellow, flame-red). $Mn_3Al_2(SiO_4)_3$. R.I. 1.80; S.G. 4.16; H. 7.

*uvarovite* (emerald-green). $Ca_3Cr_2(SiO_4)_3$. R.I. 1.87; S.G. 3.77; H. 7½.

Occurrence: *almandine,* Austria, Brazil, China, Czechoslovakia, Sri Lanka; *andradite,* Switzerland (yellow variety), USSR (demantoid); *grossular,* Canada, South Africa (hydrogrossular), Sri Lanka (especially hessonite); *pyrope,* Australia, Czechoslovakia, South Africa; *spessartite,* Brazil, the Malagasy Republic, Sri Lanka, USA; *uvarovite,* Canada, Finland, Poland, USA, USSR.

**garnet jade** A misleading name for massive green grossular garnet.

**garnet-topped doublets** See ***composite stones.***

**gauge plate** A device for estimating the weight of mounted and unmounted gemstones. See ***diamond gauge.***

**gava gem** Trade name for a synthetic rutile diamond simulant.

**gedanite** A soft light variety of amber found in Northern Germany. It contains very little succinic acid. S.G. 1.02; H. 1½–2.

**Gegat** See *jet.*

**geiger counter** An instrument for detecting and counting ionising particles emitted from radioactive materials, and used to measure the strength of their radioactivity. Can be used to detect radioactivity in ekanite and in some zircons.

**gel** A solid or semi-solid colloidal solution or jelly.

**gem** A material possessing the necessary qualities of beauty, rarity and durability for use in jewellery. Such material can be of inorganic (i.e. mineral) or organic origin.

**Gem and Mineral Society of Zimbabwe** Headquarters: P.O. Box 712, Harare (formerly Salisbury), Zimbabwe.

**gem cutter** See ***lapidary.***

**gem diamonds** Rough diamonds whose colour, quality and shape make them suitable for use in jewellery as polished stones. See also ***near gem*** and ***industrial diamonds.***

**gemerald** Trade name for a beryl doublet or a beryl coated with synthetic emerald.

**gem gravels** Alluvial gem deposits associated with existing or ancient river courses.

**geminair** Trade name for the man-made diamond simulant yttrium aluminium garnet.

**Gem Instruments Corporation** A subsidiary of the Gemological Institute of America. Headquarters: 1735 Stewart Street, P.O. Box 2147, Santa Monica, CA 90406, USA.

**Gemmological Association of All Japan** Headquarters: Tokyo Bihokaikan, 1-24 Akashi-cho, Chuo-ku, Tokyo, Japan. See also ***Gemological Association of Japan*** and ***Gemmological Society of Japan.***

**Gemmological Association of All Korea** Headquarters: c/o Mi Jo Gem Study Institute, No. 244-39 Hoo Am-Dong, Yong San Ku, Seoul, Korea. See also ***Gemmological Institute of Korea.***

**Gemmological Association of Australia** Qualified gemmologists in the Association use the suffix FGAA. Headquarters (Victoria branch): P.O. Box 5133AA, Melbourne 3001, Victoria, Australia.

**Gemmological Association of Great Britain** Founded in 1908 as the Education Committee of the National Association of Goldsmiths, it was reconstituted in 1931 as the Gemmological Association. It is affiliated with the Gemmological Association of Australia, the Canadian Gemmological Association and the Gem and Mineral Society of Zimbabwe. Fellowship of the Association is gained by taking a two-year course (evening class or correspondence) and passing the Association's Preliminary and Diploma examinations. Qualified gemmologists in the Association use the suffix FGA. Headquarters: St. Dunstan's House, Carey Lane, London EC2V 8AB, UK.

**Gemmological Association of Hong Kong** Headquarters: University of Hong Kong, Department of Physics, Hong Kong.

**Gemmological Association of Switzerland** Headquarters: Multergasse 20, CH-9000, St. Gallen, Switzerland.

**Gemmological Institute of India** Headquarters: 29/30 Gurukul Chambers, 187/9 Mumbaderi Road, Bombay 2, India.

**Gemmological Institute of Korea** Headquarters: 30-7, 3-ka, Namdaemunro, Chungku, Seoul, Korea. See also ***Gemmological Association of All Korea.***

**Gemmological Instruments Ltd** A subsidiary of the Gemmological Association of Great Britain. Headquarters: St. Dunstan's House, Carey Lane, London EC2V 8AB, UK.

**Gemmological Society of Japan** Headquarters: Institute of Mineralogy, Petrology and Economic Geology, Tohoku University, Aoba, Sendai, Japan 980. See also ***Gemmological Association of All Japan*** and ***Gemological Association of Japan.***

**gemmologist** A qualified specialist in the science of gem materials. See ***CG, FGA, FGAA,*** and ***GG.***

**Gemmologists' Association of Sri Lanka** Headquarters: 63 Bristol Buildings, York Street, Colombo 1, Sri Lanka.

**gemmology** The science of gem materials.

**Gemological Association of Japan** Headquarters: Kaneku Building, 3–27–11 Yushima, Bankyo-ku, Tokyo 113, Japan. See also ***Gemmological Association of All Japan*** and ***Gemmological Society of Japan.***

**Gemological Institute of America** An endowed non-profit jewellers' organisation founded in 1931, this has become the educational, research and testing centre of the jewellery industry in the USA. Correspondence and residential courses run by the Institute lead to the qualification Graduate Gemologist (GG). Headquarters: 1660 Stewart Street, P.O. Box 2110, Santa Monica, CA 90406, USA.

**gem refractometer** See ***refractometer.***

**Gem Society of Ceylon** Headquarters: Melbourne Estate, Tummodera, Sri Lanka.

**gem stick** A wooden stick with a metal collet at the end which is used by a lapidary to hold a rough gemstone while cutting its facets on a rotating lap or grind-stone. The gemstone is held in the collet by a special cement.

**gemstone** A polished mineral which possesses the necessary qualities of beauty, rarity and durability for use in jewellery.

**gemstone constants** Constants such as refractive index, double refraction, specific gravity and hardness which enable a gemstone to be identified.

**gemstone cuts** See ***antique cut*** (cushion), ***brilliant cut*** (round, marquise/navette, oval, pear-shape), ***baguette*** (baton), ***cabochon, emerald cut*** (trap), ***rose cut*** (Antwerp rose/Brabant) and ***scissors cut*** (cross).

**Geneva rubies** Once thought to be made by fusing together smaller fragments of natural ruby, these were originally called *reconstructed* rubies. More recent analysis of surviving specimens has indicated that the rubies were more probably manufactured by an early form of flame-fusion process, using powdered alumina (or even powdered natural ruby) rather than fragments of the natural gemstone.

**geode** An igneous occurrence in which gem minerals are precipitated as crystals in almost spherical cavities formed by

molten or aqueous residues trapped in the cooling magma. Owing to their shape when removed from the rock formation they are also called potato stones. See also ***druse*** and ***vug***.

**geological eras** See ***Precambrian, Palaeozoic, Mesozoic*** and ***Cenozoic.***

**geology** Science of the structure and composition of the earth's crust.

**georgiatite** A variety of tektite found near Georgia, USA. See ***moldavite.***

**German diamond** A misleading name for the rock crystal variety of quartz.

**German Gemmological Association** See ***Deutche Gemmologische Gesellschaft.***

**German lapis** Also called Swiss lapis, this is a blue-stained jasper used as a simulant for lapis lazuli.

**German mocoas** Trade name for a moss agate simulant.

**German silver** A misleading name for a white alloy of nickel, copper and zinc. Also called nickel silver.

**geuda stones** 'Geuda' is a term applied to Sri Lankan stones (mainly blue sapphires, but also rubies) which have a milky-white opaline appearance due to a network of inclusions (usually rutile). With some of these stones (called 'diesel' geudas) it is possible to improve their colour dramatically by means of heat treatment, the rutile being absorbed into the crystal lattice to enhance the blue of the sapphire.

**GG** A suffix used by qualified gemmologists who have passed the examinations of the Gemological Institute of America.

**GGG** See ***gadolinium gallium garnet.***

**GIA** See ***Gemological Institute of America.***

**giant conch** A pearl-producing marine mollusc found along the coast of Florida and the West Indies, and in the Gulf of California, Mexico. The giant conch (*Strombus gigas*) is a source of pink pearls, and its shell is used for cameo carving.

**Gibraltar stone** A stalagmitic deposit found in limestone caves around the Rock of Gibraltar. The stone is a translucent calcite with brown and amber-coloured wavy veins. It is polished as cabochons and used for small ornamental objects.

**gibsonite** A pink variety of thomsonite.

**gibsonville emerald** A misleading name for green quartz.

**gidgee opal** An opal variety cut from the opal and ironstone impregnated roots of the gidgee (acacia) tree. S.G. 2.65-3.00.

**gilding** The application of a fine layer of gold to an article. Originally, this was effected by coating the article with a layer of gold/mercury amalgam, and then applying heat to drive off the mercury. Present-day gilding is mainly applied by electro-plating.

**Gilson synthetic stones** Stones manufactured by Pierre Gilson SA of Aire, France.

*Gilson synthetic emerald* — a synthetic emerald grown by the flux-melt process. R.I. 1.560, 1.563; D.R. —0.003; S.G. 2.65; H. 7½ (R.I., D.R. and S.G. may be higher in more recent material).

*Gilson synthetic lapis lazuli* — a synthetic lapis lazuli which has the mineral lazurite as its chief ingredient. S.G. 2.36.

*Gilson synthetic opal* — a synthetic black or white variety of opal made by dehydrating a sodium silicate or a silicon ester. H. 4½.

*Gilson synthetic turquoise* — a turquoise simulant made from a copper phosphate and calcite. R.I. 1.592; S.G. 2.635. (Recent analysis has shown calcite to be the main component, and this material is therefore more correctly designated as a simulant.)

**giogetto** A variety of black opal.

**girasol** A fire opal or water opal. See ***opal.***

**girasol** Trade name for glass used in the manufacture of imitation pearl beads.

**girasol pearl** An imitation glass pearl.

**girasol sapphire** A cat's eye sapphire.

**girdle** The outer circumference of a polished gemstone which separates the top, or crown, from the base, or pavilion.

**girdle facets** Small facets which are polished on the curved face of a diamond's girdle to improve the overall brilliance of the stone.

**girdle facets** The triangular facets which are adjacent to the girdle on a brilliant-cut stone. There are 16 such facets above the girdle and 16 below. Also called upper and lower girdle or break facets, skill facets, skew facets and cross facets. See ***brilliant cut.***

**glass** For man-made glasses, see ***Bannister's graph, crown glass*** and ***flint glass.*** For natural glasses, see ***obsidian, Libyan glass, moldavite*** and ***tektite.***

**glass agate** A misleading name for obsidian.

**glassies** A term used to describe well-shaped, transparent and clear octahedral diamond crystals.

**glass lava** See ***obsidian.***

**glass opal** See ***hyalite.***

**glass S.G. indicators** Small glass discs made in a range of specific gravity values for the purpose of blending heavy liquids to precise values of S.G. Also used to check the S.G. of these liquids before use. *Figure G.1.*

**glass stone** See ***axinite.***

**glets** A cleavage crack in a diamond which resembles a feather. Also called a gles.

**glyptography** The art and science of gem carving and engraving.

*Figure G.1* A set of calibrated glass specific gravity indicators. (Rayner/Gemmological Instruments Ltd.)

**gneiss** A coarse-grained banded metamorphic rock containing quartz, feldspar and mica.

**goethite** A hydrated iron oxide. $Fe_2O_3.H_2O$. Red or orange platy crystals of goethite when present as inclusions in plagioclase feldspar produce the sunstone variety.

**gold** A precious metallic element used in jewellery (especially as a mount for gems). Au. Atomic number, 79; atomic weight 197.2; melting point 1063 °C; S.G. 19.3. Because of the relative softness of the pure metal, gold is usually alloyed with silver and other metals when used in jewellery (see ***carat***).

**gold alloys** See ***carat.***

**gold amalgam** A plastic combination of gold and mercury used in gilding.

**golded jade** See ***hornbill ivory.***

**golden quartz** Heat treated amethyst, also known as *burnt amethyst. See* ***heat-treated stones.***

**gold filled** A misleading illegal description in the UK of a composite jewellery metal made by bonding a layer of gold alloy to each side of silver or a base metal alloy (usually brass). In the USA, the term gold filled is used for a higher grade of rolled gold in which the total thickness of the gold layers is at least 1/20th of

the overall thickness (below 1/20th it is called rolled gold). See ***rolled gold.***

**gold foil** Gold beaten into a thin sheet (thicker than gold leaf).

**gold leaf** Gold beaten into a very thin almost translucent sheet (thinner than gold foil) and used for decorative purposes.

**gold opal** See ***opal*** (fire opal).

**gold quartz** A milky quartz containing flecks of native gold.

**gold sapphire.** A misleading name for lapis lazuli.

**gold solder** Usually 2-4 carats lower in gold content than the gold it is used to solder, this is a gold-silver-copper alloy to which a small quantity of zinc (3.5-8%) and cadmium (5%) may be added to further lower the melting point. Variations in proportions are : gold (37.5-65%) silver (15-40%) and copper (14-25%).

**goldstone** Also called aventurine glass, this is a man-made glass simulant of the sunstone or aventurine variety of plagioclase feldspar and of aventurine quartz. It consists of a soda-lime glass coloured by cuprous oxide which precipitates out as thin triangular or hexagonal plates of crystalline copper. R.I. 1.53; S.G. 2.5-2.8.

**gold topaz** A misleading name for golden quartz.

**goniometer** An instrument for measuring angles between the faces of crystal specimens. Also called a reflecting goniometer and table spectrometer, it consists basically of a light source/collimator, a table for supporting the specimen, and a radially-pivoted telescope viewer having an eyepiece fitted with cross-wires. The position of the telescope, relative to the collimator, can be read off a scale on the table. The instrument is also used for measuring dispersion and R.I. (see ***angle of minimum deviation***). *Figure G.2.*

**goshenite** See ***beryl.***

**grading of pearls** Pearls are graded for colour, which ranges from white to silver and yellowish. Fancy coloured pearls are those with a strong colour, such as rose-pink, green, blue, yellow, bronze and black. Pearls are also graded into shape categories which range from spherical and pear-shaped drop pearls, to irregularly-shaped baroque pearls. Drilled pearls are prepared for marketing by stringing each size on a silk thread. A number of sizes suitable for making up into graduated necklaces are strung together and are known as a Bombay bunch.

**grading standards (diamonds)** See under ***grading standards*** in Appendices B and C.

**grading lamps** Colour-corrected 'daylight' grading lamps are mainly used for colour grading diamonds (as an alternative to the use of 'north light'). The colour temperature of these lamps is chosen to simulate 'north sky' daylight. The lamps are sometimes enclosed in a cabinet which provides a neutral white background

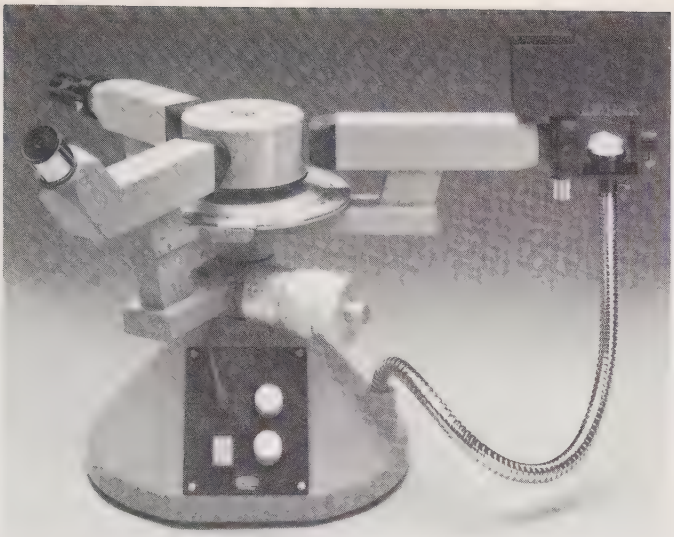


*Figure G.2* A modern version of the goniometer, with the addition of a wavelength scale (far side of shrouded table), and a gemstone holder (far right) which enables the instrument to be used as a spectroscope. The light source is built into the base unit, and light is channelled to the gemstone holder via a glass-fibre light guide. (Krüss)

for comparison grading. *Figure G.3.* See also ***diamond grading lamp*** and *Figure 7* in Appendix B.

**Graduate Gemologist** (GG) A title awarded by the Gemological Institute of America to candidates who have passed the qualifying examinations. See ***Gemological Institute of America.***

**grain** The grain of a diamond's crystal structure refers mainly to its cleavage direction. It is also used to refer to sawing and polishing directions. Diamonds are cleaved parallel to the four octahedral faces. Sawing is mainly done across the grain, parallel to the cubic plane.

**grain (diamond and pearl)** A unit of weight used with rough diamonds and pearls. 1 grain = 0.25 metric carat.

**grain (gold)** A unit of weight used for precious metals. 1 ounce troy = 480 grain. 1 tola = 0.375 ounce troy = 180 grain.

**gram** A unit of weight equivalent to five metric carats.

**grammatite** See ***tremolite.***

**grandidierite** A rare collector's stone comprising the mineral iron aluminium magnesium silicate. Orthorhombic. R.I. 1.602, 1.639; D.R. −0.037; S.G. 3.0 H. 7½. Transparent, bluish-green. Pleochroism, strong. Occurrence: The Malagasy Republic.

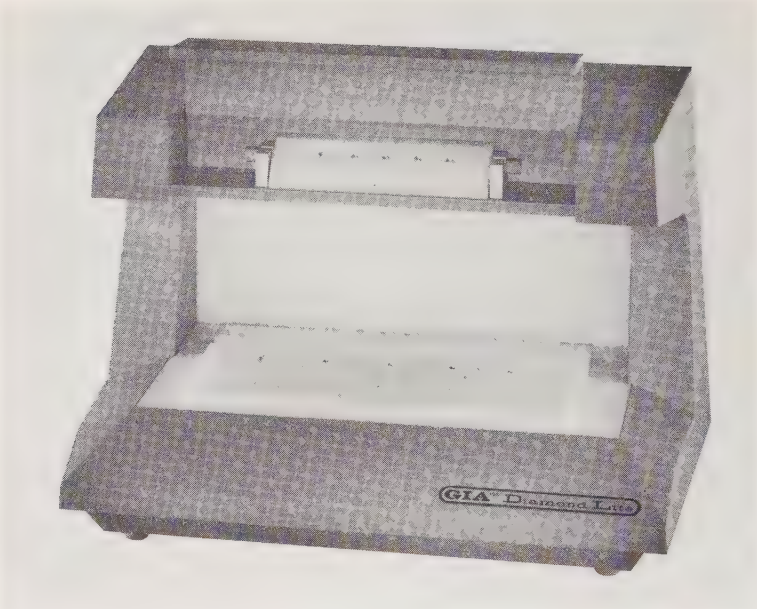



*Figure G.3* The GIA DiamondLite provides daylight-type illumination and a neutral background for the colour grading of polished diamonds. (Gem Instruments Corp.)

**granite** A granular igneous rock composed of feldspar, quartz and mica.

**graphite** One of the two crystalline forms of carbon (diamond being the other). Graphite crystallises in the hexagonal system. Because of the loose bonding between its molecular layers, it has perfect cleavage. The 'slip' between these layers makes it useful as a lubricant. S.G. 2.25.

**grating spectroscope** See ***spectroscope.***

**grease belt** A development of the grease table to facilitate the continuous separation of diamonds from rock and gravel. Because diamond is non-wettable, it sticks to grease. The continuously rotating belt has a layer of grease applied to it at one end, and this is scraped off at the other end. The diamond bearing gravels are washed across the central span of the belt, the diamonds sticking to the grease and the bulk of the gravels washing over. The recovered grease is then melted to release the diamonds. See ***grease table.***

**grease table** An early method of recovering diamonds from gravel and crushed rock, which is still in use in some mines. Because diamond is non-wettable, it sticks to grease. The grease table

*Figure G.4* Removing individual diamonds from a grease table in Kimberley, South Africa. (De Beers)

consists of a series of vibrating wooden slats which are coated with grease (*Figure G.4*). The diamond-bearing concentrate is washed over the slats, the diamonds becoming embedded in the grease and the bulk of the gravels being washed over. The diamonds are then recovered from the grease by being loaded into a perforated metal container and heated. See also ***grease belt.***

**greasy** See ***lustre.***

**green garnet** A misleading name for enstatite.

**green gold** A green-tinted gold alloy containing silver and zinc.

**green john** A massive green variety of fluorspar.

**green onyx** A misleading name for green stained chalcedony.

**Greenough microscope** A type of microscope which provides stereoscopic vision (and an upright image) by using paired objectives linked to inclined binocular eyepieces. See ***magnifiers.***

**green quartz** A misleading name for green fluorite.

**green rouge** A chromium oxide abrasive powder used for polishing gemstones.

**green starstone** See ***chlorastrolite.***

**greenstone** See ***nephrite.***

**green stone** A misleading name for chlorastrolite.

**grenalite** See *staurolite.*

**grenz rays** Soft (i.e. low energy) X-rays of long wavelength (0.5–1.0 nm). Also called infra-röntgen rays.

**Griqualandite** See *quartz* (tiger's eye variety).

**grinding** The abrasive removal of material when preforming and polishing a gemstone.

**grit** Diamond powders produced for gemstone polishing and industrial uses. May be of natural (see ***boart***) or synthetic origin.

**grossular garnet** See *garnet.*

**grospydite** A rock consisting of the minerals grossular garnet, pyroxene and kyanite.

*Figure G.5* The Gübelin jewellers' spectroscope with built-in wavelength and specimen light sources. (Gübelin)

**groups** As an aid to classification, mineral species are gathered together into a series of groups, each of which contains species having similar features or characteristics. In gemmology there are two groups, and these contain the feldspar and garnet gemstones. See ***species*** and ***varieties.***

**GTD** See ***composite stones.***

**Guadalcanal cat's eye** See ***operculum.***

**guarnaccio** A yellowish-red garnet.

**Gübelin's jewellers' spectroscope** Designed by Dr E. Gübelin in 1950, this was the first spectroscope to be produced specifically for gemmological work and which also contained a built-in adjustable source of illumination for both the specimen and the wavelength scale. Constructed in the style of a microscope stand, this unit enabled the height of the spectroscope to be adjusted relative to the stone holder, and its angle varied. The eyepiece contained a series of five lenses which could be selected to suit the user's eye, and which were also useful to correct for focus differences between the blue and red ends of the spectrum. *Figure G.5.*

**gum animé** See ***copal resin.***

**gypsum** A hydrated calcium sulphate, occurring in the varieties alabaster, satin spar and selenite. See ***alabaster.***

## H

**habit** The characteristic external shape commonly adopted by a crystalline material. Habits include acicular, bipyramid, botryoidal, columnar, dendritic, mamillary, massive, prismatic, tabular (see under appropriate heading).

**hackly fracture** See ***fracture.***

**haematite** An iron oxide used both as a gemstone and in powdered form as a polishing abrasive (jeweller's rouge). Because of its mamillary contours it is also known as kidney stone. $Fe_2O_3$. Trigonal. R.I. 2.94, 3.22; D.R. −0.28; S.G. 4.95-5.16; H. 5½-6½. Opaque, reddish-black. Occurrence: Elba, England, Switzerland.

**hailstone boart** See ***boart.***

**halbanita aquamarine** A maxixe-type indigo beryl whose colour is due to $CO_3$ impurity ions.

**half facets** See ***break facets.***

**haliotis pearl** A highly coloured, iridescent and often hollow baroque pearl from the *Haliotis* mollusc.

**Haliotis shell** See ***abalone.***

**hallmark** A mark embossed into gold and silver articles by an Assay Office indicating the maker's initials, the standard of purity of the metal, the place of assay and the year of hallmarking. See ***assay*** and ***carat.***

**halo** See ***zircon haloes.***

**hambergite** A collector's stone comprising the mineral beryllium borate. $Be_2(OH)BO_3$. Orthorhombic. R.I. 1.553, 1.625 to 1.559, 1.631; D.R. +0.072; S.G. 2.35; H. 7½. Transparent, colourless. Occurrence: The Malagasy Republic, Norway.

**hammer pearls** Baroque pearls in the shape of a hammer head.

**hand lens** Also called a loupe, this is a basic inspection aid for magnifying the internal and external features of a gemstone. Hand lenses range from inexpensive uncorrected models to fully corrected triplets (see ***aberration***). The most useful magnification factor (particularly for diamond grading purposes) is 10×. *Figure H.1.* See ***head loupe*** and ***triplet (lens).***


*Figure H.1* A range of hand lenses.

**Hanneman balance** See ***hydrostatic weighing.***

**hard ivory** A commercial description of a type of hard or bright ivory which has a 'glassy' surface and is harder to cut than the 'soft' variety (e.g. Angola and Ambriz ivory). See ***soft ivory*** and ***bastard ivory.***

**hardness** The ability of a material to resist abrasion damage is measured in gemmology and mineralogy by means of the Mohs scale of comparative hardness. Ten minerals are used as standards as follows:

1. Talc
2. Gypsum
3. Calcite
4. Fluorspar

5. Apatite
6. Feldspar
7. Quartz
8. Topaz
9. Corundum
10. Diamond

Any substance with a particular Mohs hardness number will scratch another substance having a lower number and will itself be scratched by one having a higher number. See ***hardness pencils*** and ***indentation test.***

**hardness pencils** Metal holders set with pointed fragments of the standard minerals in the Mohs hardness scale. See ***hardness.*** *Figure H.2.*

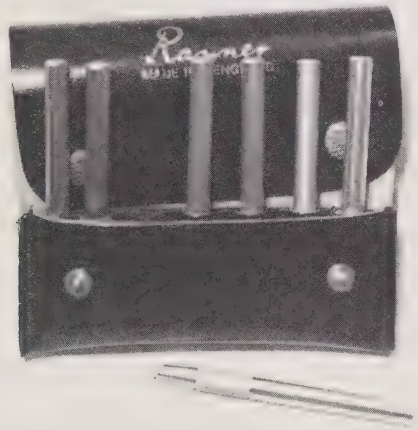



*Figure H.2* A set of seven hardness pencils. (Rayner/Gemmological Instruments Ltd.)

**hardness test plates** Test plates made of polished sections of quartz, synthetic spinel and synthetic ruby. The hardness of gemstones can be assessed by checking their ability to scratch these plates.

**harlequin opal** See ***opal.***

**haüyne** See ***haüynite.***

**haüynite** A constituent of lapis lazuli, haüynite is a complex sodium aluminium silicate and is mainly cut as a collector's stone. Cubic. R.I. 1.496; S.G. 2.4; H. 6. Translucent, blue. Occurrence: Germany, Italy.

**Hawaiian diamonds** A misleading name for the rock crystal variety of quartz.

**hawaiite** Peridot from Hawaii.

**hawksbill turtle** A sea-turtle whose shell is the main source of the gem material known as tortoiseshell.

**hawk's eye** See *quartz.*

**head loupe** A binocular lens assembly mounted on a head band enabling both hands to be free when inspecting and sorting gemstones. See ***hand lens*** and ***triplet (lens).***

**head magnifier** See ***head loupe.***

**heat conduction** See ***thermal conduction.***

**heat treated stones** Gemstones which have their colour improved or changed by means of the controlled application of heat. Amethyst is heated to produce yellow and green quartz. Dark green tourmalines from Namibia are improved to emerald green by heating. Heating is used to change pale green beryl to an aquamarine colour, zoisite to a sapphire blue , and sapphires and rubies (containing excessive iron) to a more attractive shade. Brown and yellow topaz from Brazil turns pink after being heated to 500-600 °C, and becomes colourless if taken above this temperature. Brown zircons from Cambodia turn blue if heated to 900-1000 °C in a reducing (oxygen free) atmosphere. If heated to 850-900 °C in air they turn golden brown, colourless or sometimes red. See also ***geuda stones.***

**heavily spotted** A UK clarity grade used for polished diamonds. See ***Clarity Grading Standards*** in Appendix C.

**heavy liquids** Used for measuring the specific gravity of gemstones; heavy liquids exploit Archimedes' principle (i.e. a body totally immersed in a fluid experiences an upward force equal to the weight of fluid it displaces). Commonest liquids in use for S.G. testing are:

| | | |
|---|---|---|
| *bromoform* | $CHBr_3$ | S.G. 2.89 |
| *methylene iodide* | $CH_2I_2$ | S.G. 3.32 |
| *clerici's solution* | | S.G. 4.15 |

Intermediate S.G. values can be obtained by diluting bromoform and methylene with toluene (S.G. 0.88) or monobromonaphthalene (S.G. 1.49), and by diluting Clerici's solution with water. Clerici's solution contains thallium malonate and thallium formate, and is both poisonous and corrosive. *Care should be taken when using any of these liquids to avoid skin contact or inhalation of vapour.* See ***glass S.G. indicators*** and ***specific gravity.***

**heavy media separation** A technique used to separate diamond from crushed kimberlite (blue ground) and gravel. The separator uses a cone shaped tank containing a slurry, or heavy liquid, made up of a fine ferro-silicon powder suspended in water to give it a specific gravity of 2.7–3.1. This slurry floats off the lighter elements and allows the diamonds to be drawn off from the bottom of the tank.

**heavy spar** See ***barite.***

**heliocite** Aventurine feldspar.

**heliodor** See ***beryl.***

**heliolite** A red or green variety of labradorite, the red colour being due to flakes of haematite. R.I. around 1.57; S.G. 2.7; H. 6. Occurrence: Oregon, USA.

**heliotrope** See ***chalcedony*** (bloodstone).

**hematite** See ***haematite.***

**hematite garnet** A synthetic iron-rich garnet.

**hematine** A man-made sintered simulant of haematite.

**hemihedral** A term applied to crystals which only exhibit half the number of faces required by their crystal system.

**hemimorphic** A term applied to crystals which have different forms at either end of an axis of symmetry.

**hemimorphite** Usually associated with smithsonite, this consists of the mineral zinc silicate. $Zn_4(OH)Si_2O_7.H_2O$. Orthorhombic (crystals are hemimorphic when doubly terminated; otherwise massive botryoidal). R.I. 1.614, 1.636; D.R. +0.022; S.G. 3.4-3.5; H. 5. Opaque to translucent, blue, green, often banded. Occurrence: Greece, Mexico, Namibia, Spain, USA.

**Herbert Smith refractometer** A gemstone refractometer designed in 1905 as an improved version of the Bertrand refractometer. It was further improved two years later by incorporating a scale calibrated directly in refractive indices. *Figure H.3.*

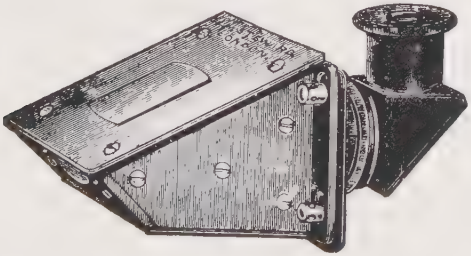


*Figure H.3* The Herbert Smith refractometer.

**herderite** A collector's stone comprising the mineral beryllium calcium fluo-phosphate. $CaBe(F,OH)PO_4$. Monoclinic. R.I. 1.594, 1.624; D.R. −0.03; S.G. 3.0; H. 5. Greyish. Occurrence: Brazil, Germany, USA.

**herkimer diamond** A misleading name for the rock crystal variety of quartz.

**herrerite** See ***smithsonite.***

**hessonite** See ***garnet.***

**hexagonal system** A crystal system having four axes, the three lateral ones being of equal length and intersecting each other at

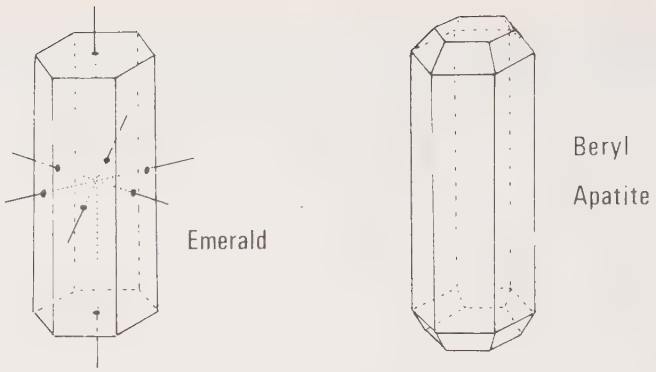



*Figure H.4* The hexagonal crystal system.

60° in the same plane. The fourth (or principal) axis is at right-angles to the others and usually longer. There are seven axes of symmetry (six two-fold and one six-fold), seven planes of symmetry and a centre of symmetry. *Figure H.4.*

**hexagonite** See ***tremolite.***

**hexakis octahedron** A 48-sided crystal which is one of the seven basic forms belonging to the highest class of symmetry in the cubic crystal system. It consists of an octahedron with each face replaced by six triangular faces.

**hidaka jade** A chrome diopside, containing a small amount of uvarovite, chromite and pectolite, found in central Hokkaido, Japan.

**hiddenite** See ***spodumene.***

**high zircon** A zircon whose internal crystal structure is relatively undamaged, and whose constants are at their maximum values. See ***zircon*** and ***low zircon.***

**hinjosa topaz** A misleading name for yellow quartz.

**hippopotamus ivory** Dentine ivory from the teeth of the hippopotamus.

**hodgkinsonite** A very rare collector's stone consisting of a hydrated magnesium zinc silicate (found in only one location in the early part of this century). $MnZn_2SiO_5.H_2O$. Monoclinic. R.I. 1.720, 1.746; D.R. 0.026; S.G. 3.95 (mean); H. 4½-5. Transparent bright pink to purplish-pink. Occurrence: New Jersey, USA.

**hole gauge** See ***diamond gauge.***

**Holocene** (Recent) The smaller and later part of the Quaternary period of geological time from 10 000 years ago to the present day. See ***Quaternary.***

**holohedral** A term applied to a crystal which exhibits the full symmetry of its crystal system.

**holosymmetrical** See *holohedral.*

**holstein** See *fossil wood.*

**homogeneous** A term applied to a substance such as a gem mineral which is composed throughout of the same chemical element or compound.

**honan jade** A misleading name for soapstone.

**honey opal** A yellow translucent non-iridescent opal similar to fire opal. Occurrence: Western Australia. See *opal.*

**Hong Kong Gemmological Association** See *Gemmological Association of Hong Kong.*

**hope sapphire** A misleading trade name for synthetic blue spinel.

**horatio diamond** A misleading name for the rock crystal variety of quartz.

**horn** A carving material derived from the horn of the rhinoceros and the antler of the deer. Rhinoceros horn consists of a closely packed mass of hairs or horny fibres having a low hardness and a density of 1.29. Deer horn more closely resembles bone, but is usually brownish. R.I. 1.56; S.G. 1.70-1.85; H. 2½.

**hornbill ivory** A rare organic material obtained from the beak and casque of the helmeted hornbill bird of southeast Asia. R.I. 1.55; S.G. 1.28-1.29; H. 2½.

**hornblende** A dark brown, black or green ferro-magnesium silicate present in many rocks including granite.

**horn coral** A black variety of coral.

**horn of the unicorn** See *whale ivory.*

**hornstone** See *jasper.*

**horsetail inclusion** See *inclusion.*

**hot-point tester** An instrument (marketed by the GIA) having an electrically heated probe which is used to test for wax- and plastic-impregnated turquoise, amber simulants, tortoiseshell and jet. The test relies on the characteristic smell given off when the tip of the heated probe is brought into contact with the gem material.

**hot springs diamond** A misleading name for the rock crystal variety of quartz.

**howlite** A massive ornamental stone comprising a complex silico-borate of calcium. Believed to be monoclinic. Mean R.I. 1.59; S.G. 2.58; H. 3½. Opaque white, veined with black. Occurrence: USA.

**hübnerite** A rare collector's stone comprising the mineral manganese tungstate. $MnWO_4$. Monoclinic. R.I. 2.1 to 2.2; S.G. 7.25; H. 4-4½. Transparent, deep red. Occurrence: Peru.

**hue** A term applied to the colour or wavelength of light. See *saturation.*

**Hungarian cat's eye** Quartz cat's eye from Bavaria.

**Hungarian opal** Opal from the Cervencia mines in Hungary.

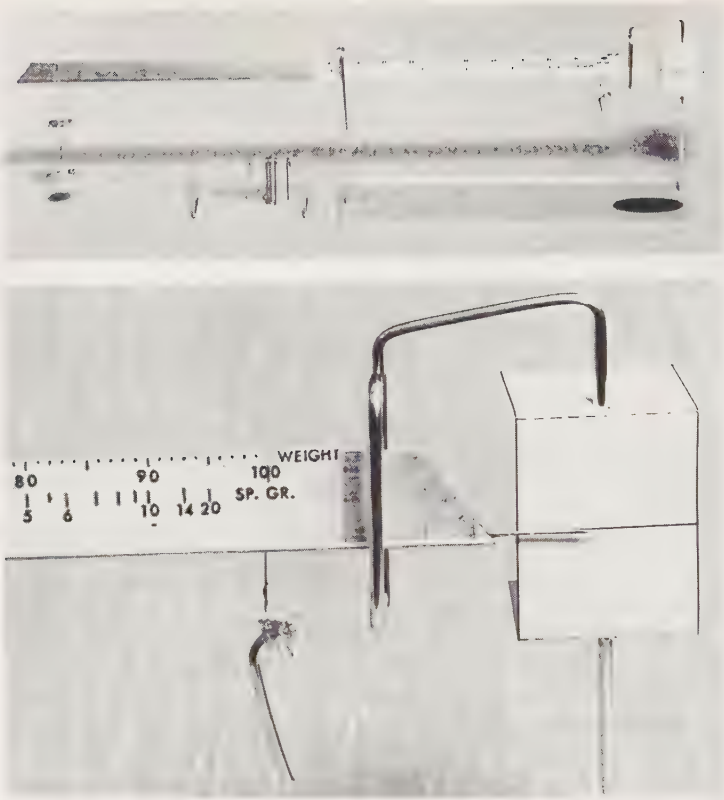



*Figure H.5* A direct-reading specific gravity balance. Two gemstone weighpans are provided (top left) for in-air and in-water weighings. The counterweight slide (bottom centre) is set to 100 for the in-air weighing, and is loaded (by means of hooked weights) to achieve equilibrium. The gemstone is then transferred to the lower weighpan for the in-water weighing, and the counterweight moved down the scale to restore equilibrium, its new position on the scale indicating the stone's S.G. (Hanneman)

**hyacinth** A former name applied to orange-brown zircons or hessonite garnets.

**hyaline** An opalescent milky quartz.

**hyalite** See *opal.*

**hyalithe** Trade name for a red, brown, green or black opaque glass.

**hydrochloric acid** A mineral acid, HCl, which is a constituent, with nitric acid, of aqua regia.

**hydro-cyclone** A method of separating diamond from crushed kimberlite (blue ground) and gravel. The hydro-cyclone consists

of a cone-shaped tank. The diamond-rich material is fed in from the side and subjected to the centrifugal action of a continuously circulating ferro-silicon slurry. The heavy diamond fraction moves to the outside of the tank, sinks, and is drawn off, the light fraction migrates to the centre and is forced upwards and floated off.

**hydrogrossular garnet** See *garnet.*

**hydrometer** An instrument incorporating a calibrated float which is used to measure the specific gravity of liquids.

**hydrophane** See *opal.*

**hydrostatic weighing** A method of determining the S.G. of a gemstone by weighing it first in air, and then when it is totally immersed in water.

$$\text{S.G.} = \frac{\text{Weight in air}}{\text{Weight in air} - \text{Weight in water}}$$

Direct-reading balances, such as the Westphal, Penfield and Hanneman balances (*Figure H.5*), can be used (or modified) to give a direct indication of S.G. without the need for calculation. The balance is first set to zero while weighing the gemstone in air. A subsequent reading (or zero adjustment) when weighing the gemstone in water then provides the S.G. value.

**hydrothermal process** A process for growing synthetic crystals by dissolving their constituents in superheated water. Seed crystals are suspended in the mineral-rich water and the temperature gradient adjusted so that the solution becomes supersaturated and precipitates out on the seed crystals. The water is superheated to around 400° C in a pressure vessel called an autoclave. *Figure A.6.*

**hypersthene** Related to enstatite and bronzite, this is an iron-magnesium silicate. $(Fe,Mg)SiO_3$. Orthorhombic. R.I. 1.673, 1.715 to 1.683, 1.731; D.R. −0.045; S.G. 3.4-3.5; H. 5-6. Opaque to translucent, dark brown. Occurrence: India.

## I

**Iceland agate** A misleading name for an obsidian.

**Iceland spar** See *calcite.*

**icosi tetrahedron** A 24-sided crystal (also called a trapezohedron) which is one of the seven basic forms belonging to the highest class of symmetry in the cubic crystal system. It consists of an octahedron whose faces have each been replaced by three four-sided faces.

**ideal cut** The name given to the modern brilliant cut whose proportions and angles are designed to produce an optimum blend of brilliance and fire in a diamond. See ***brilliant cut.***

**identification** (of polished diamonds) See ***breath test, dot-ring test, fingerprinting, light spill test, reflectivity meter, thermal conductivity diamond tester, water contact angle*** and ***X-ray diamond tester.***

**idiochromatic gems** Gem minerals which owe their colour to their basic chemical constituents rather than to impurities (the term idiochromatic meaning 'self coloured'). See also ***allochromatic.***

**idiomorphic** Term applied to a crystal which exhibits its normal habit. See ***xenomorphic*** and ***pseudomorphic.***

**idocrase** A collector's stone comprising a complex calcium aluminium silicate, which may also contain beryllium, boron, fluorine and titanium. $Ca_6Al(Al,OH)(SiO_4)_5$. Tetragonal. R.I. 1.700, 1.705 to 1.716, 1.721; D.R. −0.005 (lower values), +0.005 (higher values); S.G. 3.32-3.47; H. 6½. Transparent, olive green, yellowish-brown. Occurrence: Austria, Canada, Norway, Pakistan, Switzerland, USA, USSR.

**igmarald** Trade name for a German synthetic emerald grown by the flux-melt process but never produced commercially.

**igneous intrusion** The intrusion of molten rock magma into pre-existing rock which produces a thermal or contact metamorphism of the earlier rock. See ***contact metamorphism.***

**igneous rock** A rock which solidified from the molten magma either within the earth or on its surface. Igneous rocks which solidified deep inside the earth are called intrusive or plutonic (e.g. granite). Those which solidified rapidly on the surface are called extrusive or volcanic (e.g. lava). See also ***metamorphic rock*** and ***sedimentary rock.***

**illam** A term applied to the gem gravels of Sri Lanka.

**illumination** See ***dark-field illumination, incident illumination*** and ***light-field illumination.***

**illusion setting** A setting consisting of a large polished mount designed to increase the apparent size of a small diamond.

**image stone** An Indian variety of steatite. Alternative name for agalmatolite.

**imitation pearls** Usually solid glass spheres, mother-of-pearl spheres, or hollow glass spheres filled with wax. Imitation pearls are given a lustrous outer coating by dipping them in a fish scale preparation called 'essence d'orient'.

**imitation stones** See ***composite stones, simulants*** and ***synthetic stones.***

**immersion cell** Also called a cuvette, this consists of a small transparent glass container which is used to facilitate the internal

inspection of gemstones by reducing surface reflections. The cell is filled with a liquid having an R.I. close to that of the gemstone under inspection, and the gemstone is immersed in the liquid. Unwanted surface reflections are minimised because the reflectivity of a surface is reduced when surrounded by a medium of similar R.I. See ***Fresnel's reflectivity equation.***

**immersion contact photography** This technique uses UV light to distinguish between natural and synthetic emeralds and rubies. The test specimen is placed together with a natural stone (as a reference), table facet down on a piece of photographic paper in a darkened room. The stones and the paper are placed in the bottom of a shallow dish containing water, and exposed to SW UV light for a few seconds. When the photographic paper is developed, the reference stone will appear white (i.e. it will have absorbed the UV light) while the test specimen, if it is a synthetic, will appear black with a white rim round its profile.

**immersion contrast** Composite and coated stones can be identified by immersion in a liquid of similar R.I.

**immersion estimation of R.I.** See ***Becke line method*** and ***immersion liquids.***

**immersion liquids** Liquids having known R.I.s which are used in an immersion cell either to reduce reflections from the surface of a gemstone, or to approximate its R.I. R.I.s of suitable immersion fluids are as follows:

| | | | |
|---|---|---|---|
| Water | 1.33 | Bromoform | 1.59 |
| Alcohol | 1.36 | Iodobenzene | 1.62 |
| Petrol | 1.45 | Monobromonaphthalene | 1.66 |
| Benzene | 1.50 | Idonaphthalene | 1.70 |
| Clove oil | 1.54 | Methylene iodide | 1.74 |
| | | Refractometer contact fluid | 1.81 |

See also ***immersion cell*** and ***Becke line method.***

**imori stone** See ***victoria stone.***

**imperial jade** Emerald green translucent jadeite.

**imperial Mexican jade** A misleading name for green-dyed calcite.

**imperial sodden snow jade** White nephrite.

**imperial topaz** Sherry-brown topaz.

**imperial Yu stone** Green aventurine quartz.

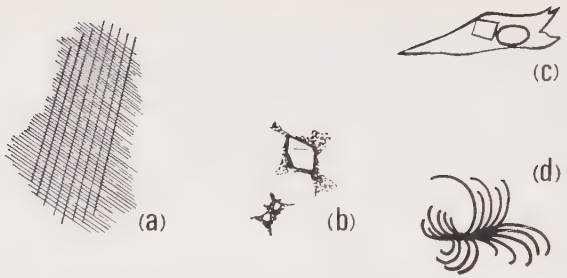
**inanga** Grey nephrite.

**inca emerald** Emerald from Ecuador.

**inca rose** See ***rhodochrosite.***

**inca stone** See ***pyrites.***

**incident illumination** Illumination in which the light rays are incident to that surface of the gemstone nearest to the viewer's eye (or to the microscope objective). See also ***dark-field illumination*** and ***light-field illumination.***




(a) Rutile needles, seen as 'silk' in rubies and sapphires.
(b) Zircon crystals surrounded by 'haloes', seen in Sri Lankan sapphires, spinels and garnets.
(c) Three-phase inclusion (liquid, bubble, crystal) in Colombian emeralds.
(d) Asbestos fibres forming a 'horsetail' inclusion in demantoid garnet.

*Figure I.1* Sketches of characteristic inclusions in natural gemstones.

**inclusions** These consist of a variety of features contained within a gemstone:

*pre-existing* inclusions are of materials which were present before the host crystal began to form (e.g. solid particles and small crystals). Also called protogenetic.

*contemporary* inclusions consist of substances which were present at the same time as the host crystal (e.g. minute droplets of aqueous solution from which the host crystal grew). Also called syngenetic.

*post-contemporary* inclusions occurred after the formation of the host crystal (e.g. various types of fissure). Also called epigenetic.

Inclusions are often given descriptive names:

*feather* or *veil* — a plane of minute cavities (usually liquid filled),

*silk* — a series of fine parallel rutile needles,

*horsetail* — a group of asbestos fibres,

*negative crystal* — a void within the gem having a crystalline shape,

*three-phase* — a liquid-filled cavity containing a bubble and a crystal,

*two-phase* — a liquid-filled cavity containing a bubble or a crystal,

*treacle* — wisps and swirls of colour,

*zircon halo* — a zircon crystal inclusion surrounded by a stress crack.

See also ***colour zoning*** and *Figure I.1.*

**indentation test** An alternative to the use of a scratch test to evaluate the hardness of a mineral. One version, the Knoop

indentation test, involves the measurement of the deformation produced in the surface of the specimen when a diamond-pointed indenter is applied to it with a known load. Another method is the micro-abrasion test which uses a small cone-shaped grinding wheel coated with diamond dust to measure the depth of abrasion over a preset time. Both these techniques produce a measurement of hardness based on an approximately linear scale (e.g. on the Knoop scale of hardness, topaz is 766, corundum is 1000 and diamond is 5180).

**index of refraction** See ***refractive index.***

**Indian agate** Moss agate.

**Indian cat's eye** Chrysoberyl cat's eye.

**Indian cut** An imperfect version of the eight cut designed to retain the maximum weight in the polished diamond.

**Indian emerald** A misleading name for green-dyed cracked quartz.

**Indian Gemmological Institute** See ***Gemmological Institute of India.***

**Indian jade** A misleading name for green aventurine quartz.

**Indian topaz** A misleading name for yellow sapphire.

**indicators** Glass or pure gemstone specimens used as S.G. indicators when blending heavy liquids. See ***heavy liquids*** and ***glass S.G. indicators.***

**indicolite** See ***tourmaline.***

**industrial diamonds** Rough diamonds whose colour, quality or shape make them unsuitable for gem use. See also ***gem diamonds*** and ***near gem.***

**inert** A material which shows no detectable reaction either to stimuli such as UV or X-ray irradiation, or to chemical reagents.

**infra red** The band of electromagnetic energy whose wavelengths lie between the deep red end of the visible spectrum (750 nm) and the microwave end of the radio spectrum (1 million nm or 1 mm).

**infra red spectrophotometer** See ***spectrophotometer.***

**inorganic** A term applied to substances not derived from living or once-living organisms.

**Instituto Gemmologico Italiano** Headquarters: 20146 Milano, Piazzale Gambara 7/6, Italy.

**Instituto Gemologico Espanol** Headquarters: Victor Hugo 1, 3, Madrid 4, Spain.

**intalgio** An incised gemstone carving produced for use as a seal.

**intasia** See ***Florentine mosaic.***

**interference** (of light rays) Light rays reflected from a thin transparent layer, or from a surface containing a series of fine regular surface indentations, travel over differing path lengths and mutually interfere with each other to produce spectral colours. *Figure I.2.*

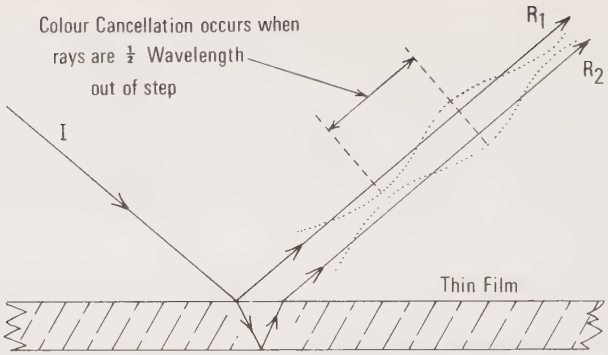



*Figure I.2* Sketch showing how colour is produced in a thin film by the mutual interference between reflected rays. A particular colour is reinforced when the extra distance travelled by ray $R_2$ brings it into phase with $R_1$. The same colour is cancelled when the rays are out of step by a half wavelength of that colour.

**interference figures** Figures produced when transparent doubly-refracting materials are viewed in polarised light under a strongly convergent lens. The figures are indicative of the optical character of the material. *Figure 1.3.* See ***konoscope.***

**interference filter** A colour filter which consists of a plate of glass on which are deposited thin metallic films interlayered with films of a low refractive index mineral such as magnesium fluoride. Light incident to the filter experiences internal reflection and interference in the different layers (see *Figure I.2*) which results in the transmission of only a narrow band of wavelengths. Interference filters are used in gemmology to simulate yellow monochromatic light (centred on the sodium emission lines at 589.3 nm) for refractive index measurements. They are also used to produce light at the B and G Fraunhofer wavelengths in the measurement of dispersion. As only a small portion of the

*Figure I.3* The interference figures seen (left) in a uniaxial stone, and (right) in a biaxial stone.

incident light is transmitted through the filter, it is necessary to use it in conjunction with a high-intensity light source.

**intermediate zircon** See ***zircon.***

**internally flawless** A clarity grade (IF) for polished diamonds indicating that no internal features are visible at 10× magnification. See ***Clarity Grading Standards*** in Appendix C.

**interpenetrant twins** Two (or more) crystals which have grown in proximity and have penetrated each other. With multiple twinning, the result is often a cross, star or hexagonal form. See also ***contact twin*** and ***polysynthetic twinning.***

**intrusive rock** See ***igneous rock.***

**invelite** Trade name for phenolic resin.

**iodobenzene** A liquid used as an immersion fluid. R.I. 1.62. See ***Becke line method*** and ***immersion cell.***

**iolanthite** A banded reddish jasper. See ***quartz.***

**iolite** See ***cordierite.***

**ion** An electrically charged atom or molecule. Certain substances such as salts, acids and alkalies ionise when dissolved in water and produce a solution which conducts electricity. Neutral atoms become ionised when they lose or gain an electron. Negatively charged ions are called *anions*, and positively charged ones *cations.*

**iridescence** See ***sheen.***

**iridium** A member of the platinum group of metals sometimes alloyed with gold or platinum. Ir. Atomic number 77; atomic weight 193.1; melting point 2443 °C; S.G. 22.4.

**iris** A mechanical device fitted above the substage illuminator in a microscope. It consists of an aperture whose diameter can be varied to control the area of light projected onto the specimen. Also used as an intensity control in the output of quartz halogen light sources.

**iris agate** An agate in which the concentric bands are packed so close that they form a diffraction grating and split transmitted light up into spectral colours.

**iris diamond** A diamond which has been coated to cause it to iridesce, this effect giving the impression of increased dispersion.

**iris quartz** A clear colourless quartz containing a series of thin cracks which produce spectral colours by interference effects.

**Irish diamonds** A misleading name for the rock crystal variety of quartz.

**Irish black marble** A variety of marble found in County Carlow, Eire.

**Irish green marble** Also known as Connemara marble, this is found in County Galway, Eire.

**iron** One of the eight transition metals mainly responsible for

colour in gemstones (e.g. almandine garnet, amethyst, aquamarine, peridot, sinhalite). Fe. Atomic number 26; atomic weight 55.84; melting point 1539°C; S.G. 7.87.

**iron opal** Red or yellow common opal.

**iron roses** Rosettes of platy haematite crystals found in Switzerland.

**irradiation of diamond** See ***treated diamonds.***

**Isle of Wight diamonds** A misleading name for the rock crystal variety of quartz.

**ISO** International Standards Organisation.

**isogyre** The dark 'brushes'produced in interference figures as seen in doubly-refracting materials under converging polarised light. See ***interference figures.***

**isometric** A crystal system having equal length axes (e.g. cubic).

**isomorphic replacement** The replacement of one element in a mineral by another element having the same valency, and resulting in the same form and crystal structure. Such replacement may cause wide variations in the mineral's constants (e.g. gems in the garnet group).

**isomorphism** Minerals exhibit isomorphism when they have identical external forms but differ chemically from each other (e.g. gems in the garnet group).

**isotopes** Forms of an element which differ from each other in atomic weight and nuclear properties while remaining the same chemically. These dissimilarities are due to differences in the number of neutrons in the atomic nucleus.

**isotropic** A singly-refracting material in which light rays travel at the same velocity in any direction. All amorphous gems and gemstones in the cubic crystal system are isotropic. See also ***double refraction*** and ***optical character.***

**itali** Aztec name for obsidian.

**Italian chrysolite** See ***idocrase.***

**Italian Gemmological Institute** See ***Instituto Gemmologico Italiano.***

**Italian lapis** A misleading name for blue-stained jasper.

**ivorine** A plastic ivory simulant.

**ivory** See ***dentine ivory, corozo nut, doom palm nut.***

**ivory pearls** A misleading name for ivory spheroids found in tusk cavities.

**ivory turquoise** A misleading name for odontolite.

## J

**jacinth** Reddish-brown zircon or hessonite garnet.

**jade** See *jadeite* and *nephrite.*

**jade-albite** A rock containing a mixture of chrome-rich jadeite and albite feldspar. Also called maw-sit-sit. Cryptocrystalline. R.I. 1.52-1.54 S.G. 2.46-3.15. Opaque, green with black markings. Occurrence: Burma.

**jadeite** A sodium aluminium silicate jade mineral comprising an aggregate of granular crystals $NaAl(SiO_3)_2$. Monoclinic (cryptocrystalline). R.I. 1.65-1.68; S.G. 3.30-3.36; H. 6½-7. Opaque to translucent, white, green, pink, lilac, violet, brown, black. Occurrence: Burma, USA. See also *nephrite.*

**jade matrix** A rock containing a mixture of tremolite and albite feldspar. Also called snowflake jade. Cryptocrystalline. R.I. 1.56; S.G. 2.80-2.95.

**jade tenace** A misleading name for saussurite.

**jadine** A misleading trade name for Australian chrysoprase.

**jager** A diamond having a blue tint which is usually caused by a strong blue fluorescence. See *overblue.*

**jamb peg** An upright wooden-capped metal post containing holes which is used by a lapidary to anchor one end of the gemstone holder (called a gem stick) when polishing side facets. The jamb peg acts as a guide enabling the lapidary to set the angles of these facets correctly.

**Japanese coral** Dark red coral with a white core.

**Japanese gemmological associations** See *Gemological Association of Japan, Gemmological Association of All Japan* and *Gemmological Society of Japan.*

**Japan pearl** A cultured blister pearl.

**jardin** A term (from the French, meaning garden) applied to the inclusions found in emeralds.

**jargon** A term applied to a low quality yellow diamond.

**jargoon** Pale or colourless zircon.

**jarra gem** A trade name for a synthetic rutile diamond simulant.

**jasp agate** A microcrystalline quartz, midway between jasper and agate. When banded this is called jasponyx.

**jaspe fleuri** See *jasp agate.*

**jasper** See *quartz.*

**jasperine** A banded variety of jasper.

**jasper jade** A misleading name for green jasper and serpentine.

**jasper opal** A red, reddish-brown or yellow-brown opal resembling jasper.

**jaspillite** A banded variety of jasper containing haematite.

**jasponal** A gem material intermediate between jasper and opal.

**jasponyx** See *jasp agate.*

**java gem** Trade name for a synthetic rutile diamond simulant.

**java onyx** An opaque stalagmitic marble. Off-white or variegated

with amber-coloured wavy bands. Occurrence: Java.

**jeremejevite** A rare gemstone comprising the mineral aluminium borate. Hexagonal (blue), orthorhombic (yellow, colourless). $AlBO_3$. R.I. 1.639, 1.648; D.R. −0.009; S.G. 3.28. Transparent, pale yellow, aquamarine blue. Pleochroism, medium (colourless, blue). Occurrence: Namibia, USSR.

**jet** A variety of fossilised wood, similar to lignite or brown coal, and halfway in formation between peat and bituminous coal. Also called gegat. Amorphous. R.I. 1.64-1.68; S.G. 1.3-1.35; H. 3½. Opaque, black, dark brown. Occurrence: France, Spain, UK (Whitby), USA.

**jet stone** Black tourmaline, also called schorl.

**jewel** An unmounted gemstone or an ornament worn for personal adornment which contains gemstones.

**jewelite** Trade name for the man-made diamond simulant strontium titanate.

**jeweller** A manufacturer or dealer in gemstones or jewellery.

**jeweller's rouge** A brownish-red abrasive powder (made from crushed haematite) used for polishing gemstones. Also called ferric oxide. See ***haematite.***

**johannes gem** Trade name for a synthetic rutile diamond simulant.

**johnite** A vitreous scaly turquoise.

**Johnson and Rösch brilliant cut** One of the earlier of several 'ideal' cuts for diamond. It has a table facet width, crown depth and pavilion depth of 56.1%, 19.2% and 40% respectively compared with the girdle diameter. The crown angle is 41.08°, and the pavilion angle is 38.67°. See ***Eppler brilliant cut, Scan DN brilliant cut, Parker brilliant cut*** and ***Tolkowsky brilliant cut.***

**joule** An SI unit of energy, work or quantity of heat expressed in newtons per metre (i.e. force × distance). Force (in newtons) = mass (in kilograms) × acceleration (in metres per sec. per sec.).

**jourado diamond** A misleading trade name for a colourless synthetic spinel used as a diamond simulant.

**Jurassic** A rock system on the earth's surface comprising the rocks laid down during the Jurassic period, 195-135 million years ago. The Jurassic period was the middle part of the Mesozoic era. See ***Mesozoic.***

## K

**kahurangi** A pale green translucent variety of New Zealand nephrite.

**kakortokite** An ornamental rock consisting of a whitish nepheline

syenite and containing red crystals of eudialite (a rare zirconium mineral) and black arfvedsonite. S.G. 2.7-2.8. Occurrence: Greenland.

**kalmuck agate** Also known as cacholong. See ***opal.***

**kandy spinel** A misleading name for a reddish-violet garnet found in Sri Lanka.

**kan huang jade** A light yellowish jade.

**kaolin** A fine white clay comprising a hydrated aluminium silicate derived from decomposed feldspar in pegmatite rocks. Used as a lapidary abrasive and in the manufacture of porcelain.

**kaolite** Trade name for imitation cameos, etc., moulded in clay and baked.

**karat** See ***carat weight.***

**karlsbad spring stone** A banded gypsum used for carvings.

**Kashan synthetic ruby** A synthetic ruby grown by the flux-melt process (and containing variable amounts of iron oxide). Kashan Laboratories, Texas, USA.

**kashgar jade** A low quality nephrite.

**Kashmir sapphire** A deep cornflower blue sapphire, having a milky semi-transparent appearance caused by minute liquid inclusions. See ***corundum.***

**kauri gum** See ***copal resin.***

**kawakawa** The normal green variety of New Zealand nephrite.

**Kelvin temperature scale** See ***absolute temperature scale.***

**kenneth lane jewel** Trade name for the man-made diamond simulant strontium titanate.

**Kenya gem** Trade name for a synthetic rutile diamond simulant.

**Kerez effect** An effect, discovered by Dr C. J. Kerez, seen in some green tourmalines which show four instead of two shadow edges on a critical-angle refractometer. The two extra anomalous shadow edges disappear if the stone is repolished, and the effect is thought to be due to skin-deep alterations caused by local overheating during polishing.

**kerf** The small groove scratched in the surface of a rough diamond (by another diamond) prior to cleaving. The kerf is positioned parallel with a cleavage plane, its radius being made smaller than that of the cleaving blade tip which then acts as a wedge to part the stone. See *Figure C.3.*

**keshi pearls** Naturally occurring non-nucleated pearls which form in a mollusc when it is returned to the water after the removal of a crop of non-nucleated cultured pearls. See also ***Biwa pearls.***

**keweenaw agate** A variety of agate found near Lake Superior, Canada.

**keystone** A trap cut stone having a keystone or trapezium outline.

**keystoneite** A blue chalcedony coloured by chrysocolla.

**khoton jade** A poor quality nephrite.

**kidney stone** See ***nephrite*** and ***haematite.***

**kiku-ishi** See ***xenotime.***

**Kilkenny black fossil marble** An Irish black marble containing white circles formed by the fossilised remains of brachiopod shells.

**killiecrankie diamond** A misleading name for colourless topaz from Australia.

**kima gem** Trade name for a synthetic rutile diamond simulant.

**kimberlite** An igneous rock rich in olivines (a type of peridot), which is found in volcanic-type pipes or vents. In diamond-bearing pipes, kimberlite is thought to be the medium which transported the diamond crystals from deep inside the earth's crust. Kimberlite is also called blue ground. This weathers on the surface to become the more friable yellow ground.

**kimberlite gem** Trade name for a synthetic rutile diamond simulant.

**kimpi** A red or brown variety of jadeite.

**king cut** An 85-facet diamond cut consisting of 49 crown facets (including a 12-sided table facet) and 36 pavilion facets (plus a culet). *Figure K.1.*

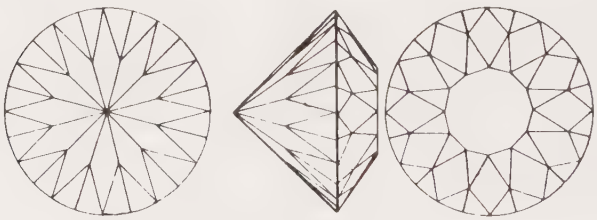


*Figure K.1* The king cut.

**kingfisher jade** A bluish-green jadeite.

**king's coral** A black coral also called akabar.

**king topaz** A misleading name for yellow sapphire.

**kinradite** An orbicular variety of jasper containing circular markings.

**kismet pearls** Trade name for imitation pearls.

**kite** A trap-cut stone having the profile of a kite.

**kite facets** The eight kite-shaped crown facets on a brilliant-cut stone (also called bezel facets and top main facets). See ***brilliant cut.***

**Klein's solution** A heavy liquid consisting of a solution of cadmium borotungstate in water. S.G. 3.28.

**Knoop indentation hardness test** See ***indentation test.***

**knot** A major distortion or discontinuity of the crystal lattice

within a diamond which often creates problems in cleaving and polishing the stone. May sometimes be an included crystal, or a twinning plane (see *macles*). Also called a naat.

**Koh-i-nur** An historic diamond (the name meaning 'mountain of light'), reputed to have been found in the Indian Kollur diamond mines. Originally a 186-carat Indian rose-type cut, it was reduced to a 108.93-carat oval diamond when incorporated in the British Crown Jewels. It is now traditionally set in the crown of the Queen Consort, and never in the crown of the monarch. When Elizabeth II became the reigning monarch, the Koh-i-nur remained in the crown of Queen Elizabeth the Queen Mother.

**kollin garnet** An almandine garnet.

**konoscope** A polariscope fitted with a strongly convergent lens which enables the optical character of doubly-refracting materials to be identified by making visible optical axis interference patterns. See ***interference figures*** and ***polariscope.***

**kopje** An Africaaner word for a small flat-topped hill. This is one of the geological formations associated with the yellow ground top of a kimberlite pipe. See ***kimberlite.***

**koranna stone** A variety of pyrophyllite, also known as South African wonderstone and Ottosdal G stone, used for ornamental objects. R.I. 1.58; S.G. 2.72; H. 1½-2. Opaque, dark grey. Occurrence: South Africa. See ***pyrophyllite.***

**Korea jade** A misleading name for green serpentine.

**Korean Gemmological Association** See ***Gemmological Association of All Korea.***

**Korean Gemmological Institute** See ***Gemmological Institute of Korea.***

**korite** Trade name for ammolite.

**kornerupine** A rare collector's stone comprising a complex borosilicate of aluminium, iron and magnesium. Orthorhombic. R.I. 1.665, 1.678 to 1.668, 1.680; D.R. −0.013; S.G. 3.28-3.35; H. 6½. Transparent to translucent (occasionally chatoyant), green, greenish-brown. Pleochroism, strong (green, yellow, brown). Occurrence: Burma, Canada, East Africa, the Malagasy Republic, South Africa, Sri Lanka.

**kurnakovite** A collector's stone consisting of a hydrated magnesium borate. $Mg_2B_6O_{11}.15H_2O$. Triclinic. S.G. 1.86; H. 4½. Transparent, colourless, pink.

**kunzite** See ***spodumene.***

**kupfernickel** See ***niccolite.***

**kyanite** A collector's stone (polymorphous with andalusite and sillimanite) comprising the mineral aluminium silicate. Also called disthene (meaning double strength). $Al_2SiO_5$. Triclinic. R.I. 1.715, 1.732; D.R. −0.017; S.G. 3.65-3.69; H. 7 (across width), 5

(across length). Transparent to translucent (occasionally chatoyant), colourless, blue, blue-green. Pleochroism, strong (colourless, light blue, dark blue). Occurrence: Austria, Burma, India, Kashmir, Kenya, Switzerland, USA.

**kyauk-ame** A black jadeite.

**kyauk-átha** A white translucent jadeite.

## L

**la beau pearls** Trade name for imitation pearls.

**labradorescence** See ***sheen.***

**labradorite** See ***feldspar.***

**labrador moonstone** The labradorite variety of plagioclase feldspar. See ***feldspar.***

**labrador spar** The labradorite variety of plagioclase feldspar. See ***feldspar.***

**lace agate** A blue and white banded chalcedony, also called blue lace agate.

**lactoid** Trade name for a casein plastic.

**laguna pearls** Trade name for imitation pearls.

**Lake George diamond** A misleading name for the rock crystal variety of quartz.

**Lake Superior fire agate** A misleading name for a glass opal simulant.

**Lake Superior greenstone** See ***chlorastrolite.***

**lamachella** See ***fire marble.***

**lamellar** A crystalline habit or structure composed of straight or curved plates or leaves.

**landerite** A pink grossular garnet in a matrix of white marble. Also called xalostocite and rosolite. Occurrence: Mexico.

**landscape agate** An agate containing dendritic 'tree'-like inclusions resembling a landscape. Also called moss agate.

**landscape marble** A marble comprising a light grey rock having dark brown or black dendritic markings resembling a landscape. Also called cotham marble. See also ***ruin marble.***

**lap** The rotary metal or wooden disc (sometimes surfaced with cloth or leather) used by lapidaries for polishing gemstones. For diamond polishing the lap is made of cast iron and is called a scaife or a mill (see *Figure T.1*).

**lapidary** A craftsman who polishes gemstones (other than diamond). See also ***diamond cutter.***

**lapis crucifer** Staurolite crystals.

**lapis lazuli** A complex rock containing several minerals including calcite, hauynite (mainly responsible for the stone's colour), lazurite, noselite, sodalite and flecks of iron pyrites. R.I. 1.5; S.G.

2.7-2.9; H. 5½. Opaque, purple blue to greenish-blue. Occurrence: Afghanistan, Canada, Chile.

**lapper** See ***cross cutter.***

**lardite** See ***agalmatolite.***

**laser** A laser (light amplification by stimulated emission of radition) is a generator of visible to infra red electromagnetic energy, that is monochromatic, collimated and coherent (i.e. all of the emitted rays are in step, or in phase). Because of these features it is possible to concentrate the energy of the laser beam into a very small cross-section.

**laser drilling of diamonds** A method by which a diamond's clarity is improved by drilling a fine hole (less than 0.005 inch diameter) through the diamond into an inclusion by means of a laser beam. A bleaching agent is leached via the hole into the inclusion to whiten it. The hole may then be filled with a transparent gel. Because diamond is transparent to the infra red laser beam, and therefore cannot be directly vapourised by its heat, drilling is initiated by placing a spot of amorphous carbon or graphite on the diamond's surface to absorb the laser energy. As the carbon vapourises it converts the diamond beneath it to carbon, and the drilling process continues.

**lasered diamond** See ***laser drilling of diamonds.***

**laser fingerprinting** A commercial instrument called a Gemprint produces a 'fingerprint' identification picture of a diamond by

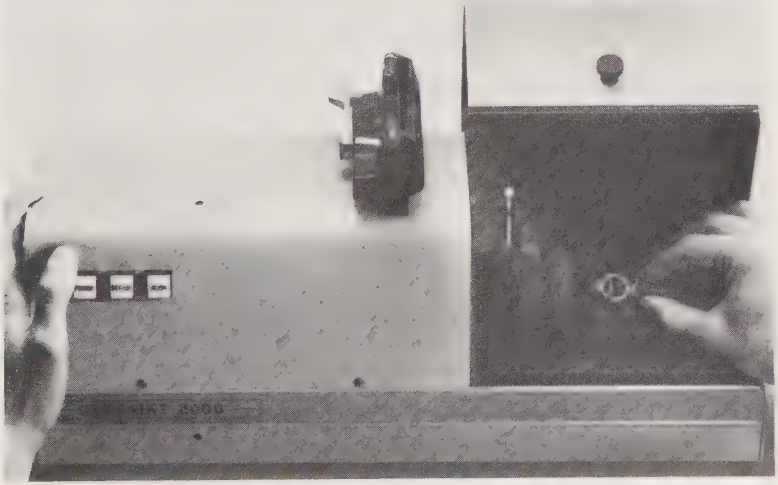


*Figure L.1* The Gemprint produces a 'fingerprint' picture of a polished diamond by using the gem to reflect and refract the light from a laser beam onto Polaroid film.

using the gem to reflect and refract the light from a laser beam onto a Polaroid film. The unique pattern of light spots recorded on the film is caused by minute and individualistic differences in the symmetry and polish on the stone's facets. *Figure L.1.* See also ***fingerprinting.***

**laser gem** Trade name for a diamond simulant doublet having a synthetic sapphire crown and a strontium titanate base.

**lasque diamond** A flat diamond used by Indian cutters to cover miniature paintings. Also called a portrait stone.

**la tausca pearls** Trade name for imitation pearls.

**lateral axes** Horizontal crystal axes which are at right-angles to the vertical or principle axis in tetragonal, hexagonal, trigonal and orthorhombic crystal systems. See ***crystal axes.***

**lathi** A Burmese weight equal to 1.75 carats. See also ***bali, rati, tickal*** and ***viss.***

**lattice** See ***crystal lattice.***

**lat yay** A cloudy variety of jadeite.

**Laue diffraction** An X-ray technique used to distinguish between natural and cultured pearls. In natural pearls, the aragonite crystals are aligned radially round the pearl with their major axes at right-angles to the surface. When the pearl is placed in a narrow beam of X-rays, these crystals scatter some of the rays and produce a Laue diffraction pattern of spots which can be recorded on a photographic film. Because of the atomic structure within the aragonite crystals, this diffraction pattern will have a hexagonal symmetry for any orientation of the natural pearl. With the nucleated cultured pearl, this hexagonal pattern is only produced in one position where the crystals in the mother-of-pearl bead are parallel to the line of the X-rays. In all other positions of the pearl a four-point symmetry pattern is produced. *Figure L.2.*

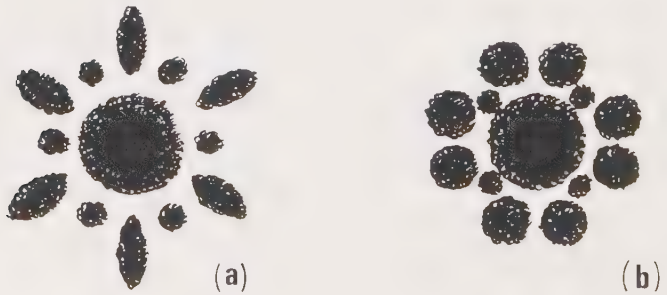



*Figure L.2* The hexagonal Laue diffraction pattern produced when a narrow beam of X-rays penetrates a natural pearl is shown at (a). With a cultured nucleated pearl, both the hexagonal and the four-point pattern, as shown at (b), can occur, depending on the orientation of the bead.

**lauegram** The characteristic pattern of spots produced on a photographic film by passing a narrow X-ray beam through a crystalline material. The pattern is caused by the diffraction of the X-ray beam by the crystal lattice. See ***Laue diffraction.***

**laurelite** See ***idocrase.***

**Laurvikite** A feldspar-rich Norwegian rock used for cladding building facades. Sometimes incorrectly called labradorite. It has a pearl-grey iridescence.

**lava** See ***igneous rock.***

**lava cameo** An opaque grey or brownish-yellow fine-grained limestone marble.

**lavendrine** See ***quartz*** (amethyst variety).

**lavernite** Trade name for synthetic periclase.

**law of reflection** The angle of incidence of a light ray striking a polished surface is equal to its angle of reflection, and both the incident ray, the normal (at the point of incidence), and the reflected ray lie in the same plane.

**law of refraction** Snell's Law states that:

1. When a ray of light passes from one medium into another there exists a definite ratio between the sines of the angle of incidence and the angle of refraction, which is dependent only on the two media and the wavelength of the light.
2. The incident ray, the normal (at the point of incidence) and the refracted ray are all in the same plane.

From *Figure L.3:*

$$\text{Refractive Index} = \frac{\text{Sine ION}}{\text{Sine MOR}}$$

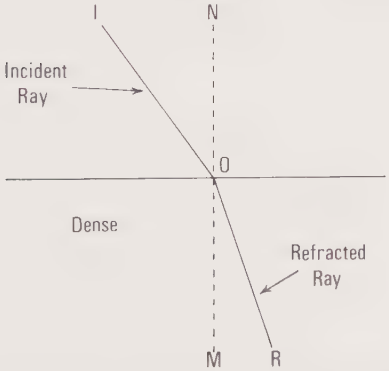



*Figure L.3* An incident ray entering an optically denser medium (such as a gemstone), at an angle other than the normal, is refracted towards the normal. A ray leaving the gemstone and passing into a less dense medium (such as air) will be refracted away from the normal.

In gemmology, R.I. values are quoted in terms of a reference wavelength of 589.3 nm (i.e. sodium light).

**lawsonite** A rare gemstone comprising the mineral calcium aluminium silicate. $H_4CaAl_2.Si_2O_{10}$. Orthorhombic. R.I. 1,665, 1.684; D.R. +0.019; S.G. 3.08-3.09; H. 7-8. Transparent, colourless, pale blue. Occurrence: Italy, Scotland, USA.

**laxey diamond** A trade term for very shallow-cut diamond brilliants.

**lazulite** A phosphate of magnesium iron and aluminium. $(Mg,Fe)Al_2(PO_4)_2(OH)_2$. Monoclinic. R.I. 1.615, 1.645; D.R. −0.03; S.G. 3.1-3.2; H. 5½. Transparent to opaque, colourless to dark blue. Pleochroism, strong (colourless, blue). Occurrence: Austria, Brazil, India, the Malagasy Republic, Sweden, USA.

**lazurapatite** A variety of apatite with lapis lazuli. Occurrence: USSR.

**lazurfeldspar** A bluish orthoclase feldspar from the USSR.

**lazurite** An isomorphous combination of hauynite and sodalite present in lapis lazuli.

**lead glass** See ***flint glass.***

**Lechleitner emerald simulants** Faceted beryls coated with a hydrothermally deposited layer of synthetic emerald by Lechleitner of Innsbruck, Austria. Constants are similar to those of natural emerald. Later Lechleitner emeralds consist of alternating layers of colourless and green synthetic beryl, also grown hydrothermally.

**lechosos opal** A variety of opal having deep green and red iridescence.

**legrandite** A rare gemstone consisting of the mineral hydrated zinc arsenate. Monoclinic. R.I. 1.675, 1.735; D.R. +0.06; S.G. 3.98-4.04; H. 5. Transparent, bright yellow. Occurrence: Mexico.

**Lennix synthetic emeralds** Synthetic flux-melt emeralds grown by M. Lens of France. The process was developed by M. Lens in the De Beers Diamond Research Laboratory, Johannesburg, South Africa, and produces rectangular rather than hexagonal crystals. R.I. 1,562, 1.566; D.R. −0.004; S.G. 2.65.

**lens** A polished piece of glass or transparent material with one or both sides curved, to converge, disperse or collimate light rays. See ***hand lens.***

**lens cut** A gemstone cut in which the crown is cut in a series of long parallel facets forming a cylindrical dome-shape, and the pavilion is step cut.

**lepidolite** An ornamental stone comprising a complex silicate of potassium, lithium and aluminium. Also called lithia mica. Monoclinic. Mean R.I. 1.55; S.G. 2.8-2.9; H. 3½. Opaque, rose red. Occurrence: the Malagasy Republic, Namibia, USA, USSR, Zimbabwe.

**lestergem** Trade name for a synthetic spinel diamond simulant.

**leucite** A collector's stone comprising the mineral potassium aluminium silicate. $KAl(SiO_3)_2$. Cubic. R.I. 1.51; S.G. 2.45–2.50; H. 5½–6. Transparent, colourless. Occurrence: Germany, Italy, USA.

**leuco-sapphire** A colourless sapphire.

**leveridge gauge** See ***caliper gauge.***

**Libyan glass** A nearly pure silica glass found in the Libyan desert. $SiO_2$. Amorphous. R.I. 1.46; S.G. 2.21; H. 6. Transparent to translucent, greenish-yellow.

**liddicoatite** A brown, blue or pink/green parti-coloured elbaite-type tourmaline, having (unlike elbaite) a high calcium content and little sodium.

**life** (of a diamond) A term used to describe the overall brilliance of a polished diamond resulting from its surface lustre and from the total internal reflection of light from its pavilion facets.

**light** A form of visible electromagnetic energy spanning the wavelengths of the spectrum from 400 nm to 750 nm. (See *Figure E.1.*) White light is composed of an approximately equal mixture of all the colours, or wavelengths, that make up the visible spectrum. Non-white light is specified in terms of its hue (i.e. colour of predominant wavelength), saturation (depth or strength of dominant colour) and lightness (shade). The velocity of light waves is 300 000 kilometers per second.

**light brown** A colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**light cape** A UK colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**light-field illumination** Illumination in which light is transmitted through the specimen to the eye. See also ***dark-field illumination*** and ***incident illumination.***

**light guide** See ***fibre optics.***

**lightning tubes** See ***fulgurites.***

**light spill test** A simple method of distinguishing a brilliant-cut diamond from a simulant (*provided they are modern ideal cuts*). The stone is viewed against a dark background, with the table facet at right-angles to the line of vision. It will appear uniformly bright because its pavilion facets will act as reflecting mirrors. If the stone is a diamond, it will be possible to tilt it (so that the eye begins to look into the table facet at increasingly shallow angles) without losing the uniformly bright appearance of the pavilion facets, even when this angle becomes very small (5 to 10°). If the stone is a simulant, and has a lower refractive index than diamond, the pavilion facets furthest from the eye will begin to look black as the stone is tilted below 60° (i.e. light will 'spill' out

*Figure L.4* Five diamond simulants photographed at an angle to illustrate the 'light spill' test. The centre stone is a YAG, and shows the greatest light leakage from its pavilion facets due to its relatively low R.I. (1.83). The top left stone is a GGG (1.97), top right is a lithium niobate (2.25), bottom left is a cubic zirconia (2.16) and bottom right is a strontium titanate (2.41) which, like diamond (2.42) shows no light leakage.

of these facets instead of being reflected back — see *Figure L.4*). The lower the refractive index of the stone, the more marked will be the effect. This test will not distinguish strontium titanate (R.I. 2.41) or synthetic rutile (R.I. 2.75) from diamond, but these two diamond simulants are recognisable by their excessive dispersion or fire.

**light yellow** A colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**lignite** A brown coal intermediate between peat and bituminous coal.

**limestone** A sedimentary rock composed mainly of calcium carbonate.

**limonite** A brown hydrated iron oxide forming the matrix in which turquoise often occurs.

**Linde A** See ***aluminium oxide.***

**Linde simulated diamond** Trade name for the man-made diamond simulant yttrium aluminium garnet.

**Linde synthetic emeralds** Synthetic emeralds produced by the

hydrothermal process. R.I. 1.571, 1.578; D.R. −0.007; S.G. 2.678. Linde Division of the Union Carbide Corporation, East Chicago, USA.

**Linde synthetic star corundum** A synthetic star corundum in which asterism is induced by adding titanium oxide to the alumina powder in the Verneuil flame-fusion process. The finished boule is then re-heated to precipitate out the titanium oxide as rutile needles along the planes of the three lateral crystal axes. See ***Verneuil furnace.***

**lines of Retzius** Term used to describe wavy parallel lines visible in dentine ivory. As these are not growth lines, but an optical effect produced by the dentine substructure, the term 'engine turned' is a more correct description.

**linobate** Trade name for the man-made diamond simulant lithium niobate.

**lintonite** A plain green variety of thomsonite (also called winchellite).

**liquid inclusion** A fissure or void within a gemstone which contains a liquid (often the remains of the aqueous 'mother' solution from which the gem crystallised).

**lithia amethyst** A misleading name for the kunzite variety of spodumene.

**lithia emerald** A misleading name for the hiddenite variety of spodumene.

**lithia mica** See ***lepidolite.***

**lithium amethyst** See ***lithia amethyst.***

**lithium niobate** A man-made diamond simulant (introduced in 1969) which has no counterpart in nature. $LiNbO_3$ (niobium, Nb, has the alternative name columbium, Cb). Trigonal. R.I. 2.21, 2.30; D.R. +0.09; S.G. 4.64; H. 5½. Transparent, colourless or green, red, blue/violet, yellow (coloured crystals are doped with transition metal oxides). Pleochroism, distinct in all colours. Crystals are grown by the Czochralski process.

**lithium tantalate** A man-made scientific crystal suitable for use as a diamond simulant. $LiTaO_3$. R.I. 2.175, 2.180; D.R. +0.005; S.G. 7.454; H. 5½-6. Transparent, colourless.

**lithosphere** The outer layer of the earth comprising the crust and upper mantle and having a thickness of 30-40 miles. The outer section of the lithosphere contains aluminium silicate rocks (e.g. feldspars) and is the most important area in the genesis of gemstones.

**lithoxylite** An opalised wood.

**litoslazuli** A massive purple fluorspar.

**liver opal** See ***menilite.***

**lode** A vein of metallic ore in a rock.

**long wave UV** See ***ultra violet light.***

**lonsdaleite** Diamonds found in meteorites which have a hexagonal rather than a cubic crystal structure (i.e. a diamond polymorph). They have also been synthesised and are classified as Type III diamond.

**lost-wax casting** A method of producing a cast metal object from a wax pattern. The wax pattern is encased in a gypsum-based moulding material, and then melted out, the vacated space forming the casting mould.

**loupe** See ***head loupe, triplet (lens)*** and ***hand lens.***

**loupe clean** A misleading clarity grading term for polished diamonds. Its use is prohibited by the American Gem Society. Loupe clean implies 'flawless' under 10× magnification, and this is the preferred term.

**lower break facets** See ***break facets.***

**low zircon** A variety of zircon in which alpha-particle bombardment from once radioactive uranium and thorium impurities have almost completely broken down the stone's internal crystalline structure. As a result, low zircons have lower constants than normal 'high' zircons and are virtually amorphous. R.I. 1.78-1.84; S.G. 3.9-4.1; H. 6½. Such zircons are usually green or brown, and are described as metamict. See also ***high zircon*** and ***zircon.***

**lucinite** A variety of variscite from Utah, USA.

**lumachella** See ***fire marble.***

**luminescence** When some substances acquire surplus energy in one form or another (below the level which would cause incandescence) they emit a visible 'cold' radiation which is often characteristic for that substance. The mechanism producing this cold radiation, or luminescence, is associated with the excitation of atoms within the substance. Of the many varieties of luminescence, photoluminescence is the most useful in gemmology, and results from the application of energy in the form of electromagnetic radiation (i.e. visible light, UV light or X-rays). Some gem materials luminesce with different characteristic colours when irradiated with SW UV, LW UV or X-rays, and this can form a useful means of identification (see ***Table of Fluorescence of Principal Gemstones*** in Appendix I). See also ***bioluminescence, cathodoluminescence, electroluminescence, fluorescence, thermophosphorescence, triboluminescence*** and ***ultra violet light.***

**lunette** A step-cut stone having a half moon profile.

**luster** See ***lustre.***

**lusterite** Trade name for a synthetic rutile diamond simulant.

**lustigem** Trade name for the man-made diamond simulant

strontium titanate.

**lustre** The lustre of a gemstone is the characteristic reflective property of its surface. The following terms are used to describe gemstone lustres:

*adamantine* — the high surface reflectivity of diamond, high zircons and demantoid garnet.

*greasy* — the surface of soapstone and nephrite.

*metallic* — the high lustre associated with metals, and seen in some metallic compounds (e.g. pyrites).

*pearly* — the lustre seen with mother-of-pearl.

*resinous* — the lustre of amber.

*silky* — the fibrous lustre of satin spar.

*vitreous* — the glass-like lustre typical of the majority of gemstones.

*waxy* — the almost matt surface of turquoise and jadeite.

**lux sapphire** A misleading name for cordierite.

**LW UV** See ***ultra violet light.***

**lydian stone** See ***basanite.***

**lynx eye** A variety of labradorite with green iridescence.

**lynx sapphire** A misleading name for cordierite.

## M

**mabe pearls** Cultured blister pearls produced by cementing a small pellet of mother-of-pearl to the inside surface of the mollusc's shell. The resulting blister pearl is sawn out of the shell and a dome-shaped piece of mother-of-pearl cemented to its base to cover the area lacking in nacre. In a later production method, a soft bead is used in place of the mother-of-pearl pellet. This bead is subsequently removed from the grown pearl, and a smaller glass bead cemented in its place. S.G. 2.72-2.78.

**maccle** See ***macles.***

**macles** A shape category for rough diamonds consisting of a contact-twin diamond crystal in which the two halves have grown with one half rotated through 180° to the other. A macle usually takes the form of a flat triangular crystal, the junction between the two halves being visible as a 'herring bone' pattern round the edge of the triangle. See also ***chips, cleavages, melée, shapes*** and ***stones.***

**macro axis** See ***brachy axis.***

**macro pinacoid** The faces of a macro pinacoid are cut by the longer (macro) axis in an orthorhombic or triclinic crystal. See ***basal pinacoid, brachy pinacoid*** and ***pinacoid.***

**macroscopic** Visible to the naked eye. See ***microscopic.***

**Madagascar aquamarine** A blue variety of beryl from the Malagasy Republic.

**Madeira topaz** A misleading name for the citrine variety of quartz.

**magalux** Trade name for a synthetic spinel diamond simulant.

**magic eye** Trade name for a honey-coloured simulant of cat's eye chrysoberyl. $MgTiO_2$.

**magma** The molten or semi-molten material beneath the earth's crust which, on cooling, solidifies to form igneous rocks.

**magna cut** A 101 facet (plus culet) diamond consisting of a ten-sided table surrounded by 60 crown facets and backed by 40 pavilion facets. *Figure M.1.*

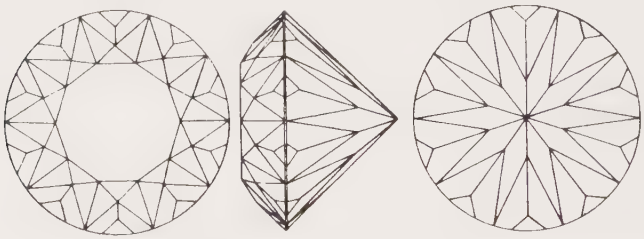


*Figure M.1* The magna cut.

**magnesioaxinite** A colour-change magnesium calcium aluminium silicate member of the axinite group. Triclinic. R.I. 1.656, 1.668; D.R. +0.012; S.G. 3.178; H. 6½. Transparent, pale blue (in daylight), pale violet (under tungsten light). Pleochroism, strong (pale blue, pale violet, pale grey). Occurrence: Tanzania.

**magnesite** A collector's stone comprising the mineral magnesium carbonate. $MgCO_3$. Trigonal. R.I. 1.515, 1.717; D.R. −0.202; S.G. 3.0-3.12; H. 4. Transparent, colourless. Occurrence: World-wide (gem quality from Brazil).

**magnetism** The magnetic phenomenon produced by an electric current and inherent in some materials. The two main types of magnetism are paramagnetism (magnetism induced in materials such as cobalt, iron, nickel, steel, etc., which are attracted towards the inducing field), and diamagnetism in which the induced magnetism tends to repel the material transversely away from the inducing field (e.g. bismuth).

**magnetite-jade** An opaque jade coloured black by magnetite inclusions. Sometimes electrolytically plated with swathes of gold. S.G. (depending on magnetite content) 3.4-4.4; H. 5½-7.

**magneto-hydrostatic separation** A technique used for the final separation of diamond from a concentrate of crushed aggregate and gravels.

**magnification** A term usually expressed as a linear (i.e. length or

diameter) magnification factor of lenses and microscopes. The overall magnification factor of a microscope is the product of the magnification of its eyepiece and its objective lens. Doubling the magnification of the objective will halve the microscope's working distance (i.e. the distance between the objective and the specimen). The magnification factor of the eyepiece does not affect the working distance.

**magnifiers** See ***hand lens, head loupe, compound microscope, binocular microscope, monocular microscope, Greenough microscope, microscope*** and ***triplet (lens).***

**main facets** A general term which refers to the large crown and pavilion facets of a brilliant-cut stone.

**make** See ***cut.***

**makeables** Rough diamonds which can be polished without the need for preliminary sawing (e.g. chips, cleavages and macles). See ***sawables.***

**making up** The weighing and sizing of rough gem diamonds in the De Beers Central Selling Organisation which follows the sorting operations, and precedes the splitting operation (prior to the sights). See ***splitting*** and ***sights.***

**malachite** A hydrated copper carbonate. $Cu_2(OH)_2CO_3$. Monoclinic. R.I. 1.655, 1.909; D.R. −0.254; S.G. 3.8; H. 4. Opaque, light and dark greens with concentric banding. Occurrence: Australia, Chile, Namibia, South Africa, USA, USSR, Zaire.

**malacolite** See ***diopside.***

**malacon** A glassy brown variety of zircon.

**Malaya garnet** See ***umbalite garnet.***

**malleability** A property of a metal which allows it to be hammered, stretched or pressed into a shape without the formation of stress cracks or factures.

**mamillary** An external mineral shape or habit consisting of rounded intersecting surfaces (a larger form of botryoidal) e.g. haematite.

**mammoth ivory** See ***fossil ivory.***

**manchandi** A Sri Lankan weight equal to 1.15 carats. See also ***chevvü.***

**manchurian jade** A misleading name for soapstone.

**manganese** One of the eight transition metals which are mainly responsible for colour in gemstones. Mn. Stones coloured by manganese include rhodochrosite, rhodonite, rose quartz and spessartite. Atomic number 25; atomic weight 54.93; melting point 1250 °C; S.G. 7.4.

**manganese dioxide** An abrasive powder used by lapidaries for gemstone polishing.

**manganese spar** See ***rhodochrosite.***

**manganotantalite** A collector's stone comprising the mineral manganese tantalum oxide. $MnTa_2O_6$. Orthorhombic. R.I. 2.14, 2.22 to 2.17, 2.25; D.R. +0.08; S.G. 7.52-7.92; H. 5½-6. Transparent, red. Occurrence: Mozambique.

**mangelin** An Indian weight equivalent to 1.75 carats. See also ***rati*** and ***tola.***

**Manilla shell** Pearl shell from the Philippines.

**man-made stones** The term generally applied to synthesised gemstones which have no counterpart in nature (e.g. lithium niobate, strontium titanate, gadolinium gallium garnet, yttrium aluminium garnet). See ***synthetic stones.***

**mantle** The protective inner tissues of the pearl-producing mollusc which secretes nacre.

**mantle** That portion of the earth's structure, 1780 miles thick, between the earth's crust and its core.

**manufactured stones** See ***composite stones*** and ***synthetic stones.***

**man yu** A blood-red variety of jade.

**Maori stone** New Zealand nephrite.

**marble** A crystalline aggregate of calcite (often having a lustrous granular texture) derived from compacted or metamorphised limestone. Commercially the term marble includes a number of ornamental stones which depart from the foregoing definition. Occurrence: World-wide.

**marcasite** A dimorphous form of pyrites which, unlike pyrites, is rarely used in jewellery. $FeS_2$. Orthorhombic. S.G. 4.85-4.90. Opaque, bronze-yellow. Occurrence: World-wide.

**marekanite** A smoky-brown, grey or black obsidian. Occurrence: Mexico, USSR.

**Margaritifera** A genus of freshwater pearl-bearing mussel.

**marialite** See ***scapolite.***

**mari diamond** A misleading name for the rock crystal variety of quartz.

**marine terrace** A wave-cut coastal shelf or raised beach.

**mariposite** A foliated rock containing green streaks of mica.

**marmarosch diamond** A misleading name for the rock crystal variety of quartz.

**marmora diamond** A misleading name for the rock crystal variety of quartz.

**marquise** A variant of the 57-facet brilliant-cut (also called a navette), having a boat-shaped profile with pointed ends. *Figure M.2.*

**marvelite** Trade name for the man-made diamond simulant strontium titanate.

**marvella pearls** Trade name for imitation pearls.

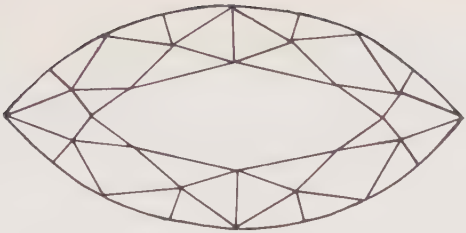


*Figure M.2* The marquise or navette cut.

**masai anyolite** See ***anyolite.***

**mascot emerald** A misleading name for a soudé emerald simulant. See ***composite stones.***

**mass** The standard unit of mass is the kilogram (kg). Mass is the measure of the inertia of a body (i.e. its acceleration when a force is applied to it), while *weight* is the force exerted on that body by the earth's gravity. The weight of an object varies slightly from place to place on the earth's surface (being greater at the poles than at the equator because of the earth's flattened spheroid shape), while the mass of a body remains constant. An object having a mass of 1 kg, which weighs 1 kg on earth, would, for example, have a *weight* of 1/6 kg on the moon, although its *mass* would still be 1 kg. *Figure M.3.*

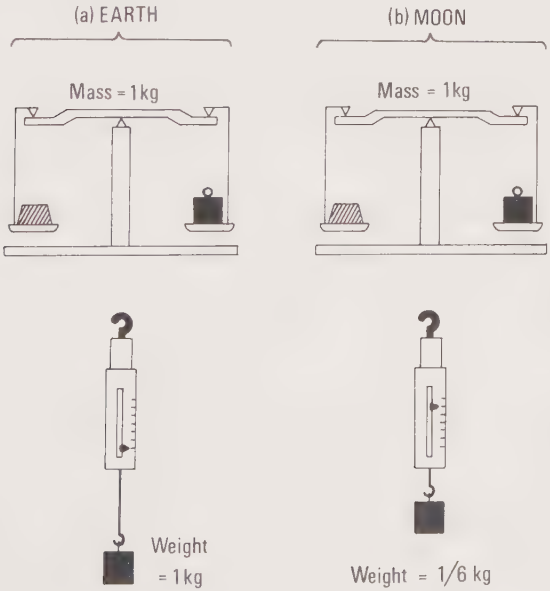



*Figure M.3* Sketch illustrating the difference between mass and weight.

**mass aqua** A misleading name for a glass simulant of aquamarine.
**massive** Without external crystalline shape.
**massive grossular** A hydrogrossular garnet, also misleadingly called Transvaal jade and African jade. See ***garnet.***
**master stones** Carefully selected polished stones which are used as standards for comparison colour grading.
**mastodon ivory** Dentine fossil ivory from the extinct mastodon elephant. Occurrence: Alaska.
**matrix** The 'mother rock' in which gemstones crystallise.
**matura diamond** A misleading name for colourless zircon.
**maw-sit-sit** See ***jade-albite.***
**maxixe** See ***beryl.***
**maxixe-type beryl** A beryl whose colour is due to $CO_3$ impurity ions.
**mayaite** A diopside-jadeite.
**mazarin cut** An early diamond cut having a cushion-shaped girdle, with seventeen crown facets (including the table) and sixteen pavilion facets (plus a large culet).
**mecca stone** The cornelian variety of chalcedony.
**mechanical dop** See ***dop.***
**mechanical faceting head** See ***faceting head.***
**medfordite** A moss agate variety of chalcedony.
**medina emerald** A misleading trade name for a green glass emerald simulant.
**meerschaum** A decomposition product of serpentine comprising a complex hydrous magnesium silicate. Also known as sepiolite. Used for pipe bowls, cigarette holders and jewellery. Orthorhombic (cryptocrystalline). R.I. 1.53; S.G. 2.0; H. 2-2½. Opaque (very porous), white, creamy-white, grey, reddish. Occurrence: Turkey.
**meionite** See ***scapolite.***
**melange** An assortment of polished diamonds of mixed sizes and/or qualities over 0.25 carats.
**melanite** See ***garnet*** (andradite).
**melée** An assortment of small polished diamonds of mixed sizes and/or qualities (usually under 0.25 carat). See ***melange.***
**melée** A shape category for rough diamonds consisting of unbroken octahedral crystals (or distorted octahedra) under 2 carats. See ***cleavages, macles, shapes*** and ***stones.***
**melichrysos** A yellow zircon.
**melinophane** A collector's stone comprising the mineral beryllium calcium sodium fluo-silicate. Tetragonal. R.I. 1.593, 1.612; D.R. −0.019; S.G. 3.0; H. 5. Transparent, yellow. Occurrence: Norway.
**menilite** An impure common opal with grey and brown banding.

**mercury-vapour lamp** A mercury discharge lamp having strong emission lines ranging from yellow to the far ultra-violet. When used as a source of UV, these lamps are filtered to remove all but the 366 nm (LW) or 254 nm (SW) UV emission lines.

**meru sapphire** A misleading name for blue zoisite.

**mesolite** A collector's stone consisting of a silicate of sodium, calcium and aluminium, this is one of the zeolite group of minerals, midway between natrolite and scolecite $(Na_2,Ca)Al_2Si_3O_{10}.2H_2O$. Monoclinic (fibrous). R.I. 1.5; S.G. 2.29; H. 5. Translucent to opaque (silky), white or colourless. Occurrence: World-wide.

**meson** An unstable elementary particle present in atomic nuclei and cosmic rays. It has a positive or negative charge equal to that of an electron, but its mass is about 150 times greater.

**Mesozoic** The third era of geological time between 225 and 65 million years ago and comprising the ***Triassic, Jurassic*** and ***Cretaceous*** periods. See also ***Cenozoic, Palaeozoic*** and ***Precambrian.***

**meta-jade** A misleading name for a Japanese glass jade simulant.

**metallic lustre** See ***lustre.***

**metameric** The term applied to materials or surfaces which appear as different colours in different types of lighting. This colour-change effect is strongest in the alexandrite variety of chrysoberyl, which appears red in tungsten light and green in daylight. The effect is due to absorption bands in the material. In the case of alexandrite, the cause is a broad band centered on 580 nm.

**metamict** A term used to describe a mineral whose crystalline structure has been broken down to an amorphous state by alpha-particle bombardment. See ***ekanite*** and ***low zircon.***

**metamorphic rock** Pre-existing igneous or sedimentary rocks which have been subjected to high pressures and temperatures, and as a result have undergone changes of chemistry and shape but without passing through a liquid phase.

**metamorphism** An alteration in the structure and chemistry of rocks brought about by natural agencies (e.g. heat and pressure).

**meteoric diamond** See ***lonsdaleite.***

**meteorites** Extra-terrestrial objects (mainly composed of iron and nickel or of olivine, pyroxene and feldspar) which on impact with the earth are suspected as being possible sources of tektites. Diamond crystals are also found in meteorites. See ***lonsdaleite.***

**methylene iodide** A volatile 'heavy' liquid used in the approximation of specific gravity, and as an immersion fluid for gemstone inspection and for the estimation of refractive index. $CH_2I_2$. R.I. 1.74; S.G. 3.32.

**metric carat** See ***carat weight.***

**metric grain** See ***grain*** (diamond and pearl).

**Mexican agate** A banded calcite or aragonite.

**Mexican diamond** A misleading name for the rock crystal variety of quartz.

**Mexican fire opal** See ***opal.***

**Mexican jade** A misleading name for green-dyed calcite.

**Mexican onyx** A misleading name for banded calcite.

**Mexican water opal** See ***opal.***

**mica** An aluminium silicate which, when it occurs in crystals, can be separated into thin transparent sheets. Also found as small lustrous particles in granite and aventurine quartz.

**micatite** Trade name for a phenolic resin plastic.

**microcline** See ***feldspar.***

**micro-diamonds** Rough diamonds of grit size which are too small to be recovered commercially, but are sometimes extracted for scientific research work.

**microlite** A collector's stone comprising the mineral calcium pyrotantalate. $(Na,Ca)_2Ta_2O_6(O,OH,F)$. Cubic. R.I. 1.93–2.02; S.G. 5.5; H. 5½. Transparent, green, brownish-green, yellowish-brown to hyacinth-red. Occurrence: Elba, Sweden, USA.

**micrometer** A precision engineering instrument for the measurement of small dimensions. A digital electronic version has been used to measure the proportions of polished diamonds when grading them for cut.

**micrometre** A unit of length measurement. One micrometre (μm) is equal to one millionth of a metre. In the measurement of wavelengths, 1 μm = 1000 nm = 10 000 Å. See ***Ångström unit, electron volt, nanometre*** and ***wave number.***

**micron** A unit of length measurement. One micron (μ) is equal to one millionth of a metre. The unit is now superseded by the micrometre.

**microphotography** See ***photomicrograph.***

**microprobe** See ***electron microprobe.***

**microscope** An optical instrument designed to produce enlarged images of objects by means of lenses. For gemmological purposes, the most useful range of magnification is 10× -40×. Microscopes are designed in monocular and binocular/stereo versions. Magnifications can be changed by replacing the eyepieces, by adding supplementary lenses to the objective, by using a multi-objective lens turret, or by means of a zoom lens. See ***compound microscope, Greenough microscope, dark-field illumination, immersion cell, incident illumination*** and ***light-field illumination.*** *Figure M4.*

**microscopic** Too small to be visible to the naked eye. See ***macroscopic.***

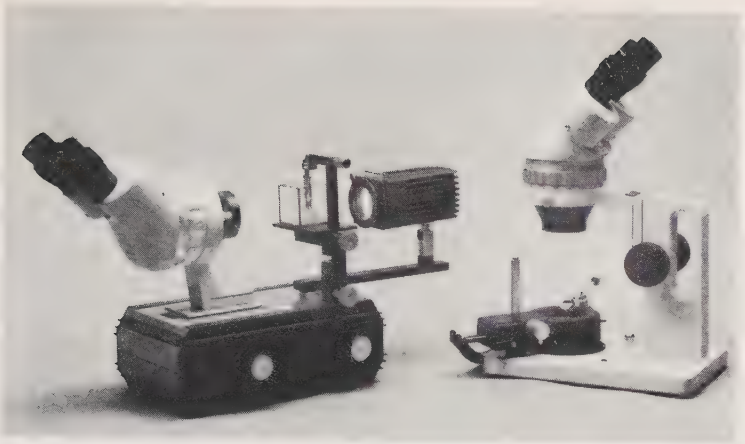


*Figure M.4* Horizontal and vertical-format stereo zoom microscopes. (Eickhorst)

**midge stone** A moss agate variety of chalcedony in which the dendritic inclusions resemble a swarm of mosquitoes. Also called mosquito agate.

**milkama pebbles** Trade name for jasper pebbles. See ***quartz***.

**milk opal** Milky-white common opal.

**milky quartz** A white translucent crystalline quartz whose milky appearance is due to minute liquid-filled cavities.

**mill** The diamond cutting bench containing the scaife (see *Figure T.1*). The term is also used to describe the plant which separates diamonds from kimberlite rock by crushing.

**Miller indices** Indices used to define crystallographic planes, faces and habits. Crystal faces are often parallel to one or more axes, and therefore only meet them at infinity. Miller indices are based on reciprocals of ratios of the distances between the crystal origin and the point at which a face is cut by an axis (the reciprocal of infinity being conveniently zero).

Miller indices consist of three numbers for a three-axis crystal. In a cubic crystal, the six crystal faces are cut by the axes x, y, z (*Figure M.1[a]*). The crystal face (*Figure M.1[b]*) is given the Miller index (001) because it is parallel to the x axis (intercept ratio = infinity, reciprocal = 0), and to the y axis (= 0), but is intersected by the z axis (= 1). The same face on the opposite side of the crystal (*Figure M.1[c]*) is identified as $(00\bar{1})$, because with the Miller system an intercept on an axis pointing away from the observer is given a negative index. $(\bar{1})$. The two faces intercepted by the y, -y axis are coded (010) and $(0\bar{1}0)$. The remaining two

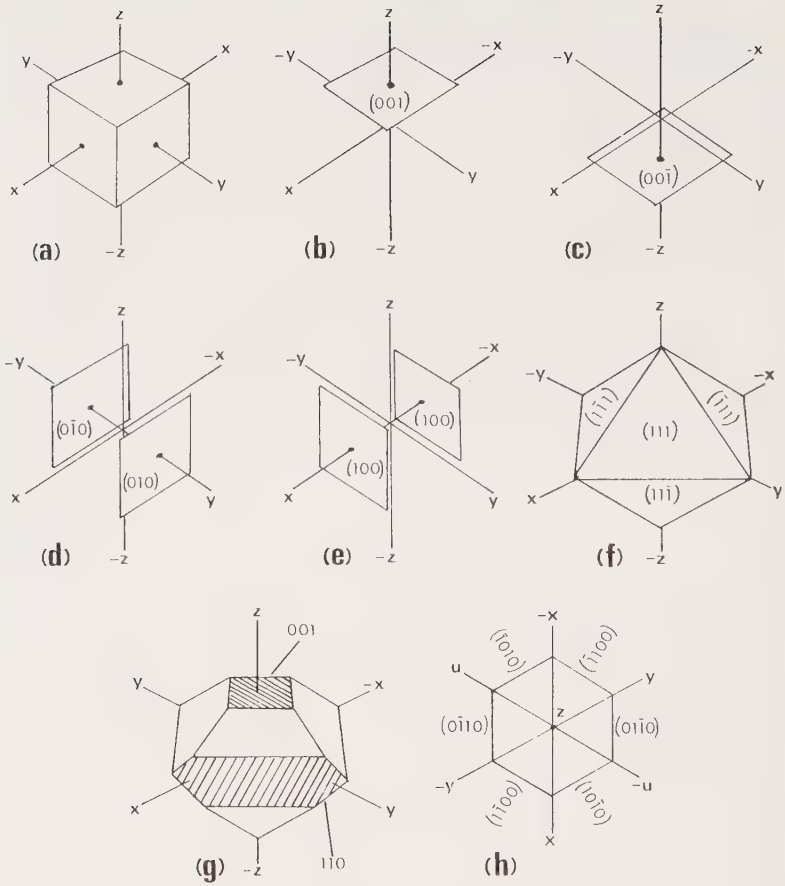



*Figure M.5* Examples of the coding of crystal faces and planes by Miller indices.

faces, intercepted by the x, -x axis, are identified as (100) and ($\bar{1}$00).

Four of the eight faces of an octahedron are similarly identified in *Figure M.1(f)*, and *Figure M.1(g)* shows the Miller indices for cubic and rhombic dodecahedron *planes* in the same crystal.

When an index is enclosed by brackets this indicates a crystal face, as in (100). If the index is enclosed in *braces,* this indicates a form comprising all the faces generated by that index. For example, {100} denotes a cube, and {111} denotes an octahedron. Used without brackets or braces, an index indicates a plane within the crystal (as illustrated by 001 and 110 in *Figure M.1[g]*).

The system was adapted by A. Bravais to suit the four-axes

hexagonal/trigonal system. With Miller-Bravais indices, the sequence of the four axes is x, y, u, z, and their polarities are arranged as shown in *Figure M.5(h)*.

**millerite** A rare collector's stone comprising the mineral nickel sulphide. Sometimes called capillary pyrites. Trigonal. S.G. 5.3-5.65; H. 3-3½. Translucent, cloudy yellowish-green. Occurrence: Namibia.

**millimicron** A thousandth part of a micron; this unit of length is now called a nanometre.

**mimetite** A collector's stone comprising the mineral lead arsenate. $Pb_5(AsO_4)_3Cl$. Hexagonal. S.G. 7.1; H. 3½. Transparent to opaque, pale yellow to bright orange. Occurrence: Mexico.

**mine** An excavation in the earth made for the purpose of extracting minerals. See ***diamond mine.***

**mineral** A homogeneous substance, formed in the earth's crust by the forces of inorganic nature, whose chemical composition and physical characteristics are constant within narrow limits.

**mineraloid** A mineralogical term applied to those organic materials, such as amber and jet, which are mined from the earth.

**mineralogy** The science of minerals.

**minimum deviation** See ***angle of minimum deviation.***

**Miocene** A division of the Tertiary period of the Cenozoic era of geological time, 26-7 million years ago. See ***Cenozoic.***

**miridis** Trade name for a synthetic rutile diamond simulant.

**mirror foiling** See ***chaton*** and ***foiled stone.***

**miscal** An Iranian weight equal to 36.44 carats or 40 Indian ratis. See also ***dirhem.***

**mixed cut** A gemstone cut used mainly for coloured stones in which the crown is brilliant cut and the pavilion step or trap cut.

**mixte** A composite stone, consisting of a natural crown, and a glass or synthetic pavilion. See ***composite stones.***

**mizzonite** See ***scapolite.***

**mocha stone** A variety of agate containing dendritic inclusions. Also called moss agate in the UK and America. Translucent, green, brown and black.

**Moe diamond gauge** A caliper gauge for estimating the weight of brilliant-cut diamonds. *Figure M.6.* See ***caliper gauge.***

**mogok diamond** A misleading name for a colourless Burmese topaz.

**Mohs' hardness scale** See ***hardness.***

**moldavite** A variety of tektite consisting of 75% silica. Amorphous. R.I. 1.488-1.503; S.G. 2.34-2.39; H. 5½. Transparent to translucent, bottle-green to brown-green. Occurrence: Australia (australite), Czechoslovakia (moldavite), USA (georgiaite).

*Figure M.6* Diamond hole gauges (top), and the Moe diamond gauge (bottom).

**molecular weight** The sum of the atomic weights of the elements in a molecule of a substance. See ***atomic weight.***

**molecule** A molecule is formed when two or more elements combine together, their atoms joining to form a stable molecule of a new substance or compound. The resulting molecule is the smallest part of the new substance which can have a separate stable existence (e.g. oxygen atoms are more stable when combined together in pairs to form the *diatomic* molecule $O_2$). However many elements are stable as single atoms (and can therefore be regarded as both atom and molecule). Such elements are called *monatomic.*

**mollusc** A phylum (Mollusca) of soft-bodied hard-shelled animals which includes cuttlefish, limpets, mussels, oysters, scallops and snails.

**molochites** A green jasper variety of quartz.

**momme** A Japanese cultured pearl weight. 1 momme = 75 pearl grains or 3.75 gram, or 18.75 carat.

**mona marble** A serpentine marble found on Holy Island off the coast of Wales, UK.

**monatomic** See ***molecule.***

**monazite** A rare colour-change phosphate exhibiting radioactivity and containing thorium, lanthanum and cerium, together with traces of other rare earths. $(Ce,La,Th)PO_4$. Monoclinic. R.I. 1.795, 1.845; D.R. +0.05; S.G. 4.9-5.4; H. 5½. Transparent,

reddish-orange (tungsten light), bright green (mercury vapour lamp or fluorescent lighting). Occurrence: the Malagasy Republic, Sri Lanka.

**monobromonaphthalene** A volatile liquid used as a dilutant for the 'heavy' liquids bromoform and methylene iodide, and as an immersion fluid for gemstone inspection and for the estimation of refractive index. $C_{10}H_7Br$. R.I. 1.66; S.G. 1.49.

**monochromatic light** A light containing only a very narrow waveband of electromagnetic energy. The standard yellow monochromatic light used for refractometer measurements is derived from a sodium vapour lamp (this actually consists of two very closely spaced emission lines, whose mean value is 589.3 nm).

**monoclinic system** A crystal system having three axes, all of different lengths. Two axes are inclined to each other (at an angle other than 90°), the third one is at right-angles to the other two. There is one axis of symmetry (two-fold), a plane of symmetry and a centre of symmetry. *Figure M.7.*

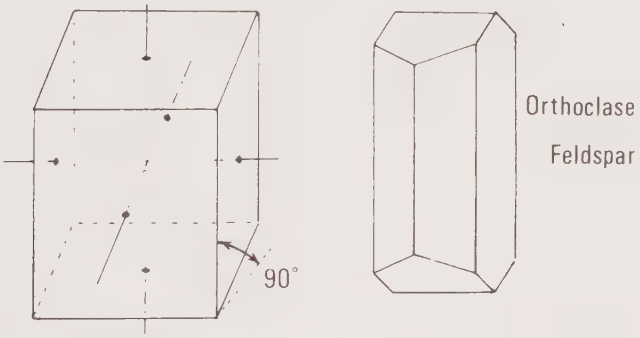



*Figure M.7* The monoclinic crystal system.

**monocular microscope** A microscope fitted with a single eyepiece and objective. See ***magnifiers.***

**Montana ruby** A misleading name for red garnet.

**Mont Blanc ruby** A misleading name for rose quartz.

**moonstone** See ***feldspar.***

**morganite** See ***beryl.***

**morion** A black variety of smoky quartz.

**moro** A Japanese blood-red coral.

**moroxite** A bluish-green apatite from Norway.

**morse ivory** Dentine ivory derived from the tusks of the walrus.

**mosaic** A pattern or picture made by fitting together small pieces of coloured ornamental stones (see ***Florentine mosaic***). Alternatively it may consist of a series of coloured glass rods cemented together (see ***Roman mosaic***).

**mosaic triplet** A composite gemstone formed by cementing a transparent segment (made from colour film) between a crown and pavilion of synthetic spinel. The film segment contains a mosaic of three colours.

**mosquito agate.** See ***midge stone.***

**moss agate** A variety of chalcedony containing brownish-green dendritic inclusions.

**mother-of-emerald** A misleading name for prase.

**mother-of-pearl** The smooth iridescent nacreous layers which cover the inside surface of mollusc shells. Mother-of-pearl consists mainly of the aragonite variety of calcium carbonate.

**mother rock** See ***matrix.***

**moukaite** A pink and white banded Australian jasper.

**mount** The metalwork or frame into which a gemstone is set.

**mountain crystal** The rock crystal variety of quartz.

**mountain jet** A misleading name for black obsidian.

**mountain mahogany** A banded black and red obsidian.

**mountain ruby** A misleading name for red garnet.

**mtorodite** A green chalcedony coloured by chromium. Also called mtorolite. Occurrence: Zimbabwe.

**mtorolite** See ***mtorodite.***

**müller's glass** See ***opal*** (hyalite).

**multifacet diamond** An American trademark used to describe a brilliant-cut diamond whose girdle has been faceted.

**mussite** See ***diopside.***

**mutton fat jade** A creamy-coloured variety of nephrite.

**mutzschen diamond** A misleading name for the rock crystal variety of quartz.

**mya yay** Best quality green jadeite.

**myrickite** A translucent white chalcedony coloured bright red or pink by inclusions of cinnabar (mercuric sulphide).

## N

**naat** See ***knot.***

**Nacken synthetic emeralds** An early (1928) synthetic emerald grown by the hydrothermal process.

**nacre** A secretion produced by the mantle of some molluscs, which forms the iridescent layers of both the pearl and the mother-of-pearl surface inside the mollusc shell. This nacreous deposit consists of a very thin network of organic conchiolin cells whose interstices are filled with minute crystals of aragonite (an orthorhombic form of calcite).

**naif** The unpolished surface or skin of a diamond crystal.

**nanometre** (nm) A length measurement used to quantify the

wavelength of light rays and X-rays. One nanometer is equal to one millionth of a millimetre. See ***Ångström unit, electron volt*** and ***wave number.***

**narwhal ivory** A dentine ivory derived from the front teeth or tusks of the narwhal (a dolphin-like arctic mammal).

**nassau pearls** Pink conch pearls found in waters around the West Indies.

**natrolite** A collector's stone consisting of a hydrated sodium aluminium silicate, this is one of the zeolite group of minerals. $Na_2Al_2Si_3O_{10}.2H_2O$. Orthorhombic. R.I. 1.480, 1.493; D.R. +0.013; S.G. 2.2-2.25; H. 5½. Transparent, colourless. Occurrence: Czechoslovakia, Norway, Scotland.

**natural** A portion of the surface or 'skin' of a rough diamond crystal which has been left on the girdle of a polished diamond (this is often left to indicate that maximum yield has been achieved from the rough crystal).

**natural grit** Abrasive powder made by crushing poor quality natural diamond such as boart.

**natural glasses** See ***basalt glass, Libyan glass, moldavite, obsidian, pit glass*** and ***tektites.***

**nautilus** A cephalopod mollusc having a multi-chambered shell. Its central whorl is used to fabricate a pearl simulant called a *coque de perle.*

**navette** A step-cut gemstone having a boat-shaped profile with pointed ends. A marquise-cut stone is sometimes referred to as a navette. See ***marquise.***

**near gem** A category of rough diamonds which contains crystals of marginal colour or quality. These become either top grade industrial stones, or low grade gem diamonds depending on which market is the most favourable in demand or price.

**needle stone** See ***sagenitic quartz.***

**negative crystal** A crystal-shaped cavity or void within a gemstone. It may take the shape of a habit occurring in the host mineral's crystal system.

**negative reading** If a gemstone is tested on a critical-angle refractometer, and has a higher refractive index than the measuring prism or the contact fluid, all of the light rays will pass out through the gemstone, and no shadow edge (other than that of the contact fluid) will be visible.

**neodymium** One of two rare-earth elements neodymium and praseodymium which occur together in nature and share the collective name of didymium. See ***didymium.***

**neolite** Trade name for turquoise simulant.

**neolith** Trade name for a German turquoise simulant comprising a mixture of bayerite and copper phosphate.

**neo-turquoise** Trade name for a turquoise simulant.

**nepheline syenite** See ***kakortokite.***

**nephelite** A collector's stone comprising the mineral sodium aluminium silicate. Hexagonal (massive). R.I. 1.539, 1.544; D.R. −0.005; S.G. 2.55-2.65; H. 5½-6. Translucent to opaque, bluish-green, brownish-red, with chatoyance. Occurrence: Italy, Norway, USA, USSR.

**nephrite** A calcium magnesium/iron silicate jade mineral consisting of an interlocking mass of fibrous crystals. Also called kidney stone (because of its alleged curative properties). $Ca_2(Mg,Fe)_5(OH)_2(Si_4O_{11})_2$. Monoclinic (crypto-crystalline). R.I. 1.600, 1.627 to 1.614, 1.641; D.R. −0.027; S.G. 2.90-3.02; H. 6½. Opaque, white, green, grey, yellowish, brown. Occurrence: Canada, China, New Zealand, Taiwan, USA, USSR.

**nerchinsk aquamarine** A misleading name for blue topaz.

**neutron** An electrically neutral particle in the nucleus of an atom having a mass slightly greater than that of a proton. See ***isotope.***

**neutron-treated diamonds** See ***treated diamonds.***

**Nevada black diamond** A misleading name for obsidian.

**Nevada diamond** A misleading name for colourless obsidian.

**Nevada topaz** A misleading name for smoky obsidian.

**Nevada turquoise** A misleading name for variscite.

**Nevada wonderstone** A volcanic rock, weathered into alternate bands of red and buff, which is used as an ornamental stone. S.G. 2.53. Occurrence: Nevada, USA.

**new jade** A misleading name for bowenite.

**New Zealand greenstone** A variety of nephrite found in New Zealand.

**niccolite** A collector's stone, also known as kupfernickel, comprising the mineral nickel arsenide. NiAs. Hexagonal (massive). S.G. 7.33-7.67; H. 5–5½. Opaque, pale red with metallic lustre. Occurrence: Canada, Europe, USA.

**nickel** One of the eight transition metals which are mainly responsible for colour in gemstones. Ni. Stones coloured by nickel include chrysoprase and synthetic green and yellow sapphires. Atomic number 28; atomic weight 58.69; melting point 1453 °C; S.G. 8.8.

**nickel silver** See ***german silver.***

**nicolo** A black or dark brown onyx with a thin bluish-white vein.

**nicol prism** A prism consisting of two sections of optically pure calcite (Iceland spar) which are cemented together with Canada balsam. Light entering the prism is split into two plane polarised rays. The refractive index of the balsam layer (1.53) is such that it produces total internal reflection of the 'ordinary' polarised ray (R.I. 1.65), while allowing the extraordinary ray (R.I. 1.49) to

pass through. See ***polarising filters.***

**night emerald** A misleading name for peridot.

**nigrine** A black variety of rutile.

**nitric acid** A highly corrosive mineral acid, $HNO_3$, which is a constituent, with hydrochloric acid, of aqua regia.

**nitrogen** A colourless gaseous element. N. Atomic number 7; atomic weight 14.008; boiling point −196 °C. Its most important relationship to gems occurs with diamond, where nitrogen dispersed within the crystal lattice (replacing carbon atoms) produces absorption bands in the blue end of the spectrum. These bands are the cause of the yellow tints in Cape Series stones. Diamonds containing only dispersed nitrogen are classified as Type Ib. Diamonds may also contain nitrogen atoms which are not dispersed with the lattice, but exist as groups of atoms within the stone. Nitrogen aggregates of this type do not produce yellow tints, and diamonds containing only this form of nitrogen are classified as Type Ia. Most diamonds are mixtures of Type Ia and Ib. Diamonds completely free of nitrogen are classified as Type IIa and IIb (the latter contain boron, are usually blue, and have semi-conductor properties).

**nixonoid** Trade name for a cellulose plastic.

**nm** See ***nanometre.***

**noble gases** Gaseous elements forming a group which rarely combine with any other elements (e.g. helium, neon, argon, krypton, xenon and radon).

**noble metals** A group of metallic elements which resist chemical action and do not tarnish in air or water (e.g. gold, platinum and the platinum group metals).

**noble opal** Precious opal. See ***opal.***

**nodule** A small rounded lump or outcrop of mineral material.

**noir Belge** A black marble found in the Hainault and Namur provinces of Belgium.

**noir Français** A black marble found in the Pas de Calais area of northern France.

**Nomarski interference contrast** A technique for increasing the surface contrast of a specimen, as viewed through a microscope, by means of polarising filters and phase interference between light rays reflected off the specimen from co-axial source of illumination. A modified version of this technique has been used to produce a photograph 'fingerprint' of a diamond showing characteristic crystallographic surface features for identification purposes. See ***fingerprinting.***

**non-nucleated pearls** See ***Biwa pearls.***

**norbide** Trade name for a boron nitride abrasive.

**normal** In optics, this is an imaginary line drawn perpendicular to

the boundary between two media at the point of incidence of a ray.

**north light** In the northern hemisphere this is the natural daylight from the north sky by which diamonds are traditionally colour graded. This is not a sufficiently reliable or constant illumination standard for present-day grading requirements, and most national and international grading nomenclatures specify a colour-balanced daylight grading lamp of a particular colour temperature (i.e. between 5000 K and 6200 K). See ***grading lamps.***

**Norwegian Gemmological Association** Headquarters: Dronningsgatan 27, Oslo, Norway.

**noselite** A constituent mineral of lapis lazuli. $Na_8(SO_2)(Al_6Si_6O_{24})$.

**nucleon** A general term for both proton and neutron.

**nucleus** The positively-charged central mass of an atom (also the central core of a pearl).

**nunkirchner jasper** A grey-brown fine-grained variety of jasper found near Idar-Oberstein, Germany.

**nyf** See ***naif.***

## O

**objective** (optics) The lens system, or object glass, at the specimen end of a microscope's body tube. See ***microscope.***

**objective** When applied to gemstone grading, the term implies the use of quantitative (i.e instrumental), rather than subjective techniques in the assessment of colour, clarity or cut.

**oblong cut** See ***emerald cut.***

**obsidian** A natural glass formed by the rapid cooling of volcanic lava and consisting of approximately 70% silica (the name 'obsidian' is sometimes incorrectly applied to moldavite). Amorphous. R.I. 1.48-1.51; S.G. 2.33-2.42; H. 5. Translucent to opaque, black, brown, grey, green — rare (sometimes with a silver or golden iridescence caused by minute bubbles or inclusions). Occurrence: Iceland, Mexico, USA.

**occidental agate** A poor quality agate.

**occidental amethyst** The amethyst variety of quartz.

**occidental cat's eye** The cat's eye variety of quartz.

**occidental chalcedony** A poor quality chalcedony.

**occidental cornelian** A poor quality cornelian.

**occidental diamond** A misleading name for the rock crystal variety of quartz.

**occidental topaz** A misleading name for citrine. See ***quartz.***

**occidental turquoise** See ***odontolite.***

**occurrence** The locality and geology of the deposit or find from which gemstones are recovered.

**octahedral cleavage** A cleavage plane parallel to any of the four pairs of triangular faces on an octahedral crystal (e.g. diamond and fluorspar have octahedral cleavage). See also ***cleavage.***

**octahedrite** See ***anatase.***

**octahedron** An eight-sided crystal, each face being an equilateral triangle. It is one of the seven basic forms belonging to the highest class of symmetry in the cubic crystal system.

**octavo** See ***oitava.***

**ocular** The eyepiece lens system of an optical instrument such as a microscope or goniometer. See ***microscope.***

**odontolite** A bluish fossil bone or ivory obtained from prehistoric animals such as the mammoth (see also ***fossil ivory***). The bone owes its colour to vivanite, an iron phosphate. It is also known as *bone* or *fossil turquoise* and is used as a turquoise simulant. Amorphous. R.I. 1.57-1.63; S.G. 3.0-3.2 H. 5. Occurrence: France.

**off-colour diamond** A diamond having an obvious and unattractive tinge of yellow, brown or green.

**oiled emeralds** Emeralds containing flaws which reach the surface, are sometimes 'oiled' to conceal these flaws (as are other gemstones). This is effected by immersing them for several days in a gently-warmed fine oil. With emeralds, the addition of green colouring matter to the oil also improves the colour of the stone. Cleaning such a stone in a detergent solution will leach out the oil and reveal the flaws. Gently warming the stone under a lamp willalso 'sweat' the oil out of the flaws and make it visible under hand lens inspection.

**oil pearl** See ***antilles pearl.***

**oitava** A Mexican weight equal to approximately 17.5 carats.

**okkolite** An ornamental stone containing various colours of epidote. Occurrence: South Africa.

**Okuda diamond-photometer** See ***diamond colorimeter.***

**old English cut** See ***eight cut.***

**old European cut** A round brilliant-cut diamond having a small table, and a deep crown and pavilion.

**old mine cut** A brilliant-cut diamond with a cushion-shaped girdle profile, a small table facet and a deep crown and pavilion.

**Oligocene** A division of the Tertiary period of the Cenozoic era of geological time, 38-26 million years ago. See ***Cenozoic.***

**oligoclase** See ***feldspar.***

**olivene** A misleading name for demantoid garnet.

**olive oil** A vegetable oil which is mixed with diamond dust to produce the abrasive paste used for sawing and polishing diamonds. See also ***castor oil.***

**olivine** The mineralogical name for the mineral iron magnesium

silicate (of which peridot is the gem variety). See ***peridot.*** Also misleadingly applied to demantoid garnet.

**onegite** A type of amethyst with needle-like inclusions.

**onyx** See ***chalcedony.***

**onyx marble** A whitish marble, veined by bands of yellow, orange and green, used for carvings and small ornamental objects. Also applied incorrectly to a banded travertine or stalagmitic calcite.

**onyx obsidian** A variety of obsidian with parallel banding.

**onyx opal** A banded opal.

**oölitic opal** A variety of opal having circular areas of iridescence.

**opal** A hardened compound of silica and water. $SiO_2nH_2O$. Amorphous. R.I. 1.44-1.46; S.G. 2.0 (fire opals), 2.1 (black and white opals); H. 5½-6½. Varieties:

*common or 'potch' opal* — opaque, without iridescence, see also ***cacholong.***

*milk opal* — yellowish, milk-white or greenish common opal.

*white opal* — white background with iridescence.

*black opal* — dark background with iridescence.

*fire opal* — transparent to translucent, orange, occasionally with iridescence.

*prase opal* — similar in appearance to chrysoprase.

*cherry opal* — transparent to translucent, cherry-red without iridescence.

*pink, yellow, green and blue opal* — translucent, without iridescence.

*water opal* — translucent to transparent, colourless or brownish-yellow with adularescence.

*hyalite* — a colourless glass-like opal without iridescence.

*hydrophane* — light-coloured opaque opal which becomes transparent and iridescent when soaked in water.

*materials petrified by opal* — e.g. wood.

*opal pseudomorphs* — shells, bones and minerals.

See also ***gidgee opal, lechosos opal, oölitic opal*** and ***vermilite.*** Occurrence: Australia, Czechoslovakia ('Hungarian opal'), Indonesia (black opal), Mexico (fire opal).

The iridescence in opal is described by terms such as harlequin, rolling flash, flash and pinfire, and is caused by a combination of interference and diffraction of the light reflected from submicroscopic cristobalite spheres. *Figure O.1.*

**opal agate** A gem material consisting of alternate bands of opal and chalcedony.

**opal doublet** See ***composite stones.***

**opalescence** See ***sheen.***

**opal glass** A milky-white translucent man-made glass used as a light diffuser.

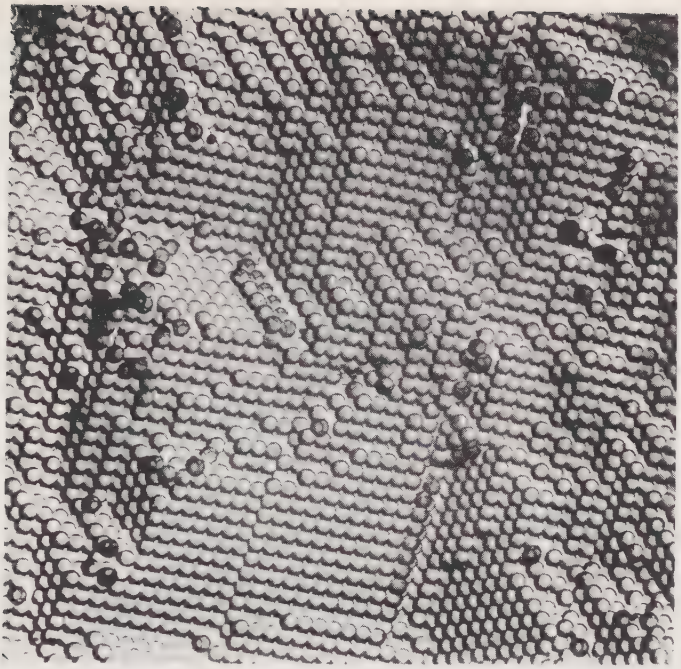


*Figure O.1* The symmetrical pattern of cristobalite spheres in iridescent opal. (Pierre Gilson)

**opaline** See ***opal matrix.***

**opalite** A term applied to varieties of common opal.

**opalised wood** An opal-petrified wood.

**opal matrix** A mixture of opal vein and the supporting rock matrix (sometimes called opaline).

**opal triplet** See ***composite stones.***

**opaque** Impenetrable to light rays. See also ***transparent*** and ***translucent.***

**open cast mining** See ***diamond mine.***

**open form** See ***form.***

**open culet** An over-large culet, easily visible to the naked eye.

**open setting** A gemstone mount in which the pavilion facets are easily visible.

**open table** A term used to describe a brilliant-cut diamond having a 'spread' table (i.e. one whose width is significantly greater than 58% of the girdle diameter).

**operculum** The closure flap found in certain types of shellfish which is sometimes used in jewellery (under the name of Chinese

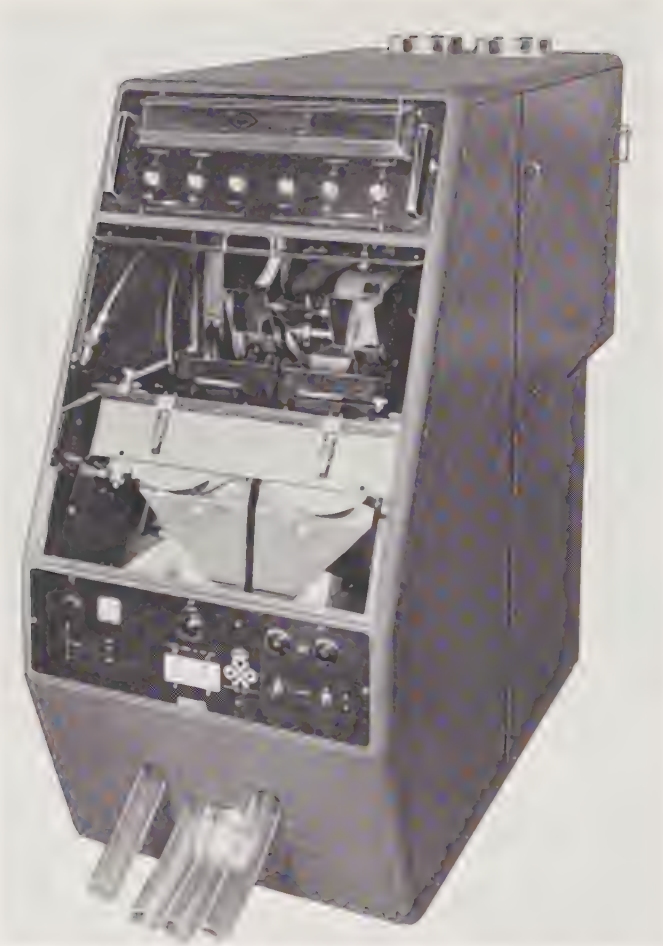


*Figure O.2* An automatic twin-channel colour sorter for small rough diamonds. (Gunson's Sortex)

cat's eye, Guadalcanal cat's eye, Pacific cat's eye or shell cat's eye).

**ophicalcite** A clouded white to green serpentine rock containing calcite and dolomite. Also called Connemara marble. Amorphous. R.I. 1.56; S.G. 2.48-2.77; H. 3.

**ophicite** See ***ophicalcite.***

**optical character** A general term used in connection with specific optical properties of a gemstone. The optical character of a stone is described as *isotropic* (if the gem is amorphous or belongs to the

cubic crystal system), as *anisotropic* (if it belongs to any of the other six crystal systems), as *uniaxial* (if it is in the tetragonal, hexagonal or trigonal systems) or as *biaxial* (if it is orthorhombic, monoclinic or triclinic). See also ***optic axes*** and ***optic sign.***

**optical density** See ***refractive index.***

**optical separator** An equipment designed to separate rough diamonds from gravel or crushed rock by using the high reflective properties of the diamond crystals. A modification of the Gunson's Sortex optical separator is used to colour-sort small rough diamonds. *Figure O.2.*

**optic axes** Directions of single refraction in an otherwise doubly-refracting material. Gemstones in the tetragonal, hexagonal and trigonal crystal systems have one such axis and are described as *uniaxial.* Gemstones in the orthorhombic, monoclinic and triclinic systems have two optic axes and are therefore *biaxial.*

**optic sign** The convention of designating birefringent crystals as optically positive or negative is based on the following relative values of the two refractive indices as measured on a critical-angle refractometer.

1. With uniaxial stones, if, on rotation of the stone, the moving extraordinary ray R.I. is greater in value than the fixed ordinary ray R.I., the gem is optically positive. If the ordinary ray R.I. is greater than the extraordinary ray R.I., the gem is optically negative. *Figure O.3.*

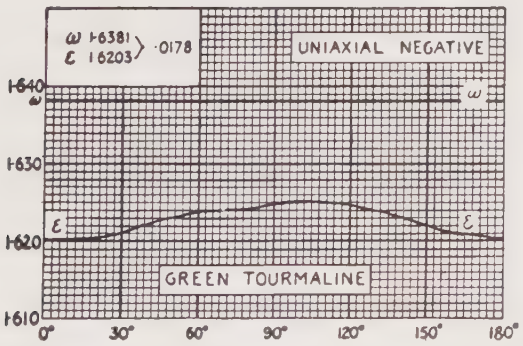



*Figure O.3* Refractometer shadow-edge movements for a uniaxial stone (green tourmaline) having a negative optic sign.

2. With biaxial stones, if rotation causes the higher R.I. index to move more than halfway from its highest-reading position towards the lowest-reading position of the other index, the gem is optically positive. *Figure O.4.* If the lower-reading R.I.

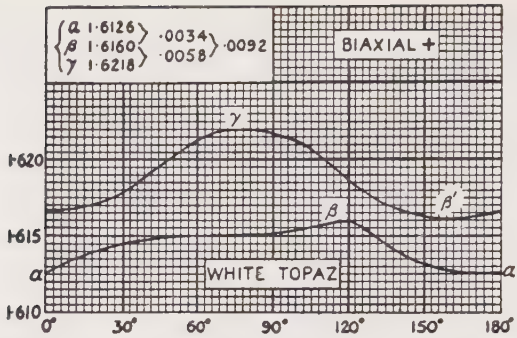



*Figure O.4* Refractometer shadow-edge movements for a biaxial stone (white topaz) having a positive optic sign.

moves more than halfway towards the higher R.I. the stone is optically negative.

**orange topaz** A misleading name for brownish-yellow quartz.

**orbicular** A term used to describe an opaque material containing spheroid inclusions (e.g. shells).

**orbicular diorite** See ***diorite.***

**orbicular jasper** A jasper containing white or grey circular areas in a red matrix, or, conversely, white/red or black/red circles in a white or yellow matrix.

**ordinary ray** Of the two polarised rays passing through a uniaxial crystal (i.e. one belonging to the tetragonal, hexagonal or trigonal system), the ordinary ray is the one whose velocity and associated R.I. ($\omega$) remains the same whatever its orientation in the crystal. See ***extraordinary ray*** and ***optic sign.***

**Ordovician** A rock system on the earth's surface comprising the rocks laid down during the Ordovician period, 500–430 million years ago. The Ordovician period is part of the Palaeozoic era. See ***Palaeozoic.***

**Oregon jade** A misleading name for the dark green plasma variety of chalcedony.

**Oregon moonstone** A misleading name for chalcedony.

**organic** A term applied to materials derived from living or once-living organisms (e.g. amber, coral, ivory, jet, pearl, tortoiseshell).

**organ-pipe fluorescence** The emission lines seen in the spectrum of a synthetic red spinel when irradiated by LW UV light.

**orient** (of pearl) The iridescent sheen of pearl caused by the interference and diffraction effects on light rays reflected from thin surface layers of nacre.

**oriental alabaster** See ***Egyptian alabaster.***

**oriental emerald** A misleading name for green sapphire or green chlorospinel.
**oriental agate** A good quality agate.
**oriental almandine** A misleading name for purple-red sapphire.
**oriental amethyst** A misleading name for violet sapphire.
**oriental aquamarine** A misleading name for light blue sapphire.
**oriental cat's eye** The cat's eye (cymophane) variety of chrysoberyl.
**oriental chalcedony** A good quality chalcedony.
**oriental chrysoberyl** A misleading name for yellowish-green sapphire.
**oriental chrysolite** A misleading name for greenish-yellow chrysoberyl or sapphire.
**oriental cornelian** A deep coloured cornelian.
**oriental topaz** A misleading name for yellow sapphire.
**orletz** The name for rhodolite in the USSR.
**ornamental stones** Those minerals or rocks which, although opaque, are valued for the beauty of their surface colours and markings and are used for carvings and ornamental objects.
**ortho axis** The lateral axis in the monoclinic crystal system which is at right-angles to the vertical axis. See ***clino axis.***
**orthoclase feldspar** See ***feldspar.***
**orthorhombic system** A crystal system having four axes, all at right-angles to each other and all of different lengths. There are three axes of symmetry (all two-fold), three planes of symmetry and a centre of symmetry. *Figure O.5.*

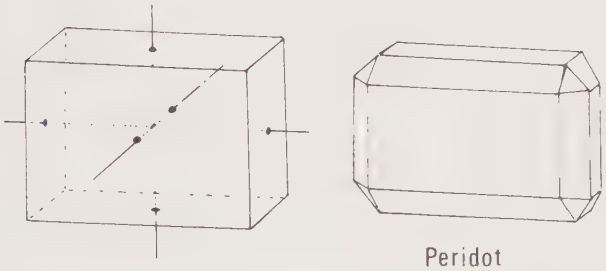



*Figure O.5* The orthorhombic crystal system.

**osmenda pearl** See ***coq de perle.***
**osseous amber** A variety of amber having the appearance of dried bone.
**Ottasdal G stone** See ***koranna stone*** and ***pyrophyllite.***
**ounce Avoir** A unit of weight equal to 28.349 grams or 141.747 carats.

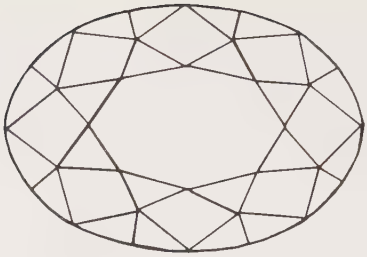


*Figure O.6* The oval cut.

**ounce Troy** A unit of weight (used for precious metals) equal to 31.103 grams or 155.517 carats.

**oval cut** A variant of the 57-facet brilliant cut. *Figure O.6.*

**overblue** A term applied to both rough and polished diamonds having a faint blue tint (usually caused by a marked blue fluorescence).

**oxalite** A trade name for an ivory or a jade simulant made from calcined beef bone.

**ox eye** A chatoyant labradorite feldspar.

**oxidised diamonds** Rough diamonds completely or partially covered with a thin yellow or orange-brown oxide film. The bulk of this film is usually removed by means of an acidising process.

**oxitol** Trade name for ethylene glycol mono-ethyl ether, a volatile low-residue liquid (R.I. 1.4) suitable for use as an immersion fluid.

**oxolite** See ***oxalite.***

**ozarkite** A snow-white variety of thomsonite from Arkansas, USA.

## P

**Pacific cat's eye** See ***operculum.***

**padparadschah** An orange-pink variety of corundum found in Sri Lanka (the name being Singhalese for 'lotus flower').

**pagoda stone** A translucent agate whose opaque white bands resemble a Burmese pagoda.

**painite** A collector's stone comprising a calcium boro-zirconium aluminate. $CaAl_9ZrO_{15}(BO_3)$. Hexagonal. R.I. 1.787, 1.816; D.R. −0.029; S.G. 4.01; H. 7½. Transparent, deep red. Pleochroism, medium (red, pale brownish-orange). Occurrence: Burma.

**painted diamonds** See ***treated diamonds.***

**pai yu** White jadeite or nephrite.

**Palaeozoic** The second era of geological time between 570 and 225

million years ago and comprising the ***Cambrian, Ordovician, Silurian, Devonian, Carboniferous*** and ***Permian*** periods. See also ***Cenozoic, Mesozoic*** and ***Precambrian.***

**palladium** A member of the platinum group of metals, sometimes used in jewellery as an alternative to platinum. Pd. Atomic number 46; atomic weight 106.7; melting point 1552°C; S.G. 11.4.

**palmeira topaz** A misleading name for brown synthetic sapphire.

**palmyra topaz** A misleading name for a pale yellow heat-treated amethyst/citrine.

**paludina limestone** A blue-grey to reddish-brown marble containing the fossilised shells of freshwater snails. Also known as Purbeck marble. Occurrence: Dorsetshire, England.

**pampille cut** A drop-shaped cut similar to the briolette.

**Panama pearls** Slate-blue to black pearls found in the Gulf of California, Mexico.

**panning** A technique for separating heavy minerals (such as gold, diamonds and other gemstones) from their associated gravels or silt. The gravels are placed in a shallow metal pan or (in the case of gem gravels) a hemispherical basket, and partially immersed in water. By means of a cyclic rotary motion of the pan, the water is swirled over the edge, carrying with it the lighter non-gem materials.

**pantha** White translucent jadeite.

**paphros diamond** A misleading name for the rock crystal variety of quartz.

**paragon pearls** Large spherical pearls. Also a trade name for imitation pearls.

**parallel growth** A multiple crystal growth in which all the edges and faces of one crystal are parallel to those of its neighbour. Parallel growth should not be confused with twinned growth, in which the faces of the adjoining crystals are not parallel but are symmetrically orientated to each other.

**paramagnetism** See ***magnetism.***

**Paris jet** A black glass simulant of jet.

**Paris pearls** Trade name for imitation pearls.

**Parker brilliant cut** One of several 'ideal' cuts for diamond, having a table facet width, crown depth and pavilion depth of 55.9%, 10.5% and 43.4% respectively compared with the girdle diameter. The crown angle is 25.5°, and the pavilion angle is 40.9°. See ***Eppler brilliant cut, Johnson and Rösch brilliant cut, Scan DN brilliant cut*** and ***Tolkowsky brilliant cut.***

**parquetry** The setting of geometrically shaped pieces of coloured stone in a metal mount.

**parrot wing** Trade name for a mainly cryptocrystalline quartz,

similar to agate or jasper. The red and yellow colours are due to quartz, green-blue to chrysocolla and brown to limonite. Occurrence: USA.

**parti-coloured stones** Stones cut from allochromatic crystals whose colour has changed during their growth (due to a change in the chemistry of the matrix). Tourmaline crystals often exhibit two or three changes of colour (e.g. from pink through colourless to green), and parti-coloured stones are cut from the colour-change sections.

**parting** See ***false cleavage.***

**passau pearl** A freshwater pearl from Central Europe.

**paste** Gemstone simulants made from glass (usually flint glass).

**pate ce riz** A glass jade simulant.

**patricia pearls** Trade name for imitation pearls.

**paua shell** See ***abalone.***

**pauline trigere** Trade name for the man-made diamond simulant strontium titanate.

**paulite** Blackish hypersthene with coppery inclusions.

**pavé setting** A setting in which a group of small stones are set as close together as possible with the minimum of mount visible.

**pavilion** That section of a polished stone beneath the girdle. See ***crown.***

**pavilion angle** The angle between the plane of the girdle and the main facets of the pavilion. See ***brilliant cut.***

**pavilion depth** The perpendicular distance between the plane of the girdle and the culet, measured as a percentage of the girdle diameter. See ***brilliant cut.***

**pavonazzo marble** A group of white or pale yellow marbles traversed with purple veins.

**peacock stone** See ***malachite.***

**pearl** An organic gem produced by pearl-bearing molluscs which consists of a central small nucleus surrounded by concentric layers of nacre (see ***mantle***). Composition of the pearl is 86% calcium carbonate (in the form of orthorhombic aragonite crystals), 12% conchiolin, 2% water. R.I. 1.52-1.66 (black, 1.53-1.69); S.G. 2.6-2.78; H. 3-4. Varieties and Occurrence: See under the following headings, ***baroque, black, blister, cultured (Biwa, mabe), cyst, freshwater*** and ***pink.***

**pearl doublet** A cultured blister pearl. See ***mabe pearls.***

**pearl opal** See ***cacholong.***

**pearl spar** See ***dolomite.***

**pearly** See ***lustre.***

**pear-shaped cut** See ***pendeloque.***

**pecos diamonds** A misleading name for the rock crystal variety of quartz.

**pectolite** A sodium calcium silicate usually cut as cabochons, and in its massive form used as a simulant of jade. $HNaCa_2(SiO_3)_3$. Monoclinic. R.I. 1.595, 1.633; D.R. +0.038; S.G. 2.74-2.88; H. 5. Translucent, white or grey with a silky lustre. Occurrence: Italy, Scotland, USA.

**pectolite jade** A misleading name for pectolite.

**pedrara onyx** A misleading name for a stalagmitic marble from Mexico, comprising a white or green translucent rock veined with dark orange, yellow or brown.

**peganite** See ***variscite.***

**pegmatite** A coarse-grained granite (i.e. a granular igneous rock comprising quartz, feldspar and mica).

**Peiping (Peking) jade** Any true jade, but usually nephrite.

**pelhamine** A gem quality serpentine.

**pendeloque** A varient of the 57-facet brilliant cut having a pear or drop profile. *Figure P.1.*

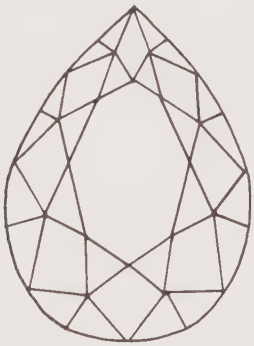


*Figure P.1* The pendeloque or pear-shaped cut.

**penetration twins** See ***interpenetrant twins.***

**Penfield balance** See ***hydrostatic weighing.***

**pentelicum marble** A pure white granular marble from Greece.

**pentlandite** A collector's stone comprising the mineral nickel iron sulphide. $(Fe, Ni)_9S_8$. Cubic. S.G. 5.0; H. 3½-4. Bronze-yellow. Occurrence: Canada, Finland.

**peredell topaz** A greenish variety of topaz.

**periclase** A magnesium oxide mineral. MgO. Cubic. R.I. 1.737; S.G. 3.55-3.60; H. 5. Transparent to translucent, colourless, yellowish, grey-green. A synthetic periclase has been marketed under the trade name 'lavernite' and used as a spinel simulant.

**peridene** Trade name for green heat-treated quartz.

**peridot** A magnesium iron silicate also called olivine (by mineralogists) and chrysolite. $(Mg,Fe)_2SiO_4$. Orthorhombic. R.I.

1.654, 1.690; D.R. +0.036; S.G. 3.34; H. 6½. Transparent, yellow-green, olive-green, brown (rare). Occurrence: Brazil, Burma, China, Hawaii, Norway, USA, Zeberget or the Isle of St. John (Red Sea).

**perigem** Trade name for a synthetic light yellow-green spinel.

**peristerite** An opaque albite variety of feldspar with bluish iridescence on a white or brown body colour. H. 6½.

**Permian** A rock system on the earth's surface comprising the rocks laid down during the Permian period, 280-225 million years ago. The Permian period is the last part of the Palaeozoic era. See ***Palaeozoic.***

**perspex** Trade name for a transparent acrylic resin from which faceted gemstone simulants are moulded. R.I. 1.5; S.G. 1.18.

**perthite** An intergrowth of albite or oligoclase in orthoclase or microcline feldspar, used as an ornamental stone. Opaque, white, red, reddish-brown with golden labradorescence. Occurrence: Canada, Scotland.

**peruzzi cut** Thought to be the origin of the modern brilliant cut, the peruzzi cut had 57 facets (plus a culet), and was developed towards the end of the 17th century. It is attributed to the Venetian cutter Vincenzio Peruzzi.

**petalite** A collector's stone comprising the mineral lithium sodium aluminium silicate. $(Li,Na)(AlSi_4O_{10})$. Monoclinic (massive). R.I. 1.504, 1.518; D.R. +0.014; S.G. 2.39-2.46; H. 6. Transparent to translucent, colourless, pink. Occurrence: Australia, Brazil, Namibia, Sweden, USA.

**petal pearls** Pearls having a distorted flattened shape.

**petoskey stone** A patterned marble derived from a fossil coral limestone. Occurrence: USA.

**petrified dinosaur bone** A fossil bone used for ornamental purposes. Occurrence: USA. See also ***dinny bone.***

**petrified wood** See ***fossil wood.***

**petrology** The study of the origin, structure and mineralogy of rocks.

**Petworth marble** A marble similar to paludina limestone but containing larger shells. Occurrence: England.

**pewter** Originally an alloy of tin with lead, it now is mainly made from a tin, copper, antimony alloy resembling silver (also called britannia metal).

**phianite** Trade name for the diamond simulant cubic zirconium oxide manufactured by the Lebedev Physical Institute in Moscow, USSR.

**phase-difference microscopy** See ***Nomarski interference contrast.***

**phenacite** See ***phenakite.***

**phenakite** A collector's stone comprising the mineral beryllium

silicate. $Be_2SiO_4$. Trigonal. R.I. 1,654, 1.670; D.R. +0.016; S.G. 2.95-2.97; H. 7½-8. Transparent, colourless, greenish-blue, wine-yellow, pink. Occurrence: Brazil, Mexico, Namibia, Switzerland, USA, USSR.

**phosgenite** A collector's stone (which has a strong yellow fluorescence under UV light and X-rays) comprising the mineral lead chlorocarbonate. $Pb_2(Cl_2CO_3)$. Tetragonal. R.I. 2.114, 2.140; D.R. +0.026; S.G. 6.2; H. 3. Transparent, colourless, yellow-white, greenish, brownish-yellow. Occurrence: Australia, Namibia, Sardinia.

**phosphophyllite** A rare collector's stone comprising a hydrated zinc phosphate. Monoclinic. R.I. 1.595, 1.616; D.R. +0.021; S.G. 3.1; H. 3½. Transparent, bluish-green. Occurrence: Bolivia, Germany.

**phosphorescence** See *fluorescence* and *luminescence.*

**photoconductivity** A property possessed by some gemstones, such as diamond, in which their normally high electrical resistance falls when they are exposed to UV light. Semiconductor Type IIa diamonds (containing boron) are photoconductive to gamma radiation, and are used (like a geiger tube) as radioactive counters in situations which call for a strong corrosion-resistant sensor material.

**photoluminescence** See *luminescence.*

**photometer** See *diamond colorimeter* and *spectrophotometer.*

**photomicrograph** Photograph taken of a specimen through a microscope. Depth of focus can be increased by stopping down the microscope objective (by means of a small aperture in an opaque mask) and increasing the exposure time to compensate. Some microscopes are provided with an extra 'trinocular' port for the attachment of a camera. Camera adaptors are also provided for use in place of an ocular.

**photon** A unit quantity or 'packet' of electromagnetic radiation, whose energy is proportional to the frequency of radiation and which forms the mechanism by which light is emitted according to the quantum theory. See also *wave theory of light.*

**phylum** Major division of plant or animal kingdom, containing species having the same general form.

**picotite** A black variety of spinel.

**picrolite** See *serpentine.*

**picture jasper** A jasper containing banding or dendritic inclusions which produce a scenic picture. Occurrence: Namibia, USA.

**piedmontite** An opaque cherry-red variety of epidote found in Italy.

**pierre des Incas** See *pyrites.*

**pietersite** Trade name for a cabochon-cut disorientated pseudo-

crocidolite containing limonite, found in Namibia. See ***quartz (tiger's eye).***

**pietra dura mosaic** See ***Florentine mosaic.***

**piezoelectric effect** A property possessed by some gem mineral crystals such as tourmaline and quartz, which become electrically charged when stressed or bent in certain directions. Conversely, if an electric potential is applied across the crystal, this sets up mechanical stresses in the form of minute dimensional changes.

**pigeon blood agate** The cornelian variety of chalcedony.

**pigeon's blood** A colour description applied to the best quality Burmese rubies.

**pigeon stone** See ***peristerite.***

**pile-irradiated diamonds** Diamonds coloured by neutron bombardment in an atomic pile or reactor. See ***treated diamonds.***

**pinacoid** A pair of crystal faces which are parallel to two crystal axes, and are cut by the third. In a prismatic crystal, these are the terminating faces. See ***basal pinacoid, brachy pinacoid*** and ***macro pinacoid.***

**pineapple opal** An opalised glauberite pseudomorph.

**pinchbeck** A gold-like alloy of copper and zinc (83% Cu, 17% Zn).

**Pinctada** A genus of pearl-bearing oyster.

**pink moonstone** A misleading name for the opalescent pink variety of scapolite.

**pink pearls** Pearls fished off the coast of Florida and the Gulf of California, Mexico. S.G. 2.85.

**pinna pearls** Pearls from the pinna mussel.

**pipe** A core of rock that has solidified in the vent shaft of a volcano. Pipes composed of kimberlite sometimes contain diamonds. See ***diamond mine*** and ***kimberlite.***

**piqué (pk)** A term used in the clarity grading of polished diamonds. See ***Clarity Grading Standards*** in Appendix C.

**piqué work** The inlaying of pin-head dots of silver into tortoiseshell objects.

**pistacite** See ***epidote.***

**pit amber** See ***amber.***

**pit glass** A glass, thought to be a natural glass similar to obsidian, found at gem gravel sites such as those in Sri Lanka.

**pi yu** A vegetable-green jade.

**PK synthetic rubies** Synthetic rubies grown by a flux-melt process developed by Professor P. O. Knischka of Steyr, Austria. They have constants substantially the same as the natural gemstone, but unlike natural rubies lack any trace of iron (normally detected with an X-ray spectrometer or by SW UV transparency).

**placer deposit** A deposit of mineral-rich gravels which have been carried downstream by river currents and then trapped in a

depression in the river bed.

**plagioclase** See ***feldspar.***

**planchéite** A hydrated copper silicate having the appearance of turquoise or azurite. $2CuSiO_3H_2O$. Monoclinic (fibrous). R.I. around 1.75; S.G. 3.8. H. 3½-4. Opaque, blue. Occurrence: USA, Zaire.

**plane of symmetry** A plane through a crystal which divides it into two mirror-image halves. A cube has nine such planes. *Figure P.2.*

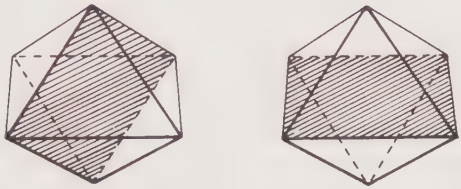


*Figure P.2* Two of the planes of symmetry in an octahedron.

**plasma** See ***chalcedony.***

**plastics** A general term for a man-made material (usually a resin based polymer) that can be extruded or moulded by heat or pressure.

**platinum** A white ductile metallic element, resistant to common acids, which is used in jewellery, particularly as a diamond setting. Pt. Atomic number 78; atomic weight 195.23; melting point 1769°C; S.G. 21.4.

**Plato test** A method, developed by Dr W. Plato, for identifying synthetic Verneuil corundum containing no inclusions or detectable curved stria. The direction of the stone's optic axis is first detected by using a polariscope (see ***konoscope***). The stone is then viewed under crossed polars at 20–30X magnification while immersed in methylene iodide. If two sets of lines intersecting at 60° are visible when viewing the stone in a direction parallel to the optic axis, the stone is a synthetic Verneuil corundum. See ***Verneuil corundum.***

**play of colour** The iridescent sheen seen in precious opal and labradorite. See ***sheen.***

**Pleistocene** The larger and earlier part of the Quaternary period of the Cenozoic era of geological time, 2 million to 10 thousand years ago, the later part being classed as the *Holocene* or *Recent.* Deposits from this epoch are mostly sands and clays deposited by Ice Age glaciers. See ***Quaternary.***

**pleochroism** See ***dichroism.***

**pleonaaste** See ***spinel.***

**Pliocene** A division of the Tertiary period of the Cenozoic era of geological time, 7–2 million years ago. See ***Cenozoic.***

**plume agate** A variety of moss agate in which the markings resemble ostrich feathers.

**plutonic rock** See ***igneous rock.***

**pneumatolytic rocks** Rocks altered by the action of chemically-active vapours.

**pocket lens** See ***hand lens, loupe*** and ***head loupe.***

**point** A unit of weight used for polished diamonds. 1 carat equals 100 points.

**point chalcedony** A grey variety of chalcedony with red spots.

**point-cut diamonds** An early cutting style in which the natural faces of an octahedral crystal were polished, but the basic shape left intact.

**polariscope** An optical instrument consisting of two polarising filters which enables gemstones to be inspected under plane polarised light, usually from a built-in light source. The lower filter is provided with a rotateable glass specimen platform, and the top viewing or 'analyser' filter is set for extinction of the

*Figure P.3* The Rayner polariscope. (Gemmological Instruments Ltd.)

polarised light from the bottom filter. A doubly-refracting gem 'rotates' the polarised light from the lower filter, making it visible through the top filter at four positions when the stone is orientated through 360°. Singly-refracting stones do not produce this marked effect, and cryptocrystalline stones transmit light through the top filter in all positions. Internal strains in glass imitation stones appear as a strong cross-pattern of dark lines, while strains in some man-made materials, such as synthetic spinel, produce an effect known as anomalous double refraction, which is never as clearly defined as true double refraction. *Figure P.3.*

**polarised light** Light in which the majority of rays are vibrating in the same direction or plane. With unpolarised light, the rays vibrate in all directions at right-angles to the line of transmission. With plane polarised light, the rays vibrate only in one direction or plane. Light entering a doubly-refracting gemstone is split into two sets of rays which are plane polarised at right-angles to each other. See also ***polarising filters.***

**polarising angle** See ***Brewster angle.***

**polarising filters** The majority of polarising filters consist of a plastic sheet containing either microscopic crystals of quinine idosulphate or, more recently, 'long' molecules, which are orientated so that they transmit light with minimum absorption only when it is vibrating in one plane, and are optically opaque to rays which are polarised at right-angles to this plane. Filters are often protected by being sealed between plates of glass. See ***nicol prism.***

**polaroid** Trade name for a plastic polarising filter.

**polishing** The technique of achieving a lustrous surface finish on a gemstone. See ***lapidary, diamond cutter*** and ***Beilby layer.***

**polka dot agate** A variety of translucent chalcedony with small red, brown or yellow dots.

**pollucite** A rare collector's stone containing caesium. $H_2Cs_4Al_4(SiO_3)_9$. Cubic. R.I. 1.517–1.525; S.G. 2.85–2.94; H. 6½. Transparent to translucent, colourless, white, mauve-white. Occurrence: Afghanistan, Elba, Sweden, USA.

**polybern** Trade name for a German amber simulant consisting of small pieces of natural amber in a coloured polyester resin.

**polycrystalline diamond** A natural diamond which is composed of a mass of small or microscopic crystals. This type of diamond is normally only suitable for crushing as an industrial grit. See ***boart.***

**polymorphism** A term used where minerals have the same chemical composition but differ in their crystalline form (e.g. andalusite, kyanite and sillimanite). See also ***dimorphism.***

**polystyrene** A hard thermoplastic styrene polymer from which

faceted gemstone simulants are moulded. R.I. 1.59; S.G. 1.05; H. 2½. Dissolves in hydrocarbon liquids such as toluene, bromoform, monobromonaphthalene and methylene iodide.

**polysynthetic twinning** The repeated twinning of a crystal which results in a series of thin plates of alternate orientation. This repeated or lamellar twinning often results in a symmetrical habit uncharacteristic of the gem's crystal system (e.g. the pseudo-hexagonal twinning of chrysoberyl). It also produces parting or planes of false cleavage. See also ***contact twin*** and ***interpenetrant twins.***

**pomegranate ruby** A misleading name for red spinel.

**pompadour pearls** Trade name for imitation pearls.

**Pong Kham quartz** A rock crystal variety of quartz found in the Pong Kham mountain range of Northern Thailand.

**poppy stone** See ***orbicular jasper.***

**porcelain** A type of fine earthenware made from white kaolin clay. It has been used as a simulant for gems such as turquoise. S.G. 2.1-2.5. See also ***streak plate.***

**porphyry** An igneous rock containing comparatively large well-formed crystals embedded in a homogeneous fine-grained matrix. The red porphyry mined in Egypt consisted of crystals of white and pink feldspar in a dark red matrix.

**portrait stones** See ***bevel cut*** and ***lasque diamond.***

**Portugese cut** A modified brilliant cut occasionally used on large stones. It consists of two rows of rhomboid facets and two rows of triangular facets on both crown and pavilion.

**positron** An elementary particle with the same mass as an electron and an equal but opposite charge.

**post-contemporary inclusions** See ***inclusions.***

**potato stone** See ***geode.***

**potch opal** A poor quality opal showing little or no iridescence.

**pounamu** A Maori name for New Zealand nephrite.

**powder diffraction analysis** An X-ray technique for producing a lauegram from powder scrappings taken from a specimen. See ***lauegram.***

**prase** See ***quartz.***

**praseodymium** One of two rare-earth elements neodymium and praseodymium which occur together in nature and share the collective name of didymium. See ***didymium.***

**prase opal** A non-iridescent green opal (coloured by nickel) found in Poland.

**prasiolite** Trade name for green quartz produced by heat treating a variety of Brazilian amethyst.

**Precambrian** The first era of geological time stretching from the origin of the earth to about 570 million years ago. It may be

divided into the ***Archaean,*** in which no life existed, and the ***Proterozoic*** in which the earliest life-forms were present. See also ***Cenozoic, Mesozoic*** and ***Palaeozoic.***

**precious metals** A general term which includes high-value jewellery metals such as gold, silver, platinum, iridium and palladium.

**precious stones** An imprecise term, now little used, which encompassed such high-value gems as diamond, emerald, ruby and sapphire.

**pre-existing inclusions** See ***inclusions.***

**preforming** The grinding of the basic profile of a gem prior to faceting.

**prehnite** A hydrated calcium aluminium silicate carving material, also cut as cabochons. $Ca_2Al_2.(OH)_2Si_3O_{10}$. Orthorhombic. R.I. 1.61, 1.64; D.R. +0.03; S.G. 2.88-2.94; H. 6. Transparent to translucent, yellow-green, brown-yellow. Occurrence: Australia, China, France, Scotland, South Africa, USA.

**pressed amber** See ***ambroid.***

**Primary group of rocks** An obsolete term for rocks of the Palaeozoic era. See ***Palaeozoic.***

**Primer Instituto Gemologico Latin Americano** Headquarters: Sourdeaux 1312, Bella Vista, F.C.S.M., Buenos Aires, Republic of Argentina.

**princess cut** The original name for what is now called the profile cut.

**principal axis** The vertical axis of a crystal or prism. The remaining axes are called laterals.

**prism** An optical component used to bend or disperse light rays. In a microscope, prisms are used to bend and invert the rays to produce an 'upright' image for viewing by the ocular(s). In the prism type polariscope the prism is used to disperse light into its spectral colours so that those parts of the spectrum absorbed by a gemstone can be made visible as dark bands or lines.

**prismatic** A crystal habit consisting of parallelogram faces. See ***prism (form).***

**prismatic cleavage** A cleavage direction parallel to the principal axis (i.e. length) of a prism.

**prismatic moonstone** A misleading name for chalcedony.

**prismatic quartz** A misleading name for cordierite.

**prismatine** See ***kornerupine.***

**prism (form)** A crystal form whose faces are parallel to the principal axis, and are cut by the lateral axes. In *first-order* prisms each prism face is cut by two lateral axes; in *second-order* prisms each face is cut by only a single lateral axis.

**prism spectroscope** See ***spectroscope.***

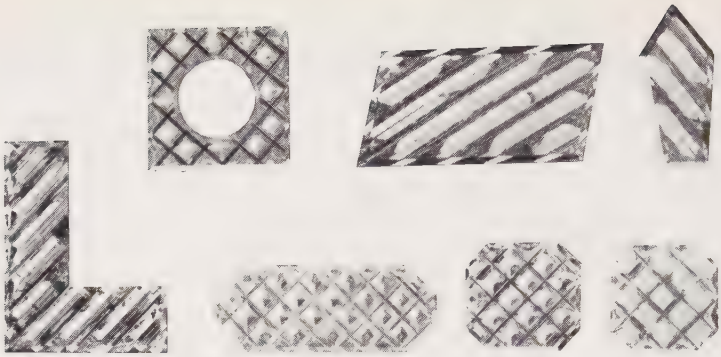


*Figure P.4* The profile or princess cut.

**profile cut** A diamond cut, designed for the economic use of flat crystals, which provides a large table area for little weight. Flat crystals are sawn and polished into various shapes having a polished top and a series of narrow V-shaped parallel grooves on the underside. Originally known as the princess cut. *Figure P.4.*

**propagation of light** See ***wave theory of light.***

**proportion** A term used when grading polished stones, particularly diamond, for cut. The proportions of an ideally-cut diamond are based on the width of the table facet, the depth of the crown and pavilion and the thickness of the girdle as percentages of the girdle diameter, together with the crown and pavilion facet angles. See ***brilliant cut.***

**prosopite** A turquoise simulant comprising gem-quality calcium aluminium hydroxide fluoride. Monoclinic. R.I. around 1.50; S.G. 2.69–2.85; H. 4½. Opaque, blue. Occurrence: Mexico, USA.

**Proterozoic** The later part of the Precambrian era. See ***Precambrian.***

**protogenetic inclusions** See ***inclusions*** (pre-existing).

**proton** An elementary particle in the nucleus of an atom with a unit positive charge and a mass slightly less than that of a neutron.

**proustite** A collector's stone which darkens on exposure to light. $3Ag_2S.As_2S_3$. Trigonal R.I. 2.881–3.084; D.R. +0.203; S.G. 5.57–5.64; H. 2½. Transparent, red. Occurrence: Canada, Chile, Czechoslovakia, France, Mexico, USA.

**pseudochrysolite** A misleading name for moldavite.

**pseudo-cleavage** See ***false cleavage.***

**pseudocrocidolite** A quartz pseudomorph of crocidolite, better known as tiger's eye. See ***crocidolite*** and ***quartz.***

**pseudomalachite** A copper phosphate similar in habit and colour to malachite. $Cu_3P_2O_83Cu(OH)_2$. Monoclinic. Mean R.I. 1.80;

S.G. 3.6; H. 4½. Opaque, green. Occurrence: Germany, USSR, Zambia.

**pseudomorphic** Term applied to a mineral which has adopted an external form other than its normal habit by copying, for example, the shape of a pre-existing crystal or organic structure.

**pseudophite** A variety of aluminous serpentine used for small ornamental objects. R.I. 1.57; S.G. 2.69; H. 2½. Opaque, green. Occurrence: Austria.

**psilomelane** A colloidal manganese oxide used as a haematite simulant. S.G. 4.35; H. 5½-6½. Opaque, silvery lustre (can be distinguished from haematite by its strong electroconductivity and brownish-black streak).

**pudding stone** A conglomerate formed by pebbles cemented together by secondary mineralisation (e.g. Hertfordshire pudding stone).

**pulling method of crystal growth** See ***Czochralski process.***

**pumice powder** A powdered volcanic rock used as a polishing abrasive.

**Purbeck marble** See ***paludina limestone.***

**pure melt method of crystal growth** See ***Bridgeman-Stockbarger process.***

**purity** See ***clarity*** and ***quality.***

**purpurite** An ornamental material comprising the mineral manganese iron phosphate. $(Mn,Fe)PO_4$. Orthorhombic. R.I. 1.87; S.G. 3.69; H. 4-4½. Opaque, deep rose to purplish-red. Occurrence: Namibia.

**putty powder** A creamy-white abrasive polishing powder, containing mainly tin oxide, which is used for polishing gemstones (also called stannic oxide and tin oxide).

**pyknometer** See ***specific gravity bottle.***

**pyralspite garnet series** An isomorphous series of garnets encompassing the pyrope-almandine-spessartite species. See also ***ugrandite garnet series.***

**pyramid** A form consisting of a group of triangular faces whose planes are cut by three crystal axes (e.g. an octahedron).

**pyrites (iron pyrites)** Also known as 'Fool's gold' and inca stone, this iron sulphide is dimorphous with marcasite. $FeS_2$. Cubic. S.G. 4.84-5.10; H. 6½. Opaque, brass yellow. Occurrence: World-wide. See also ***marcasite.***

**pyroclastic rock** Igneous rock fragments ejected by an erupting volcano.

**pyroelectric effect** A property possessed by some gemstones, such as tourmaline and quartz, which become electrically charged when heated.

**pyroemerald** A misleading name for green fluorite.

**pyrope** See *garnet.*

**pyrophyllite** An aluminium silicate similar in appearance and composition to soapstone. $H_2Al_2(SiO_3)_4$. R.I. around 1.6; S.G. 2.8; H. 1½. Opaque, white, grey or greenish. Also called South African wonderstone, Ottosdal G stone and koranna stone, it has been used both as an ornamental stone and as a container for the reaction constituents in the synthesis of industrial diamonds (the melting point of pyrophyllite rises from 1360 °C to 2720 °C under high pressure). Occurrence: Brazil, South Africa, USA, USSR.

**pyroxene** A group of silicate minerals linked by similar physical and optical characteristics (e.g. diopside, enstatite, jadeite and spodumene).

**pyroxmangite** A rare collector's stone comprising the mineral manganese/iron silicate. $(Mn,Fe)SiO_3$. Triclinic. R.I. 1.726, 1.744 to 1.748, 1.764; D.R. +0.016 to +0.018; S.G. 3.61-3.90; H. 5½-6. Transparent, bright pink/purple. Occurrence: Japan.

## Q

**quality** A term used in the sorting of rough diamonds which is equivalent to clarity for polished diamonds (i.e. freedon from internal flaws and inclusions). See ***Sorting Standards for Rough Diamonds*** in Appendix D.

**quartz** A crystalline form of silica. $SiO_2$. Trigonal. R.I. 1.544, 1.553; D.R. +0.009; S.G. 2.65; H. 7. Varieties:

*rock crystal* — transparent, colourless.
*milky quartz* — translucent, white.
*amethyst* — transparent, purple.
*citrine* — transparent, yellow.
*rose quartz* — translucent, pink.
*aventurine quartz* — opaque, green or golden-brown with spangles of mica.
*jasper* — impure multi-crystalline quartz; opaque, brown, green (called *prase*), pink, yellow.
*hornstone* — a form of jasper.
*cairngorm* — transparent, brown.
*blue quartz* — called *siderite,* opaque.
*smoky quartz* — called *morion*; transparent, greyish.
*quartz cat's eye* — translucent, light greenish or brownish chatoyant.
*quartz tiger's eye* — opaque, golden brown chatoyant.
*quartz hawk's eye/falcon's eye* — opaque, blue/green chatoyant.
*rutilated quartz* — called *venus hair stone, fleche d'amour*;

transparent, colourless with rutile needle inclusions.
*tourmalated quartz* — called *thetis hair stone*; transparent, colourless with needle-like tourmaline inclusions.
Pleochroism, medium in amethyst (bluish-violet, reddish-violet). Occurrence: World-wide except for tiger's eye and hawk's eye which come mainly from South Africa, and quartz cat's eye which comes mainly from Sri Lanka and India.

**quartz en chemise** A milky white quartz in which the milkyness is only skin deep.

**quartz glass** A fused amorphous quartz. R.I. 1.46; S.G. 2.21.

**quartzite** A rock consisting of a granular interlocking mass of quartz crystals (when small crystals of mica are present it forms aventurine quartz). R.I. around 1.55; S.G. 2.64-2.69. Occurrence: India, Spain, Tanzania, USSR.

**quartz-schist** An opaque quartzite heavily impregnated with fuchsite mica.

**quartz topaz** A misleading name for the citrine variety of quartz.

**quasima diamond** A misleading name for the rock crystal variety of quartz.

**Quaternary** The period of geological time representing the last 2 million years. It is the later part of the Cenozoic era and comprises the ***Pleistocene*** and ***Holocene (Recent)*** epochs. See also ***Cenozoic*** and ***Tertiary.***

**Quebec diamond** A misleading name for the rock crystal variety of quartz.

**queen conch** See ***giant conch.***

**queenstownite** A slaggy natural glass grouped with those glasses associated with meteorite craters. Transparent to opaque, colourless, yellowish-green, olive-green, black. R.I. 1.47-1.50; S.G. 2.27-2.29. Occurrence: Tasmania.

**quetzalztli** A variety of translucent green jade found in Mexico.

**quincite** A pink sepiolite or a pink common opal.

**quoin facets** Four of the bezel facets and four of the pavilion facets on a brilliant-cut stone. See ***brilliant cut.***

## R

**radient** Trade name for a synthetic colourless spinel.

**radioactive** A material which emits elementary particles or rays as a result of the spontaneous disintegration of atomic nuclei. See ***ekanite*** and ***zircon.***

**radiograph** An X-ray or gamma ray shadowgraph for the internal inspection of materials transparent or translucent to those rays (e.g. pearls). Also used to distinguish diamonds, which are

transparent to X-rays, from diamond simulants, which are either opaque or translucent to X-rays. See *X-rays* and *X-ray diamond tester.*

**radioisotope** A radioactive isotope such as cobalt-60 which emits gamma rays and is used in the artificial colour treatment of diamonds. See *treated diamonds.*

**radium diamond** A misleading name for smoky quartz.

**radium-treated diamonds** See *treated diamonds.*

**rainbow agate** An iridescent agate. See also *fire agate.*

**rainbow diamond** A misleading name for a synthetic rutile diamond simulant.

**rainbow gem** Trade name for a synthetic rutile diamond simulant.

**rainbow magic diamond** A misleading trade name for a synthetic rutile diamond simulant.

**rainbow obsidian** An iridescent obsidian.

**rainbow quartz** See *iris quartz.*

**Raman spectroscopy** When a high intensity light (such as a laser beam) falls on a surface, a minute amount of it undergoes Raman scattering. This scattered light is shorter in wavelength than the incident beam, the effect being caused by the excitation of molecular vibrations in the surface of the material. The degree of wavelength difference, or Raman shift, between the incident beam and the scattered light depends on the nature of the surface atoms and their structural bonding. This spectral shift enables diagnostic absorption spectra in the infra red to be seen in the visible region of the spectrum by means of a standard spectrometer.

**rape seed oil** An oil derived from the seed of the rape or colza plant which is used to clarify cloudy amber. The warmed oil penetrates the amber and enters the air cavities causing the cloudiness. Overheating of the amber produces stress cracks known as sun spangles.

**rare-earth elements** The lanthanide group of 15 rare metallic elements, which includes rare-earths such as cerium (Ce), erbium (er), holium (Ho), neodymium (Nd), praseodymium (Pr), terbium (Tb) and thulium (Tm), and whose oxides are used as colour dopants in various man-made gems. Praseodymium occurs in nature with neodymium (with a collective name of didymium) and these elements are the cause of the colour in yellow apatite. See *Table of Elements* in Appendix H.

**rare-earth garnets** Man-made garnets containing rare-earth elements as part of their composition (e.g. yttrium aluminium garnet, gadolinium gallium garnet).

**rare-earth spectra** When rare-earths are present in a gemstone they give rise to characteristic absorption spectra called 'fine line' spectra.

**rare white/rarest white** Colour grades for polished diamonds. See *Colour Grading Standards* in Appendix B.

**raspberry spar** See *rhodochrosite.*

**rati** An Indian/Burmese unit of weight equal to 0.911 carat. See also *mangelin* and *tola.*

**Rayner Prize** A prize (of gemmological equipment provided by the Rayner Optical Company Ltd.) awarded to the top candidate in the annual Preliminary Examination of the Gemmological Association of Great Britain, whose papers also meet the required standards for this award and who also derives his or her main income from activities essentially connected with the jewellery trade. See also *Anderson Medal* and *Tully Medal.*

**Recent** (Holocene) See *Quaternary.*

**reconstructed rubies** See *Geneva rubies.*

**reconstructed stones** Stones fabricated by fusing together small pieces of the natural gem. See *ambroid* and *Geneva rubies.*

**recovery plant** A plant, usually comprising a series of units, which is used to separate rough diamonds from crushed rock or gravel. See *heavy media separation, hydro-cyclone, grease belt, grease table, magneto-hydrostatic separation, optical separator* and *X-ray separator.*

**red gold** A red tinted gold made by alloying gold with either copper or copper and silver.

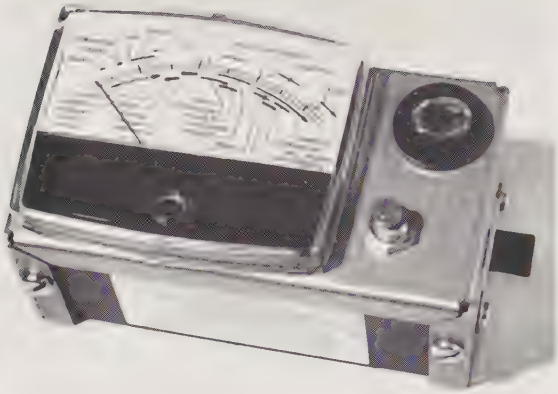
**red jade** A misleading name for a reddish quartzite, and the reddish variety of dumortierite in quartz.

**red ogwell marble** A red limestone marble from Devon, England, containing white fossilised coral known as favosites.

**red sea pearls** A misleading name for coral beads.

**reflectivity** The light reflected from a surface (or from an interface between two media) is a measure of that surface's reflectivity or lustre. See *Fresnel's reflectivity equation, law of reflection* and *lustre.*

**reflectivity meter** An instrument for measuring the reflectivity of a surface. Reflectivity meters developed for the purpose of gemstone identification are based on the Fresnel relationship between reflectivity and refractive index (see *Fresnel's reflectivity equation*). Such instruments do not measure absolute reflectivity, but are calibrated in terms of comparative reflectivity, and are particularly useful in the identification of diamond and those man-made diamond simulants whose R.I. is above the range of the critical-angle refractometer. The first reflectivity instrument for gemstone identification (using a visual-optical comparator) was built by L. C. Trumper, FGA, in 1959. Modern instruments use infra-red light-emitting diodes and photo-detectors, and display the result either by means of an analogue meter or on a



digital display. Important criteria are cleanliness of the stone and a scratch-free flat test surface (more recent developments with focused fibre optics have made it possible to test cabochons). *Figure R.1.*

**refraction** The bending of light rays as they pass through the interface (at angles other than the normal) of media having different optical densities. The greater the difference in the optical densities of the two media, the greater will be the angle of refraction. See ***angle of refraction, double refraction*** and ***refractive index.***

**refractive index** (R.I.) A measure of the degree by which a material bends or refracts the light rays entering it from the surrounding medium (air) at angles other than the normal. The refractive index of a material can be expressed as the ratio between its optical density and that of air (the standard medium for all practical gemmological purposes).

$$\text{R.I.} = \frac{\text{Optical density of material}}{\text{Optical density of air}}$$

As the velocity of light is decreased in an optically dense material (and is inversely proportional to optical density), R.I. can also be expressed as the ratio of the velocity of light in air to that in the material.

From ***Snell's law***, the refractive index of a material can also be obtained from the relationship between the angle of incidence of a light ray in air, and its angle of refraction in the material. From *Figure L.3:*

$$\text{R.I.} = \frac{\text{Sine of angle ION}}{\text{Sine of angle MOR}}$$

Because the refractive index of a material varies with the wavelength of light, monochromatic sodium light, with a wavelength of 589.3 nm, is chosen as the standard for gemmological work.

In doubly-refracting biaxial stones, the maximum value index is designated the *gamma* index ($\gamma$), and the minimum value is called the *alpha* index ($\alpha$). An intermediate value *beta* ($\beta$) corresponds either with the lowest value for the higher index or the highest

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*Figure R.1* The 'Jeweler's Eye' (top) is a two-range reflectivity meter whose lower range covers from glass up to garnet. (Hanneman). The 'Diamond Checker' (middle) is a single-range meter designed specifically for diamond identification. (Culti Corp.). The 'Gemlusta 400×' (bottom) uses a digital display and can detect the small difference in reflectivity between machine-cut synthetic corundums and hand-cut natural corundums.

value for the lower index (see ***extraordinary ray*** and ***ordinary ray***). See also ***refractometer, Becke line method*** and ***direct method.***

**refractometer** An optical instrument designed to measure the refractive indices of various substances. For gem identification purposes, a specialised instrument is used which enables the refractive index of a stone to be measured as a shadow line on a scale. This shadow line is produced as the result of the critical angle of total reflection at the interface between the gemstone and refractometer's measuring prism (see *Figure R.2* and ***critical angle***). Because of the difficulty in obtaining a good optical contact between the gemstone facet and the surface of the prism, use is made of a contact liquid (see ***contact liquid***). To achieve higher ranges, special refractometers have been marketed using blende, diamond or strontium titanate prisms (the latter using a thermo-plastic contact paste and a heated prism.*Figure R.3.*). The refractive index of curved surface gems (cabochons) can also be measured on a refractometer (see ***distant vision method***) and this is facilitated by an instrument such as the Rayner Dialdex refractometer (*Figure R.3*) which uses a calibrated control in place of a calibrated internal scale. See also ***Abbé refractometer, Bertrand refractometer, Erb and Gray refractometer, Herbert Smith refractometer, spinel refractometer*** and ***Tully refractometer.***

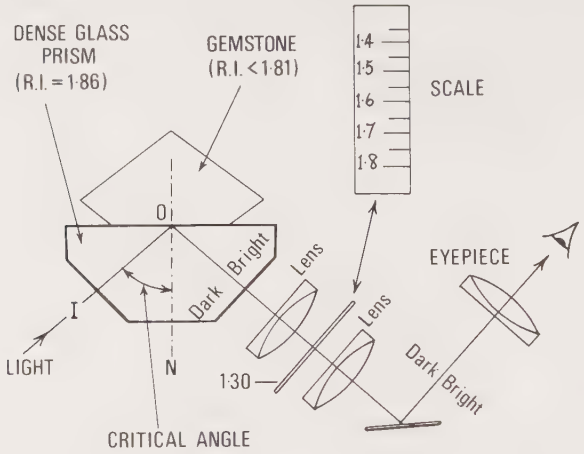



*Figure R.2* Sketch showing the optical design of a modern critical-angle refractometer.

**regency synthetic emerald** A synthetic emerald produced by the hydrothermal process (Vacuum Ventures Inc.).

*Figure R.3* The Rayner Dialdex critical-angle refractometer (top) is fitted with a calibrated control in place of a calibrated internal scale. (Gemmological Instruments Ltd.) The Kruss ER602 extended-range refractometer (bottom) uses a heated strontium titanate measuring prism. The bottle of thermo-plastic contact paste is heated to liquid temperature (40° C) in a special socket on the control plinth. A sodium light source is fitted at the rear of the plinth. R.I. of the contact paste is 2.22, and the range of the refractometer is 1.79–2.21.

**relative density** A term used instead of specific gravity in connection with liquids. See ***specific gravity.***

**reniform** See ***mamillary.***

**repeated twinning** See ***polysynthetic twinning.***

**repoussé** A technique in silver- and gold-smithing of pushing metal into a raised design from the reverse side.

**resinoid** Trade name for a phenolic resin plastic.

**resinous lustre** See ***lustre.***

**resistivity** The electrical resistance (per cm) which limits the passage of an electric current through a conductor. Basic unit of measurement is the ohm (kilohm, megohm). See ***electro-conductivity.***

**retinalite** A honey yellow variety of serpentine.

**Retzius** See ***lines of Retzius.***

**Rhine diamond** A misleading name for the rock crystal variety of quartz.

**rhinestone** A coloured (sometimes multicoloured) glass gemstone simulant.

**Rhodesian Gem and Mineral Society** See ***Gem and Mineral Society of Zimbabwe.***

**Rhodesian moonstone** A bluish-white translucent quartz.

**rhodium** A member of the platinum group of metals, used for plating jewellery. Rh. Atomic number 45; atomic weight 102.91; melting point 1960 °C; S.G. 12.44.

**rhodizite** A rare collector's stone comprising the mineral potassium aluminium borate. $KAl_2B_3O_8$. Cubic. R.I. 1.69; S.G. 3.4; H. 8. Transparent, pink, light-yellow, greenish. Occurrence: the Malagasy Republic, USSR.

**rhodochrosite** An ornamental stone comprising the mineral manganese carbonate (also called inca rose). $MnCo_3$. Trigonal (crystals and massive crystalline aggregate). R.I. 1.60, 1.82; D.R. −0.22; S.G. 3.50-3.65; H. 4. Transparent (crystals) to opaque (massive), rose red. The opaque ornamental material is banded with white and shades of pink. Occurrence: Argentine, India, Southern Africa (Kalahari), USA.

**rhodoid** Trade name for a non-flammable variety of celluloid.

**rhodolite** A violet variety of garnet with a composition between that of pyrope and almandine. R.I. 1.76; S.G. 3.84; H. 7¼. Occurrence: Brazil, Sri Lanka, Tanzania, USA, Zambia.

**rhodonite** An ornamental stone comprising the mineral manganese silicate $MnSiO_3$. Triclinic (crystals and massive crystalline aggregate). R.I. 1.733, 1.744; D.R. +0.011; S.G. 3.6-3.7; H. 6. Transparent (crystals) to opaque (massive), red with black inclusions or veining of oxidised manganese. Pleochroism, medium (orange-red, brownish-red). Occurrence:

Australia, Mexico, South Africa, Sweden, USA, USSR.

**rhombic** See ***orthorhombic.***

**rhombic dodecahedron** See ***dodecahedron.***

**rhombohedron** A crystal form consisting of six identical rhombus (four-sided) faces.

**rhombus** An oblique equilateral parallelogram (i.e. a 'diamond' shape).

**riband jasper** See ***ribbon jasper.***

**ribbon jasper** A jasper containing ribbon-like colour stripes. See ***quartz.***

**richlieu pearls** Trade name for imitation pearls.

**ricolite** A banded variety of fine-grained serpentine from Mexico.

**river** A colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**river agate** Water worn pebbles of moss agate.

**river pearl** A natural pearl from a freshwater mussel.

**rock** A naturally-occurring solidified mixture of various minerals (e.g. granite is a rock consisting of feldspar, quartz and mica). See also ***igneous rock, metamorphic rock*** and ***sedimentary rock.***

**rock crystal** See ***quartz.***

**rock glass** See ***obsidian.***

**rock ruby** A misleading name for pyrope garnet.

**rock systems** See ***geological eras.***

**rogueite** A greenish variety of jasper.

**rejection** A clarity grade for polished diamonds. See ***Clarity Grading Standards*** in Appendix C.

**rolled gold** A thin layer of gold or gold alloy (not less than 9 carat) thermally bonded to silver or a base metal alloy (usually brass), which is then rolled to reduce it to the required overall thickness. See also ***gold filled.***

**Roman mosaic** A mosaic made not from natural stones but from small coloured-glass rods. These are cut to length and cemented in an upright position in a frame so as to make a picture. Also called Byzantine mosaic.

**Roman pearls** A misleading name for glass-bead imitation pearls.

**romanzovite** A brown grossular garnet.

**rondisting** See ***bruting.***

**röntgen rays** See ***X-rays.***

**rosaline** See ***zoisite.***

**rose cut** An ancient cutting style used for diamonds, which consists of a flat base and a dome of triangular facets. *Figure R.4.* See also ***Antwerp rose cut*** and ***Dutch rose cut.***

**rose de France** Trade name for a pinkish amethyst or a pink synthetic sapphire.

**rosée pearl** A much prized pink-tinted pearl.

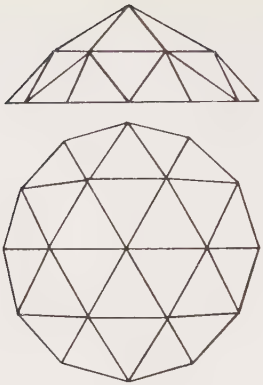


*Figure R.4* The rose cut.

**rose garnet** See ***landerite.*** Also a misleading name for rhodonite.
**roseki** See ***agalmatolite.***
**rose kunzite** A misleading name for synthetic pink sapphire.
**rose quartz** See ***quartz.***
**rose moonstone** A misleading trade name for pink scapolite.
**rosinca** See ***rhodochrosite.***
**rosolite** See ***landerite.***
**rossini jewel** Trade name for the man-made diamond simulant strontium titanate.
**rosterite** A variety of rose-red beryl from Elba.
**rothoffite** A yellow-brown variety of andradite garnet.
**rottenstone** A white to pale-brownish silica-based 'soft' abrasive powder used for polishing gemstones, and derived from decomposed limestone (also called silicon dioxide and tripoli).
**rouge** Powdered haematite (jeweller's rouge) or chromium oxide (green rouge).
**rough diamond** A diamond crystal in its natural unpolished state.
**roumanite** A variety of amber from Romania.
**round brilliant cut** See ***brilliant cut.***
**royal azel** Trade name for sugilite.
**royalite** Trade name for a purplish-red glass.
**royal lavulite** Trade name for sugilite.
**royal topaz** Blue topaz.
**rozircon** A misleading trade name for rose-coloured synthetic spinel.
**rubace** Trade name for red-stained cracked quartz.
**rubellite** A misleading name for pink tourmaline.
**rubicelle** A misleading name for yellow-orange spinel.
**rubolite** A red-coloured common opal.

**ruby** See *corundum.*
**ruby balas** A misleading name for red spinel.
**ruby powder** See *aluminium oxide.*
**ruby spinel** A misleading name for red spinel.
**ruin agate** Brecciated or dendritic agate with markings resembling ruins.
**ruin marble** A yellow marble with brown markings resembling ruins.
**run-of-mine** A normal month's production from a diamond mine.
**Russian jade** A spinach-green variety of nephrite.
**ruthenium** A member of the platinum group of metals. Rh. Atomic number 44; atomic weight 101.7; melting point 2400 °C; S.G. 12.3.
**rutilated quartz** See *quartz.*
**rutile** A naturally-occurring titanium oxide. $TiO_2$. Tetragonal. R.I. 2.616, 2.903; D.R. +0.287; S.G. 4.2–4.3; H. 6–6½. Transparent, red, red-brown, black. Occurrence: Brazil, France, Italy, the Malagasy Republic, Scandinavia, Switzerland, USA, USSR. Synthetic rutile crystals, having the same constants as natural rutile but yellowish in colour, are grown in a modified Verneuil furnace by the flame-fusion process, and cut as diamond simulants.

## S

**sabalite** A variety of banded green variscite found in the USA.
**safirina** A blue spinel or blue quartz.
**sagenitic agate** An agate variety which contains needle-like inclusions of other minerals.
**sagenite** A quartz containing needle-like inclusions. Also an acicular rutile.
**sagenitic quartz** A variety of rock crystal quartz containing needle-like inclusions (e.g. rutilated quartz, known as 'Venus hair stone' and 'Flêches d'amour'; tourmalated or actinolated quartz, known as 'Thetis hair stone').
**Saint Stephen's stone** A red-spotted white chalcedony.
**salamanca topaz** A misleading name for a fiery-coloured citrine variety of quartz.
**salininha emeralds** Brazilian beryl coloured green by vanadium. Because of this they are more correctly classified as green beryl, as emerald is coloured by chromium.
**samarskite** A complex mixture of tantalum, niobium (columbium) and rare-earth oxides. S.G. 4.1–6.2; H. 5–6. Opaque, velvet-black with a semi-metallic lustre.

**San Diego ruby** A misleading name for red tourmaline.

**sandstone** A sedimentary rock formed from the compacted debris of pre-existing rock masses. See ***sedimentary rock.***

**sang-i-yeshan** A dark green bowenite.

**sanidine** A glassy variety of orthoclase feldspar found in Germany. R.I. 1.516, 1.522 to 1.520, 1.526; D.R. −0.006; S.G. 2.57-2.58; H. 6. Transparent, light grey to light brown.

**sapphire** See ***corundum.***

**sapphire powder** See ***aluminium oxide.***

**sapphire quartz** A misleading name for blue chalcedony or the hawk's eye variety of quartz.

**sapphire spinel** A misleading name for blue spinel.

**sapphirine** A misleading name for blue chalcedony, blue spinel and a blue glass sapphire simulant.

**sapphirised titania** Trade name for a synthetic rutile.

**sard** See ***chalcedony.***

**sardium** Artificially coloured sard.

**sardoine** A dark variety of cornelian.

**sardonyx** See ***chalcedony.***

**satelite** A fibrous serpentine.

**satin spar** A fibrous white or pink variety of calcite. Occurrence: England, Scotland, USA. Also a white fibrous variety of gypsum.

**saualpite** Original name for the mineral zoisite.

**saussurite** A rock consisting mainly of decomposed plagioclase feldspar and zoisite (plus some mica and calcite) sometimes used as a jade simulant. R.I. 1.57-1.70; S.G. 3.0-3.4; H. 6½. Opaque, variegated white/green, grey-green, yellow-green or moss-green. Occurrence: Switzerland.

**sawables** Rough diamonds having a blocky shape (e.g. whole crystals such as stones and shapes) which are sawn before being polished. See ***makeables.***

**sawing** A method used to divide rough gem material. With rough diamonds it is used to part a crystal in two, in directions other than those of the cleavage planes. The diamond cutting saw consists of a clamped thin phosphor-bronze blade which is coated with a mixture of olive oil and diamond dust and rotated at 5000 to 10 000 rev/min.

**sawyer** A diamond cutter who operates a bank of diamond sawing machines, often comprising up to 40 individual saws.

**saxon diamond** A misleading name for colourless topaz.

**saxon chrysolite** A misleading name for topaz.

**saxon topaz** A misleading name for the citrine variety of quartz.

**scaife** A cast iron lap used for polishing diamonds. The scaife has a porous surface which is coated with a mixture of olive (or castor) oil and diamond dust. It is rotated at 2500 rev/min, and the

diamond, secured in a holder or dop, is brought into pressure contact with the treated surface. See *Figure T.1.*

**Scan DN** The Scandinavian nomenclature and grading standards for polished diamonds. See ***Grading Standards*** in Appendices B and C.

**Scan DN brilliant cut** One of several 'ideal' cuts for diamond, which together with the Eppler cut is mainly favoured in Europe (see *Figure B.6.*). See ***Eppler brilliant cut, Johnson and Rösch brilliant cut, Parker brilliant cut*** and ***Tolkowsky brilliant cut.***

**scanning electron microscope** (SEM) See ***electron microscope.***

**scapolite** A member of the scapolite isomorphous series whose end members are marialite, $Na_4Cl(AlSi_3O_8)_3$, and meionite $Ca_6(Al_2Si_2O_8)_3(SO_4CO_3)$. Scapolite is an aluminium-calcium-sodium-silicate combination of these two end members. Tetragonal. R.I. (blue) 1.544, 1.560; R.I. (yellow) 1.548, 1.568; R.I. (pink and colourless) 1.540, 1.549; D.R. −0.009 to −0.02; S.G. (blue) 2.634; S.G. (yellow) 2.70; S.G. (pink and colourless) 2.63; H. 6. Transparent, colourless, blue (chatoyant), violet, yellow, pink (chatoyant). Pleochroism, strong in pink (colourless, pink) and violet (dark blue, pale blue), medium in yellow (colourless, yellow). Occurrence: Brazil, Burma, Canada (opaque yellow), the Malagasy Republic, Mozambique.

**schaumberg diamond** A misleading name for the rock crystal variety of quartz.

**scheelite** A collector's stone comprising the mineral calcium tungstate. $CaWO_4$. Tetragonal. R.I. 1.918, 1.934; D.R. +0.016; S.G. 5.9-6.1; H. 4½-5. Transparent to translucent, colourless, yellowish-white, brownish, orange. Occurrence: Mexico, USA. Synthetic scheelite has been grown by the Czochralski and Bridgeman-Stockbarger processes.

**schiller** See ***sheen.***

**schiller spar** Also known as bastite, this is a leek-green altered enstatite. S.G. 2.6; H. 3½-4. Opaque. Occurrence: Germany.

**schist** A metamorphic rock consisting of layers of different minerals which split up into thin irregular plates.

**schlossmacherite** A complex hydrated calcium alumina sulphur arsenide belonging to the alunite-jerosite series. Hexagonal. R.I. around 1.597. Opaque, green. Occurrence: Chile.

**schnide** A blue glassy common opal.

**schorl** See ***tourmaline.***

**scientific brilliant** A misleading name for colourless synthetic corundum.

**scientific emerald** A misleading name for a beryl glass simulant of emerald.

**scientific hematite** A misleading name for a metallic alloy made to

imitate haematite. See ***hematine.***

**scientific topaz** A misleading name for a synthetic pink corundum.

**scintillation** The multiple and alternating reflections of light from the facets of a polished gemstone when there is relative movement between the observer and the light source or the gemstone.

**scissors cut** A rectangular gemstone cut, also called a cross cut. *Figure S.1.*

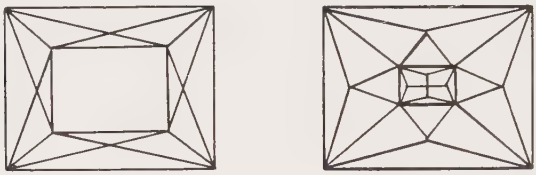



*Figure S.1* The scissors or cross cut.

**scolecite** A collector's stone consisting of a hydrated silicate of calcium and aluminium, this is one of the zeolite group of minerals. $CaAl_2Si_3O_{10}.3H_2O$. Monoclinic. R.I. around 1.49; S.G. 2.3; H. 5-5½. Opaque to translucent, colourless to white, yellowish, greenish, reddish.

**scorodite** A rare collector's stone comprising a hydrated ferric arsenate. $FeAsO_4.2H_2O$. Orthorhombic. R.I. 1.785, 1.816; D.R. +0.031; S.G. 3.29; H. 3½-4. Transparent to translucent, dark blue. Pleochroism, strong. Occurrence: Namibia.

**Scotch pearls** Freshwater pearls from mussels found in the rivers of Scotland.

**Scotch topaz** A misleading name for cairngorm, citrine or smoky quartz.

**scratch hardness** See ***hardness.***

**sea amber** See ***amber.***

**sea horse ivory** Ivory from the teeth of the hippopotamus.

**secondary deposit** See ***alluvial deposit.***

**secondary group of rocks** An obsolete term for rocks of the Mesozoic era. See ***Mesozoic.***

**second water** See ***first water.***

**sedimentary rock** A rock formed from deposits of the fine fragments of sand, grit and clay eroded from pre-existing rocks, or by natural chemical precipitation on the sea bed, e.g. sandstone and limestone.

**seed pearls** Very small pearls (less than ¼ grain) found mainly in the Gulf of Mannar, between India and Sri Lanka.

**selective absorption** The suppression or absorption of certain

wavelengths or colours in white light by a gemstone. See also ***differential selective absorption.***

**selenite** A crystalline variety of gypsum. See ***alabaster.***

**semi-conductor diamonds** See ***Type II diamonds.***

**semi-precious stones** An imprecise term (whose use is prohibited by CIBJO) which once encompassed the majority of less costly gems (i.e. gems other than, for instance, diamond, emerald, ruby and sapphire).

**senaille** Small diamond chips cut with a flat base and irregular triangular facets.

**sepiolite** See ***meerschaum.***

**serpentine** A hydrated silicate of magnesium. $Mg_6(OH)_8(Si_2O_5)_2$. Monoclinic. R.I. 1.56 (mean); S.G. 2.5-2.7; H. 2½. Opaque, mottled dark green, leafy-green (antigorite). Occurrence: Found in many countries including Austria, England, Scotland, South Africa. See also ***bowenite, verd antique*** and ***williamsite.***

**serra stone** Brazilian agate.

**setter** A craftsman who sets gemstones in rings and other jewellery.

**shadow method of R.I. approximation** With this technique, the gemstone under test is immersed in turn in a series of liquids of known R.I.s in an immersion cell placed on a white surface. A black straight edge is slid under the cell so that it obscures the light passing through one edge of the stone. If the stone and the liquid have the same R.I., the image of the straight edge will appear unbroken by the stone. If the R.I. of the liquid is higher than that of the stone, the black edge will appear to advance into the stone. If the R.I. of the liquid is lower, the outline of the stone will appear to cut into the black straight edge.

**shaft mining** See ***diamond mine.***

**shale** A solidified mud or clay forming a stratified sedimentary rock which splits readily into thin plates.

**Shanghai jade** A misleading name for steatite (i.e. soapstone) or talc.

**shape categories (rough gem diamonds)** See ***chips, cleavages, macles, melée, shapes*** and ***stones.***

**shapes** Distorted (but unbroken) rough gem diamond octahedrons over 2 carats in size are called shapes. Under 2 carats these are called melée. See also ***chips, cleavages, macles, stones,*** and *Figure C.3.*

**shatter marks** See ***fire marks.***

**shattuckite** See ***planchéite.***

**sheen** The optical effect created by light rays reflected back from beneath the surface of a gemstone.

*chatoyancy* — the cat's eye effect caused by the reflection of light from parallel groups of fibres, crystals or channels within

the stone (e.g. as in the tiger's eye variety of quartz and the cymophane variety of chrysoberyl).

*asterism* — a star effect present in a few gemstones such as ruby and sapphire (which are polished as cabochons to show the effect to best advantage). Asterism is caused by sets of fine parallel fibres or crystals which have aligned themselves along the crystal axes (in star corundum there are three sets intersecting at 60°). In star diopside and some garnets a four-pointed star is produced as the result of two sets of inclusions intersecting at approximately right-angles.

*iridescence* — the 'play' of rainbow-coloured light caused by extremely small regular structures beneath the surface of the gemstone which 'interfere' with the reflected light (see ***interference***). In precious opal, iridescence is caused by millions of microscopic spheres of cristobalite (*Figure O.1*) which colour the reflected light by a combination of interference and diffraction effects.

*labradorescence* — a particular form of iridescence seen in the labradorite and spectrolite varieties of feldspar which is caused by thin layers or flakes beneath the surface.

*adularescence* — also known as Schiller and opalescence, this is the bluish iridescence seen in moonstone, and is caused by lamellar twinning.

**shell** The hard outer casing of a mollusc.

**shell cat's eye** See ***operculum.***

**shell marble** A marble containing fossil shells. See ***paludina limestone, Petworth marble, Kilkenny black fossil marble*** and ***fire marble.***

**Shipley colorimeter** See ***diamond colorimeter.***

**short wave UV** See ***ultra violet light.***

**shot boart** See ***boart.***

**shoulders** The parts of a ring shank adjacent to the stone mount.

**Siam aquamarine** A misleading trade name for heat-treated blue-green zircon.

**Siberian chrysolite** A misleading name for demantoid garnet.

**Siberian ruby** A misleading name for the pink variety of tourmaline.

**siberite** A violet variety of tourmaline.

**Sicilian marble** A misleading name for a white Italian marble which is clouded with greyish veins.

**siderite (blue quartz)** See ***quartz.***

**siderite** A collector's stone comprising the mineral iron carbonate (also called chalybite). $FeCO_3$. Trigonal. R.I. 1.633, 1.873; D.R. −0.24; S.G. 3.83-3.88; H. 3½-4. Transparent, gold-brown, red-brown. Occurrence: Portugal.

**sights** The five-weekly sale of parcels of rough gem diamonds by the Diamond Trading Company (the principal company in De Beers Central Selling Organisation). See also ***splitting.***

**sign of refraction** See ***optic sign.***

**silex** A variety of brown jasper having red spots. Occurrence: Egypt.

**silica glass** For natural silica glasses see ***Libyan glass, moldavite, pit glass*** and ***tektites.*** Man-made silica glass is produced by melting rock crystal at 1700 °C. The resulting change from crystalline quartz to amorphous silica glass causes a fall in R.I. and S.G. to 1.46 and 2.21 respectively.

**silicified wood** See ***fossil wood.***

**siliciophite** Chrysotile in common opal.

**silicon carbide** See ***carborundum.***

**silicon dioxide** See ***rottenstone.***

**silk** See ***inclusions.***

**silky** See ***lustre.***

**sillimanite** See ***fibrolite.***

**Silurian** A rock system on the earth's surface comprising the rocks laid down during the Silurian period, 430–395 million years ago. The Silurian period is part of the Palaeozoic era. See ***Palaeozoic.***

**silver** A precious white metallic element used in jewellery. Ag. Atomic number 47; atomic weight 107.88; melting point 961 °C; S.G. 10.5.

**silver cape** A UK colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**silver peak jade** A misleading name for malachite.

**silver solder** A silver-copper-zinc alloy used as a solder for joining silver components in jewellery. There are five basic grades, 'extra-easy' with a melting point of 680–700 °C, 'easy' (melting point of 705–723 °C), 'medium' (melting point of 720–765 °C), 'hard' (melting point of 745–778 °C) and 'enamelling' (with a melting point of 730–800 °C, i.e. a solder which does not soften during the enamelling process). The constituents vary from 67–82% for silver, 14–24% for copper and 4–9% for zinc.

**simetite** A reddish-brown variety of amber found in Sicily.

**simpsonite** A rare aluminium tantalate. Hexagonal. R.I. 1.994–2.04; D.R. −0.046; S.G. 5.9–7.3; H. 7. Bright orange-yellow. Occurrence: Brazil.

**simulant** A term used to describe materials which simulate or imitate a gemstone. A gemstone simulant, while having a superficial resemblance to the gem it imitates, differs from it either in composition, structure or physical constants (often in all three). See also ***composite stones*** and ***synthetic stones.***

**single-cut** See ***eight cut.***

**single refraction** The refraction of light which occurs in an amorphous material or with a crystalline substance belonging to the cubic system. Unlike doubly-refracting materials, these do not polarise the light into two separately refracted rays, but transmit it as a single refracted ray.

**sinhalite** A magnesium aluminium iron borate (until 1952 classified as a brown peridot). $Mg(Al,Fe)BO_4$. Orthorhombic. R.I. 1.67, 1.71; D.R. −0.038; S.G. 3.47-3.49; H. 6½. Transparent, yellow, brown. Pleochroism, medium (pale brown, greenish-brown, dark brown). Occurrence: Sri Lanka.

**sinopal** A misleading name for a reddish aventurine quartz.

**Sioux Falls jasper** A quartzite from South Dakota, USA.

**sizes** A category for rough diamonds over 2 carats.

**sizing** The separation of rough diamonds into weight categories.

**skaif** See ***scaife.***

**skeif** See ***scaife.***

**skew facets** See ***break facets.***

**skill facets** See ***break facets.***

**skinning** A technique for improving the appearance of a badly-coloured or blemished pearl by carefully polishing or filing away the outer layer.

**skull crucible process** A method, originated in the Lebedev Physical Institute, Moscow, which is used to grow crystals of cubic zirconium oxide (manufactured as a diamond simulant). Because of the high melting point of zirconia powder, the process uses a cold 'skull' crucible, which consists of a cylindrical arrangement of water-cooled copper pipes. The zirconia powder (plus a stabilizer to maintain the cubic crystal structure of the material as it cools) is melted within the crucible by means of radio frequency induction heating. The bulk of the powder melts, except for a thin crust next to the cooled copper tubes, which then acts as a high-temperature crucible for the molten zirconia. After several hours, the R.F. heating power is slowly reduced, and the cubic zirconium crystals form as the melt cools.

**slate** A fine-grained grey metamorphic rock which can be easily split into flat sheets.

**slightly tinted white** A CIBJO colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**slocum stone** An opal simulant made from a form of sodium-rich silicon glass containing some calcium and magnesium. The manufacturing process produces extremely thin parallel layers within the glassy matrix, and these are the cause of the material's iridescence. R.I. 1.49-1.52; S.G. 2.4-2.5; H. 6.

**smalls** A size category for rough diamonds under 2 carats.

**smaltite** A collector's stone comprising the mineral cobalt

arsenide. $CoAs_3$. Cubic (massive). S.G. 6.0-6.3; H. 5½. Opaque, tin-white to steel-grey. Occurrence: Canada, Chile, Europe.

**smaragdite** A jade-like variety of actinolite (also called edenite). $Ca_2(Mg,Fe)_5(Si_4O_{11})_2(OH)_2$. Monoclinic. R.I. 1.608, 1.630; D.R. −0.022; S.G. 3.25; H. 6½. Translucent to opaque, grass-green to emerald-green.

**smaragdolin** Trade name for a green beryl glass.

**smaryll** Trade name for an emerald simulant comprising a crown and pavilion of poor quality beryl cemented together with an emerald-coloured cement.

**smithsonite** A zinc carbonate cut as cabochons. Also called bonamite. $ZnCO_3$. Trigonal. R.I. 1.621, 1.849; D.R. −0.228; S.G. 4.3; H. 5. Translucent to opaque, pale green, pale blue, pink. Occurrence: Greece, Mexico, Namibia, Spain, USA.

**smoky quartz** See ***quartz.***

**smoky topaz** A misleading name for smoky quartz.

**Snell's law** The law of refraction, which states that:

1. When a ray of light passes from one medium into another, there exists a definite ratio between the sines of the angle of incidence and the angle of refraction, which is dependent only on the two media and the wavelength of the light.
2. The incident ray, the normal (at the point of incidence) and the refracted ray are all in the same plane. See ***refractive index.***

**snowflake jade** See ***jade matrix.***

**snowflake obsidian** See ***flowering obsidian.***

**soapstone** See ***steatite.***

**sobrisky opal** A variety of opal from California.

**Société Belge de Gemmologie** Headquarters: Rue du Midi 118, 1000 Bruxelles, Belgium.

**sodalite** One of the principal components of lapis lazuli, it is a complex chloric sodium aluminium silicate. Cubic. R.I. 1.48; S.G. 2.28 H. 5½-6. Opaque to translucent, blue, grey. Occurrence: Brazil, Canada, Namibia, USA.

**sodium light** The standard illuminant used when specifying the refractive indices of gemstones. Sodium light is monochromatic and has a wavelength of 589.3 nm. Because of the cost of sodium discharge lamps, yellow colour filters and interference filters (centered on 589.3 nm) are often used, in conjunction with a white light source, as an alternative when measuring gemstone R.I.s. Yellow light-emitting diodes (LEDs) with an emission peak at 585 nm are also used.

**soft ivory** A commercial description for a type of ivory which is easier to cut than the hard more 'glassy' variety. It is also more tolerant to changes in temperature and does not crack so easily (e.g. Zanzibar and Mozambique ivory). See ***hard ivory*** and ***bastard ivory.***

**sogdianite** A complex aluminium/lithium silicate with potassium, sodium, zircon, titanium and iron. R.I. 1.606, 1.608; D.R. +0.002; S.G. 2.765; H. 6–7. Opaque, violet. Occurrence: South Africa.

**solar spectrum** See ***Fraunhofer lines*** and ***Table of Principal Fraunhofer Lines*** in Appendix J.

**solder dop** A metal holder containing a low melting-point solder which is used to secure a diamond during polishing. See ***dop.***

**soldered emerald** A soudé emerald. See ***composite stones.***

**solitaire** A ring mounted with a single gemstone, usually a diamond.

**soochow jade** A misleading name for bowenite or steatite (soapstone).

**sorella** Trade name for the man-made diamond simulant strontium titanate.

**sorting** A general term covering the sorting of rough diamonds for colour, quality and shape. See ***Sorting Standards for Rough Diamonds*** in Appendix D.

**soudé emeralds** See ***composite stones.***

**soudé spinels** Composite simulants made from a coloured centre layer (often a sintered glass) fused to a crown and pavilion of colourless synthetic spinel.

**sousmansite** See ***wardite.***

**South African emerald** A misleading name given to a faceted emerald-green fluorspar from Namibia.

**South African jade** See ***garnet (grossular).***

**South African wonderstone** See ***koranna stone*** and ***pyrophyllite.***

**Spanish emerald** A misleading name for a green glass emerald simulant.

**Spanish Gemmological Association** See ***Association Espancia de Gemologia.***

**Spanish Gemmological Institute** See ***Instituto Gemmologico Espanol.***

**Spanish lazulite** A misleading name for cordierite.

**Spanish topaz** A misleading name for orange-brown quartz.

**sparklite** Trade name for colourless heat-treated zircon.

**spat** Spawn of the pearl oyster.

**species** A classification of minerals which are separated into individual species by their chemical composition and crystal system. See ***groups*** and ***varieties.***

**specific gravity** The ratio of the mass of a substance to the mass of an identical volume of pure water at 4 °C (by definition, the specific gravity of water is 1). See also ***density, density bottle, relative density, heavy liquids*** and ***hydrostatic weighing.***

**specific gravity bottle** See ***density bottle.***

**specific gravity indicators** Small samples of inclusion-free gem minerals (having known stable S.G. values) which are used to blend and check the specific gravity of heavy liquids (e.g. rock crystal, fluorspar and corundum). See also ***glass S.G. indicators.***

**spectra** See ***absorption spectrum, emission spectrum, flame spectrum, rare-earth spectra.***

**spectrolite** Finnish variety of labradorite feldspar.

**spectrometer** See ***goniometer.***

**spectrophotometer** An instrument for measuring the absorption spectrum of a specimen, often as a means of objectively (and precisely) specifying its colour. It consists of a light source (which may cover the UV and IR as well as the visible section of the spectrum), a monochromator which can be tuned over the spectral range, a detector unit for sampling the transmitted or reflected light from the specimen and a control unit to amplify and display the output of the detector unit. Spectrophotometers may also contain the means for automatic scanning and recording of an absorption spectrum, and the computing ability to translate this into tristimulus values and CIE colour co-ordinates. See ***diamond colorimeter.*** *Figure S.2.*

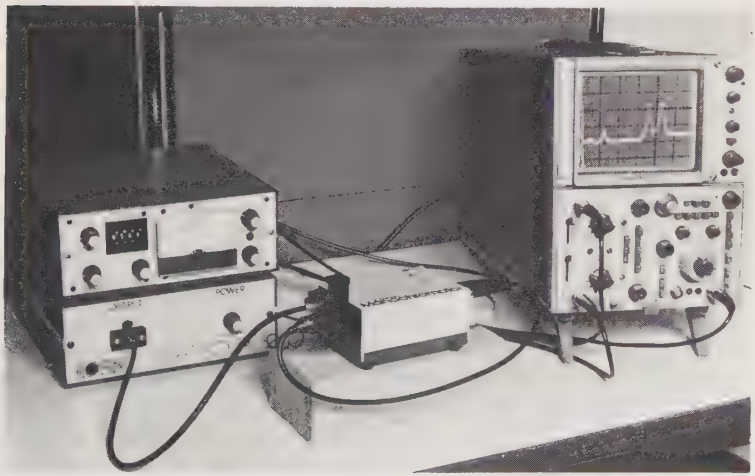


*Figure S.2* The 6010 spectrophotometer, comprising a light source, a scanning monochromator (using a diffraction grating disc rotating at 10 Hz) with sample holder and photoelectric detector, and a wavelength marker. The absorption spectrum of the specimen is displayed on a standard oscilloscope. (Rofin)

**spectroscope** An optical instrument which makes those sections of white light absorbed by a gemstone visible by dispersing or

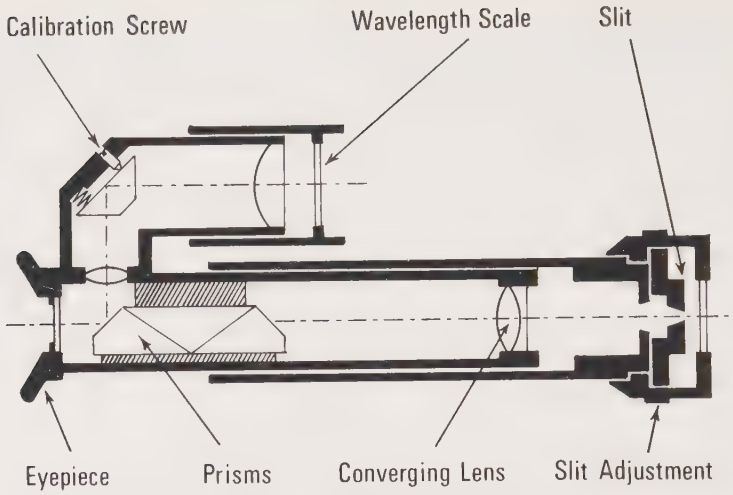



*Figure S.3* Sketch showing the construction of a prism-type spectroscope with a built-in wavelength scale.

spreading out the resultant reflected or transmitted light into its spectral colours (see ***absorption spectrum***). Two methods of light dispersion are used in these instruments: a compound prism which produces a bright spectrum, but one which is cramped at the red end and spread out at the violet end, and a diffraction grating, which produces a weaker, but evenly spaced, spectrum (see ***diffraction grating***). Prism spectroscopes often incorporate a superimposed wavelength scale (*Figure S.3.*). Spectroscope units may also contain built-in light sources (*Figure S.4.*). See also ***Gübelin's jewellers' spectroscope.***

**specularite** See ***haematite.***

**speed of light** See ***velocity of light.***

**spessartine** See ***garnet*** (spessartite).

**spessartite** See ***garnet.***

**sphalerite** A collector's stone comprising the mineral zinc sulphide (also called blende and zinc blende). ZnS. Cubic. R.I. 2.37; S.G. 4.09; H. 3½-4. Transparent to translucent, dark brown, green, colourless. Occurrence: Central Africa (green), Mexico, Spain.

**sphene** A titanium calcium silicate (also called titanite). $CaTiSiO_5$. Monoclinic. R.I. 1.885, 1.990 to 1.915, 2.050; D.R. +0.105 to +0.135; S.G. 3.52-3.54; H. 5½. Transparent, yellow, brown, green. Pleochroism, strong (green, colourless, yellow; and yellow, colourless, reddish). Occurrence: Austria, Brazil, Canada, the Malagasy Republic, Sri Lanka, Switzerland, USA.

**spherical aberration** See ***aberration.***

*Figure S.4* A unit combining a variable-intensity self-contained light source, a colour filter disc and a prism-type wavelength spectroscope. (Krüss)

**spinach jade** See ***nephrite.***

**spinel** An isomorphous magnesium aluminate in which the magnesium may be replaced by manganese or iron, and the aluminium by iron or chromium. $MgO.Al_2O_3$. Cubic. R.I. 1.718; S.G. 3.6; H. 8. Transparent, colourless (rare), red, pink, brownish, grass-green (called chlorospinel), dark green/black (called ceylonite and pleonaste), yellowish, blue, violet, purple. Occurrence: Brazil, Burma, Sri Lanka, Thailand, USA. See also ***ceylonite*** and ***gahnospinel.***

**spinel refractometer** A critical-angle Rayner refractometer with a measuring prism made from synthetic spinel. Although spinel restricts the measuring range of the instrument (1.3 to 1.68), it has the advantages of hardness and a dispersion which matches that of the majority of gemstones, this latter feature making it possible to use a white light source without producing strong colour fringing of the shadow edges. Another advantage of the spinel refractometer is its open scale which enables more accurate readings to be taken.

**spinel ruby** A misleading name for red spinel.

**splintery fracture** See *fracture.*

**splitting** A stage in the preparation of rough diamonds for the De Beers sights in which diamonds from all the sorted categories of weight, shape, colour and quality are allocated or split into parcels for the individual buyers. Each buyer, depending on the value of his allocation and his requirements, is offered an equitable selection of diamonds from each available category. See also *sights.*

**spodumene** A lithium aluminium silicate. $LiAl(SiO_3)_2$. Monoclinic. R.I. 1.660, 1.675; D.R. +0.015; S.G. 3.17–3.19; H. 7. Transparent, yellow, yellowish-green, pink (kunzite), emerald-green (hiddenite, coloured by chromium — rare). Pleochroism, strong in kunzite and hiddenite (violet, deep violet, colourless and bluish-green, emerald-green, yellowish-green respectively). Occurrence: Brazil, Burma, the Malagasy Republic, USA.

**spot method** (of R.I. measurement) See *distant vision method.*

**spotted** A UK clarity grade for polished diamonds. See *Clarity Grading Standards* in Appendix C.

**spread stone** See *open table.*

**spread table** See *open table.*

**Sri Lankan Gemmologists' Association** See *Gemmologists' Association of Sri Lanka.*

**stalactite** A deposit (usually of calcium carbonate) shaped like a hanging icicle, and formed by the evaporation of dripping water in a cave or cavern.

**stalagmite** A deposit, similar to a stalactite, formed by the evaporation of dripping water but growing upwards from the floor of a cave, and often uniting with a hanging stalactite.

**stannic oxide** See *putty powder.*

**star facets** The eight triangular facets immediately adjacent to the table facet on a brilliant-cut stone. See *brilliant cut* and *Figure B.6.*

**starilian** Trade name for the man-made diamond simulant strontium titanate.

**Star of India** A 536-carat star sapphire which originated from Ceylon (now Sri Lanka), and is now in the Museum of Natural History in New York.

**star stones** See *sheen* (asterism).

**starlite** Trade name for a blue zircon.

**starolite** Trade name for a star rose quartz doublet.

**starred agate** An agatised coral, found on the south-west coast of England, which consists of a pale brown chalcedony containing a pattern of chalk-white stars. See also *fossil coral.*

**star-tania** Trade name for a synthetic rutile diamond simulant.

**star topaz** A misleading name for a yellow star sapphire.

**staurolite** A collector's stone, but mainly prized as a mineral specimen for its cross-shaped interpenetrant twin crystals (also called a 'cross stone', or 'fairystone', and grenalite). The mineral is a hydrated aluminium iron silicate. $Al_2\ SiO_5\ Fe\ (OH)_2$. Orthorhombic. R.I. 1.739, 1.750 to 1.747, 1.762; D.R. +0.011 to +0.015; S.G. 3.65-3.78; H. 7-7½. Transparent, reddish-brown. Pleochroism, medium (colourless, yellow or red). Occurrence: Brazil, France, Scotland, Switzerland, USA, USSR. See also ***zincian staurolite.***

**steatite** A variety of the mineral talc, an acid metasilicate of magnesium. In its massive form it is used as a carving material and called 'soapstone'. $H_2Mg_3(SiO_3)_4$. Monoclinic. R.I. 1.54-1.59 (around 1.54 for soapstone); D.R. 0.05; S.G. 2.2-2.8; H. 1 (often higher due to impurities). Opaque, yellow, greenish, brown, reddish. Occurrence: Canada, Central Africa, India, Zimbabwe.

**stellarite** Trade name for a blue quartz with blue/green and metal grey/black veins due to a copper matrix, chrysocolla and haematite. Interference colours are caused by the presence of planchéite. Occurrence: USA.

**step cut** See ***emerald cut.***

**stereo microscope** See ***binocular microscope.***

**sterling silver** An alloy consisting of 92.5% silver and 7.5% copper.

**stewartite** See ***boart.***

**stibiotantalite** A collector's stone consisting of a niobate and tantalate of antimony. $SbO_2(Ta,Nb)_2O_6$. (note: niobium, Nb, has the alternative name columbium, Cb). Orthorhombic. R.I. 2.39, 2.46; D.R. +0.07; S.G. around 7.4; H. 5½-6. Transparent, brownish-yellow. Occurrence: USA.

**stichtite** A collector's stone comprising a decomposition product of chrome-serpentine. $Mg_6Cr_2(OH)_{16}CO_3.4H_2O$. Trigonal (massive, fibrous). R.I. around 1.53; S.G. 2.15-2.22; H. 2½. Opaque, rose-red, lilac. Occurrence: Algeria, Canada, South Africa, Tasmania.

**Stokes Law** A law associated with photoluminescent phenomena which states that the fluorescent glow from a material is always of a longer wavelength than that of the exciting radiation.

**stolberg diamond** A misleading name for the rock crystal variety of quartz.

**stone gauges** See ***caliper gauge*** and ***diamond gauge.***

**stone paper** A folded paper container for gemstones, often containing a tissue paper inner lining. See diagram under ***Stone Papers*** in Appendix E.

**stones** A term used in the shape sorting of rough gem diamonds to

denote well-shaped octahedral crystals over 2 carats in size. Under 2 carats these crystals are called melée. See also ***chips, cleavages, macles, shapes,*** and *Figure C.3.*

**stone tongs** See ***tweezers.***

**stoping** An underground mining technique used in diamond mines, involving the progressive step-cutting of the gem-bearing rock.

**strass** A highly dispersive glass, containing lead or thallium, used for gemstone simulants.

**strawberry pearl** A pink-coloured baroque freshwater pearl with a pimpled surface.

**streak** The mark produced when a mineral is rubbed on the unglazed surface of a plate of white porcelain (called a 'streak plate'). As the colour of a mineral's powder is sometimes quite different from its body colour, this forms a useful identification feature in mineralogy.

**stremlite** Trade name for a blue zircon.

**stria** Roughly parallel or concentric lines or channels on the surface of crystals, or within stones.

**strongite** Trade name for a synthetic spinel.

**strontium titanate** A man-made diamond simulant (introduced in 1953) which has no counterpart in nature. $SrTiO_3$. Cubic. R.I. 2.41; S.G. 5.13; H. 6. Transparent, colourless (yellow, brown or red when doped with transition metal oxides). Crystals are grown by the flame-fusion process using a special burner which supplies extra oxygen to the boule. The blackened boules are then annealed in an oxidizing atmosphere to produce a colourless crystal.

**Sturmlechner emerald simulants** Faceted beryls coated with a hydrothermally deposited layer of synthetic emerald by Sturmlechner of Vienna, Austria.

**styles of cutting** See ***antique cut*** (cushion), ***brilliant cut*** (round, marquise/navette, oval, pear-shape), ***baquette*** (baton), ***cabochon, emerald cut*** (trap or step cut), ***rose cut*** (Antwerp/Brabant) and ***scissors cut*** (cross).

**Styrian jade** A misleading name for pseudophite.

**subjective** When applied to gemstone grading the term implies the comparative assessment of colour, clarity or cut by eye rather than by quantitative (i.e. objective or instrumental) techniques.

**succinic acid** A constituent of amber.

**sugar stone** A pink variety of datolite from Michigan, USA.

**sugilite** A complex sodium/lithium silicate similar to sogdianite but containing no aluminium or zircon. R.I. 1.607–1.610; D.R. +0.003; S.G. 2.74. Opaque, blue-purple, red-purple, magenta. Occurrence: South Africa.

**sun opal** See ***opal*** (fire opal).

**sun-spangled amber** Amber clarified by heating it in oil. See ***rape seed oil.***

**sunstone** See ***feldspar.***

**surface tension** The tension existing in the surface film of a liquid which acts to minimise the area of that surface.

**sweetwater agate.** A fluorescent moss agate from Wyoming, USA.

**Swiss cut** A simplified version of the 57-facet brilliant-cut designed for small diamonds. It consists of an eight-sided table surrounded by 16 triangular facets. There are eight triangular lower girdle facets and eight four-sided main facets on the pavilion.

**Swiss Gemmological Association** See ***Gemmological Association of Switzerland.***

**Swiss jade** A misleading name for green-stained jasper. See ***quartz.***

**Swiss lapis** See ***German lapis.***

**SW UV** See ***ultra violet light.***

**syenite** See ***kakortokite.***

**symant** Trade name for the man-made diamond simulant strontium titanate.

**symerald** Trade name for a faceted beryl gemstone coated hydrothermally with synthetic emerald. See ***Lechleitner emeralds.***

**symmetry** (crystallography) There are three principal 'elements' of symmetry. See ***axis of symmetry, centre of symmetry*** and ***plane of symmetry.***

**symmetry** (polished stones) The correct facet alignment and overall balance and proportions of a polished gemstone.

**syndite** Trade name for a material made from sintered diamond particles for use in machine tool tips and marketed by De Beers Industrial Diamond Division.

**syngenetic inclusions** See ***inclusions*** (contemporary).

**synthetic 'alexandrite'** A misleading trade name for a colour-change synthetic corundum or spinel.

**synthetic 'aquamarine'** A misleading trade name for synthetic blue corundum or spinel.

**synthetic stones** Synthetically-produced materials which have the same composition, structure and physical constants as their naturally-occuring counterparts (e.g. corundum, chrysoberyl, emerald, opal and rutile). Synthetically-grown products which have no counterpart in nature are more accurately described as man-made. See ***lithium niobate, gadolinium gallium garnet, yttrium aluminium garnet*** and ***strontium titanate.***

*synthetic alexandrite* — see *synthetic chrysoberyl.*

*synthetic corundum* — grown mainly by the flame-fusion process. Synthetic rubies are also grown by the flux-melt process (e.g. Kashan, Chatham, and PK synthetic rubies). See

***Linde synthetic star corundum.***

*synthetic chrysoberyl* — the alexandrite (colour change) variety of chrysoberyl is grown synthetically by both the flux-melt and the Czochralski 'crystal pulling' processes.

*synthetic cubic moissanite* — a possible diamond and coloured gemstone simulant. Cubic. SiC. R.I. 2.651; S.G. 3.218; H. 9½.

*synthetic diamond* — industrial synthetic diamond grits are produced by dissolving graphite in molten iron or nickel at high temperatures and pressures (i.e. 3300 °C and 110 000 atmospheres) in special presses. Experimental gem quality synthetic diamonds, grown from synthetic diamond 'seeds' using a diffusion technique, have been produced up to 1 carat in size, but are not commercially viable.

*synthetic emerald* — see ***Chatham synthetic emeralds, Lechleitner emerald simulants, Lennix synthetic emeralds, Linde synthetic emeralds, Nacken synthetic emeralds, Sturmlechner emerald simulants*** and ***Zerfass synthetic emeralds.***

*synthetic lapis lazuli* — see ***Gilson synthetic lapis lazuli.***

*synthetic opal* — see ***Gilson synthetic opal.***

*synthetic quartz* — for the jewellery industry, the amethyst variety of synthetic quartz is grown by both the hydrothermal and flux-melt processes.

*synthetic rutile* — introduced as a diamond simulant in 1948. See ***rutile.***

*synthetic spinel* — because synthetic spinel boules (grown by the flame-fusion process) are brittle if they are made from constituents in precisely the same proportions as the natural stone ($MgO.Al_2O_3$), extra alumina is added ($MgO.3Al_2O_3$). This increases the R.I. and S.G. of the material to 1.727 and 3.65 respectively. H. 8. Transparent, colourless, blue, green, pink, red (rare).

*synthetic turquoise* — see ***Gilson synthetic turquoise.***

## T

**taaffeite** A very rare beryllium magnesium aluminate. $BeMg_3Al_8O_{16}$. Hexagonal. R.I. 1.717, 1.721 to 1.719, 1.723; D.R. −0.004; S.G. 3.60-3.61; H. 8. Transparent, pale mauve. Occurrence: Unknown, but probably Sri Lanka.

**tabby extinction** A term describing the anomalous double refraction seen typically when rotating a synthetic spinel on a polariscope. The 'tabbycat' stripes are caused by strains within the material.

**table-cut diamonds** An early cutting style (developed from the point-cut) in which one of the points of an octahedral diamond crystal was truncated and polished to form a table facet, and the opposite point was polished to form a large culet of about half the width of the table facet. The remaining faces of the crystal were also given a surface polish.

**table facet** The large central facet on the crown of a polished gemstone.

**table spectrometer** See ***goniometer.***

**tabular** A crystal having a flattened tablet-like habit.

**tachylyte** See ***basalt glass.***

**tailings** The gravel, rock and silt residue of a mine's output once the gem content has been extracted.

**Taiwan cat's eye** A chatoyant tremolite. R.I. 1.613, 1.637; S.G. 3.05; H. 6-7. Translucent to opaque, greenish-yellow, pale yellow, dark green, dark brown, black. Occurrence: Taiwan.

**takara pearls** Imitation pearls cut from the shell of a mussel.

**talc** A hydrated magnesium silicate used as a carving material. R.I. around 1.54; S.G. 2.7-2.8; H. 1. Opaque, white, silvery-white. Occurrence: World-wide. See ***steatite.***

**tallow-topped cabochon** A cabochon with a very flat dome.

**tang** A metal tong-shaped holder for a diamond dop which is

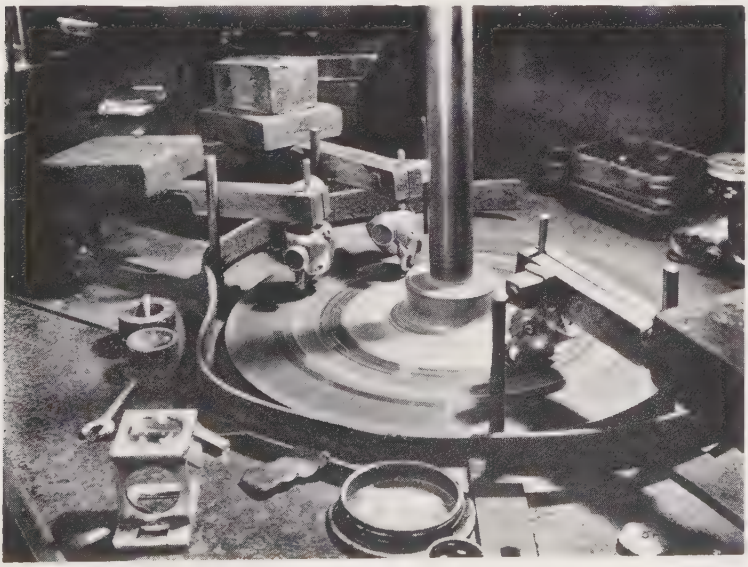


*Figure T.1* Mechanical claw-type dops holding diamonds on a scaife or lap. The dops are mounted in the end of tangs, which are weighted to achieve the necessary polishing pressure. (De Beers)

weighted to produce the correct grinding pressure between the diamond and the surface of the scaife. *Figure T.1.*

**tangiwaite** Maori name for New Zealand bowenite.

**tania-59** Trade name for a synthetic rutile.

**tantalite** A collector's stone comprising the mineral iron/manganese tantalate. $(Fe,Mn)Ta_2O_6$. Orthorhombic. R.I. 2.24, 2.41; D.R. +0.17; S.G. 5.18–8.20; H. 5–6. Translucent, reddish-brown.

**tantalite** Trade name for lithium tantalate.

**tanzanite** See ***zoisite.***

**taprobanite** Provisional name for a transparent red beryllium-containing mineral found in Sri Lanka in 1978. This was later identified as taaffeite.

**tawmawite** A deep green chrome epidote found in Burma and Zimbabwe.

**tecali marble** A Mexican marble, also known as 'Mexican onyx', which is sometimes used as a jade simulant.

**tektite** A collective name for natural glasses which have a high silica content and are similar to the volcanic glass obsidian. See ***basalt glass, Libyan glass, moldavite*** and ***pit glass.***

**television stone** See ***ulexite.***

**templet** An alternative name for the first four bezel facets which are polished immediately after the table facet on a brilliant-cut diamond.

**termination** The crystal form found at the end of a prism.

**temperature scales** See ***absolute temperature scale, Celsius temperature scale*** and ***Fahrenheit temperature scale.***

**tempering** Altering the hardness of metals by controlled heating and cooling.

**Tertiary** A rock system on the earth's surface comprising the rocks laid down 65-2 million years ago. The Tertiary period, consisting of the ***Eocene, Oligocene, Miocene*** and ***Pliocene*** divisions, constitutes the bulk of the Cenozoic era. See also ***Cenozoic*** and ***Quarternary.***

**tetragonal system** A crystal system having three axes. Two of these are of equal length and at right angles to each other. The third or principal axis is either shorter or longer than the other two, and is at right-angles to them. There are five axes of symmetry (four two-fold and one four-fold), five planes of symmetry and a centre of symmetry. *Figure T.2.*

**tetrahedron** A crystal form having four triangular faces, which is one of the seven basic forms belonging to the highest class of symmetry in the cubic crystal system.

**tetraiodoethylene** A constituent of the contact liquid used to provide an air-free optical seal between a gemstone and the

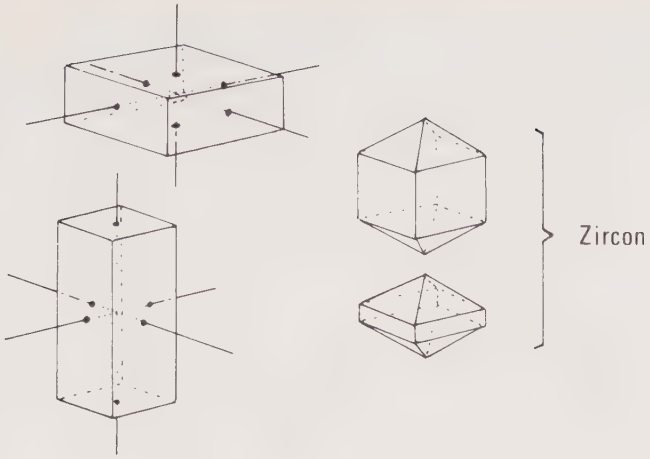



*Figure T.2* The tetragonal crystal system.

measuring prism of a critical-angle refractometer. See ***contact liquid.***

**tetrakis hexahedron** A 24-sided crystal which is one of the seven basic forms belonging to the highest class of symmetry in the cubic crystal system. It consists of a cube whose faces have each been replaced by four triangular faces. See ***triakis octahedron.***

**thermal conductivity** The capability of a material to conduct heat. At room temperature, Type I diamonds have twice the thermal conductivity of copper. Type IIa diamonds have six times the thermal conductivity of copper, and for this reason are used as a substrate to conduct heat away from semiconductor devices and thereby increase their power ratings. Thermal conductivity ($k$) is measured (in SI units) in watts per square metre per °C (i.e. the rate of heat flow through a unit area of the material per unit temperature gradient). $k = 1000$ for Type I diamond, 430 for silver, 320 for gold, 40 for corundum, 10 for cubic zirconium oxide, 1 for glass.

**thermal conductivity diamond tester** An instrument which identifies diamond by its high thermal conductivity (all of the natural and man-made simulants of diamond are bad thermal conductors). The tester consists of a control unit and a pen-like probe. The probe contains a miniature heating element in thermal contact with a metal tip. When this tip is held against the surface of a diamond, heat is conducted away, and the electronic circuits in the control unit detect the lowering of the tip temperature. With diamond simulants, the tip temperture remains high. *Figure T.3.*

**thermal metamorphism** See ***contact metamorphism.***


*Figure T.3* The Rayner Diamond Tester distinguishes diamond from diamond simulants by detecting its high thermal conductivity. (Gemmological Instruments Ltd.)

**thermal reaction tester** See ***hot-point tester.***

**thermophosphorescence** The phenomenon exhibited by some materials which are able to store energy acquired from electromagnetic radiation and then release it in the form of a luminous glow when heated.

**thetis hair stone** See ***quartz.***

**thomsonite** A banded hydrated calcium sodium aluminium silicate belonging to the zeolite group of minerals. $NaCa_2(Al_5Si_5O_{20}).6H_2O$. Orthorhombic. R.I. around 1.52-1.54; S.G. 2.3-2.4; H. 5. Translucent (occasionally with chatoyance or schiller), white, yellow, reddish, brown, greenish. Occurrence: USA.

**three-phase inclusions** See ***inclusions.***

**three-point** A cutting orientation for diamond where the table has been polished nearly parallel to a possible octahedral crystal face. See ***four-point*** and ***two-point.***

**thulite** See ***zoisite.***

**thunder eggs** Agate-filled nodules found in the USA. The spherical nodules, when cut, often show a 'star' profile agate filling.

**tickal** A Burmese unit of weight equal to 80 carats. See also ***Bali, lathi, rati*** and ***viss.***

**tigerite** See ***quartz*** (tiger's eye).

**tiger's eye** A quartz pseudomorph of crocidolite. See ***quartz.***

**tilt test** See ***light spill test.***

**tin cut** Cast glass gemstone simulants whose facets are polished on a tin lap using tin oxide as a polishing powder.

**tin oxide** See ***putty powder.***

**tinstone** See ***cassiterite.***

**tinted colour** A CIBJO colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**tinted white** A colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**tinting** See ***treated diamonds.***

**tiree marble** A variety of marble found on the island of Tiree off the west coast of Scotland.

**tirum gem** Trade name for a synthetic rutile diamond simulant.

**titangem** Trade name for a synthetic rutile diamond simulant.

**titania** Trade name for a synthetic rutile diamond simulant.

**titania brilliante** Trade name for a synthetic rutile diamond simulant.

**titania midnight stone** Trade name for a synthetic rutile diamond simulant.

**titanite** See ***sphene.***

**titanium** One of the eight transition metals which are mainly responsible for colour in gemstones. Ti. A stone coloured by titanium is the blue sapphire. Atomic number 22; atomic weight 47.9; melting point 1680 °C; S.G. 4.5.

**titanium** Trade name for a synthetic rutile diamond simulant.

**titanium rutile** Trade name for a synthetic rutile diamond simulant.

**titanstone** Trade name for a synthetic rutile diamond simulant.

**tokay lux sapphire** A misleading name for Hungarian obsidian.

**tola** An Indian unit of weight used for gold. One tola = 58.32 carats. See also ***mangelin*** and ***rati.***

**Tolkowsky brilliant cut** One of several 'ideal' cuts for diamond, mainly favoured in America (see *Figure B.6.*). See also ***Eppler brilliant cut, Johnson and Rösch brilliant cut, Parker brilliant cut*** and ***Scan DN brilliant cut.***

**toluene** A volatile hydrocarbon used for the dilution of methylene iodide and bromoform in the heavy liquid determination of specific gravity (S.G. 0.8737 at 10°C; 0.637 at 20°C). Because of its low surface tension it is used in place of water in hydrostatic weighing (the results are adjusted to allow for its lower S.G.).

**tomb jade** A buried jade which has changed colour to reddish-brown.

**tongue test** A test for glass gemstones which, because of their poorer thermal conductivity, feel warmer against the tongue than,

for instance, quartz stones.

**tooth turquoise** A misleading name for odontolite.

**topaz** A fluosilicate of aluminium. $Al_2(F,OH)_2SiO_4$. Orthorhombic. Blue, yellow and colourless stones — R.I. 1.61, 1.62; D.R. +0.01; S.G. 3.56; H. 8. Brown and pink stones — R.I. 1.63, 1.64; D.R. +0.008; S.G. 3.53; H. 8. Transparent, blue, brown, yellow, colourless, pink (the latter two produced by heat treatment — see ***heat treated stones***). Pleochroism, strong in heat-treated pink stones (colourless and two shades of pink); medium in brown stones (two shades of yellow, pinkish-yellow), and blue stones (colourless, pale pink, blue). Occurrence: Australia, Brazil, Burma, Sri Lanka, Tasmania, USA, USSR.

**topaz cat's eye** A misleading name for chatoyant yellow sapphire.

**topazolite** A misleading name for the yellow variety of andradite garnet.

**topaz quartz** A misleading name for brownish-yellow quartz.

**topaz saffronite** A misleading name for brownish-yellow quartz.

**top cape** A colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**top crystal** A colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**top main facets** See ***bezel facets.***

**top silver cape** A colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**top wesselton** A colour grade for polished diamonds. See ***Colour Grading Standards*** in Appendix B.

**tortoiseshell** An organic gem material derived mainly from the shell of the Hawksbill sea turtle. The individual plates, or *blades,* of the shell are a mottled yellow-brown. The front blades are called *shoulder plates,* the centre ones *cross-backs,* the side ones *main plates* and the rear ones *tail plates.* A clear yellow tortoiseshell is obtained from the turtle's under-shell. R.I. 1.55; S.G. around 1.3; H. 2½. Occurrence: Most tropical and sub-tropical seas, particularly around Malaysia, the West Indies and Brazil.

**tosa coral** A Japanese coral.

**total internal reflection** An optical condition by which the light rays entering a gemstone are reflected back from the pavilion facets to re-emerge from the crown facets (see *Figure D.7.*). This total internal reflection of light rays enhances the brilliance of the gemstone. It is achieved by adjusting the angles of the crown and pavilion facets so that the majority of rays meet the interior faces of the pavilion facets at angles to the normal which are *greater* than the critical angle of the gem material (see *Figure T.4.*). It is also important that the rays reflected back from the pavilion

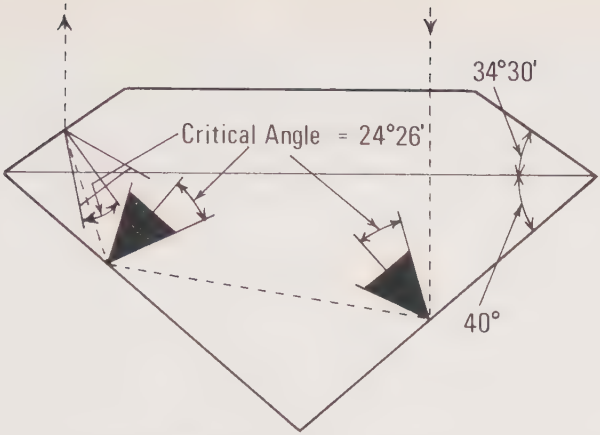



*Figure T.4* The total internal reflection of light rays in a brilliant-cut diamond is achieved by arranging the crown and pavilion angles so that as many rays as possible meet the interior faces of the pavilion facets at angles greater than the critical angle. The exit rays must meet the crown facets at angles *less* than the critical angle if they are to emerge.

facets meet the crown facets at angles *less* than the critical angle. See also ***critical angle.***

**touchstone** A fine-grained dark schist or jasper used to check precious metals. The metals are rubbed on the touchstone, and the resulting streak tested with various acids.

**tourmalated quartz** See ***quartz.***

**tourmaline** A complex borosilicate of aluminium and alkalies with calcium, fluorine, lithium, magnesium, manganese, potassium and water. Alkali-rich tourmalines (containing sodium, lithium or potassium) are colourless, red or green (elbalite — see also ***liddicoatite***). Iron-rich tourmalines are dark blue (indicolite), bluish-green or black (schorl). Manganese tourmalines are colourless or yellow-brown to brownish-black (dravite — see also ***uvite***). Trigonal. R.I. around 1.62, 1.64; D.R. −0.014 to −0.021; S.G. 3.02-3.26 (pink 3.03; red and pale green 3.05; brown 3.06; dark green 3.08; blue and yellow 3.10; black 3.15-3.26); H. 7-7½. Transparent, single- and parti-coloured. Pleochroism, strong in deeper colours (two shades of body colour). Occurrence: Brazil, Burma, the Malagasy Republic, Namibia, Sri Lanka, USA, USSR.

**tourmaline green** A misleading name for synthetic dark-green spinel.

**trainite** A banded variscite found in Utah, USA.

**transition elements** The eight metallic elements which are the main

cause of colour in gemstones. See ***titanium, vanadium, chromium, manganese, iron, cobalt, nickel*** and ***copper.***

**translucent** A term used to describe a material which passes some light, but does not transmit a clear image of any object. See also ***opaque*** and ***transparent.***

**transparent** A term used to describe a material which transmits light freely without distortion. The opposte of transparent is opaque. See also ***translucent.***

**Transvaal jade** A misleading name for massive green grossular garnet.

**trap cut** See ***emerald cut.***

**trapeze cut** A gemstone whose profile is a trapezium (i.e. having two parallel sides and two inclined sides).

**trapiche emeralds** Emerald crystals from Colombia which contain central hexagonal crystals whose faces extend outwards as radial 'spokes'. The spaces between these radial arms are filled with a fine-grained white beryl. *Figure T.5.*

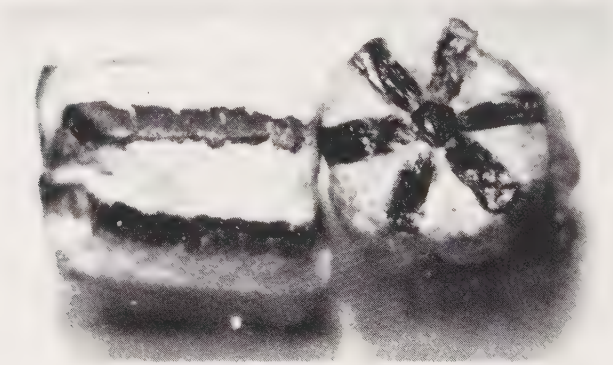


*Figure T.5* End and side views of two trapiche emeralds from Colombia.

**traversellite** A green variety of diopside.

**travertine** A white or light-coloured sedimentary rock composed mainly of crystalline calcium carbonate which has been precipitated from calcium bicarbonate-rich spring waters by the action of heat and pressure.

**treacle inclusion** See ***inclusions.***

**treated diamonds** The artificial coloration of a diamond is aimed at either improving its colour by making its appear whiter, or changing its colour to a more attractive and valuable 'fancy' hue. The simplest technique of improving the colour of a yellow diamond is to apply a thin translucent coat of blue dye to its pavilion facets to complement the body colour. A bluish fluoride

coating (as applied to camera lenses) has been used for this purpose. Diamonds can also be artificially coloured by irradiating them with neutrons in an atomic reactor. This produces a homogeneous green body colour which can be changed to yellow or a cinnamon brown by a subsequent heat treatment. Some rarer types of diamond can be changed to red or purple by this method. The stones are intensely radioactive after treatment, but this dies away rapidly. Diamonds were first artifically coloured by irradiation in the early part of this century by Sir William Crookes who used a radium source to turn diamonds green. This was only a skin-deep colour, and surviving specimens have remained radioactive up to the present day. A colour change can also be produced by means of electron bombardment in an electron accelerator. With this process, some diamonds turn a pale blue or a bluish-green. The colour is only skin-deep and can be polished off if not suitable. The protons, deutrons and alpha particles generated by a cyclotron can also be used to change the colour of a diamond, the resulting hues after heat treatment being only skin-deep, and the diamonds rapidly losing their initial radioactivity. Detection of artificial coloration of diamonds by irradition is mainly by means of spectroscopic analysis, usually at very low temperatures. See also ***umbrella effect.***

**treated opal** A poor quality opal which has been stained black to improve its iridescence.

**treatment of pearls** See ***skinning.***

**treatment plant** See ***recovery plant.***

**tree stone** A moss agate.

**tremolite** A calcium magnesium silicate (also called grammatite) occurring in fibrous form as mutton-fat jade (nephrite), also as a greenish chatoyant variety, and as a transparent lilac-pink variety called hexagonite. Tremolite is one end member of the amphibole series, the other end member being actinolite. Monoclinic. R.I. 1.60, 1.62-1.63; D.R. −0.02 to −0.028; S.G. 2.976 (chatoyant variety), 2.980 (hexagonite); H. 5½-6. Opaque, greenish, lilac-pink, emerald-green. Occurrence: Burma, Canada, USA.

**trenton diamond** A misleading name for the rock crystal variety of quartz.

**triakis octahedron** A 24-sided crystal which is one of the seven basic forms belonging to the highest class of symmetry in the cubic crystal system. It consists of an octahedron whose faces have each been replaced by three triangular faces. See ***tetrakis hexahedron.***

**triamond** Trade name for the man-made diamond simulant yttrium aluminium garnet.

**Triassic** A rock system on the earth's surface comprising the rocks laid down during the Triassic period, 225-195 million years ago.

The Triassic period is the first part of the Mesozoic era. See *Mesozoic.*

**triboelectric effect** A property possessed by some gem materials, such as amber and plastic, whose surfaces develop an electrical charge when rubbed.

**triboluminescence** A property possessed by a material which causes it to luminesce or glow when it is rubbed or abraded (i.e. frictional luminescence).

**trichroism** See *dichroism.*

**triclinic system** A crystal system having three axis, all of different lengths and all inclined to each other at angles other than right-angles. There is a centre of symmetry, but no axes or planes of symmetry. *Figure T.6.*

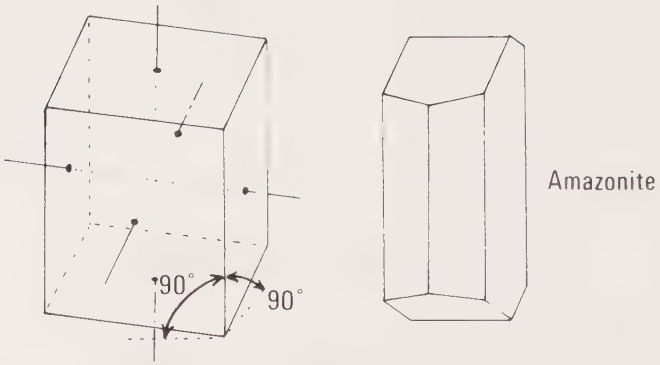



*Figure T.6* The triclinic crystal system.

**trigon** A triangular growth or etch mark on the face of a diamond crystal. The 'points' of the trigon are always orientated towards the straight edges of the crystal's octahedral face.

**trigonal system** A crystal system having four axes which are arranged in the same manner as in the hexagonal system. The symmetry of the trigonal system is, however, lower than that of the hexagonal system. A trigonal crystal with *maximum* symmetry has four axes of symmetry (three two-fold and one three-fold), three planes of symmetry and a centre of symmetry. The bulk of trigonal crystals have *normal* symmetry, and this consists of one axis of symmetry (three-fold), three planes of symmetry and a centre of symmetry.

**trilliant cut** A 43-facet (plus culet) diamond cut, having a polished and rounded triangular girdle. It is designed for macles and consists of 25 crown facets and 18 pavilion facets.

**trillings** Forms produced by triple twinning (e.g. the pseudo-hexagonal trilling produced by chrysoberyl).

**trinitite** A vesicular greenish fused sand glass formed by the first experimental atomic bomb exploded in New Mexico, USA, in 1945. Samples of trinitite are still strongly radioactive.

**triplet** See ***composite stones.***

**triplet** (lens) A compound-lens hand loupe which achieves distortion-free magnification by the use of three separate lenses. *Figure T.7.* See ***hand lens*** and ***head loupe.***

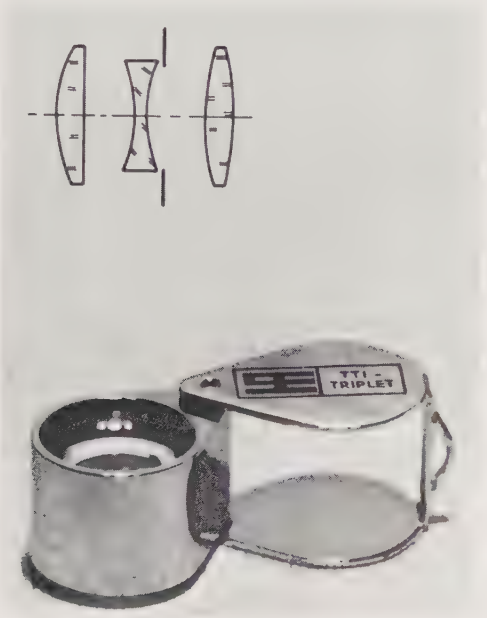



*Figure T.7* The components of a triplet hand lens.

**tripletine** Trade name for an emerald-coloured beryl triplet.

**tripoli** See ***rottenstone.***

**troida** A triangular diamond cut designed for macles. It has 47 facets plus a culet.

**Troy weight** See ***ounce Troy.***

**tsavolite** A transparent green grossular garnet coloured by chromium and vanadium. $Ca_3Al_2(SiO_4)_3$. R.I. 1.734–1.744; S.G. 3.68; H. 6½–7. Occurrence: Kenya, Tanzania.

**tsavorite** See ***tsavolite.***

**tsavolithe** See ***tsavolite.***

**tsilaisite** A manganese-rich tourmaline.

**tube agate** A variety of agate containing tubes, or channels, often liquid-filled.

**tufa** See *aragonite.*

**tugtupite** An ornamental mineral close to sodalite in composition. Tetragonal. R.I. 1.496, 1.502; D.R. +0.006; S.G. 2.30-2.57 (depending on impurities); H. 6½. Transparent to opaque, cyclamen-red (massive material is light and dark red, mottled with white). Pleochroism, strong (bluish-red, orange-red). Occurrence: Greenland, USSR.

**Tully Medal** A medal awarded to the candidate submitting the best papers in the annual Fellowship Examination of the Gemmological Association of Great Britain, which also meet the required standard set for the award. See also ***Rayner Prize*** and ***Anderson Medal.***

**Tully refractometer** The first table refractometer for gemstone use which employed a rotateable hemisphere of glass and an erect scale. Designed by B. G. Tully in 1925.

**tumbling** The polishing of gemstones into rounded and irregular shaped 'pebbles' by tumbling them (first with a coarse abrasive and then with a polishing powder) in a rotating drum. A technique used mainly by hobbyists.

**turkey-fat ore** A yellow smithsonite coloured by cadmium.

**turquoise** A hydrous copper aluminium phosphate with some iron oxide replacing the alumina. $CuAl_6(PO_4)_4(OH)_8.5H_2O$. Triclinic (crypto-crystalline). R.I. around 1.62; S.G. 2.6-2.9 (2.6-2.7 for porous USA stones; 2.7-2.9 for Iranian stones); H. 5½-6. Opaque (sometimes veined with sandstone or limonite matrix), sky-blue, blue-green, green. Occurrence: Afghanistan, Australia, China (Tibet), Iran, Israel (Sinai), USA.

**turquoise matrix** A turquoise cut complete with a section of its associated dark grey sandstone or brown limonite matrix.

**turtle back** A turquoise or variscite matrix, or a chlorastrolite.

**turtle-back pearl** A natural oval blister pearl with a high dome.

**turritella agate** An ornamental orbicular stone consisting of agatised turritella shells.

**tweezers** Metal tongs for handling gemstones, which may take a variety of forms from self-locking and reverse-action types to spring-loaded prong versions. *Figure T.8.*

**twinning** See ***contact twin, interpenetrant twins*** and ***polysynthetic twinning.***

**two-phase inclusions** See ***inclusions.***

**two-point** A cutting orientation for diamond where the table has been polished parallel to a possible dodecahedron crystal face (i.e. parallel to the edge of the octahedron's pyramid-based natural girdle). See ***four-point*** and ***three-point.***

**Type I diamond** A category of diamonds which contain nitrogen as the main impurity. This is further sub-divided into Type Ia

*Figure T.8* A selection of tweezers. (Rubin and Son)

diamond, containing clusters of nitrogen atoms (which do not affect the colour of the stone) and Type Ib diamond in which the nitrogen atoms are dispersed throughout the crystal lattice and replace carbon atoms (this causes the stone to absorb light at the violet end of the spectrum and produces the yellow body colour of Cape series diamonds). Natural diamonds are normally a mixture of Type Ia and Type Ib. Synthetic diamonds containing nitrogen are all Type Ib.

**Type II diamond** A category of diamonds which contain no nitrogen impurities. This is further sub-divided into Type IIa which contains no other impurity, and Type IIb which contains boron. The boron atoms in Type IIb diamonds replace carbon atoms in the crystal lattice and make the stone electrically semi-conducting. Type IIb diamonds often have a blue body colour (blue diamonds artificially coloured by irradation are not semi-conductors).

**Type III diamond** See ***lonsdaleite.***

**tyrolese onyx** A slightly translucent onyx marble with orange-coloured veins found in Austria.

## U

**ugrandite garnet series** An isomorphous series of garnets

encompassing the uvarovite — grossularite — andradite species. See also ***pyralspite garnet series.***

**uigite** A variety of chlorastrolite found on the island of Skye off the coast of Scotland.

**ulexite** A collector's stone comprising a fibrous hydrated borate of calcium and sodium. $NaCaB_5O_9.H_2O$. Ulexite is not strictly a gemstone, but is of interest because when a slab of the material is cut and polished with both faces at right-angles to the stone's fibres, an image presented to one face is transmitted to the other face (as with coherent fibre optics). Because of this phenomenon it is called a 'television stone'. R.I. around 1.51; S.G. 1.65-1.99; H. 1-2. Occurrence: USA.

**ultrabasic rock** A type of rock containing very little or no silica.

**ultralite** Trade name for reddish-violet synthetic corundum.

**ultramafic** A term used to describe rocks having a low silica content but which are unusually rich in magnesium, iron and possibly alumina.

**ultramarine** A blue pigment originally produced from powdered lapis lazuli.

**ultrasonic cleaning** An efficient method of cleaning gemstones and jewellery which employs ultrasonic vibrations. Ultrasonic baths or tanks designed for this purpose consist of a container for the cleaning fluid, and a piezo-electric transducer (e.g. a slab of zirconate titanate) which vibrates the tank at frequencies in the region of 50 000-100 000 Hz. The ultrasonic energy produces

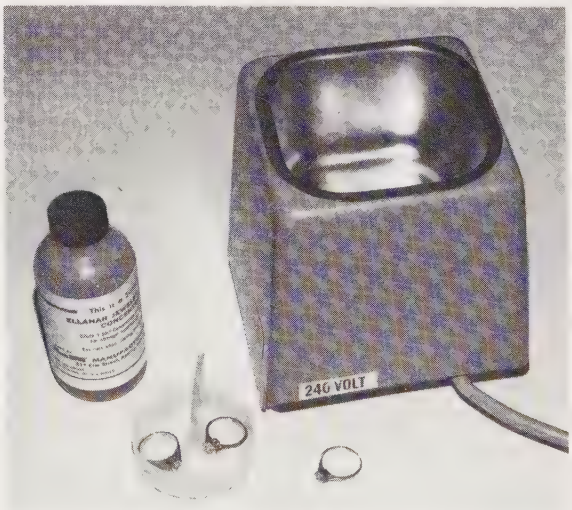



*Figure U.1* A small ultrasonic bath for cleaning jewellery. (Dawe)

cavitation of the cleaning fluid. This is the creation of thousands of minute cavities or bubbles which, when they collapse, release enough mechanical energy to dislodge particles of dirt. On no account should gemstones containing stress flaws, such as emeralds, opals, zoisites or strontium titanate diamond simulants, be cleaned by ultrasonics as the cleaning energy could damage the stone. *Figure U.1.*

**ultra violet light** Electromagnetic radiation having wavelengths which range from just beyond the violet end of the visible spectrum at roughly 380 nm down to the longest X-ray wavelengths at around 20 nm. Because of the visible emission peaks in the mercury discharge lamps and low-pressure mercury vapour lamps used to produce UV light for gem testing, these lamps are filtered to produce light at 365 nm (LW UV) and 254 nm (SW UV). See ***UV lamps.***

**umbalite garnet** Provisional name for an orange or dark orange to brown garnet of the pyrope-spessartite series. Some stones contain vanadium and show a colour change (bluish-mauve under daylight, magenta under tungsten light). R.I. 1.74-1.76. Occurrence: Kenya, Tanzania.

**umbrella effect** Diamonds artificially coloured by cyclotron irradiation through the pavilion (at right-angles to the plane of the girdle) show a pattern round the culet which, when viewed through the table facet, looks like an opened umbrella. *Figure U.2.*

*Figure U.2* The 'umbrella' effect as seen round the culet of a cyclotron-treated diamond.

**unakite** A type of granite rock containing quartz, pink feldspar and green epidote, usually cut in cabochon form or tumbled. R.I. varies from 1.52 for the pink sections to 1.76 for the green areas; S.G. 2.85–3.2. Occurrence: Eire, South Africa, USA, Zimbabwe.

**uniaxial** The term used to describe a doubly-refracting crystal having a single optical axis along which it is singly-refractive. In the seven crystal systems, tetragonal, hexagonal and trigonal crystals all have uniaxial optical characters. See ***biaxial.***

**unionite** See ***zoisite*** (thulite).

**unit cell** The smallest part of a crystalline structure which still exhibits all the characteristic properties of the crystal.

**univalve mollusc** A shellfish such as the abalone and giant conch which has a shell in one piece, rather than in two halves as in bivalve molluscs such as the oyster.

**unripe pearls** A term used to describe poor quality pearls.

**upper break facets** See ***break facets.***

**upper girdle facets** The triangular facets adjacent to the girdle on the crown of a brilliant-cut stone. See ***brilliant cut.*** *Figure B.6.*

**uralian emerald** A misleading name for a demantoid garnet.

*Figure U.3* A dual-range (LW, SW) combined ultra-violet lamp and viewing cabinet. (GAAJ/Gemmological Instruments Ltd.)

**uralian sapphire** A misleading name for blue tourmaline.

**uraninite** A radioactive mineral containing uranium and thorium.

**uranium glass** A yellow glass, also called canary glass, sometimes used as a gemstone simulant.

**utahlite** See ***variscite.***

**utah onyx** A misleading name for a translucent lemon-coloured stalagmitic marble containing orange veins, and found in Utah, USA.

**utah turquoise** A misleading name for variscite.

**uvarovite** See ***garnet.***

**uvite** A brown dravite-type tourmaline having (unlike dravite) a high calcium content and little sodium. Occurrence: Brazil, Burma, Sri Lanka.

**UV lamps** For gem testing purposes these are either LW or SW types, and are often combined in one unit. The LW version uses a mercury discharge lamp whose dominant mercury emission line at 366 nm is separated from the lamp's visible emission spectrum by means of a Wood's glass filter (e.g. a Chance OX1 filter) which contains cobalt and nickel. The SW UV lamp uses a low-pressure mercury lamp whose dominant 254 nm emission line is separated out by a Chance OX7 filter. *Figure U.3.*

## V

**vabanite** A reddish-brown jasper speckled with yellow, from California, USA.

**valencianite** An adularia variety of orthoclase feldspar.

**valency** A unit of combining power between elements, based on the number of hydrogen atoms with which it can combine or which it can replace. Carbon has a valency of four and its atom can link with four other atoms by sharing common orbital electrons. See ***Table of Elements*** in Appendix H.

**vallum diamond** A misleading name for the rock crystal variety of quartz.

**vanadium** One of the eight transition metals which are mainly responsible for colour in gemstones. V. Stones coloured by vanadium are green beryls, natural and synthetic colour-change sapphires. Atomic number 23; atomic weight 50.95; melting point 1920 °C; S.G. 6.0.

**vanadium emerald** A misleading name for a green beryl coloured with vanadium. The emerald variety of beryl is coloured by chromium. Occurrence: Brazil. Synthetic vanadium beryl is grown by the hydrothermal process.

**varieties** A mineral species may have several varieties which differ

from each other in appearance (e.g. ruby and sapphire are colour varieties of the mineral species corundum). See also ***groups*** and ***species.***

**variolite** A variety of dark green orthoclase feldspar with light green orbicular inclusions.

**variscite** A hydrous aluminium phosphate with replacement of some of the aluminium by chromium and iron. $AlPO_4.2H_2O$. Orthorhombic (fibrous). R.I. around 1.56; S.G. 2.4–2.6; H. 5. Translucent to opaque, green to greenish-blue. Occurrence: Australia, USA.

**vashegyrite** A yellow or brown aluminium phosphate, similar to variscite.

**vega gem** Trade name for a synthetic corundum diamond simulant.

**vegetable ivory** See ***corozo nut*** and ***doom palm nut.***

**velocity of light** Light travels at a speed of 300 000 kilometres per second in air. In a gemstone or any other medium this is modified by the factor:

$$\frac{1}{\text{R.I. of medium}}$$

**venus hair stone** See ***quartz.***

**verd antique** See ***serpentine.***

**verdelite** A misleading name for green tourmaline.

**verdite** An ornamental muscovite-mica rock formed from compacted clay. R.I. around 1.58; S.G. 2.80–2.99; H. 3. Opaque, green (the colour is due to chrome mica). Occurrence: South Africa, Swaziland, USA.

**vermeil** A misleading name for orange-red zircons, garnets or spinels.

**vermilite** A variety of opal containing cinnabar.

**Verneuil corundum** A synthetic corundum produced by the flame-fusion process. See ***Verneuil furnace.***

**Verneuil furnace** An oxy-hydrogen blowpipe-type furnace designed mainly to grow boules of synthetic corundum by the flame-fusion process. The furnace consists of an inverted blowpipe burner, a powder dispenser and a ceramic pedestal. When corundum is being synthesised, the dispenser is filled with high-purity alumina powder, which is dropped at a controlled rate down the blowpipe's central oxygen feed tube. As the powder drops through the 2200 °C oxy-hydrogen flame, it melts and recrystallises on the ceramic pedestal. As the crystalline boule starts to grow, the height of the pedestal is adjusted so as to maintain the top of the crystal in the hottest part of the flame. Synthetic spinel, synthetic rutile and strontium titanate boules are

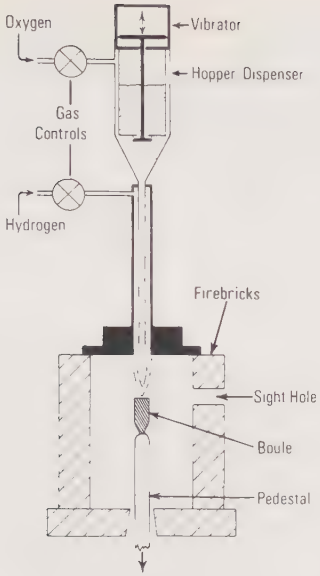



*Figure V.1* Simplified sketch of a Verneuil furnace.

also grown in the Verneuil furnace, extra oxygen being supplied for the latter two by use of a tricone burner. *Figure V.1.* See also ***boule.***

**vespa gem** Trade name for a synthetic corundum diamond simulant.

**vesuvian garnet** A misleading name for leucite.

**vesuvianite** See ***idocrase.***

**vesuvianite jade** A misleading name for californite.

**victoria stone** Trade name for a glass-like Japanese gemstone simulant having a fibrous aggregate structure, which gives it a chatoyant effect. Made in various colours, it is also produced to imitate jade, and is manufactured by fusing together minerals such as quartz, calcite, fluorspar, magnesite and feldspar to form a reconstructed stone. R.I. 1.62; S.G. 3.02; H. 6.

**victron** Trade name for polystyrene.

**Vienna turquoise** A misleading name for a glass simulant of turquoise. Also a turquoise simulant made from compacted aluminium phosphate powder coloured with copper oleate.

**vigorite** Trade name for a phenolic resin plastic.

**viluite** See ***idocrase.***

**vinegar spinel** A yellowish-orange variety of spinel.

**violet stone** See ***cordierite.***

**violan** See ***violane.***

**violane** A massive violet-blue diopside. Translucent to opaque. R.I. around 1.69; S.G. 3.23; H. 6. Occurrence: Italy.

**violite** Trade name for a synthetic corundum.

**viscoloid** Trade name for a cellulosic plastic.

**viss** A Burmese unit of weight equal to 880 carats. See also ***rati, bali, tickal*** and ***lathi.***

**visual colorimeter** An instrument in which the eye is used to compare and match the colour of a specimen with an image produced by selecting the appropriate combination of hue, brightness and colour saturation. See *Figure V.2.*


*Figure V.2* The GIA ColourMaster is a visual colorimeter which can be used to match and code coloured stones for hue, brightness and colour saturation. (Gem Instruments Corp.)

**vitreous lustre** See ***lustre.***

**vivianite** A collector's stone comprising the mineral hydrous ferrous sulphate. $Fe_3(PO_4)_2.8H_2O$. Monoclinic. R.I. 1.580, 1.627; D.R. +0.047; S.G. 2.6; H. 2. Transparent, colourless, blue-green. Occurrence: Australia, Bolivia, England, Romania, USA.

**volcanic chrysolite** A misleading name for idocrase.

**volcanic glass** See ***obsidian.***

**volcanic rock** See ***igneous rock.***

**vorobievite** A pink variety of beryl.

**vug** A rock cavity or fissure often lined with crystals which have grown from trapped mineral-rich water, and which are of a different composition to the surrounding rock. See also ***druse*** and ***geode.***

**vulcanite** A hard black vulcanised rubber (also called ebonite) used as a simulant for jet.

**vulpinite** A granular variety of anhydrite found in Vulpino, Italy. S.G. 2.90–2.92.

## W

**walderite** A synthetic colourless corundum.

**walrus ivory** An ivory derived from the teeth of the walrus.

**wardite** A complex hydrous phosphate of sodium, calcium and aluminium. Tetragonal. R.I. 1.590, 1.599; D.R. +0.009; S.G. 2.81; H. 5. Translucent to opaque, bluish-green (resembling turquoise).

**wart pearls** See ***blister pearls.***

**washita diamond** A misleading name for the rock crystal variety of quartz.

**water agate** See ***enhydros.***

**water chrysolite** A misleading name for moldavite.

**water contact angle** The degree of wettability of a material can be assessed by measuring the contact angle formed by the edges of a droplet of pure (distilled) water deposited on a clean, flat and horizontal surface polished on the material. As diamond has a much lower water contact angle than all of its man-made simulants, this forms a practical method of identification.

For the water droplet test to succeed it is important that the surface of the specimen is first thoroughly cleaned. This is best done with a polishing powder, such as Linde A, to remove any surface coating (sometimes produced by irradiation). The water can be applied with a hypodermic syringe or a glass dropper with a fine tip, taking care that the resulting droplet is round and is not touching the edges of the table facet. Typical water contact angles are as follows (measured as included angles within the droplet):

| | | | |
|---|---|---|---|
| corundum | 95° | rutile | 73° |
| YAG | 93° | zircon | 60° |
| strontium titanate | 91° | diamond | 55° |
| cubic zirconium oxide | 91° | quartz | 0° (wets surface) |
| GGG | 84° | glass | 0° (wets surface) |

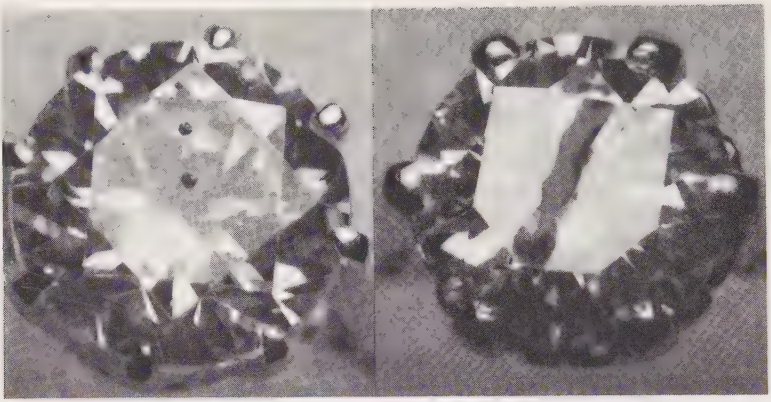


*Figure W.1* The difference between the water contact angle of cubic zirconia (left) and diamond (right) is revealed by drawing an 'ink' line across their table facets with a GIA Gem Diamond Pen. The pen uses a draughting-type nib/dispenser, and a reservoir filled with a non-drying viscous fluid containing inert chemicals and a blue dye. The ink gathers into droplets on diamond simulants (having an R.I. greater than 1.8), but remains as a continuous line on the surface of a diamond.

The effect of the relatively low water contact angle of diamond compared with the majority of its simulants is exploited in the GIA gem diamond pen. *Figure W.1.*

**water droplet test** See ***water contact angle.***

**water-melon tourmaline** A variety of bi-coloured tourmaline in which the crystal prism has a central colourless core surrounded by a green rim.

**water opal** See ***opal.***

**water sapphire** A misleading name for cordierite.

**water stone** A glassy orthoclase feldspar, or the hyalite variety of opal.

**wavelength** The distance between successive crests in a wave train. In the electromagnetic radiation of light this distance is very small, and wavelengths are measured in nanometres or Ångström units (one nanometre = ten Ångström units = one millionth of a millimetre). See also ***electron volt*** and ***wave number.***

**wavelength spectroscope** See ***spectroscope.***

**wave number** A method of indicating the frequency, or wavelength of an electromagnetic radiation, such as light or X-rays, in terms of the number of waves per centimetre:

$$\text{i.e. wavelength in nm} = \frac{10\,000\,000}{\text{wave number}}$$

$$\text{wave number} = \frac{10\,000\,000}{\text{wavelength (nm)}}$$

See also ***electron volt.***

**wave theory of light** This theory is based on the wave-motion propagation of light through an all-pervading hypothetical medium called the *ether*. It was modified by Maxwell's electromagnetic theory which suggested that the ether vibrations which transmitted light were caused by oscillation in the electrical and magnetic condition of the ether. Hertz later experimentally confirmed the existence of electromagnetic waves. A more complete picture of the emission and absorption of light was provided by Max Planck's quantum theory. See ***photon.***

**wax agate** A yellow to yellowish-red variety of agate with a waxy lustre.

**wax opal** A yellowish-brown common opal with a waxy lustre.

**waxed turquoise** A turquoise whose colour has been deepened by soaking it in paraffin wax.

**waxy lustre** See ***lustre.***

**weight** See ***mass.***

**weight estimation of polished stones** See ***caliper gauge, diamond gauge*** and ***moe diamond gauge.***

**wellington** Trade name for the man-made diamond simulant strontium titanate.

**wernerite** See ***scapolite.***

**wesselsite** A variety of sugilite found in the Wessels mine in South Africa.

**Wessex starred agate** See ***starred agate.***

**Westphal balance** See ***hydrostatic weighing.***

**West's solution** An 8:1:1 mixture of yellow phosphorus and sulphur in methylene iodide having an R.I. of 2.05. It is used as a contact liquid for extended range refractometers (e.g. diamond prism versions). As it contains phosphorus it must be handled with care, as the dried residue is spontaneously combustible.

**wet diggings** Diamond mining associated with alluvial rather than pipe deposits. See ***dry diggings.***

**whale ivory** An ivory derived from the incisor tooth or tusk of the narwhal, a species of arctic whale.

**whewellite** A collector's stone comprising the mineral hydrated calcium oxalate. $CaC_2O_4.H_2O$. Monoclinic. R.I. 1.490, 1.650; D.R. +0.16; S.G. 2.23; H. 2½. Transparent, colourless. Occurrence: Czechoslovakia, France, Germany.

**Whitby jet** The jet mined from the sea cliffs near Whitby in Yorkshire, England.

**white** A colour grade for polished diamonds. See ***Colour Grading***

*Standards* in Appendix B. Also a commercial name for transparent colourless stones.

**white garnet** A misleading name for leucite.

**white gold** Gold alloyed with nickel, silver, platinum or palladium.

**white graphite** A white abrasive powder consisting of hexagonal boron nitride.

**white light** Light containing an approximately equal mixture of all the colours or wavelengths that make up the visible spectrum.

**white opal** An iridescent opal having a whitish background.

**wilconite** A purplish-red variety of scapolite.

**wild pearl** A naturally initiated pearl.

**willemite** A collector's stone comprising the mineral zinc silicate. $Zn_2SiO_4$. Trigonal. R.I. 1.69, 1.72; D.R. +0.028; S.G. 3.89-4.18; H. 5½. Transparent, greenish-yellow, orange-brown. Occurrence: USA.

**williamsite** See ***serpentine.***

**wilsonite** A purplish-red variety of scapolite.

**wiluite** A variety of idocrase found in Siberia, USSR.

**winchellite** A plain green variety of thomsonite (also called lintonite).

**window** A facet polished on a coated or frosted (i.e. matt-surfaced) diamond crystal to enable its interior to be inspected for inclusions or flaws.

**wing pearl** A baroque pearl in the shape of a wing.

**Wisconsin pearls** Freshwater pearls from the Mississippi, USA.

**witherite** A collector's stone comprising the mineral barium carbonate. $BaCO_3$. Orthorhombic. R.I. 1.532, 1.680; D.R. −0.148; S.G. 4.27-4.35; H. 3½. Transparent, pale yellow, colourless. Occurrence: Canada, England, Japan, USA.

**wolf's eye** The moonstone variety of orthoclase feldspar, or the tiger's eye variety of quartz.

**wollastonite** A collector's stone comprising a calcium metasilicate. $CaSiO_3$. Monoclinic. R.I. 1.61, 1.63; D.R. −0.02; S.G. 2.8-2.9; H. 4½-5. Opaque, white. Occurrence: Finland, Mexico, Romania, USA.

**wonderstone** See ***pyrophyllite.***

**wood agate** See ***fossil wood.***

**Wood's glass filter** See ***UV lamps.***

**wood opal** See ***opal.***

**wood stone** See ***fossil wood.***

**work-hardening** An effect which occurs when 'working' metals (i.e. hammering, bending or stretching). They can be restored to their soft condition by heat treatment. See ***annealing.***

**wulfenite** A collector's stone comprising the mineral lead molybdate. $PbMoO_4$. Tetragonal. R.I. 2.304, 2.402; D.R.

—0.098; S.G. 6.7-7.0; H. 3. Transparent to translucent, yellow, orange, red, green, grey, white. Occurrence: Australia, Austria, Germany, Mexico, Morocco, USA, Yugoslavia, Zaire.

**Wyoming jade** A variety of nephrite from Wyoming, USA. See also ***jade matrix.***

## X

**xalostocite** See ***landerite.***

**xanthite** A yellowish-brown variety of idocrase from New York State, USA.

**xenomorphic** Term applied to a crystal having a crystal form alien to its normal habit. See ***idiomorphic*** and ***pseudomorphic.***

**xenolith** A fragment of rock which is foreign to its its host rock.

**xenotime** An yttrium phosphate ($Y_2O_3.P_2O_5$) present with zircon as flower-like radiating crystals in an ornamental basaltic rock. The rock is called kiku-ishi. Xenotime is sometimes found as an inclusion in diamond. Occurrence: Japan, Canada (Vancouver Island).

**X-ray diamond tester** An instrument for distinguishing between diamonds (which are transparent to X-rays) and diamond simulants (which are translucent or opaque). The stone under test is placed on a fluorescent plate inside the unit, and low-energy X-rays reveal the transparency or opacity of the stone as a shadow profile. *Figure X.1.*

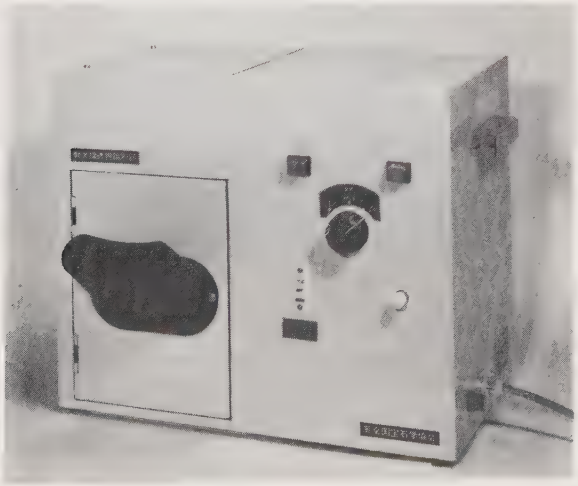


*Figure X.1* An X-ray tester for distinguishing diamond from its simulants by its transparency to X-rays. (GAAJ)

**X-ray luminescence** See ***luminescence*** and ***Table of Fluorescence*** in Appendix I.

**X-rays** Highly penetrating electromagnetic radiation having a range of wavelengths extending from the vicinity of the shortest ultra-violet rays at about 20 nm down to around 0.001 micrometre (i.e. a millionth of a nanometre). X-rays are produced in a vacuum tube by first accelerating electrons in a high-potential electric field, and then using them to bombard a tungsten target. X-rays are emitted as the high-energy electrons rapidly decelerate on striking the tungsten atoms. See ***lauegram, radiograph*** and ***X-ray diamond tester.***

**X-ray separator** An equipment which uses the X-ray fluorescent property of diamonds to separate them from crushed rock and gravels at the mine. The diamond concentrate is passed under an X-ray beam, and any fluorescing stone is detected by a photo-multiplier which activates an air jet to eject the stone from the main stream. See ***recovery plant.***

**X-ray spectroscopy** See ***electron microprobe.***

**X-ray topography** A technique used in the experimental fingerprinting of diamonds which makes visible the unique lattice structure defects inside the gem. A vertical ribbon-like beam of collimated X-rays is used to scan the diamond, which is positioned so that the beam is diffracted by the atomic layers in the crystal lattice. The emerging X-rays fall on a photographic plate to produce a projection topograph showing a pattern of crystal defects within the stone. *Figure X.2.* See also ***fingerprinting.***

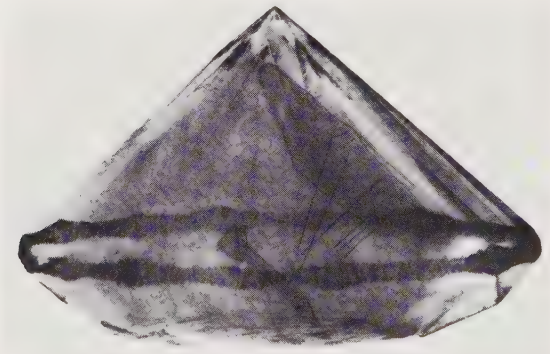


*Figure X.2* An X-ray projection topograph picture of a brilliant-cut diamond which reveals distinguishing crystal defects. (De Beers)

**xyloid jasper** A jasper fossil wood.

**xylonite** Trade name for a cellulosic plastic.

**xylopal** An opalised fossil wood.

**YAG** See *yttrium aluminium garnet.*

**yakutite** An impure dark-coloured diamond or boart, similar to carbonado, found in Yakutia, Siberia, USSR. See ***boart.***

**yanolite** A violet-coloured variety of axinite.

**yaqui onyx** A misleading name for a marble found in Baja California, Mexico.

**yava onyx** A misleading name for a marble found in Yavapai County, Arizona, USA.

**yellow ashover spar** A yellow fluorspar found in Derbyshire, England.

**yellow ground** See ***kimberlite.***

**yellow pearls** Pearls from the *Pinctada carcharium* mollusc fished off the coast of Shark Bay, Western Australia.

**YIG** See *yttrium iron garnet.*

**yttralox** Trade name for a man-made material originaly developed for the optical industry. It is a transparent ceramic produced by heating powdered yttrium oxide ($Y_2O_3$) under high pressure. Ten percent of thorium oxide ($ThO_2$) is added to stabilise the material in the cubic form. R.I. 1.92; S.G. 5.3; H. 6½.

**yttrium aluminate** A man-made crystal (produced for the laser industry). $YA10_3$. Orthorhombic. R.I. 1.938, 1.955; D.R. −0.017; S.G. 5.35; H. 8. Transparent, red, pink, orange-pink, bluish-violet (coloured by rare-earth oxides). Crystals are grown by the Czochralski process.

**yttrium aluminium garnet** A man-made diamond simulant (introduced in 1969) which has no counterpart in nature. $Y_3Al_5O_{12}$. Cubic. R.I. 1.832; S.G. 4.58; H. 8½. Transparent, colourless and yellow, green, blue, red, lilac (produced by doping the crystal with transition element oxides and rare-earth oxides). Crystals are grown by the Czochralski and flux-melt processes.

**yttrium iron garnet** A man-made crystal, grown for its magnetic properties (as a modulator for infra-red laser beams) but too dark for gem use.

**yttrium oxide** A man-made crystal with potential as a diamond simulant. $Y_2O_3$. Cubic. R.I. 1.92; S.G. 4.84; H. 7½-8.

**yttro garnet** Trade name for an yttrium aluminium garnet.

**yu** The Chinese name for jade.

**yui ko lu jade** A tomb jade coloured green by bronze articles buried near it.

**yunnan jade** Burmese jadeite marketed through the Chinese province of Yunnan.

**yu yen stone** A massive greenish-grey variety of serpentine.

**zaba gem** Trade name for a synthetic rutile diamond simulant.

**zabeltitzten diamond** A misleading name for the rock crystal variety of quartz.

**zarafina** A blue variety of spinel or a blue chalcedony.

**zeasite** See ***opal*** (wood opal).

**zeathite** Trade name for a strontium titanate.

**zebra crocidolite** A parti-coloured blue/brown silica pseudomorph of crocidolite. See ***quartz*** (tiger's eye variety).

**zektzerite** A collector's stone comprising the mineral lithium sodium zirconium silicate. $LiNaZrSi_6O_{15}$. Orthorhombic. R.I. 1.582, 1.585; D.R. −0.003; S.G. 2.79; H. 6. Transparent, colourless to pale pink. Occurrence: USA.

**zenithite** Trade name for the man-made diamond simulant strontium titanate.

**zeolites** A group of minerals having the basic formula $X.Al_2Si_3O_{10}.nH_2O$. (e.g. natrolite, mesolite and scolecite).

**Zerfass synthetic emeralds** Synthetic emeralds grown by the flux-melt process. R.I. 1.560, 1.563; D.R. −0.003; S.G. 2.65. Zerfass of Idar-Oberstein, Germany.

**zeuxite** A variety of green tourmaline from Brazil.

**Zimbabwe Gem and Mineral Society** See ***Gem and Mineral Society of Zimbabwe.***

**zinc blende** See ***sphalerite.***

**zincian staurolite** A collector's stone comprising the colour-change zinc-rich variety of staurolite. R.I. 1.721, 1.731; D.R. +0.01; S.G. 3.79; H. 7. Transparent, yellowish-green (under fluorescent light), red-brown (under tungsten light). Pleochroism, medium (green, yellow, red). See ***staurolite.***

**zincite** A collector's stone comprising the mineral zinc oxide. ZnO. Hexagonal. R.I. 2.013, 2.029; D.R. +0.016; S.G. 5.66; H. 4-4½. Transparent, red, orange-yellow. Occurrence: USA.

**zircolite** Trade name for a synthetic corundum diamond simulant.

**zircon** A zirconium silicate. $ZrSiO_4$. Tetragonal. R.I. 1.929–1.990; D.R. +0.059; S.G. 4.67–4.70; H. 7-7½. Transparent, yellow, green, brown, red, orange, sky-blue, golden-brown, colourless (the latter three produced by heat treatment — see ***heat-treated stones***). Pleochroism, medium in blue stones (colourless, blue). Constants for zircon vary from those given above to the much lower values measured in metamict zircons. See ***high zircon*** and ***low zircon.*** Occurrence: Australia, Burma, Cambodia, France (red zircon), Indo-China, Norway, Sri Lanka, Thailand.

**zircon cut** A style, based on the brilliant cut, which is designed to improve the brilliance of a zircon. The zircon cut reduces light

leakage from the rear of the stone by having an additional eight facets placed between the culet and the main pavilion facets.

**zircon haloes** A crystalline defect or stress crack seen in Sri Lankan sapphires, spinels and garnets, and caused by once radioactive zircon crystal inclusions, or by the unequal thermal expansion between these crystals and the host stone (or even by the transition of the zircon inclusions to a more bulky metamict state). See also ***inclusions.***

**zirconia** Trade name for the man-made diamond simulant cubic zirconium oxide manufactured by Swarovski & Co., of Wattens, Austria. Also the name of a reddish-brown abrasive powder used for polishing gemstones.

**zirconium dioxide** See ***cubic zirconium oxide.***

**zircon spinel** A misleading trade name for a synthetic blue spinel.

**zirctone** Trade name for a synthetic bluish-green sapphire.

**zoisite** A calcium aluminium silicate member of the epidote group of minerals. $Ca_2(OH)Al_3(SiO_4)_3$. Orthorhombic. Varieties:

*green zoisite* — also called anyolite, and originally called saualpite. Opaque chrome-rich with black hornblende inclusions, found with large opaque ruby crystals. R.I. 1.692, 1.700; D.R. +0.008; S.G. 3.35; H. 6.

*blue zoisite* — also called tanzanite. Transparent, blue to violet, occasionally chatoyant. R.I. 1.696, 1.703; D.R. +0.007; S.G. 3.38; H. 6.

*yellow zoisite* — transparent, turns colourless on heating.

*thulite* — also called rosaline. Opaque, pink. R.I. around 1.70; S.G. 3.10; H. 6.

Pleochroism strong in blue zoisite (purple, blue, slate-grey; less pronounced after heat treatment). Occurrence: Kenya (dark blue), Tanzania.

**zonite** A chert or jasper found in Arizona, USA. See ***quartz.***

**zoom microscope** A microscope employing a lens system which by variation of focal length provides a stepless change of magnification factors. See also ***microscope.***

**zylonite** Trade name for a cellulosic plastics material.

**spring balance** This operates by relating the known extension or compression properties of a helical spring to the weight of an object suspended from it (*Figure 1*). Unlike the beam balance, which is self-compensating for variations in gravity (and therefore measures *mass*), the spring balance indicates the gravitational force acting upon the load (i.e. its *weight*. See also under ***mass*** in dictionary section).

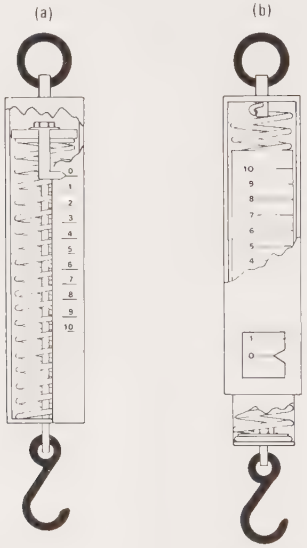



*Figure 1* The construction of a compression spring balance (a), and an extension spring balance (b).

**beam balance** This uses one of the oldest of mechanical systems, the lever. In its simplest form, it consists of an equal-arm beam balance with a central fulcrum or pivot and a weighpan suspended from each arm of the beam (*Figure 2*).

**substitutional beam balance** An improved version of the simple beam balance designed to reduce the latter's inherent errors by providing a constant load. When an object is placed on the weighpan (Ms in *Figure 3*), the appropriate substitutional weights (Mx) are removed (usually by means of calibrated control knobs which provide remote manipulation of the weights) until the balance pointer is within the range of its scale. Total weight of the object is then arrived at by the addition of the scale reading to that of the control knobs.

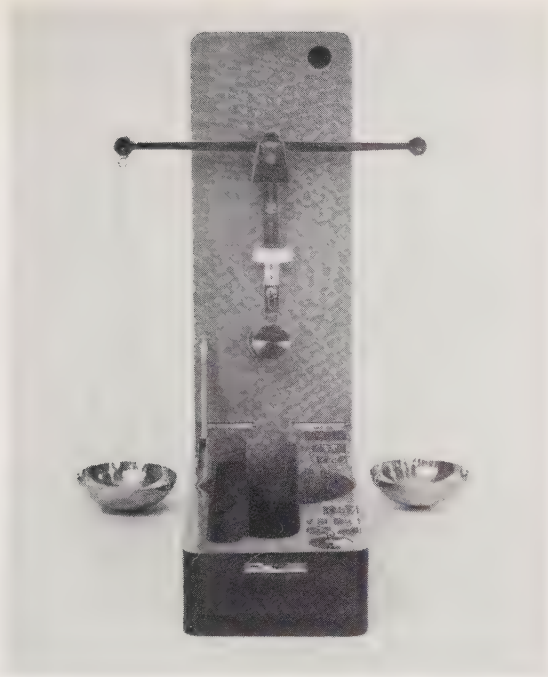


*Figure 2* A diamond dealer's portable beam balance. (Haigis)

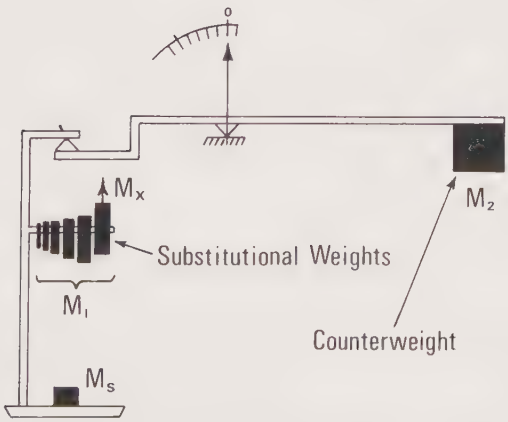



*Figure 3* Simplified sketch of a substitutional beam balance. A constant pivot load is maintained by making $M_s + M_1$ always equal to $M_2$.

**top pan balance** This was developed from the substitutional balance and the Roberval counter balance to facilitate rapid weighing. The top pan design sacrifices a degree of sensitivity in return for convenience (*Figure 4*).

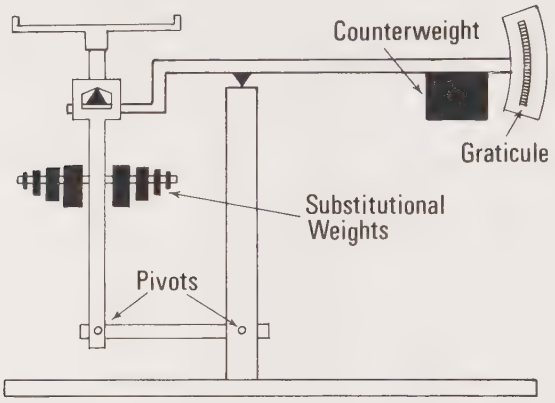
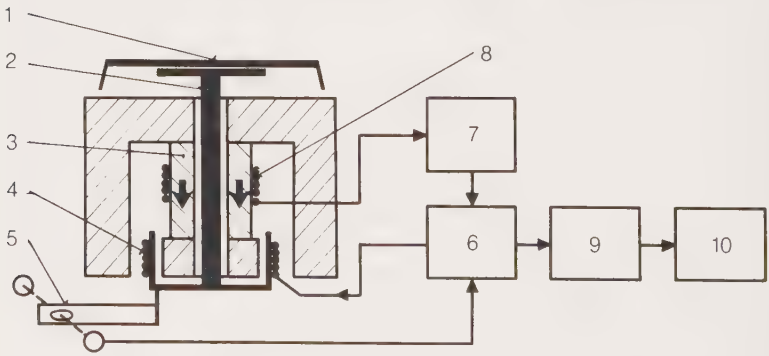



*Figure 4* Simplified sketch of a top pan substitutional balance.

**electronic balance** This instrument uses some of the components of the beam balance, but replaces the substitutional weights with a magnetic force-balance system. When an object is placed on the weighpan, an out-of-balance detector adjusts the current in a counter-balance coil to restore the beam to equilibrium. This




1 Weighing pan
2 Pan holder
3 Magnet
4 Coil
5 Optical scanning unit
6 Variable-gain amplifier/AD converter
7 Constant current source
8 Temperature sensor
9 Tare calculator
10 Digital display

*Figure 5* Diagrammatic representation of a beamless all-electronic balance. (Mettler)


*Figure 6* An all-electronic carat balance with digital display. (Mettler)

current is then measured and displayed as a weight reading. The latest designs dispense with pivots and beams, and suspend the weighpan/force coil assembly from centering flexures (*Figures 5* and *6*). The advent of the microprocessor has made it possible to incorporate such features as weight unit change (e.g. gram to carat), automatic tare, weight integration (averaging of several successive weighings to guard against vibration errors), and stand-still operation (inhibition of read-out until the weighpan has stopped moving).

**balances for hydrostatic weighing** Several manufacturers of analytical balances of the substitutional type provide accessories for hydrostatic weighing (as do the Gem Instruments Corporation). Also see the Westphal, Penfield and Hanneman balances under ***hydrostatic weighing*** in the dictionary section.

## Appendix B Colour Grading Standards for Polished Diamonds

Polished diamonds are visually graded for colour by inspecting them through the side of the pavilion against a neutral white background (i.e. in a folded white grading card or a grading tray).

## Table of Colour Grading Standards for Polished Diamonds

| UK | German RAL Scan DN (0.5 carats upwards) | Scan DN (under 0.5 carats) | GIA | AGS | CIBJO |
|---|---|---|---|---|---|
| Finest White | River | Rarest White | D | 0 | Exceptional White + |
| | | | E | | Exceptional White |
| Fine White | Top Wesselton | Rare White | F | 1 | Rare White + |
| | | | G | 2 | Rare White |
| White | Wesselton | White | H | 3 | White |
| Commercial White | Top Crystal | Slightly Tinted White | I | 4 | Slightly Tinted White |
| Top Silver Cape | Crystal | | J | 5 | |
| Silver Cape | Top Cape | Tinted White | K | | Tinted White |
| | | | L | 6 | |
| Light Cape | Cape | Slightly Yellowish | M | | Tinted Colour |
| | | | N | 7 | |
| Cape | Light Yellow | Yellowish | O | | |
| | | | P | 8 | |
| | | | Q | | |
| | | | R | 9-10 | |
| Dark Cape | Yellow | Yellow | S–Z | | |

Comparison colour grading is carried out in a 'north' light, or under a colour-corrected diamond grading lamp, which often incorporates a LW UV lamp to enable the stone to be checked for fluorescence (*Figure 7*). Blue fluorescence tends to make a

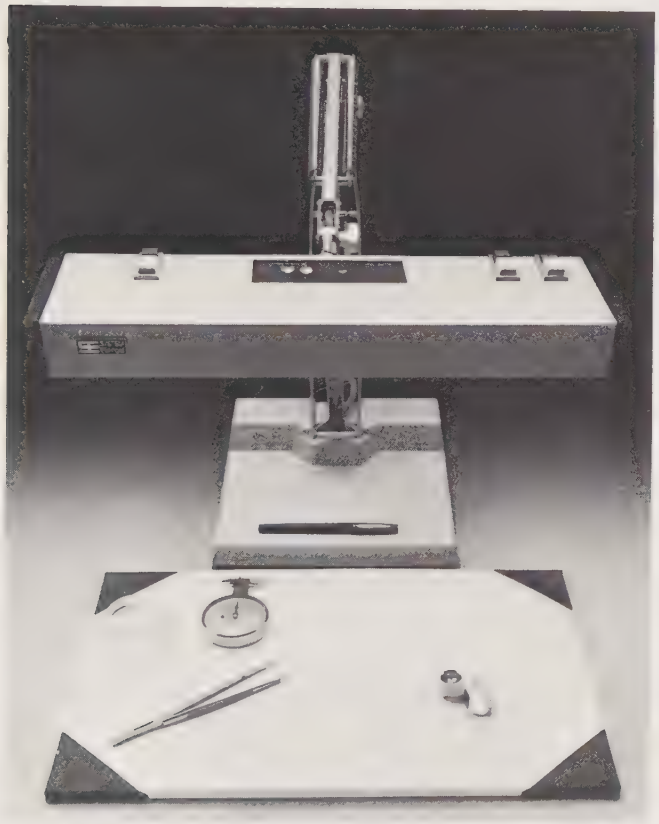


*Figure 7* A diamond grading lamp with a UV lamp window on top for checking fluorescence. (Eickhorst)

yellowish diamond appear whiter, and this is taken into account when grading strongly fluorescing stones. Master stones for comparison grading are selected to indicate the bottom limit of each grade. The following table shows the relationship between the various national grading systems and the international CIBJO grades.

## Appendix C Clarity Grading Standards for Polished Diamonds

Clarity grading standards are based on the use of 10× magnification, although some systems which use microscope measuring graticules may use higher values with appropriate compensation. Clarity grading systems employing graticules normally incorporate 'weighting' factors to allow for the position of the flaw or inclusion within the stone, and to compensate for its opacity or transparency. The first of the following three tables shows the relationship between the various national grading systems and the international CIBJO grades. The second table indicates the size and position of inclusions associated with the UK grades, and the third table indicates the CIBJO clarity grading standards.

### Table of Clarity Grading Standards for Polished Diamonds

| UK | RAL | Scan DN | GIA | Belgium | CIBJO |
|---|---|---|---|---|---|
| Flawless | IF | FL<br>IF | FL | IF | Loupe-clean |
| VVS | VVS | VVSI 1<br>VVSI 2 | VVSI 1<br>VVSI 2 | VVS | VVS 1<br>VVS 2 |
| VS | VS | VSI 1<br>VSI 2 | VSI 1<br>VSI 2 | VS | VS 1<br>VS 2 |
| SI | SI | SI 1<br>SI 2 | SI 1<br>SI 2 | SI | SI |
| 1st PK | PK 1 | PK 1 | I 1 | | PI |
| 2nd PK | PK 2 | PK 2 | I 2 | | PII |
| 3rd PK | PK 3 | PK 3 | I 3 | | PIII |
| Spotted | | | | | |
| Heavily Spotted | | | | | |
| Rejection | | | | | |

**Table of UK Clarity Grading Standards (10× magnification)**

| | |
|---|---|
| Flawless | Clean Stone |
| VVS | Very fine white or black spots, not central |
| VS | Fine white or black spots, not central |
| SI | Small inclusions, some central |
| 1st PK | Black or white spots, seen with difficulty, mainly central |
| 2nd PK<br>3rd PK | Several white or black spots, easily seen — can be central in 3rd PK |
| Spotted<br>Heavily Spotted<br>Rejection | Obvious large inclusions, cracks, etc. |

**Table of CIBJO Clarity Grading Standards (10× magnification)**

| | |
|---|---|
| Loupe-clean | A diamond is classified as loupe-clean if it is completely transparent and free from visible inclusions |
| VVS<br>(VVS 1, VVS 2) | Very, very small inclusion(s) which are hard to find with 10× loupe |
| VS<br>(VS 1, VS 2) | Very small inclusion(s) which can just be found with a 10× loupe |
| SI | Small inclusion(s), easy to find with a 10× loupe, but not seen with the naked eye through the crown facets |
| PI | Inclusion(s) immediately evident with a 10× loupe, but difficult to find with the naked eye through the crown facets. Not impairing the brilliancy |
| PII | Large and/or numerous inclusion(s), easily visible to the naked eye through the crown facets, and which slightly reduce the brilliance of the diamond |
| PIII | Large and/or numerous inclusion(s), very easily visible with the naked eye through the crown facets, and which reduce the brilliancy of the diamond |

Note: Sub-grades VVS 1, VVS 2, VS 1, VS 2 are used only for stones of 0.47 carats and larger.

## Appendix D Sorting Standards for Rough Gem Diamonds

1. **Colour classification for stones above 2 carats**
   Extra collection (top colour)
   Collection
   Extra Special
   Blue
   Fine
   White

2. **Colour classification for stones below 2 carats**
   Collection (top colour)
   1st Colour
   2nd Colour

3. **Shape categories**
   Stones (unbroken octahedra)
   Shapes (distorted but unbroken octahedra)
   Cleavages (broken crystals)
   Macles (twinned diamonds — usually triangular)
   Flats
   Note: under 2 carats, stones and shapes are called melée, and cleavages are called chips.

4. **Quality categories** (equivalent to clarity in polished stones)
   Over 2 carats, stones and shapes are divided into five qualities; cleavages, macles and flats are divided into four qualities. Under 2 carats, melée are divided into four qualities (finest, fine, dark, black); chips, macles and flats are divided into two qualities (fine and 'chips/macles/flats').

## Appendix E Stone Papers

Stone papers are manufactured in several sizes, the most popular being the No. 2 paper which, when folded, measures $50 \times 100$ mm, and can comfortably hold up to 50 stones in the one carat size range. Stone papers are usually supplied with an inner tissue lining to provide further protection for the contents, and these liners are sometimes coloured to provide an appropriate background for colourless or coloured gems. *Figure 8* gives the dimensions and folding sequence for making a No. 2 stone paper.

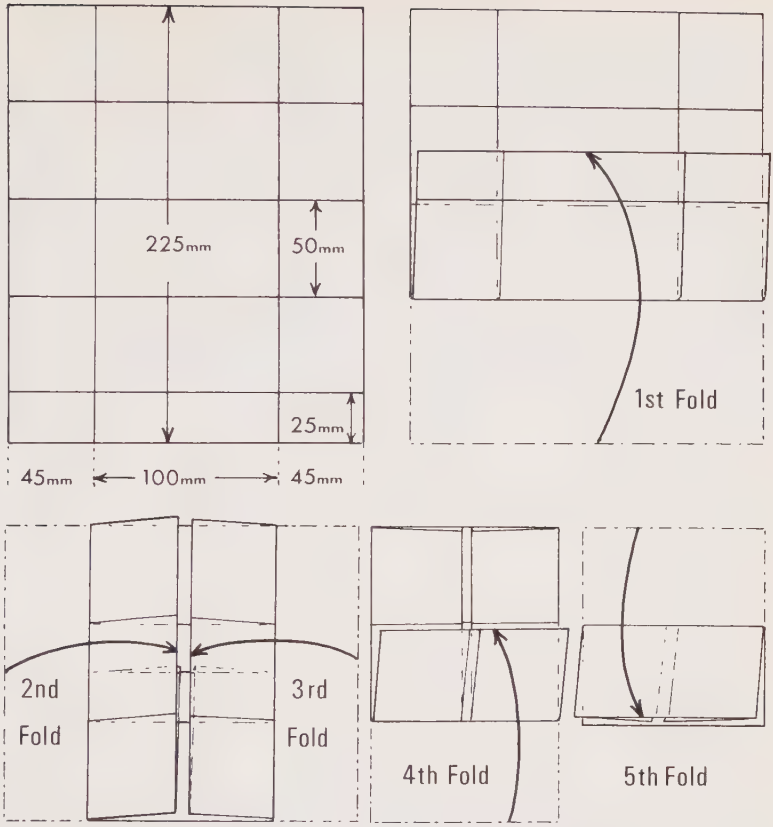



*Figure 8* Dimensions and folding sequence for making a No. 2 size stone paper.

## Appendix F Dispersion

The dispersion of white light into its spectral colours as it passes through a gemstone produces the multi-coloured flashes of light known as 'fire' when the gemstone or the light source is moved relative to the observer. This effect is seen most clearly in colourless gems, particularly where these have a high value of dispersion (e.g. diamond and some of the diamond simulants). The dispersion of a gemstone is measured as the difference between its refractive indices at the B and G Fraunhofer wavelengths (i.e. at 687 nm and 430.8 nm). The following table lists the values for those principal gemstones whose dispersion is 0.02 and above.

| Gemstone | Dispersion | Gemstone | Dispersion |
|---|---|---|---|
| Almandine garnet | 0.027 | Peridot | 0.020 |
| Benitoite | 0.044 | Pyrope garnet | 0.022 |
| Cassiterite | 0.071 | Rutile | 0.280 |
| Cubic moissanite | 0.044 | Smithsonite | 0.031† |
| Cubic zirconium oxide | 0.065 | Spessartite garnet | 0.027 |
| Demantoid garnet | 0.057 | Sphene | 0.051 |
| Diamond | 0.044 | Spinel | 0.020 |
| Dioptase | 0.036† | Strontium titanate | 0.190 |
| Epidote | 0.030 | Yttralox | 0.039 |
| Flint glass | 0.040* | Yttrium aluminate | 0.028 |
| Gadolinium gallium garnet | 0.045 | Yttrium aluminium garnet | 0.028 |
| Hessonite garnet | 0.027 | Yttrium oxide | 0.050 |
| Kyanite | 0.020 | Zinc blende | 0.156 |
| Lithium niobate | 0.120 | Zircon | 0.039 |
| Lithium tantalate | 0.087 | | |

* Mean value.
† Maximum value.

## Appendix G Units of Measurement

### Weight

The standard international (SI) unit of weight is the kilogram (kg). The most frequently used sub-divisions are the gram and the milligram.

1 kilogram = 1000 grams
1 gram = 1000 milligrams
= 0.03527 ounce Avoir (1 ounce Avoir = 28.349 grams)
= 0.03215 ounce Troy (1 ounce Troy = 31.103 grams)

For gemstone weighing, the standard unit is the metric carat.

1 carat = 0.2 gram (1 gram = 5 carats)
= 0.007055 ounce Avoir (1 ounce Avoir = 141.747 carats)
= 0.006430 ounce Troy (1 ounce Troy = 155.517 carats)

For pearl weighing, the standard unit is the grain.

1 grain = 0.25 carats (1 carat = 4 grains)

*Note:* The weight of small rough diamonds is sometimes expressed in grains (e.g. a 1.0 carat stone may be called a 'four grainer').

Polished diamonds under 1.0 carat in weight are measured in points.

1 point = 0.01 carat (1 carat = 100 points)

**Length**

The standard international (SI) unit for the measurement of length is the metre (m). The most frequently used sub-divisions are the centimetre (cm), millimetre (mm), micrometre (μm, previously called 'micron') and nanometre (nm).

1 m = 100 cm
1 cm = 10 mm = $10^{-2}$ m
1 mm = 1000 μm = $10^{-3}$ m
1 μm = 1000 nm = $10^{-6}$ m
1 nm = $10^{-9}$ m

**Wavelength**

The standard internatinal (SI) unit for the measurement of light wavelengths is the nanometre (nm).

1 nm = $10^{-9}$ m (one thousand-millionth of a metre)
1 nm = 10 Å (ångstrom units)
Light wavelengths are also sometimes given in microns (μm)
1 μm = 1000 nm = $10^{-6}$ m

**Temperature**

The standard international (SI) unit for temperature is the Kelvin (K), and the degree Celsius (°C), both of which span equal temperature intervals. The Kelvin is used mainly for thermodynamic work and represents an *absolute* temperature.

0 °C = 273.16 K
0 K = -273.16 °C (the temperature at which no more internal energy can be extracted from an object, and at which the volume of a gas is theoretically zero).

## Appendix H Table of Elements

| Element | Symbol | Atomic Number | Atomic Weight | Valency | Specific Gravity |
|---|---|---|---|---|---|
| Actinium | Ac | 89 | 227.0 | — | — |
| Aluminium | Al | 13 | 26.97 | 3 | 2.6 |
| Americum | Am | 95 | 243.0** | — | — |
| Antimony | Sb | 51 | 121.76 | 3, 5 | 6.6 |
| Argon | A | 18 | 39.944 | 0 | — |
| Arsenic | As | 33 | 74.91 | 3, 5 | 5.72 |
| Astatine | At | 85 | 210.0** | — | — |
| Barium | Ba | 56 | 137.36 | 2 | 3.8 |
| Berkelium | Bk | 97 | 247.0** | — | — |
| Beryllium | Be | 4 | 9.02 | 2 | 1.83 |
| Bismuth | Bi | 83 | 209.0 | 3, 5 | 9.8 |
| Boron | B | 5 | 10.82 | 3 | 2.5 |
| Bromine | Br | 35 | 79.916 | 1 | 3.1 |
| Cadmium | Cd | 48 | 112.41 | 2 | 8.64 |
| Caesium | Cs | 55 | 132.91 | 1 | 1.87 |
| Calcium | Ca | 20 | 40.08 | 2 | 1.54 |
| Californium | Cf | 98 | 249.0** | — | — |
| Carbon | C | 6 | 12.01 | 4 | 1.9–2.3† |
| Cerium* | Ce | 58 | 140.13 | 3, 4 | 6.9 |
| Chlorine | Cl | 17 | 35.457 | 1 | — |
| Chromium | Cr | 24 | 52.01 | 3, 6 | 7.1 |
| Cobalt | Co | 27 | 58.94 | 2, 3 | 8.6 |
| Copper | Cu | 29 | 63.57 | 1, 2 | 8.93 |
| Curium | Cm | 96 | 248.0** | — | — |
| Dysprosium* | Dy | 66 | 162.46 | 3 | — |
| Einsteinium | Es | 99 | 254.0** | — | — |
| Erbium* | Er | 68 | 167.64 | 3 | 4.8 |
| Europium* | Eu | 63 | 152.0 | 3 | — |
| Fermium | Fm | 100 | 253.0** | — | — |
| Francium | Fr | 87 | 223.0** | — | — |
| Gadolinium* | Gd | 64 | 156.9 | 3 | 5.9 |
| Gallium | Ga | 31 | 69.72 | 3 | 5.95 |
| Germanium | Ge | 32 | 72.6 | 4 | 5.47 |
| Gold | Au | 79 | 197.2 | 1, 3 | 19.3 |
| Hafnium | Hf | 72 | 178.6 | — | — |
| Helium | He | 2 | 4.002 | 0 | — |
| Holium* | Ho | 67 | 163.5 | 3 | — |
| Hydrogen | H | 1 | 1.0078 | 1 | — |
| Indium | In | 49 | 114.76 | 3 | 7.3 |
| Iodine | I | 53 | 126.92 | 1 | 4.95 |
| Iridium | Ir | 77 | 193.1 | 4 | 22.4 |
| Iron | Fe | 26 | 55.84 | 2, 3 | 7.87 |
| Krypton | Kr | 36 | 83.7 | 0 | — |
| Lanthanum* | La | 57 | 138.92 | 3 | 6.12 |

**Appendix H Table of Elements** — *contd.*

| Element | Symbol | Atomic Number | Atomic Weight | Valency | Specific Gravity |
|---|---|---|---|---|---|
| Lawrencium | Lw | 103 | 257.0** | — | — |
| Lead | Pb | 82 | 208.0 | 2, 4 | 11.34 |
| Lithium | Li | 3 | 6.94 | 1 | 0.53 |
| Lutecium* | Lu | 71 | 175.0 | 3 | — |
| Magnesium | Mg | 12 | 24.32 | 2 | 1.74 |
| Manganese | Mn | 25 | 54.93 | 2, 3 | 7.4 |
| Mendelevium | Md | 101 | 256.0** | — | — |
| Mercury | Hg | 80 | 200.61 | 1, 2 | 13.59 |
| Molybdenum | Mo | 42 | 96.0 | 4, 6 | 10.0 |
| Neodymium* | Nd | 60 | 144.27 | 3 | 6.96 |
| Neon | Ne | 10 | 20.183 | 0 | — |
| Neptunium | Np | 93 | 237.0** | — | — |
| Nickel | Ni | 28 | 58.69 | 2, 3 | 8.8 |
| Niobium‡ | Nb | 41 | 92.91 | 5 | 8.5 |
| Nitrogen | N | 7 | 14.008 | 3, 5 | — |
| Nobelium | No | 102 | 253.0** | — | — |
| Osmium | Os | 76 | 191.5 | 6 | 22.5 |
| Oxygen | O | 8 | 16.0 | 2 | — |
| Palladium | Pd | 46 | 106.7 | 2, 4 | 11.4 |
| Phosphorus | P | 15 | 31.02 | 3, 5 | 1.8†† |
| Platinum | Pt | 78 | 195.23 | 2, 4 | 21.4 |
| Plutonium | Pu | 94 | 242.0** | — | — |
| Polonium | Po | 84 | 210.0 | — | — |
| Potassium | K | 19 | 39.096 | 1 | 0.86 |
| Praseodymium* | Pr | 59 | 140.92 | 3 | 6.48 |
| Promethium* | Pm | 61 | 146.0** | — | — |
| Protactinium | Pa | 91 | 231.0 | — | — |
| Radium | Ra | 88 | 226.0 | 2 | — |
| Radon | Rn | 86 | 222.0 | — | — |
| Rhenium | Re | 75 | 186.31 | — | 21.2 |
| Rhodium | Rh | 45 | 102.91 | 3 | 12.44 |
| Rubidium | Rb | 37 | 85.48 | 1 | 1.53 |
| Ruthenium | Ru | 44 | 101.7 | 6, 8 | 12.3 |
| Samarium* | Sm | 62 | 150.43 | 3 | 7.8 |
| Scandium | Sc | 21 | 45.10 | 3 | — |
| Selenium | Se | 34 | 78.96 | 2 | 4.8 |
| Silicon | Si | 14 | 28.06 | 4 | 2.3 |
| Silver | Ag | 47 | 107.88 | 1 | 10.5 |
| Sodium | Na | 11 | 22.997 | 1 | 0.97 |
| Strontium | Sr | 38 | 87.63 | 2 | 2.54 |
| Sulphur | S | 16 | 32.06 | 2, 4 | 2.07 |
| Tantalum | Ta | 73 | 180.88 | 5 | 16.6 |
| Technetium | Tc | 43 | 97.88** | — | — |
| Tellurium | Te | 52 | 127.61 | 2 | 6.25 |

## Appendix H Table of Elements — *contd.*

| Element | Symbol | Atomic Number | Atomic Weight | Valency | Specific Gravity |
|---|---|---|---|---|---|
| Terbium* | Tb | 65 | 159.2 | 3 | — |
| Thallium | Tl | 81 | 205.0 | 1 | 11.9 |
| Thorium | Th | 90 | 232.0 | 4 | 11.3 |
| Thulium* | Tm | 69 | 169.4 | 3 | — |
| Tin | Sn | 50 | 118.7 | 2, 4 | 7.28 |
| Titanium | Ti | 22 | 47.9 | 4 | 4.5 |
| Tungsten | W | 74 | 184.0 | 6 | 19.3 |
| Uranium | U | 92 | 238.0 | 4, 6 | 18.7 |
| Vanadium | V | 23 | 50.95 | 3, 5 | 6.0 |
| Xenon | Xe | 54 | 131.3 | 0 | — |
| Ytterbium* | Yb | 70 | 173.04 | 3 | 5.5 |
| Yttrium | Y | 39 | 88.92 | 3 | 3.8 |
| Zinc | Zn | 30 | 65.38 | 2 | 7.1 |
| Zirconium | Zr | 40 | 91.22 | 4 | 6.5 |

* One of the rare-earths in the lanthanum group.
** Isotope with the longest known half-life.
† Graphite
‡ Formerly called columbium (Cb)
†† Yellow (red = 2.2)

## Appendix I Table of Fluorescence of Principal Gemstones

| Gemstone | LW UV | SW UV | X-rays |
|---|---|---|---|
| Alexandrite | Red | Red | Red (faint) |
| Apatite (yellow) | Lilac | Lilac/pink | Pinkish-white, pinkish-yellow, mauve |
| Apatite (blue) | Blue | Blue | Faint pinkish-straw, faint blue |
| Cubic zirconium oxide (stabilized with $Y_2O_3$) | — | Greenish-yellow (faint) | Distinct whitish |
| Cubic zirconium oxide (stabilised with CaO) | — | Yellow (distinct) | Distinct whitish |
| Danburite | Sky-blue | Blue | Violet |
| Diamond (only 10–15% of diamonds luminesce under UV) | Blue*, green, yellow, red or pink | Same colours, but less frequent | White, yellow, blue (no phosphorescence) |
| Emerald (natural) | Red (some) | Red (some) | Red |
| Emerald (synthetic) | Red (strong) | Red (strong) | Red |

## Appendix I Table of Fluorescence of Principal Gemstones — *contd.*

| Gemstone | LW UV | SW UV | X-rays |
|---|---|---|---|
| Fire opal | Brownish-red | — | — |
| Fluorspar | Violet (strong) | Violet (weak) | Blue, violet |
| GGG (gadolinium gallium garnet) | Pale Yellow (weak) | Orange | Lilac |
| Kunzite | Orange | — | Orange |
| Lapis lazuli | Orange spots and streaks | — | — |
| Massive grossular garnet | — | — | Orange |
| Opal (natural) | Random. White, bluish, brownish or greenish (weak), or no fluorescence** | | Green (some) |
| Opal (Gilson synthetic) | Random | Dusty-green | — |
| Paste | — | Pale blue or green | Green, blue (some) |
| Ruby (natural and synthetic) | Red (strong in synthetic) | Red (strong in synthetic) | Red (synthetic shows phosphorescence) |
| Sapphire (white, natural) | Orange | Orange | Crimson |
| Sapphire (white, synthetic) | — | Deep blue (weak) | Orange, violet (some) |
| Sapphire (yellow, natural from Sri Lanka) | Yellow | — | Orange |
| Sapphire (yellow synthetic) | — | — | Violet (some) |
| Sapphire (orange synthetic) | Red (strong) | Red | Red with phosphorescence |
| Sapphire (blue natural) | pink (few) | — | Red |
| Sapphire (blue synthetic) | — | Greenish-blue | Blue |
| Scapolite | Yellow | Pink | White, orange, green, violet |
| Scheelite | — | Blue | Blue |
| Spinel (green, yellow, synthetic) | Green (strong) when coloured by manganese | Green | Red (green spinel), green (yellow spinel) |
| Spinel (blue synthetic) | Red | — | Red, blue |
| Spinel (blue natural) | — | — | — |
| Spinel (white, synthetic) | — | Blue/white (strong) | Green, blue (some) |
| Spinel (red, pink) | Red (strong) | Red (strong) | Red |
| Strontium Titanate | — | — | — |
| Topaz | Yellow, orange | — | Orange (some), green, blue |
| YAG (yttrium aluminium garnet) | Yellow | — | Yellow |
| Zircon | Yellow | Yellow | Yellow, blue, violet |

* Faint yellow phosphorescence (when in association with blue UV fluorescence, this is diagnostic for diamond).

** All colours may show a persistent green phosphorescence.

## Appendix J Table of Principal Fraunhofer Lines

| Fraunhofer line | Wavelength (nm) | Element | |
|---|---|---|---|
| A | 762.8 (deep red) | Oxygen | in the earth's atmosphere |
| B | 686.7 (red) | Oxygen | |
| C | 656.3 (orange) | Hydrogen | |
| $D_1$ | 589.6 (yellow) | Sodium | elements in the sun's chromosphere |
| $D_2$ | 589.0 (yellow) | Sodium | |
| E | 527.0 (green) | Iron | |
| $b_1$ | 518.4 | Magnesium | |
| $b_2$ | 517.3 | Magnesium | |
| $b_3$ | 516.9 | Iron | |
| $b_4$ | 516.7 | Magnesium | |
| F | 486.1 (blue-green) | Hydrogen | |
| G | 430.8 (blue) | Calcium | |
| H | 396.8 (violet) | Calcium | |
| K | 395.3 (violet) | Calcium | |

*Note:* The twin sodium lines $D_1$, $D_2$ (with a mean wavelength of 589.3 nm) are used as the standard source when specifying gemstone refractive indices. Dispersion is measured as the difference in refractive index at the B and G wavelengths.

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**K G Jackson, revised R Feinberg**

This second edition has been completely reset, many new entries having been added and existing ones revised or deleted. The changes take account of the developments in electrical engineering itself, and also in those areas of electronics with which the modern engineer needs to be familiar—in particular, semiconductor devices and optical-fibre techniques. An important general change is that terminology has been brought into line with the recent revision of relevant chapters of the International Electrotechnical Vocabulary issued by the International Electrotechnical Commission. SI units are used throughout. The dictionary will continue to be of value to apprentices and students of electrical engineering, as well as to experienced engineers in this and related fields.

1981 356 pages 0 408 00450 9

### Dictionary of Electronics

**S W Amos**

This illustrated dictionary provides clear explanations of the meanings of the many terms used in the electronics industry. Extensive cross-referencing brings associated terms to the reader's attention. As with the other dictionaries in this series a valuable appendix lists many commonly used abbreviations and acronyms. Students, engineers, managers and others engaged in the various branches of the electronics industry will find this an essential work of reference.

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### Dictionary of Telecommunications

**S J Aries**

This dictionary provides clear definitions and explanations of standard terms and of the many new terms coined as a result of recent advances in telecommunications. Entries describing the scope, purpose and constitution of various international bodies are a particularly useful feature. Many terms are covered at some length, with the newer techniques and more complex concepts described in short articles and supporting diagrams.

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